CITY OF VANCOUVER
BRITISH COLUMBIA

BUILDING BY-LAW NO. 12511

**This By-law is printed under and
by authority of the Council of
the City of Vancouver**

July 23, 2019

BY-LAW NO. 12511

A By-law to regulate the construction of buildings and related matters

THE COUNCIL OF THE CITY OF VANCOUVER, in public meeting, enacts the following:

SECTION 1
BUILDING BY-LAW ESTABLISHED

SHORT TITLE

1.1 The name of this By-law, for citation, is the "Building By-law".

PARTS OF BY-LAW

1.2 The Building By-law shall consist of two parts: Book I (General) and Book II (Plumbing Systems) which are attached as Schedule 1 and Schedule 2.

1.3 The table of contents for this By-law is for convenient reference only, and is not for use in interpreting or enforcing this By-law.

SEVERABILITY

1.4 A decision by a court that any part of this By-law is illegal, void, or unenforceable severs that part from this By-law, and is not to affect the balance of this By-law.

SECTION 2
REPEAL AND ENACTMENT

REPEAL AND TRANSITION

2.1 Council repeals By-law No. 10908 as amended from time to time, except that the provisions of By-law No. 10908, with respect to matters other than administration, continue to apply as if unrepealed in respect of permits applied for under By-law No. 10908 before November 1, 2019 for work which complies with the provisions of Section 3.3. of Part 3, of Division C of Book I (General) and Book II (Plumbing Systems) of this By-law.

FORCE AND EFFECT

2.2 This By-law is to come into force and take effect on the 1st day of November, 2019.

ENACTED by Council this 23rd day of July, 2019

Signed "Kennedy Stewart"
Mayor

Signed "Katrina Leckovic"
City Clerk

Schedule 1
Book I (General)

Preface

The 2019 Building By-law (hereinafter the "Building By-law") is an objective-based code which identifies the minimum standard in the City of Vancouver for buildings to which this By-law applies. These address the same objectives of the Building By-law's parent codes.

The Building By-law establishes standards for building materials, products and assemblies. Some standards are explicitly provided in the Building By-law while others are incorporated by reference to existing standards for materials products and assemblies which are developed and published by specialist organizations.

The Building By-law is substantially based on Book I (General) and Book II (Plumbing Systems) of the British Columbia Building Code, which in turn is substantially based on the model National Building Code of Canada 2015 and the model National Plumbing Code of Canada 2015. This model of adoption of national model codes helps promote consistency among building codes.

This Building By-law replaces the 2014 Building By-law and also contains certain transition provisions which apply to permits issued under the 2014 Building By-law. The Building By-law is regularly updated and users should ensure that the By-law is current.

Code Development

Development of Codes Canada

The Canadian Commission on Building and Fire Codes (CCBFC) is responsible for the content of the National Model Codes. The CCBFC is an independent body made up of volunteers from across the country and from all facets of the code-user community. Members of the CCBFC and its standing committees include builders, engineers, skilled trade workers, architects, building owners, building operators, fire and building officials, manufacturers and representatives of general interests.

Codes Canada (formerly named the Canadian Codes Centre) of the National Research Council (NRC) provides technical and administrative support to the CCBFC and its standing committees. NRC publishes Codes Canada and periodic revisions to the Codes to address pressing issues. However, such periodic revisions do not have legal effect until adopted into law.

British Columbia Building Code

In British Columbia, the 2018 Building Code is the legal adoption of National Model Building and Plumbing Codes under the authority of the government of the Province of British Columbia. This includes much of the National Model Codes as amended from time to time, but also includes provincially applicable requirements to address provincial priorities and concerns.

Vancouver Building By-law

This By-law consists of two Books, that set out the minimum standard for the design and construction of new buildings as applicable. It also applies to the alteration, change of use and demolition of existing buildings.

The By-law, is substantially based upon the British Columbia Building Code and establishes requirements to address five objectives, which are fully described in Division A of the By-law.

General Requirements

Building By-law - Book I (General) requirement must address at least one of the Code's five stated objectives:

- safety
- health
- accessibility for persons with disabilities
- fire and structural protection of buildings
- environment

Code provisions do not necessarily address all the characteristics of buildings that might be considered to have a bearing on the Code's objectives. The design of a technically sound building depends upon many factors beyond simple compliance with building regulations. Such factors include the availability of knowledgeable practitioners who have received appropriate education, training and experience and who have some degree of familiarity with the principles of good building practice and experience using textbooks, reference manuals and technical guides.

The Building By-law does not list acceptable proprietary building products. It establishes the criteria that building materials, products and assemblies must meet. Some of these criteria are explicitly stated in the By-law while others are incorporated by reference to material or product standards published by standards development organizations. Only those portions of the standards related to the objectives of this By-law are mandatory.

Plumbing Requirements

Book II (Plumbing Systems) of the Building By-law sets out technical provisions for the design and installation of new plumbing systems. It also applies to the extension, alteration, renewal and repair of existing plumbing systems. Book II (Plumbing Systems) establishes requirements to address the following four objectives, which are fully described in Division A of the Code:

- safety
- health
- protection of buildings and facilities from water and sewage damage
- environment

Code provisions do not necessarily address all the characteristics of buildings and facilities that might be considered to have a bearing on the Code's objectives. It is not a textbook on plumbing system design or installation. The design of a technically sound plumbing system depends upon many factors beyond simple compliance with plumbing regulations. Such factors include the availability of knowledgeable practitioners who have received appropriate education, training and experience and who have some degree of familiarity with the principles of good plumbing practice and experience using textbooks, reference manuals and technical guides.

The Building By-law does not list acceptable proprietary plumbing products. It establishes the criteria that plumbing materials, products and assemblies must meet. Some of these criteria are explicitly stated in the By-law while others are incorporated by reference to material or product standards published by standards development organizations. Only those portions of the standards related to the objectives of this By-law are mandatory.

Additional Information

Numbering System

A consistent numbering system has been used throughout this By-law. The first number indicates the Part of the By-law; the second, the Section in the Part; the third, the Subsection; and the fourth, the Article in the Subsection. The detailed provisions are found at the Sentence level (indicated by numbers in brackets), and Sentences may be broken down into Clauses and Subclauses. This structure is illustrated as follows:

B	Division
3	Part
3.5.	Section
3.5.2.	Subsection
3.5.2.1.	Article
3.5.2.1.(2)	Sentence
3.5.2.1.(2)(a)	Clause
3.5.2.1.(2)(a)(i)	Subclause

Change Indication

Where a technical change or addition has been made relative to the Building By-law National Building Code (NBC) and National Plumbing Code (NPC) 2010 edition, a vertical line has been added in the margin next to the affected provision to indicate the approximate location of new or modified content. No change indication is provided for renumbered or deleted content.

In addition to the above noted vertical lines, which indicate a change to the NBC or NPC that has been included in the British Columbia Building Code (BCBC), further technical changes or additions relative to the 2012 edition of the BCBC are identified. These changes are underlined, wherever practical. The vertical lines and underlining are for convenience only and have no legal effect. No change indication is provided for renumbered or deleted provisions.

The term “reserved” is included in place of certain deleted National Codes content which has not been adopted. The term “reserved” is generally used so that the numbering structure of the BCBC is aligned with the model National Codes, easing comparability and possible future harmonization.

Unique to Vancouver Indication

All text in the By-law that is unique to Vancouver is provided with a grey background wherever practical. This identifier was utilized to provide the user of the By-law with a means by which to differentiate the Vancouver provisions of this By-law from those of the 2018 British Columbia Building and Plumbing Codes. Where the provisions of Vancouver have required the deletion of the 2018 British Columbia Building and Plumbing Code text, and no Vancouver text has replaced the deleted text, the word “deleted” has been used to alert the user that a deletion has been made and that there is a difference from the 2018 British Columbia Building and Plumbing Codes text.

Meaning of the words “and” and “or” between the Clauses and Subclauses of a Sentence

Multiple Clauses and Subclauses are connected by the word “and” or “or” at the end of the second last Clause or Subclause in the series. Although this connecting word appears only once, it is meant to apply to all the preceding Clauses or Subclauses within that series.

For example, in a series of five Clauses – a) to e) – in a By-law Sentence, the appearance of the word “and” at the end of Clause d) means that all Clauses in the Sentence are connected to each other with the word “and.” Similarly, in a series of five Clauses – a) to e) – in a By-law Sentence, the appearance of the word “or” at the end of Clause d) means that all Clauses in the Sentence are connected to each other with the word “or.”

In all cases, it is important to note that a Clause (and its Subclauses, if any) must always be read in conjunction with its introductory text appearing at the beginning of the Sentence.

Metric Conversion
All values in this By-law, other than nominal sizes, are given in metric units. A conversion table of imperial equivalents for the most common units used in plumbing system design and installation is located at the end of the By-law.

Parts in Division B and Professional Disciplines
Division B is organized into Parts that are largely related to disciplines. However, this does not mean that persons of a certain discipline who are executing the design or construction of a particular building component can necessarily deal with only one Part of the Code in isolation since provisions related to that building component may be found in more than one Part.

For example:

- provisions that deal with fire safety issues related to heating, ventilating and air-conditioning systems are located in Part 3 of Division B, Fire Protection, Occupant Safety and Accessibility, and not in Part 6, Heating, Ventilating and Air-conditioning;

- structural requirements related to loads on handrails and grab bars are located in Part 3 of Division B, Fire Protection, Occupant Safety and Accessibility, while structural requirements related to loads on guards and handrails are located in Part 4, Structural Design.

For this reason, the part-based structure of Division B is not well suited for use as the basis for allocating responsibilities to different professions or as the basis for contractual arrangements.

Acknowledgements and Copyright

Requests for permission to reproduce the unique to Vancouver provisions of the By-law must be sent to:

Code Development Engineer
Office of the Chief Building Official
Community Service
453 West 12th Avenue
Vancouver, BC
V5Y 1V4

Contact Information
The Provincial government and CCBFC welcomes comments and suggestions for improvements to the Building Code and Plumbing Code. To submit comments or suggestions or to request printed copies of Internet material referred to in this Preface, contact:

Building and Safety Standards Branch
Office of Housing and Construction Standards
614 Humboldt Street
PO Box 9844 Stn Prov Govt
Victoria BC V8W 9T2
Email: building.safety@gov.bc.ca

Persons interested in the development of the National Codes, the model document for the British Columbia Codes can contact:

The Secretary
Canadian Commission on Building and Fire Codes
Codes Canada
National Research Council of Canada
Ottawa, Ontario K1A 0R6
Telephone: 613-993-9960
Fax: 613-952-4040
E-mail: Codes@nrc-cnrc.gc.ca

Relationship of the Building By-law to Standards Development and Conformity Assessment

The development of many provisions in this By-law and the assessment of conformity to those provisions are supported by several of the member organizations of Canada's National Standards System (NSS).

The NSS is a federation of accredited organizations concerned with standards development, certification, testing, inspection, personnel and management systems registration that is established under the auspices of the Standards Council of Canada Act. Activities of the NSS are coordinated by the Standards Council of Canada (SCC), which has accredited 8 standards development organizations, 36 certification organizations, 21 registration organizations, and 344 calibration and testing laboratories.

The SCC is a federal non-profit Crown corporation responsible for the coordination of voluntary standardization in Canada. It also has responsibilities for Canada's activities in voluntary international standardization.

Canadian Standards
The By-law contains many references to standards published by accredited standards development organizations in Canada. As part of the accreditation requirements, these organizations adhere to the principles of consensus. This

generally means substantial majority agreement of a committee comprising a balance of producer, user and general interest members, and the consideration of all negative comments. The organizations also have formal procedures for the second-level review of the technical preparation and balloting of standards prepared under their auspices. (The Canadian Commission on Building and Fire Codes (CCBFC) follows these same principles of consensus in the operation of its Code development process.)

The following organizations are accredited as standards development organizations in Canada:

- American Society for Testing and Materials International (ASTM)
- Bureau de normalisation du Québec (BNQ)
- Canadian General Standards Board (CGSB)
- Canadian Standards Association (CSA)
- ULC Standards (ULC)
- Underwriters' Laboratories (UL)

Table 1.3.1.2. of Division B lists the standards referenced in this By-law. Standards proposed to be referenced in this By-law are reviewed to ensure their content is compatible with the Code. Thereafter, referenced standards are reviewed as needed during each Code cycle. Standards development organizations are asked to provide information on any changes in the status of their standards referenced in this By-law – withdrawals, amendments, new editions, etc. This information is passed on to the CCBFC, its standing committees, the provinces and territories, and interested stakeholders on particular issues, all of whom are given the opportunity to identify any problems associated with the changes. These bodies do not necessarily review in detail the revised standards; rather, the approach relies on the consensus process involved in the maintenance of the standards and on the extensive knowledge and backgrounds of committee members, provincial or territorial staff, NRC staff, and consulted stakeholders to identify changes in the standards that might create problems in the By-law.

Non-Canadian Standards
A number of subject areas for which the Canadian standards development organizations have not developed standards are covered in this By-law. In these cases, the Code often references standards developed by organizations in other countries, such as the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) and the National Fire Protection Association (NFPA). These standards are developed using processes that may differ from those used by the Canadian standards development organizations; nevertheless, these standards have been reviewed by the relevant standing committees and found to be acceptable in the context in which they are referenced by this By-law.

Conformity Assessment
This By-law establishes minimum measures, either within its own text or that of referenced standards. However, this By-law does not deal with the question of who is responsible for assessing conformity to the measures or how those with this responsibility might carry it out.

In Vancouver, the Chief Building Official is authorized to, by bylaw, regulate construction and to enforce the requirements of this By-law.

Those persons responsible for ensuring that a material, appliance, system or equipment meets the performance requirements of this By-law have several means available to assist them. These means vary from on-site inspection to the use of certification services provided by accredited third-party organizations. Test reports or mill certificates provided by manufacturers or suppliers can also assist in the acceptance of products. Engineering reports may be required for more complex products.

Requirements for Registered Professionals are located in Division C of this By-law.

Testing

The accreditation programs of the SCC include many organizations accredited for testing and calibration that are capable of reliably testing building products to specified standards. The test results produced by these organizations can be used in the evaluation, qualification and certification of building products to Code provisions. The SCC's Web site (www.scc.ca) lists accredited certification bodies and allows users to search the scope of accreditation for each of these organizations.

Certification

Certification is the confirmation by an independent organization that a product or service meets a requirement. Certification of a product, process, or system entails physical examination, testing as specified in the appropriate standards, plant examination, and follow-up unannounced plant inspections. This procedure leads to the issuing of a formal assurance or declaration, by means of a certification mark or certificate, that the product, process or system is in full conformity with specified provisions.

In some cases, a product for which no standard exists can be certified using procedures and criteria developed by the accredited certifying organization and specifically designed to measure the performance of that product. Certification bodies publish lists of certified products and companies.

Registration

Quality Registration Organizations assess a company's conformance to quality assurance standards like the International Organization for Standardization ISO 9000.

Evaluation

An evaluation is a written opinion by an independent professional organization that a product will perform its intended function in a building. An evaluation is very often done to determine the ability of an innovative product, for which no standards exist, to satisfy the intent of a By-law requirement. Follow-up plant inspections are not normally part of the evaluation process. Several organizations, including the Canadian Construction Materials Centre (CCMC), offer such evaluation services. While the development of such an evaluation is useful to establish a basis for acceptance, this it does not mean that there will be an automatic assumption of By-law compliance by the Chief Building Official for any given material, product or assembly covered by this evaluation or that will necessarily be deemed applicable in every situation.

Qualification

The qualification of building products also evaluates the ability of a product to perform its intended function by verifying that it meets the requirements of a standard. Qualification normally includes some follow-up plant inspection. Some organizations publish lists of qualified products that meet the specified requirements. Some organizations qualify manufacturing and/or testing facilities for building products for compliance with the By-law and relevant standards.

Division A
Compliance, Objective and Functional Statements

Part 1
Compliance

Section 1.1. General

1.1.1. Application of this By-law

1.1.1.1. Application of this By-law

1) This By-law applies to any one or more of the following:

a) the design and construction of a new *building*,
b) the *occupancy* of any *building*,
c) a change in *occupancy* of any *building*,
d) an *alteration* of any *building*,
e) an addition to any *building*,
f) the demolition of any *building*,
g) the reconstruction of any *building* that has been damaged by fire, earthquake or other cause,
h) the correction of an *unsafe condition* in or about any *building*,
i) all parts of any *building* that are affected by a change in *occupancy*,
j) the work necessary to ensure safety in parts of a *building*
  i) that remain after a demolition,
  ii) that are affected by but that are not directly involved in *alterations*, or
  iii) that are affected by but not directly involved in additions,
k) except as permitted by the Fire By-law, the installation, replacement, or *alteration* of materials or equipment regulated by this By-law,
l) the work necessary to ensure safety in a relocated or removed *building* during and after relocation or removal,
m) safety during construction of a *building*, including protection of the public,
n) the design, installation, extension, *alteration*, renewal or repair of *plumbing systems*,
o) the *alteration*, rehabilitation and change of *occupancy* of *heritage buildings*,
p) the design and *construction* of a *marina*,
q) the *alteration* of a *marina*, and
r) retaining structures greater than 1.2 m in height.

2) This By-law does not apply to the following:

a) *sewage*, water, electrical, telephone, rail or similar public infrastructure systems located on, or in a *street* or a public transit right of way,
b) utility towers and poles, and television, radio and other communication aerials and towers, except for loads resulting from their being located on or attached to *buildings*,
c) mechanical or other equipment and *appliances* not specifically regulated in these regulations,
d) flood control and hydro electric dams and structures,
e) accessory *buildings* less than 10 m^2 in *building area* that do not create a hazard,
f) with the permission of the *authority having jurisdiction*, temporary *buildings* including
  i) construction site offices,
  ii) seasonal storage *buildings*,
  iii) **Deleted**,
  iv) emergency facilities, and
  v) similar structures with the permission of the Chief Building Official,

g) factory built housing and components complying with CSA-Z240 MH Series standard, but this exemption does not extend to on site preparations (siting, foundations, mountings), connection to services and installation of *appliances*,

h) areas that are specifically exempted from provincial *building* regulations by provincial or federal enactments.

i) an existing residential *building* with not more than two *dwelling units* located on a parcel which is the subject of an application for a *building permit* to construct a laneway house if there is no renovation or change in use of the existing *building*,

j) a *noncombustible container* used only for storage of emergency supplies and required by the City's Emergency Social Services Program if

i) the *building area* of the *container* is no more than 15 m^2,

ii) the *container* is located at least 3 m from any *building*, and

iii) the location of the *container* does not obstruct the *exit* path of an *existing building* and the firefighter's access path to an *existing building*, and

k) structures necessary for the operation of a *public bike share station* if the *public bike share station*

i) does not interfere with any public works, public facilities or public amenities,

ii) does not include any enclosed structures,

iii) is located at least 3 m from any *building*,

iv) does not obstruct the *exit* path of an *existing building* and the firefighter's access path to an *existing building*.

3) This By-law applies to both site-built and factory-constructed *buildings*. (See Note A-1.1.1.1.(3).)

4) *Farm buildings* shall conform to the requirements in the National Farm Building Code of Canada 1995.

5) For *heritage buildings*, the Alternate Acceptable Solution for Heritage Buildings in Section 11.5. of Division B and the alternative acceptable solutions in Sentence (6) may be substituted for requirements contained elsewhere in this By-law. (See Note A-1.1.1.1.(5).)

6) Alternative acceptable solutions to assist in the rehabilitation of *existing buildings* in Section 11.3. of Division B may be substituted for the requirements contained elsewhere in this By-law if the conditions for using the alternatives have been met.

7) Alternative acceptable solutions to assist in the conversion of *existing buildings* in Section 11.4 of Division B may be substituted for the requirements contained elsewhere in this By-law if the condition for

1.1.1.2. Application to Existing Buildings

1) Where a *building* is altered, rehabilitated, renovated or repaired, or there is a change in *major occupancy*, the *building* shall be upgraded in accordance with Part 11 of Division B. (See Appendix A.)

1.1.2. Internal References to this By-law

1.1.2.1. Book I (General) of the By-law

1) This is the first of the two Books, Book I (General) and Book II (Plumbing Systems), that together form the Building By-law.

1.1.2.2. Internal References to the By-law

1) Unless a Book is specified, references to "the Vancouver Building By-law," "the Building By-law," "the By-law," "this By-law" and the like shall be read as references to the Book in which they appear.

1.1.3. Appendices, Notes and Annotations

1.1.3.1. Appendices, Notes and References to Appendices and Notes have No Legal Effect

1) The Appendices and Notes of this By-law have no legal effect, except for the Appendices and Appendix Notes that are directly referenced in a Part of this By-law, being the following:

a) the following Notes:

i) A-1.4.1.2.(1) Designated flood plain of Division A, including Figures A-1.4.1.2.(1)-C, D and E,

ii) A-1.4.1.2.(1) Flood construction level requirements of Division A,

iii) A-Table 9.23.3.5.-B of Division B,

iv) A-9.23.13. of Division B, including Table A-9.23.13., and

v) A-11.2.1.2. of Division B,

b) Appendix C of Division B, and

c) Appendix D of Division B.

2) References in parentheses to the Appendices and Notes of this By-law have no legal effect.

Section 1.2. Compliance

1.2.1. Compliance with this By-law

1.2.1.1. Compliance with this By-law

1) Compliance with this By-law shall be achieved by

a) complying with the applicable acceptable solutions in Division B (See Note A-1.2.1.1.(1)(a).), or

b) except as required by Sentence (3), using alternative solutions, accepted by the *Chief Building Official* under Section 2.3 of Division C, that will achieve at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the applicable acceptable solutions (See Note A-1.2.1.1.(1)(b).).

2) For the purposes of compliance with this By-law as required in Clause 1.2.1.1.(1)(b), the objectives and functional statements attributed to the acceptable solutions in Division B shall be the objectives and functional statements referred to in Subsection 1.1.2. of Division B.

3) An alternative solution shall not be used in place of an acceptable solution if the acceptable solution expressly requires conformance to a provincial enactment other than Book I (General) or Book II (Plumbing Systems) of the Building By-law.

1.2.1.2. Responsibility of Owner

1) Unless otherwise specified in this By-law, the owner of a *building* shall be the person responsible for carrying out the provisions of this By-law in relation to that *building*.

2) The owner of a *building* is in no way relieved of full responsibility for complying with this By-law by the *Chief Building Official*

a) granting a building permit,

b) approving drawings or specifications, or

c) carrying out inspections.

1.2.2. Materials, Appliances, Systems and Equipment

1.2.2.1. Characteristics of Materials, Appliances, Systems and Equipment

1) All materials, *appliances*, systems and equipment installed to meet the requirements of this By-law shall possess the necessary characteristics to perform their intended functions when installed in or serving a *building*.

1.2.2.2. Storage on the Building Site

1) All *building* materials, *appliances* and equipment on the *building* site shall be stored in such a way as to prevent the deterioration or impairment of their essential properties.

1.2.2.3. Used Materials, Appliances and Equipment

1) Unless otherwise specified, used materials, *appliances* and equipment are permitted to be reused when they meet the requirements of this By-law for new materials and are satisfactory for the intended use.

Section 1.3. Divisions A, B and C of this By-law

1.3.1. General

1.3.1.1. Scope of Division A

1) Division A contains the compliance and application provisions, objectives and functional statements of this By-law.

1.3.1.2. Scope of Division B

1) Division B contains the acceptable solutions of this By-law.

1.3.1.3. Scope of Division C

1) Division C contains the administrative provisions of this By-law.

1.3.1.4. Internal Cross-references

1) Where the Division of a referenced provision is not specified in this By-law, it shall mean that the referenced provision is in the same Division as the referencing provision.

1.3.2. Application of Division A

1.3.2.1. Application of Parts 1, 2 and 3

1) Parts 1, 2 and 3 of Division A apply to all *buildings* covered in this By-law. (See Article 1.1.1.1.)

1.3.3. Application of Division B

1.3.3.1. Application of Parts 1, 7, 8 and 10

1) Parts 1, 7, 8 and 10 of Division B apply to all *buildings* covered in this By-law. (See Article 1.1.1.1.)

1.3.3.2. Application of Parts 3, 4, 5 and 6

1) Parts 3, 4, 5, and 6 of Division B apply to all *buildings* described in Article 1.1.1.1. and

a) classified as *post-disaster buildings*,

b) used for *major occupancies* classified as

i) Group A, *assembly occupancies*,

ii) Group B, *care*, *treatment* or *detention occupancies*, or

iii) Group F, Division 1, *high-hazard industrial occupancies*, or

c) exceeding 600 m^2 in *building area* or exceeding 3 *storeys* in *building height* used for *major occupancies* classified as

i) Group C, *residential occupancies*,

ii) Group D, *business and personal services occupancies*,

iii) Group E, *mercantile occupancies*, or

iv) Group F, Divisions 2 and 3, *medium-* and *low-hazard industrial occupancies*.

2) Part 4 applies to all *buildings* except *buildings* containing not more than two principal *dwelling units* and their *ancillary residential units* and accessory *buildings*.

3) Part 5 applies to all Group C *multi-family buildings* and *Artist Live/Work Studios* that are

a) more than 2 *storeys* in *building height*, or

b) more than 600 m^2 in *building area* excluding *firewalls*.

4) Notwithstanding Sentence (1), Section 3.8 applies to all Part 9 *buildings*.

1.3.3.3. Application of Part 9, 11 and 12

1) Except as provided in Sentences 1.3.3.2.(2) and (3), Part 9 of Division B applies to all *buildings* described in Article 1.1.1.1. of 3 *storeys* or less in *building height*, having a *building area* not exceeding 600 m^2, and used for *major occupancies* classified as

a) Group C, *residential occupancies* (See Note A-9.1.1.1.(1) of Division B),

b) Group D, *business and personal services occupancies*,

c) Group E, *mercantile occupancies*, or

d) Group F, Divisions 2 and 3, *medium*- and *low-hazard industrial occupancies*.

2) Part 11 applies to the *alteration*, rehabilitation, renovation, repair, *addition* or change of *major occupancy* of an *existing building* and as defined in Appendix Note A-11.2.1.2 of Division B.

3) Part 12 applies to the design and *construction* of all new *marinas* and *float homes*; and to existing *marinas* and existing *float homes* as defined in Article 11.2.1.11. of Division B.

1.3.3.4. Building Size Determination

1) Where a *firewall* divides a *building*, each portion of the *building* so divided shall be considered as a separate *building*, except when this requirement is specifically modified in other parts of this By-law. (See Note A-1.3.3.4.(1).)

2) Except as permitted in Sentence (4), where portions of a *building* are completely separated by a vertical *fire separation* that has a *fire-resistance rating* of not less than 1 h and extends through all *storeys* and *service spaces* of the separated portions, each separated portion is permitted to be considered as a separate *building* for the purpose of determining *building height*, provided

a) each separated portion is not more than 4 *storeys* in *building height* and is used only for *assembly*, *residential*, and *business and personal services occupancies*, and

b) the unobstructed path of travel for a firefighter from the nearest *street* to one entrance of each separated portion is not more than 45 m.

(See Note A-1.3.3.4.(2) & (3).)

3) Except as permitted in Sentence (4), where portions of a *building* are completely separated by a distance of at least 3 m, each separated portion is permitted to be considered as a separate *building* for the purpose of determining *building height*, provided

a) each separated portion complies with the requirements of Subsection 3.2.3. of Division B,

b) all connecting construction is

i) of *noncombustible construction*, and

ii) contains only F3 occupancies, or uses and occupancies subsidiary to the remainder of the building,

c) a vertical *fire separation* that has a *fire-resistance rating* of not less than 2 h and extends through all *storeys* and *service spaces* of the connecting construction, and

d) the unobstructed path of travel for a firefighter from the nearest *street* to one entrance of each separated portion is not more than 45 m.

(See Note A-1.3.3.4.(2) & (3).)

4) The vertical *fire separation* referred to in Sentence (2) may terminate at the floor assembly immediately above a *basement* provided the *basement* conforms to Article 3.2.1.2. of Division B.

1.3.3.5. Air Space Subdivision

1) Where a subdivision of land creates an *air space parcel* boundary in or through a *building*, which otherwise complies with this By-law, such *building* or a portion of the *building* may, at the discretion of the *Chief Building Official*, be considered as a single *building* not requiring internal *firewalls* or *party walls* along *air space parcel* boundaries if legal agreements are registered against title to all *air space parcels* and the remainder whereby

a) all relevant *owners* grant easements necessary to ensure common access to the fire and life safety systems and exits required for the *building* to function as a single *building* and to allow the *owners* to operate and maintain the *building* and its common systems, and

b) all owners grant a covenant to the *City* on terms acceptable to its Director of Legal Services and the *Chief Building Official* whereby the owners

i) acknowledge and agree that they have requested the *Chief Building Official* to treat the building as a single *building*,

ii) release and indemnify the *City* and the *Chief Building Official* for, without limitation, all liability arising from the *Chief Building Official* agreeing to treat the *building* or a portion of the *building* as a single *building* for the purposes of this By-law, and

iii) agree to inspect, test and keep in good repair and good working order all common fire and life safety systems, common utilities and shared *exits* located on their parcel and, to the extent necessary, use the easements referred to in Clause (1)(a) for that purpose.

1.3.3.6. Automatic Sprinkler Systems

1) Except for *buildings* described in Sentence (2), all newly constructed *buildings* shall be provided with an automatic *sprinkler system* designed and installed in accordance with Article 3.2.5.12. of Division B.

2) The following *buildings* are not required to be *sprinklered*

a) temporary *buildings* conforming to Subsection 1.6.8. of Division C, and tents and *air-supported structures* conforming to Subsection 3.1.6. of Division B,

b) one *storey* non-residential storage *buildings* less than 100 m² in *building area*, and having a *limiting distance* on all sides of not less than 15 m,

c) one *storey* detached residential garages and carports,

d) one *storey* detached *buildings* which are accessory to a residential *building* containing not more than two *dwelling units*, and which are less than 50 m² in *building area*,

e) *industrial* or *hazardous occupancies* where the *Chief Building Official* accepts that the installation of an automatic *sprinkler system* would represent a hazard to the occupants or would be incompatible with the use of the *building*,

f) public concession stands and changing room buildings less than 100 m² in *building area* and having a *limiting distance* on all sides of not less than 15 m,

g) ticket kiosks,

h) bleachers which do not contain roofed *occupancies*,

i) farm *buildings*, except farm *buildings* with caretaker residential *suites*,

j) greenhouses used solely for the growing of plants where no public admittance is permitted, and

k) one storey portable classroom *buildings* of less than 100 m² in *building area* with an *occupancy* classification of Group A Division 2 or Group D. (See Note A-1.3.3.6.(2)(k).)

1.3.4. Application of Division C

1.3.4.1. Application of Parts 1, 2 and 3

1) Parts 1, 2 and 3 of Division C apply to all *buildings* covered in this By-law. (See Article 1.1.1.1.)

Section 1.4. Terms and Abbreviations

1.4.1. Definitions of Words and Phrases

1.4.1.1. Non-defined Terms

1) Words and phrases used in this By-law that are not included in the list of definitions in Article 1.4.1.2. shall have the meanings that are commonly assigned to them in the context in which they are used, taking into account the specialized use of terms by the various trades and professions to which the terminology applies.

2) Where objectives and functional statements are referred to in this By-law, they shall be the objectives and functional statements described in Parts 2 and 3.

3) Where acceptable solutions are referred to in this By-law, they shall be the provisions stated in Parts 3 to 10, and 12 of Division B.

4) Where alternative solutions are referred to in this By-law, they shall be the alternative solutions mentioned in Clause 1.2.1.1.(1)(b).

1.4.1.2. Defined Terms

1) The words and terms in italics in this By-law shall have the following meanings:

Acceptable means acceptable to the *Chief Building Official*.

Accepted means accepted by the *Chief Building Official*.

Access or Accessible means an area and its facilities, or both, as required by this By-law, which is easy to approach, enter, exit, operate, participate in, pass to and from, and use safely and independently by *persons with disabilities*. (See Note A-1.4.1.2.(1).)

Access to exit means that part of a *means of egress* within a *floor area* that provides access to an *exit* serving the *floor area*.

Adaptable dwelling unit means a *dwelling unit* designed and constructed to facilitate future modification to provide *access*.

Addition means an alteration to any building which will increase the total aggregate floor area or the building height (in storeys).

Adfreezing means the adhesion of *soil* to a *foundation unit* resulting from the freezing of *soil* water. (Also referred to as “frost grip.”)

Air barrier system means the assembly installed to provide a continuous barrier to the movement of air.

Air space parcel has the meaning assigned to it by the Land Title Act of British Columbia.

Air-supported structure means a structure consisting of a pliable membrane which achieves and maintains its shape and support by internal air pressure.

Alarm signal means an audible signal transmitted throughout a zone or zones or throughout a *building* to advise occupants that a fire emergency exists.

Alert signal means an audible signal to advise designated persons of a fire emergency.

Alteration means a change or extension to any matter or thing or to any *occupancy* regulated by this By-law.

Ancillary residential building meaning a *building* entirely of *residential occupancy*, constructed on the same parcel and smaller than the primary *residential building* and containing not more than one *dwelling unit* and its subsidiary uses, such as a laneway house

Ancillary residential unit means a self-contained *dwelling unit* that is located within a *building* of only *residential occupancy* that:

- with its primary *dwelling unit* constitute a single real estate entity, and
- is smaller than the principal *dwelling unit.*

Apparent sound transmission class (ASTC) means a single number rating of the airborne sound attenuation of *building* assemblies separating two adjoining spaces, taking into account both the direct and flanking sound transmission paths. (See Note A-1.4.1.2.(1).) (See also Note A-9.11. of Division B.)

Appliance means a device to convert fuel into energy and includes all components, controls, wiring and piping required to be part of the device by the applicable standard referred to in this By-law.

Apprentice means a regularly indentured apprentice under the provisions of the Industry Training Authority Act of British Columbia.

Approved (as used in Book II) means *accepted*.

Area of refuge means a space that facilitates a safe delay in egress, is sufficiently protected from fire conditions developing in the *floor area*, and provides direct access to an exit or firefighters' elevator.

Artesian groundwater means a confined body of water under pressure in the ground.

Artist Live/Work Studio means an Artist Studio and a Residential Unit associated with and forming an integral part of an Artist Studio, as defined in the Zoning and Development By-law.

Artist studio — Class A means Artist studio-Class A as defined in the Zoning and Development By-law.

Artist studio — Class B means Artist studio-Class B as defined in the Zoning and Development By-law.

Arts and culture indoor event means an event of an artistic or cultural nature, including but not limited to visual, performing, media, literary, craft or interdisciplinary arts, for a maximum of 250 persons, with or without liquor service, which occurs no more than three days per month in a *building* or portion of a *building* not approved for *assembly occupancy*.

Assembly occupancy means the *occupancy* or the use of a *building*, or part thereof, by a gathering of persons for civic, political, travel, religious, social, educational, recreational or like purposes, or for the consumption of food or drink.

Attic or roof space means the space between the roof and the ceiling of the top *storey* or between a dwarf wall and a sloping roof.

Basement means a *storey* or *storeys* of a *building* located below the *first storey*.

Bearing surface means the contact surface between a *foundation unit* and the *soil* or *rock* upon which it bears.

Boiler means an *appliance* intended to supply hot water or steam for space heating, processing or power purposes.

Braced wall band means an imaginary continuous straight band extending vertically and horizontally through the *building* or part of the *building*, within which *braced wall panels* are constructed.

Braced wall panel means a portion of a wood-frame wall where bracing, sheathing, cladding or interior finish is designed and installed to provide the required resistance to lateral loads due to wind or earthquake.

Breeching means a *flue pipe* or chamber for receiving *flue* gases from one or more *flue* connections and for discharging these gases through a single *flue* connection.

Building means any structure used or intended for supporting or sheltering any use or *occupancy*, including any *float home* or *marina* and any retaining structures greater than 1.2 m in height.

Building area means the greatest horizontal area of a *building* above *grade* within the outside surface of exterior walls or within the outside surface of exterior walls and the centre line of *firewalls*.

Building energy use means non site-renewable energy used for space heating, cooking and/or operation of *buildings* intended for human *occupancy*.

Building Envelope Professional means a *registered professional* who is:

- a member or licensee of the Architectural Institute of British Columbia, or
- a member or licensee of the Association of Professional Engineers and Geoscientists of British Columbia qualified by virtue of training or experience to provide building enclosure services.

Building height (in *storeys*) means the number of *storeys* contained between the roof and the floor of the *first storey*.

Business and personal services occupancy means the *occupancy* or use of a *building* or part thereof for the transaction of business or the rendering or receiving of professional or personal services.

Caisson (See *Pile*).

Care means the provision of services other than *treatment* by or through care facility management to residents who require these services because of cognitive, physical or behavioural limitations.

Care occupancy means the *occupancy* or use of a *building* or part thereof where *care* is provided to residents. (See Note A-1.4.1.2.(1).)

Cavity wall means a construction of masonry units laid with a cavity between the wythes. The wythes are tied together with metal ties or bonding units, and are relied on to act together in resisting lateral loads.

Certified Professional means a Certified Professional as defined in the Certification of Professionals By-law.

Chief Building Official means the *City Building Inspector*, and any person authorized to act on behalf of the *City Building Inspector*.

Child Care Facility means a care facility within the meaning of the Child Care Licensing Regulation of the Community Care and Assisted Living Act.

Children means persons under the age of 13 years.

Chimney means a primarily vertical shaft enclosing at least one *flue* for conducting *flue* gases to the outdoors.

Chimney liner means a conduit containing a *chimney flue* used as a lining of a *masonry or concrete chimney*.

City means the City of Vancouver.

City Building Inspector means the person appointed as such by City Council pursuant to the provisions of the Vancouver Charter.

City Engineer means the person appointed as such by City Council pursuant to the provisions of the Vancouver Charter.

Clear-water waste means waste water with impurity levels that will not be harmful to health and may include cooling water and condensate drainage from refrigeration and air-conditioning equipment and cooled condensate from steam heating systems, but does not include *storm water*. (See Book II, Division A, Note A-1.4.1.2.(1).)

Closure means a device or assembly for closing an opening through a *fire separation* or an exterior wall, such as a door, a shutter, a damper, wired glass or glass block, and includes all components such as hardware, closing devices, frames and anchors.

Combustible means that a material fails to meet the acceptance criteria of CAN/ULC-S114, "Test for Determination of Non-Combustibility in Building Materials."

Combustible construction means that type of construction that does not meet the requirements for *noncombustible construction*.

Combustible dusts means dusts and particles that are ignitable and liable to produce an explosion.

Combustible fibres means finely divided, combustible vegetable or animal fibres and thin sheets or flakes of such materials which, in a loose, unbaled condition, present a flash fire hazard, including cotton, wool, hemp, sisal, jute, kapok, paper and cloth.

Combustible liquid means a liquid having a *flash point* at or above 37.8°C and below 93.3°C.

Community Care Facility means Community Care Facility as defined in the Zoning & Development By-law.

Conditioned space means any space within a *building* the temperature of which is controlled to limit variation in response to the exterior ambient temperature by the provision, either directly or indirectly, of heating or cooling over substantial portions of the year.

Construction means, with respect to a *building*: erection, repair, *alteration*, enlargement, *addition*, *demolition*, *deconstruction*, removal and excavation.

Construction Safety Officer means a person who has been trained specifically to understand and apply safe *construction* practice as it relates to the worksite and as it affects the public, neighbouring properties and utilities, and who has been retained by the *owner*, or the *owner's* principal *contractor* or *project* manager, to coordinate all sub trade supervisors relating to *construction* safety at the *project* site.

Construction Safety Plan means a plan containing *construction* procedures and fire safety measures designed to protect workers on a project, neighbouring private property, public property, and members of the general public.

Constructor means a person who contracts with an owner or their authorized agent to undertake a project, and includes an *owner* who contracts with more than one person for the work on a project or undertakes the work on a project or any part thereof.

Contained use area means a supervised area containing one or more rooms in which occupant movement is restricted to a single room by security measures not under the control of the occupant.

Container means a metal transportable structure designed for the storage and transport of goods, the typical dimensions of which are 2.44 m in width, 2.59 m in height, and 6.1 m in length.

Contractor means a person who contracts with an owner or an authorized agent of an *owner* to undertake a *project*, and includes an *owner* who contracts with more than one person for the work on a *project* or undertakes the work on a *project* or any part thereof.

Cooktop means a cooking surface having one or more burners or heating elements.

Coordinating registered professional means a *registered professional* retained under Clause 2.2.7.2.(1)(a) of Division C to coordinate all design work and *field reviews* of the *registered professionals* who are required for a project.

Dangerous goods means products, materials or substances that are

(a) regulated by TC SOR/2008-34, “Transportation of Dangerous Goods Regulations (TDGR)” (See Table 3.2.7.1. of Division B of the Fire By-law), or

(b) classified as controlled products under HC SOR/2015-17, “Hazardous Products Regulations” (See Note A-Table 3.2.7.1. of Division B of the Fire By-law).

(See Note A-1.4.1.2.(1).)

Dead load means the weight of all permanent structural and non-structural components of a *building*.

Deconstruction means demolition by systematic disassembly of a building resulting in the reuse, recycling or recovery of not less than 75% of all building materials, excluding materials which are hazardous or banned from landfill.

Deep foundation means a *foundation unit* that provides support for a *building* by transferring loads either by end-bearing to *soil* or *rock* at considerable depth below the *building*, or by adhesion or friction, or both, in the *soil* or *rock* in which it is placed. *Piles* are the most common type of *deep foundation*.

Demolition means the action or process of demolishing a *building*, and includes *deconstruction*.

Designated flood means a flood which may occur in any given year, of such magnitude as to equal a flood having a 200 year return period.

Designated flood plain means those lands in the *City* which are hereby designated, for the purposes of section 306(1)(cc) of the Vancouver Charter, as flood plains susceptible to flooding and subject to *flood construction level requirements*, and those lands so designated include:

(a) lands located in the proximity to the *natural boundary* of the Burrard Inlet, English Bay, False Creek and the Fraser River, which are located within the areas shown shaded or crosshatched on the maps attached to this By-law as Diagrams A1 and A2. (See Figure A-1.4.1.2.(1)-C for Diagram A1: Burrard Inlet, English Bay, False Creek and Fraser River flood plains and Figure A-1.4.1.2.(1)-D for Diagram A2: Burrard Inlet, English Bay, False Creek and Fraser River flood plain, wave effect zone.); and

(b) lands located in the areas shown crosshatched on the map attached to this By-law as Diagram B.

(See Figure A-1.4.1.2.(1)-E for Diagram B: Still Creek flood plain and *flood construction levels*.)

Designated Structural Engineer (Struct. Eng.) means a person who is registered or licensed to practice as a professional engineer under the Engineers and Geoscientists Act of British Columbia, and a person who is designated by the Association of Professional Engineers and Geoscientists of British Columbia as a Designated Structural Engineer.

Designer means the person responsible for the design.

Detention occupancy means the *occupancy* by persons who are restrained from or are incapable of evacuating to a safe location without the assistance of another person because of security measures not under their control.

Distillery means a *process plant* where *distilled beverage alcohols* are produced, concentrated or otherwise processed, and includes facilities on the same site where the concentrated products may be blended, mixed, stored or packaged.

Distilled beverage alcohol means a beverage that is produced by fermentation and contains more than 20% by volume of water-miscible alcohol.

Direct-vented (as applying to a fuel-fired space- or water-heating *appliance*) means an *appliance* and its venting system in which all the combustion air is supplied directly from the outdoors and the products of combustion are vented directly to the outdoors via independent, totally enclosed passageways connected directly to the *appliance*.

Drainage system means an assembly of pipes, fittings, *fixtures*, *traps* and appurtenances that is used to convey *sewage*, *clear-water waste* or *storm water* to a public *sewer* or a *private sewage disposal system*, but does not include *subsoil drainage pipes*. (See Book II, Division A, Figure A-1.4.1.2.(1)-F in Note A-1.4.1.2.(1).)

Dwelling unit means a *suite* operated as a housekeeping unit, used or intended to be used by one or more persons and usually containing cooking, eating, living, sleeping and sanitary facilities.

Excavation means the space created by the removal of *soil*, *rock* or *fill* for the purposes of construction.

Exhaust duct means a duct through which air is conveyed from a room or space to the outdoors.

Existing building means a *building* lawfully constructed and completed under a permit before submission of the current *permit* application.

Exit means that part of a *means of egress*, including doorways, that leads from the *floor area* it serves to a separate *building*, an open public thoroughfare, or an exterior open space protected from fire exposure from the *building* and having access to an open public thoroughfare. (See Note A-1.4.1.2.(1).)

Exit level means the level of an *exit* stairway at which an exterior *exit* door or *exit* passageway leads to the exterior.

Exit storey (as applying to Subsection 3.2.6. of Division B) means a *storey* having an exterior *exit* door.

Exposing building face means that part of the exterior wall of a *building* that faces one direction and is located between ground level and the ceiling of its top *storey* or, where a *building* is divided into *fire compartments*, the exterior wall of a *fire compartment* that faces one direction.

Factory-built chimney means a *chimney* consisting entirely of factory-made parts, each designed to be assembled with the other without requiring fabrication on site.

Farm building means a *building* or part thereof that does not contain a *residential occupancy* and that is associated with and located on land devoted to the practice of farming, and used essentially for the housing of equipment or livestock, or the production, storage or processing of agricultural and horticultural produce or feeds. (See Note A-1.4.1.2.(1).)

Field review means a review of the work

- at a *building* site, and
- where applicable, at locations where *building* components are fabricated for use at the *building* site that a *registered professional* in his or her professional discretion considers necessary to ascertain whether the work substantially complies in all material respects with the plans and supporting documents prepared by a *registered professional*.

Fill means *soil*, *rock*, rubble, industrial waste such as slag, organic material or a combination of these that is transported and placed on the natural surface of *soil* or *rock* or organic terrain. It may or may not be compacted.

Fire block means a material, component or system that restricts the spread of fire within a concealed space or from a concealed space to an adjacent space.

Fire compartment means an enclosed space in a *building* that is separated from all other parts of the *building* by enclosing construction providing a *fire separation* having a required *fire-resistance rating*.

Fire damper means a *closure* consisting of a damper that is installed in an air distribution system or a wall or floor assembly and that is normally held open but designed to close automatically in the event of a fire in order to maintain the integrity of the *fire separation*.

Fire detector means a device that detects a fire condition and automatically initiates an electrical signal to actuate an *alert signal* or *alarm signal* and includes *heat detectors* and *smoke detectors*.

Fire load (as applying to an *occupancy*) means the *combustible* contents of a room or *floor area* expressed in terms of the average weight of *combustible* materials per unit area, from which the potential heat liberation may be calculated based on the calorific value of the materials, and includes the furnishings, finished floor, wall and ceiling finishes, trim and temporary and movable *partitions*.

Fire-protection rating means the time in minutes or hours that a *closure* will withstand the passage of flame when exposed to fire under specified conditions of test and performance criteria, or as otherwise prescribed in this By-law.

Fire-resistance rating means the time in minutes or hours that a material or assembly of materials will withstand the passage of flame and the transmission of heat when exposed to fire under specified conditions of test and performance criteria, or as determined by extension or interpretation of information derived therefrom as prescribed in this By-law. (See D-1.2.1.(2) in Appendix D of Division B.)

Fire-retardant-treated wood means wood or a wood product that has had its surface-burning characteristics, such as flame spread, rate of fuel contribution and density of smoke developed, reduced by impregnation with fire-retardant chemicals.

Fire separation means a construction assembly that acts as a barrier against the spread of fire. (See Note A-1.4.1.2.(1).)

Fire stop means a system consisting of a material, component and means of support used to fill gaps between *fire separations* or between *fire separations* and other assemblies, or used around items that wholly or partially penetrate a *fire separation*.

Fire stop flap means a device intended for use in horizontal assemblies required to have a *fire-resistance rating* and incorporating protective ceiling membranes, which operates to close off a duct opening through the membrane in the event of a fire.

Firewall means a type of *fire separation* of *noncombustible construction* that subdivides a *building* or separates adjoining *buildings* to resist the spread of fire and that has a *fire-resistance rating* as prescribed in this By-law and has structural stability to remain intact under fire conditions for the required fire-rated time.

First storey means the uppermost *storey* having its floor level not more than 2 m above *grade*.

Fixture (as applying to plumbing) means a receptacle, appliance, apparatus or other device that discharges *sewage* or *clear-water waste*, and includes a *floor drain*.

Fixture outlet pipe means a pipe that connects the waste opening of a *fixture* to the *trap* serving the *fixture*. (See Book II, Division A, Figure A-1.4.1.2.(1)-H in Note A-1.4.1.2.(1).)

Flame-spread rating means an index or classification indicating the extent of spread-of-flame on the surface of a material or an assembly of materials as determined in a standard fire test as prescribed in this By-law.

Flammable liquid means a liquid having a *flash point* below 37.8°C and having a vapour pressure not more than 275.8 kPa (absolute) at 37.8°C as determined by ASTM D 323, "Vapor Pressure of Petroleum Products (Reid Method)."

Flash point means the minimum temperature at which a liquid within a container gives off vapour in sufficient concentration to form an ignitable mixture with air near the surface of the liquid.

Flight means a series of steps between landings. (See Note A-1.4.1.2.(1).)

Float home means any structure incorporating a floatation system, intended for use or occupancy or being used or occupied for residential purposes, containing one dwelling unit only, and not primarily intended for, or useable in, navigation, but does not include any *water craft* designed or intended for navigation.

Flood construction level means the minimum elevation of the underside of a floor system, or of the top of a concrete slab, of a building which is used or may be used for habitation, business, or for the storage of goods which may be damaged by flood water.

Flood construction level requirements means

(a) on the Burrard Inlet, English Bay, False Creek and Fraser River flood plains:

(i) for *buildings* located within the areas shown shaded or crosshatched on the map attached to this By-law, the underside of a floor system or the top of a concrete slab of a *buildings* used for habitation, business or storage of goods, shall not be lower than 4.6m Greater Vancouver Regional District datum.

(See Figure A-1.4.1.2.(1)-C for Diagram A1: Burrard Inlet, English Bay, False Creek and Fraser

River flood plains); and

(ii) for *buildings* located in the areas shown shaded or crosshatched on the map attached to this By-law, an additional elevation allowance above 4.6 m may be required for wave run-up, at a level as determined by a Professional Engineer and to the satisfaction of the *Chief Building Official*. (See Figure A-1.4.1.2.(1)-D for Diagram A2: Burrard Inlet, English Bay, False Creek and Fraser River flood plain wave effect zone); and

(b) on the Still Creek flood plain:

(i) the underside of a floor system or the top of a concrete slab of any *buildings* used for habitation, business or storage of goods shall not be lower than the applicable elevation shown on the map attached to this By-law. (See Figure A-1.4.1.2.(1)-E for Diagram B: Still Creek flood plain and *flood construction levels*.)

Floor area means the space on any *storey* of a *building* between exterior walls and required *firewalls*, including the space occupied by interior walls and *partitions*, but not including *exits*, *vertical service spaces*, and their enclosing assemblies.

Floor drain means a fixture used to receive water from the floor of a *building*.

Flue means an enclosed passageway for conveying *flue* gases.

Flue collar means the portion of a fuel-fired *appliance* designed for the attachment of the *flue pipe* or *breeching*.

Flue pipe means the pipe connecting the *flue collar* of an *appliance* to a *chimney*.

Forced-air furnace means a *furnace* equipped with a fan that provides the primary means for the circulation of air.

Foundation means a system or arrangement of *foundation units* through which the loads from a *building* are transferred to supporting *soil* or *rock*.

Foundation unit means one of the structural members of the *foundation* of a *building* such as a footing, raft or *pile*.

Frost action means the phenomenon that occurs when water in *soil* is subjected to freezing which, because of the water/ice phase change or ice lens growth, results in a total volume increase or the build-up of expansive forces under confined conditions or both, and the subsequent thawing that leads to loss of *soil* strength and increased compressibility.

Furnace means a *space-heating appliance* using warm air as the heating medium and usually having provision for the attachment of ducts.

Gas vent means that portion of a venting system designed to convey vent gases to the outdoors from the *vent connector* of a gas-fired *appliance* or directly from the *appliance* when a *vent connector* is not used.

General Manager, Park Board means the person appointed as such by the Park Board.

General Manager, Real Estate and Facilities Management means the person appointed as such by City Council.

Grade means the lowest of the average levels of finished ground adjoining each exterior wall of a *building*, except that localized depressions need not be considered in the determination of average levels of finished ground. (See *First storey* and Note A-1.4.1.2.(1).)

Greenhouse gases has the meaning attributed to it in section 559 of the Vancouver Charter.

Green roof means a structure constructed on top of a roof, which is designed to support the growth of vegetation and to capture rainwater.

Green roof assembly means the components of a green roof and includes a waterproof barrier which is impervious to root migration, a filtering layer, roof drainage, soil or other growing medium and plants, installed on top of a roof assembly.

Groundwater means a free standing body of water in the ground.

Groundwater level (groundwater table) means the top surface of a free standing body of water in the ground.

Group Residence means Group Residence as defined in the Zoning & Development By-law.

Guard means a protective barrier around openings in floors or at the open sides of stairs, landings, balconies, *mezzanines*, galleries, raised *walkways* or other locations to prevent accidental falls from one level to another. Such a barrier may or may not have openings through it.

Heat detector means a *fire detector* designed to operate at a predetermined temperature or rate of temperature rise.

Heavy timber construction means that type of *combustible construction* in which a degree of fire safety is attained by placing limitations on the sizes of wood structural members and on the thickness and composition of wood floors and roofs and by the avoidance of concealed spaces under floors and roofs.

Heritage building is a *building* which is legally protected or officially recognized as a heritage property by the Provincial government or the City, or a building that in the opinion of the City Building Inspector, has sufficient heritage value or heritage character to justify its conservation. (See Note A-1.1.1.1.(5).)

High-hazard industrial occupancy (Group F, Division 1) means an *industrial occupancy* containing sufficient quantities of highly *combustible* and flammable or explosive materials which, because of their inherent characteristics, constitute a special fire hazard.

Horizontal exit means an *exit* from one *building* to another by means of a doorway, vestibule, *walkway*, bridge or balcony.

Horizontal service space means a space such as an attic, duct, ceiling, roof or crawl space oriented essentially in a horizontal plane, concealed and generally inaccessible, through which *building* service facilities such as pipes, ducts and wiring may pass.

Impeded egress zone means a supervised area in which occupants have free movement but require the release, by security personnel, of security doors at the boundary before they are able to leave the area, but does not include a *contained use area*.

Indirect service water heater means a *service water heater* that derives its heat from a heating medium such as warm air, steam or hot water.

Industrial flex space means an industrial use which is located in a new building containing Group C major occupancies.

Industrial occupancy means the *occupancy* or use of a *building* or part thereof for the assembling, fabricating, manufacturing, processing, repairing or storing of goods and materials.

Interconnected floor space means superimposed *floor areas* or parts of *floor areas* in which floor assemblies that are required to be *fire separations* are penetrated by openings that are not provided with *closures*.

Journeyman plumber means a person, other than an *apprentice*, who holds a certificate issued pursuant to the provisions of the Industry Training Authority Act of British Columbia authorizing the person to engage in the plumbing trade.

Lane means a public thoroughfare or way not more than 10.1 m in width which affords only a secondary means of access to a site, at the side or rear.

Limiting distance means the distance from an *exposing building face* to a property line, the centre line of a *street*, lane or public thoroughfare, or to an imaginary line between 2 *buildings* or *fire compartments* on the same property, measured at right angles to the *exposing building face*.

Live load means a variable load due to the intended use and *occupancy* that is to be assumed in the design of the structural members of a *building*. It includes loads due to cranes and the pressure of liquids in containers.

Liveaboard vessel means any *water craft* intended primarily for use in navigation and used for residential purposes.

Loadbearing (as applying to a *building* element) means subjected to or designed to carry loads in addition to its own *dead load*, excepting a wall element subjected only to wind or earthquake loads in addition to its own *dead load*.

Low-hazard industrial occupancy (Group F, Division 3) means an *industrial occupancy* in which the *combustible* content is not more than 50 kg/m^2 or 1 200 MJ/m^2 of *floor area*.

Major occupancy means the principal *occupancy* for which a *building* or part thereof is used or intended to be used, and shall be deemed to include the subsidiary *occupancies* that are an integral part of the principal *occupancy*. The *major occupancy* classifications used in this By-law are as follows:

A1 – *Assembly occupancies* intended for the production and viewing of the performing arts
A2 – *Assembly occupancies* not elsewhere classified in Group A
A3 – *Assembly occupancies* of the arena type
A4 – *Assembly occupancies* in which the occupants are gathered in the open air
B1 – *Detention occupancies* in which persons are under restraint or are incapable of self-preservation because of security measures not under their control
B2 – *Treatment occupancies*
B3 – *Care occupancies*
C – *Residential occupancies*
D – *Business and personal services occupancies*
E – *Mercantile occupancies*
F1 – *High-hazard industrial occupancies*
F2 – *Medium-hazard industrial occupancies*
F3 – *Low-hazard industrial occupancies*

Marina means any structure or installation, including *marina walkways*, which provides moorage space for *water craft.*

Marina walkway means any surface extending over navigable water used to accommodate pedestrian traffic, and used so that *water craft* and *float homes* may lie alongside to receive and discharge cargo and passengers.

Marine toilet means any toilet on or within a *water craft.*

Masonry or concrete chimney means a *chimney* of brick, stone, concrete or masonry units constructed on site.

Means of egress means a continuous path of travel provided for the escape of persons from any point in a *building* or contained open space to a separate *building*, an open public thoroughfare, or an exterior open space protected from fire exposure from the *building* and having access to an open public thoroughfare. *Means of egress* includes *exits* and *access to exits*.

Mechanically vented (as applying to a fuel-fired space- or water-heating *appliance*) means an *appliance* and its combustion venting system in which the products of combustion are entirely exhausted to the outdoors by a mechanical device, such as a fan, blower or aspirator, upstream or downstream from the combustion zone of the *appliance*, and the portion of the combustion venting system that is downstream of the fan, blower or aspirator is sealed and does not include draft hoods or draft control devices. (See Note A-1.4.1.2.(1).)

Medium-hazard industrial occupancy (Group F, Division 2) means an *industrial occupancy* in which the *combustible* content is more than 50 kg/m^2 or 1 200 MJ/m^2 of *floor area* and not classified as a *high-hazard industrial occupancy*.

Mercantile occupancy means the *occupancy* or use of a *building* or part thereof for the displaying or selling of retail goods, wares or merchandise.

Mezzanine means an intermediate floor assembly between the floor and ceiling of any room or *storey* and includes an interior balcony.

Multi-family means a *residential occupancy* with more than two principal *dwelling units*.

Natural boundary means the visible high water mark of any lake, river, stream or other body of water where the presence and action of the water are so common and usual, and so long continued in all ordinary years, as to mark on the soil of the bed of the body of water a character distinct from that of its banks, in vegetation, as well as in the nature of the soil itself.

Noncombustible means that a material meets the acceptance criteria of CAN/ULC-S114, “Test for Determination of Non-Combustibility in Building Materials.”

Noncombustible construction means that type of construction in which a degree of fire safety is attained by the use of *noncombustible* materials for structural members and other *building* assemblies.

Occupancy means the use or intended use of a *building* or part thereof for the shelter or support of persons, animals or property.

Occupant load means the number of persons for which a *building* or part thereof is designed.

Open-air storey means a *storey* in which at least 25% of the total area of its perimeter walls is open to the outdoors in a manner that will provide cross-ventilation to the entire *storey*.

Operating permit means permission or authorization in writing by the *Chief Building Official* to install or retain existing equipment or systems for which an operating permit is required under this By-law.

Owner means a registered owner, a holder of an agreement for sale and purchase and, in the case of Crown-owned lands, owner shall mean the occupier.

Partition means an interior wall 1 *storey* or part-*storey* in height that is not *loadbearing*.

Party wall means a wall jointly owned and jointly used by 2 parties under easement agreement or by right in law, and erected at or upon a line separating 2 parcels of land each of which is, or is capable of being, a separate real-estate entity.

Perched groundwater means a free standing body of water in the ground extending to a limited depth.

Permit means permission or authorization in writing by the *Chief Building Official* to perform work regulated by this By-law and, in the case of an *occupancy permit*, to occupy any *building* or part thereof, but does not include an *operating permit*.

Persons with disabilities means persons who have a permanent or temporary physical, mental, intellectual or sensory impairment which, in interaction with various barriers, may hinder their full and effective participation in society on an equal basis with others. (See Note A-1.4.1.2.(1).)

Pile means a slender *deep foundation unit* made of materials such as wood, steel or concrete or a combination thereof, that is either premanufactured and placed by driving, jacking, jetting or screwing, or cast-in-place in a hole formed by driving, excavating or boring. (Cast-in-place bored *piles* are often referred to as *caissons* in Canada.)

Plenum means a chamber forming part of an air duct system.

Plumbing contractor means a person licensed as a *contractor* pursuant to the License By-law and who is either a plumber or a person who employs a plumber on a full time basis.

Plumbing system means a *drainage system*, a *venting system* and a *water system* or parts thereof. (See Book II, Division A, Figure A-1.4.1.2.(1)-L in Note A-1.4.1.2.(1).)

Post-disaster building means a *building* that is essential to the provision of services in the event of a disaster, and includes
- hospitals, emergency treatment facilities and blood banks,
- telephone exchanges,
- power generating stations and electrical substations,
- control centres for air, land and marine transportation,
- public water treatment and storage facilities, and pumping stations,
- sewage treatment facilities,
- *buildings* having critical national defence functions, and
- *buildings* of the following types, except *buildings* exempted from this designation by the *authority having jurisdiction*:
- emergency response facilities,
- fire, rescue and police stations and housing for vehicles, aircraft or boats used for such purposes, and
- communications facilities, including radio and television stations.

(See Note A-1.4.1.2.(1).)

Private sewage disposal system means a privately owned plant for the treatment and disposal of sewage (such as a septic tank with an absorption field).

Private water supply system means an assembly of pipes, fittings, valves, equipment and appurtenances that supplies water from a private source to a *water distribution system*.

Process plant means an *industrial occupancy* where materials, including *flammable liquids*, *combustible liquids*, or gases, are produced or used in a process. (See Table 3.2.7.1. of Division B of the Fire By-law)

Project means any *construction*, *alteration* or *demolition* operation.

Protected floor space means that part of a *floor area* protected from the effects of fire and used as part of a *means of egress* from an *interconnected floor space*.

Public bike share means a service that provides the general public with an opportunity to rent bicycles through an automated system, on a short term basis for use within the *City* as part of a network comprised of no fewer than 50 *public bike share stations* located on separate sites.

Public bike share station means a bicycle sharing facility where bicycles are stored and from which the general public may rent and return bicycles and other objects or equipment necessary for or appurtenant to the operation of a *public bike share*.

Public corridor means a corridor that provides *access to exit* from more than one *suite*. (See Note A-1.4.1.2.(1).)

Public way means a sidewalk, *street*, highway, square or other open space to which the public has access, as of right or by invitation, expressed or implied.

Pump-out facility means a device or method for the removal of sewage from a holding tank connected to a *marine toilet* or from a self-contained *marine toilet*.

Registered professional means

- a person who is registered or licensed to practise as an architect under the Architects Act, or
- a person who is registered or licensed to practise as a professional engineer under the Engineers and Geoscientists Act.

Registered professional of record means a *registered professional* retained to undertake design work and *field reviews* in accordance with Subsection 2.2.7. of Division C.

Re-occupancy permit means permission or authorization in writing by the *Chief Building Official* to re-occupy any *building* or part thereof in respect of which the *Chief Building Official* has issued an order to cease *occupancy* because of an *unsafe condition*.

Repair garage means a *building* or part thereof where facilities are provided for the repair or servicing of motor vehicles.

Residential occupancy means the *occupancy* or use of a *building* or part thereof by persons for whom sleeping accommodation is provided but who are not harboured for the purpose of receiving *care* or *treatment* and are not involuntarily detained.

Return duct means a duct for conveying air from a space being heated, ventilated or air-conditioned back to the heating, ventilating or air-conditioning *appliance*.

Rim joist means the outermost member in floor framing, other than blocking, be it parallel, perpendicular or on an angle to the floor joists. (See Note A-1.4.1.2.(1).)

Rock means that portion of the earth's crust that is consolidated, coherent and relatively hard and is a naturally formed, solidly bonded, mass of mineral matter that cannot readily be broken by hand.

Row housing means a *building* of *residential occupancy* where no *dwelling unit* is located above another *dwelling unit* and there is no common interior or exterior *means of egress*.

Run means the horizontal distance between two adjacent tread nosings on a stair. (See Figure A-9.8.4.-B in Note A-9.8.4. of Division B.)

Sanitary drainage system means a drainage system that conducts sewage.

Service room means a room provided in a *building* to contain equipment associated with *building* services. (See Note A-1.4.1.2.(1).)

Service space means space provided in a *building* to facilitate or conceal the installation of *building* service facilities such as chutes, ducts, pipes, shafts or wires.

Service water heater means a device for heating water for plumbing services.

Sewage means any liquid waste other than *clear-water waste* or *storm water*.

Sewage sump means an *approved* airtight tank or pit which receives sewage or liquid waste and which is located below the normal grade of the gravity system and must be emptied by mechanical means.

Sewer means an underground drain or conduit to remove waste water and organic refuse.

Shallow foundation means a *foundation unit* that derives its support from *soil* or *rock* located close to the lowest part of the *building* that it supports.

Single room accommodation means a room designated as accommodation pursuant to the Single Room Accommodation By-law.

Small suite means a *suite* classified as a Group A Division 2, Group D, Group E, Group F Division 2 (wholesale showroom) or Group F, Division 3 occupancy where the *occupant load* for the entire *suite* does not exceed 60 persons.

Smoke alarm means a combined *smoke detector* and audible alarm device designed to sound an alarm within the room or *suite* in which it is located upon the detection of smoke within that room or *suite*.

Smoke detector means a *fire detector* designed to operate when the concentration of airborne combustion products exceeds a predetermined level.

Soil means that portion of the earth's crust that is fragmentary, or such that some individual particles of a dried sample may be readily separated by agitation in water; it includes boulders, cobbles, gravel, sand, silt, clay and organic matter.

Solid masonry means a single wythe or multi-wythe construction made of *solid masonry units* or semi-solid, cored, or hollow masonry units, the cells of which may or may not be filled with mortar or grout. In multi-wythe masonry construction, the space between the wythes consists of a mortar-filled collar joint or grout-filled space and the wythes may or may not be constructed of the same masonry materials.

Solid masonry unit means a concrete block or brick unit, a clay brick unit, or calcium silicate brick unit whose net solid area is at least 75% of its gross area. (See Note A-1.4.1.2.(1).)

Sound transmission class (STC) means a single number rating of the airborne sound attenuation of a *building* assembly separating two adjoining spaces, taking into account the direct sound transmission path. (See Note A-1.4.1.2.(1).) (See also Note A-9.11. of Division B.)

Space heater means a *space-heating appliance* for heating the room or space within which it is located, without the use of ducts.

Space-heating appliance means an *appliance* intended for the supplying of heat to a room or space directly, such as a *space heater*, fireplace or *unit heater*, or to rooms or spaces of a *building* through a heating system such as a central *furnace* or *boiler*.

Sprinkler contractor means a person licensed as a *contractor* pursuant to the License By-law and who is either a *sprinkler system installer* or a person who employs a *sprinkler system installer* on a full-time basis.

Sprinkler system means an automatic fire extinguishing system designed to the National Fire Protection Association 13, 13D or 13R standard and all applicable associated sprinkler standards, and which consists of a system of devices and equipment designed to automatically detect a fire and discharge water or another approved fire extinguishing agent in the area of or onto a fire.

Sprinkler system installer means a person who has successfully completed an accredited program as a *Sprinkler System Installer* under the Industry Training Authority Act and Industry Training Regulation of British Columbia.

Sprinklered (as applying to a *building* or part thereof) means that the *building* or part thereof is equipped with a system of automatic sprinklers.

Stage means a space that is designed primarily for theatrical performances with provision for quick change scenery and overhead lighting, including environmental control for a wide range of lighting and sound effects and that is traditionally, but not necessarily, separated from the audience by a proscenium wall and curtain opening.

Storage garage means a *building* or part thereof intended primarily for the storage or parking of motor vehicles and containing no provision for the repair or servicing of such vehicles. (See Note A-1.4.1.2.(1).)

Storage-type service water heater means a *service water heater* with an integral hot water storage tank.

Storey means that portion of a *building* that is situated between the top of any floor and the top of the floor next above it, and if there is no floor above it, that portion between the top of such floor and the ceiling above it.

Storm water means water that is discharged from a surface as a result of rainfall or snowfall.

Stove means an *appliance* intended for cooking and space heating.

Street means a public road, highway, bridge, viaduct, *lane*, and sidewalk, and any other way normally open to the use of the public, but does not include a private right-of-way on private property and, for the purposes only of Part 3 and Part 9 of this By-law, a street which is less than 9 m in width or a *lane* or sidewalk.

Subsoil drainage pipe means a pipe that is installed underground to intercept and convey subsurface water.

Subsurface investigation means the appraisal of the general subsurface conditions at a *building* site by analysis of information gained by such methods as geological surveys, in situ testing, sampling, visual inspection, laboratory testing of samples of the subsurface materials and *groundwater* observations and measurements.

Suite means a single room or series of rooms of complementary use, operated under a single tenancy, and includes *dwelling units*, individual guest rooms in motels, hotels, boarding houses, rooming houses and dormitories as well as individual stores and individual or complementary rooms for *business and personal services occupancies*. (See Note A-1.4.1.2.(1).)

Sump means a receptacle installed between the storm or *combined sewer* and the *building* storm system to intercept the flow of debris into the *building* or public *sewer* and to prevent the outflow of *sewer* gas.

Supervisory staff means those occupants of a *building* who have some delegated responsibility for the fire safety of other occupants under the fire safety plan.

Supply duct means a duct for conveying air from a heating, ventilating or air-conditioning *appliance* to a space to be heated, ventilated or air-conditioned.

Temporary special event means a presentation of an artistic or cultural nature, including but not limited to visual, performing, media, literary, craft or interdisciplinary arts, for a maximum of 250 people, with or without liquor service, which occurs not more than two days per month in a *building* not approved for *assembly occupancy*.

Tapered tread means a tread with non-parallel edges that increases or decreases its *run* uniformly over its width. (See Note A-1.4.1.2.(1).)

Theatre means a place of public assembly intended for the production and viewing of the performing arts or the screening and viewing of motion pictures, and consisting of an auditorium with permanently fixed seats intended solely for a viewing audience.

Trades safety coordinator means an agent, employee or officer of a company supplying, installing or using materials at a *construction* site who has been trained to understand and apply safe *construction*, installation or *demolition* techniques, as applicable, respecting those materials and their relationship to the worksite, neighbouring property, public utilities and the general public.

Training school means a School-Arts or Self-Improvement, School – Business, or School - Vocational or Trade, as defined in the Zoning & Development By-law.

Trap means a fitting or device that is designed to hold a liquid seal that will prevent the passage of gas but will not materially affect the flow of a liquid.

Treatment means the provision of medical or other health-related intervention to persons, where the administration or lack of administration of these interventions may render them incapable of evacuating to a safe location without the assistance of another person. (See Note A-1.4.1.2.(1).)

Treatment occupancy means the *occupancy* or use of a *building* or part thereof for the provision of *treatment*, and where overnight accommodation is available to facilitate the *treatment*. (See Note A-1.4.1.2.(1).)

Unit heater means a suspended *space heater* with an integral air-circulating fan.

Unprotected opening (as applying to *exposing building face*) means a doorway, window or opening other than one equipped with a *closure* having the required *fire-protection rating*, or any part of a wall forming part of the *exposing building face* that has a *fire-resistance rating* less than that required for the *exposing building face*.

Unsafe condition means any condition that could cause undue hazard or risk to the life, limb or health of any person authorized, expected or anticipated to be on or about the premises, *building* or *construction*.

Unstable liquid means a liquid, including *flammable liquids* and *combustible liquids*, that is chemically reactive to the extent that it will vigorously react or decompose at or near normal temperature and pressure conditions or that is chemically unstable when subjected to impact.

Vapour barrier means the elements installed to control the diffusion of water vapour.

Vent connector (as applying to heating or cooling systems) means the part of a venting system that conducts the *flue* gases or vent gases from the *flue collar* of a gas *appliance* to the *chimney* or *gas vent*, and may include a draft control device.

Venting system means an assembly of pipes and fittings that connects a *drainage system* with outside air for circulation of air and the protection of trap seals in the *drainage system*. (See Book II, Division A, Figures A-1.4.1.2.(1)-F and A-1.4.1.2.(1)-G in Note A-1.4.1.2.(1).)

Vertical service space means a shaft oriented essentially vertically that is provided in a *building* to facilitate the installation of *building* services including mechanical, electrical and plumbing installations and facilities such as elevators, refuse chutes and linen chutes.

Walkway means a covered or roofed pedestrian thoroughfare used to connect 2 or more *buildings*.

Water craft means any boat, hull, barge, or houseboat which is afloat, whether self-propelled or not, and includes pleasure and commercial craft.

Water distribution system means an assembly of pipes, fittings, valves and appurtenances that conveys water from the *water service pipe* or *private water supply system* to water supply outlets, *fixtures*, appliances and devices.

Water service pipe means a pipe that conveys water from a public water main or private water source to the inside of the *building*.

Water system means a *private water supply system,* a *water service pipe*, a *water distribution system* or parts thereof.

1.4.2. Symbols and Other Abbreviations

1.4.2.1. Symbols and Other Abbreviations

1) The symbols and other abbreviations in this By-law shall have the meanings assigned to them in this Article and Article 1.3.2.1. of Division B.

1 in 2	slope of 1 vertical to 2 horizontal
cm	centimetre(s)
CRP	coordinating registered professional
°	degree(s)
°C	degree(s) Celsius
dBA	A-weighted sound level
diam	diameter
ERV	energy recovery ventilator
g	gram(s)
GHG	greenhouse gas
h	hour(s)
HDD	heating degree-day(s)
HRV	Heat Recovery Ventilator
HVAC	heating, ventilating and air-conditioning
Hz	hertz
Inc.	Incorporated
J	joule(s)
K	degree(s) Kelvin
kg	kilogram(s)
kN	kilonewton(s)
kPa	kilopascal(s)

kW	kilowatt(s)
kWh	kilowatt hour(s)
L	litre(s)
lx	lux
m	metre(s)
M	metric nomenclature for reinforcing bars
max.	maximum
mg	milligram(s)
min.	minimum
min	minute(s)
MJ	megajoule(s)
mm	millimetre(s)
MPa	megapascal(s)
N	newton
n/a	not applicable
ng	nanogram(s)
No.	number(s)
o.c.	on centre
OSB	oriented strandboard
Pa	pascal(s)
PM	particulate matter
ppb	part(s) per billion
ppm	part(s) per million
R	thermal resistance value (imperial unit)
RP	registered professional
RSI	thermal resistance value (metric unit)
s	second(s)
W	watt(s)
%	percent
μg	microgram(s)
μm	micrometre(s)
U-value	overall thermal transmittance
VBBL ………..	Vancouver Building By-law

Section 1.5. Referenced Documents and Organizations

1.5.1. Referenced Documents

1.5.1.1. Application of Referenced Documents

1) Except as provided in Sentence (2), the provisions of documents referenced in this By-law, and of any documents referenced within those documents, apply only to the extent that they relate to

a) *buildings*, and

b) the objectives and functional statements attributed to the applicable acceptable solutions in Division B where the documents are referenced.

(See Note A-1.5.1.1.(1).)

2) Where a provision of this By-law references the Fire By-law, the NECB, or Book II (Plumbing Systems) of this By-law, the applicable objectives and functional statements shall include those found in that referenced document. (See Note A-2.1.1.2.(6).)

1.5.1.2. Conflicting Requirements

1) In case of conflict between the provisions of this By-law and those of a referenced document, the provisions of this By-law shall govern.

1.5.1.3. Applicable Editions

1) Where documents are referenced in this By-law, they shall be the editions designated in Subsection 1.3.1. of Division B.

1.5.2. Organizations

1.5.2.1. Abbreviations of Proper Names

1) The abbreviations of proper names in this By-law shall have the meanings assigned to them in Article 1.3.2.1. of Division B.

Notes to Part 1
Compliance

A-1.1.1.1.(3) Factory-Constructed Buildings. The Building By-law applies the same requirements to site-built and factory-constructed buildings. However, it can often be difficult to determine whether a factory-constructed building complies with the By-law once it has been delivered to the construction site because many of the wall, roof and floor assemblies are closed in and so their components cannot be inspected. CSA A277, "Procedure for Factory Certification of Buildings," was developed to address this problem with regard to residential, commercial and industrial buildings. This standard describes a procedure whereby an independent certification agency can review the quality control procedures of a factory and make periodic unannounced inspections of its products. The standard is not a building code, only a procedure for certifying compliance of factory-constructed components with a building code or other standard. If a factory-constructed building bears the label of an accredited certification agency indicating that compliance with the National Building Code has been certified using the CSA A277 procedure, the accepting authority will have some assurance that the concealed components do not require re-inspection on site.
On the other hand, standards in the CSA Z240 MH Series, "Manufactured Homes," do resemble a building code. These portions contain requirements in many of the areas where the Building By-law also has requirements and frequently the requirements are different. Other portions of these requirements are different. Other portions of the Z240 standards deal with special requirements for manufactured homes related to the fact that these houses must be moved over roads, which is an issue the Building By-law does not address. The Building By-law considers mobile homes certified to the Z240 standard as acceptable housing and they are permitted under Clause 1.1.1.1.(2)(g).
The Building By-law does reference CSA Z240.10.1, "Site Preparation, Foundation, and Anchorage of Manufactured Homes," which is not actually part of the CSA Z240 MH Series. This standard contains requirements for surface foundations where buildings – not just houses – comply with the deformation resistance test provided in CSA Z240.2.1, "Structural Requirements for Manufactured Homes."

A-1.1.1.1.(5) Heritage Buildings. The City has identified conservation of selected heritage properties, or protection of the heritage character of certain areas, as being community planning objectives. The City's planning objectives and growth strategy encourage and support the retention of these properties and ways to make restoration and rehabilitation of heritage buildings economically viable for the properties' owners.
It is generally recognized that the present Building By-law was primarily written for new construction and provides for a performance level that is significantly higher than what exists with many older buildings. To apply present By-law provisions to existing buildings is, in many cases, impractical and with heritage buildings may compromise historic appearances or authenticity. Therefore, Section 11.5 was developed to provide alternate methods for complying with the performance level intended by the By-law. The use of sprinklers is advocated as one of the primary methods in assuring this performance level for heritage buildings. Sprinkler systems not only control the fire, which aids evacuation, but also provides the added benefit of protecting the building from possible destruction by fire.
Section 11.5. represents some of the ways that restoration and rehabilitation of heritage buildings can be facilitated without compromising the objectives of the By-law.

Only buildings which have been identified by the provincial or a local government are included in the definition of "heritage building." However, subject to the discretion of the Chief Building Official, buildings with character merit may also qualify under Section 3 of the Heritage By-law. For these buildings, conservation is also a public objective. Heritage buildings often offer unique problems and opportunities, and each situation must be assessed individually. The use of the Alternate Compliance Methods in Table A-1.1.1.5. is not mandatory, and an owner may choose

- to apply acceptable solutions in Division B,
- to apply alternate solutions under Clause 1.2.1.1.(1)(b),
- to apply alternate compliance methods in Table A-1.1.1.5., or
- to combine these options.

A-1.1.1.2.(1) Application to Existing Buildings. This By-law is most often applied to existing or relocated buildings when an owner wishes to rehabilitate a building, change its use, or build an addition, or when an enforcement authority decrees that a building or class of buildings be altered for reasons of public safety. It is not intended that the Building By-law be used to enforce the retrospective application of new requirements to existing buildings or existing portions of relocated buildings, unless specifically required by local regulations or bylaws. For example, although the Fire By-law could be interpreted to require the installation of fire alarm, standpipe and hose, and automatic sprinkler systems in an existing building for which there were no requirements at the time of construction, it is not intended that the Fire By-law be applied in this manner to these buildings unless the authority having jurisdiction has determined that there is an inherent threat to occupant safety and has issued an order to eliminate the unsafe condition, or where substantial changes or additions are being made to an existing building or the occupancy has been changed. (See also Note A-1.1.1.1.(1) of Division A of the Fire By-law.)

Relocated buildings that have been in use in another location for a number of years can be considered as existing buildings, in part, and the same analytical process can be applied as for existing buildings. It should be noted, however, that a change in occupancy may affect some requirements (e.g. loads and fire separations) and relocation to an area with different wind, snow or earthquake loads will require the application of current By-law requirements. Depending on the construction of the building and the changes in load, structural modifications may be required. Similarly, parts of a relocated or existing building that are reconstructed, such as foundations and basements, or parts being modified are required to be built to current codes.

Whatever the reason, By-law application to existing or relocated buildings requires careful consideration of the level of safety needed for that building. This consideration involves an analytical process similar to that required to assess alternative design proposals for new construction. See Clause 1.2.1.1.(1)(b) for information on achieving compliance with the By-law using alternative solutions.
In developing By-law requirements for new buildings, consideration has been given to the cost they impose on a design in relation to the perceived benefits in terms of safety. The former is definable; the latter difficult to establish on a quantitative basis. In applying the By-law requirements to an existing building, the benefits derived are the same as in new buildings. On the other hand, the increased cost of implementing in an existing building a design solution that would normally be intended for a new building may be prohibitive.
The successful application of By-law requirements to existing construction becomes a matter of balancing the cost of implementing a requirement with the relative importance of that requirement to the overall By-law objectives. The degree to which any particular requirement can be relaxed without affecting the intended level of safety of the By-law requires considerable judgment on the part of both the designer and the authority having jurisdiction.
Further information on the application of By-law requirements to existing or relocated buildings can be found in the following publications:

- “User’s Guide – NBC 1995, Fire Protection, Occupant Safety and Accessibility (Part 3)”
- “Guidelines for Application of Part 3 of the National Building Code of Canada to Existing Buildings”
- Commentary entitled “Application of NBC Part 4 of Division B for the Structural Evaluation and Upgrading of Existing Buildings” of the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)”
- “User’s Guide – NBC 1995, Application of Part 9 to Existing Buildings”
- CBD 230, “Applying Building Codes to Existing Buildings”

These publications can be ordered through NRC’s Web site.

A-1.2.1.1.(1)(a) By-law Compliance via Acceptable Solutions. If a building design (e.g. material, component, assembly or system) can be shown to meet all provisions of the applicable acceptable solutions in Division B (e.g. it complies with the applicable provisions of a referenced standard), it is deemed to have satisfied the objectives and functional statements linked to those provisions and thus to have complied with that part of the By-law. In fact, if it can be determined that a design meets all the applicable acceptable solutions in Division B, there is no need to consult the objectives and functional statements in Division A to determine its compliance.

A-1.2.1.1.(1)(b) By-law Compliance via Alternative Solutions. Where a design differs from the acceptable solutions in Division B, then it should be treated as an "alternative solution." A proponent of an alternative solution must demonstrate that the alternative solution addresses the same issues as the applicable acceptable solutions in Division B and their attributed objectives and functional statements. However, because the objectives and functional statements are entirely qualitative, demonstrating compliance with them in isolation is not possible. Therefore, Clause 1.2.1.1.(1)(b) identifies the principle that Division B establishes the quantitative performance targets that alternative solutions must meet. In many cases, these targets are not defined very precisely by the acceptable solutions – certainly far less precisely than would be the case with a true performance code, which would have quantitative performance targets and prescribed methods of performance measurement for all aspects of building performance. Nevertheless, Clause 1.2.1.1.(1)(b) makes it clear that an effort must be made to demonstrate that an alternative solution will perform as well as a design that would satisfy the applicable acceptable solutions in Division B – not "well enough" but "as well as."

In this sense, it is Division B that defines the boundaries between acceptable risks and the "unacceptable" risks referred to in the statements of the By-law's objectives, i.e. the risk remaining once the applicable acceptable solutions in Division B have been implemented represents the residual level of risk deemed to be acceptable by the broad base of Canadians who have taken part in the consensus process used to develop the By-law.

Level of Performance

Where Division B offers a choice between several possible designs, it is likely that these designs may not all provide exactly the same level of performance. Among a number of possible designs satisfying acceptable solutions in Division B, the design providing the lowest level of performance should generally be considered to establish the minimum acceptable level of performance to be used in evaluating alternative solutions for compliance with the By-law.

Sometimes a single design will be used as an alternative solution to several sets of acceptable solutions in Division B. In this case, the level of performance required of the alternative solution should be at least equivalent to the overall level of performance established by all the applicable sets of acceptable solutions taken as a whole.

Each provision in Division B has been analyzed to determine what it is intended to achieve. The resultant intent statements clarify what undesirable results each provision seeks to preclude. These statements are not a legal component of the By-law, but are advisory in nature, and can help By-law users establish performance targets for alternative solutions. They are published as part of the online By-law subscriptions and as a separate electronic document entitled "Supplement to the NBC 2015: Intent Statements," which is available on NRC's Web site. These intent statements should be cross referenced with the associated requirements of the Building By-law.

Areas of Performance

A subset of the acceptable solutions in Division B may establish criteria for particular types of designs (e.g. certain types of materials, components, assemblies, or systems). Often such subsets of acceptable solutions are all attributed to the same objective: Fire Safety for example. In some cases, the designs that are normally used to satisfy this subset of acceptable solutions might also provide some benefits that could be related to some other objective: Fire Protection of the Building for example. However, if none of the applicable acceptable solutions are linked to Objective OP1, Fire Protection of the Building, it is not necessary that alternative solutions proposed to replace these acceptable solutions provide a similar benefit related to Fire Protection of the Building. In other words, the acceptable solutions in Division B establish acceptable levels of performance for compliance with the By-law only in those areas defined by the objectives and functional statements attributed to the acceptable solutions.

Applicable Acceptable Solutions

In demonstrating that an alternative solution will perform as well as a design that would satisfy the applicable acceptable solutions in Division B, its evaluation should not be limited to comparison with the acceptable solutions to which an alternative is proposed. It is possible that acceptable solutions elsewhere in the By-law also apply. The proposed alternative solution may be shown to perform as well as the most apparent acceptable solution which it is replacing but may not perform as well as other relevant acceptable solutions. For example, an innovative sheathing material may perform adequately as sheathing in a wall system that is braced by other means but may not perform adequately as sheathing in a wall system where the sheathing must provide the structural bracing. All applicable acceptable solutions should be taken into consideration in demonstrating the compliance of an alternative solution.

A-1.2.1.2.(1) Responsibility of Owner. Sentence 1.1.1.1.(1) is not intended to imply that a person who becomes the owner of a building must bring the entire building into compliance with the By-law. The By-law applies only in the cases and to the extent specified by Article 1.1.1.1., and the owner of a building is therefore made responsible for ensuring the building complies with the By-law by Sentence 1.2.1.2.(1) only in the cases and to the extent specified by Article 1.1.1.1. and Part 11. If none of the provisions in Sentence 1.1.1.1.(1) and Part 11 apply to the building, the owner is not required to make any changes to the building.

A-1.3.3.4.(1) Buildings Divided by Firewalls. This concept relates to the provisions directly regulated by this By-law and does not apply to electrical service entrance requirements, which are regulated by other documents.

A-1.3.3.4.(2) & (3) Buildings on Sloping Sites. Application of the definition of grade to stepped buildings on sloping sites often results in such buildings being designated as being greater than 4 storeys in building height even though there may be only 2, 3 or 4 storeys at any one location. Figure A-1.3.3.4.(2)-A illustrates this application compared to a similar building on a flat site.

Under Sentence 1.3.3.4.(2), Building A can be considered as being 4 storeys in building height instead of 7 storeys in building height. Both Building A and B are comparable with regard to fire safety and egress.

This relaxation applies to the determination of building height only. All other requirements continue to apply as appropriate.

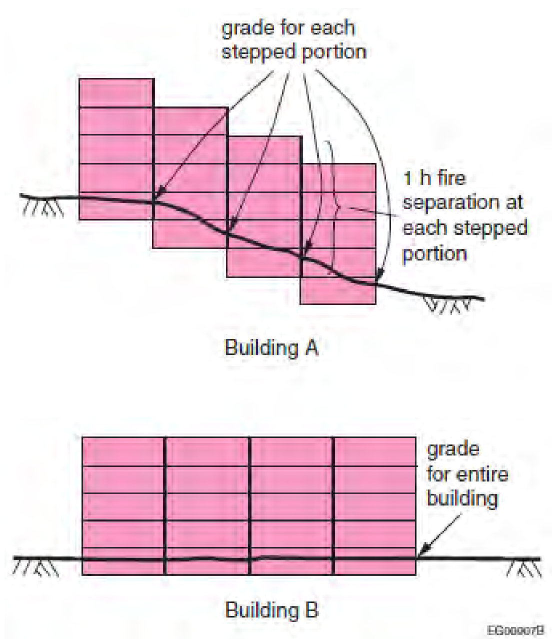


Figure A-1.3.3.4.(2)-A
Application of the definition of grade

Larger buildings also have significant challenges due to sloping sites

Figure A-1.3.3.4.(2)-B illustrates this application of Sentence (3). Under Sentence 1.3.3.4.(2), Building A and B can be considered separately as these would have a level of fire safety and egress comparable with buildings constructed as separate entities.

As with the 4 storey case, this relaxation applies to the determination of building height only. All other requirements continue to apply as appropriate.

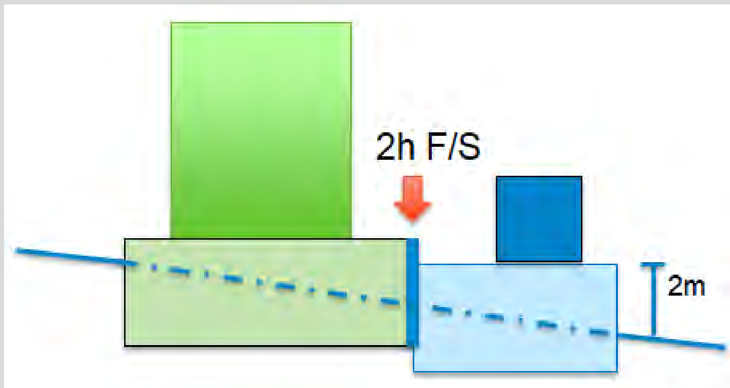


Figure A-1.3.3.4.(2)-B
Application of the definition of grade for physically separate components

A-1.3.3.6.(2)(k) Portable Classroom Exemption This exemption is based on the following considerations
• the building area is less than 100 m2 in building area and each unit is provided with exiting directly to the exterior,
• the building is constructed with smoke detection in all major rooms and with adequate portable fire extinguishers,
• the building is properly supervised with a practised and drilled fire safety plan and with supervisory staff fully trained in securing the rapid evacuation of the facilities upon initiation of any alarm device, and
• the building, its construction type and any required fire ratings are otherwise in full conformance with the requirements of the By-law.

A-1.4.1.2.(1) Defined Terms.

Access or Accessible and Persons with Disabilities

The terms “access” or “accessible” and the term “persons with disabilities” are revised in this edition of the By-law for greater alignment with the United Nations (UN) Convention on the Rights of Persons with Disabilities. This does not alter the objectives and functional statements attributed to the provisions of this By-law regarding access for persons with disabilities. The revised definitions are to provide greater clarity as to why the By-law applies requirements the way it does.

ASTC and STC

The higher the ASTC or STC rating, the more the assembly or the system of assemblies protects occupants from noise in adjacent spaces.
These ratings, which are determined in accordance with ASTM E 413, “Classification for Rating Sound Insulation,” roughly describe the noise reduction in decibels (dB) provided by the separating floor or wall, or in the case of the ASTC rating, by the system of separating and adjoining walls and floors. For example, where an 80 dB sound on one side of a wall/floor/ceiling is reduced to 30 dB on the other side, that partition is said to have an STC of 50.
The dB scale is a logarithmic one and the human ear perceives a 10 dB reduction in sound as roughly halving the volume: for example, a 40 dB noise, subjectively, seems half as loud as a 50 dB one.

Care Occupancy
Support services rendered by or through care facility management refer to services provided by the organization that is responsible for the care for a period exceeding 24 consecutive hours. They do not refer to services provided by residents of dwelling units or suites, or to services arranged directly by residents of dwelling units or suites with outside agencies.
In the context of care occupancies, these services may include a daily assessment of the resident's functioning, awareness of their whereabouts, the making of appointments for residents and reminding them of those appointments, the ability and readiness to intervene if a crisis arises for a resident, supervision in areas of nutrition or medication, and provision of transient medical services. Services may also include activities of daily living such as bathing, dressing, feeding, and assistance in the use of washroom facilities, etc. No actual treatment is provided by or through care facility management.

Dangerous Goods
In previous editions of the Building By-law, the terminology used to identify dangerous goods came from TC SOR/2008-34, "Transportation of Dangerous Goods Regulations (TDGR)." The TDGR apply solely to the adequate identification of hazards related to dangerous goods in the contexts of transportation and emergency response.

Dangerous goods in the workplace are identified in accordance with the "Workplace Hazardous Materials Information System (WHMIS)," established in accordance with the "*Hazardous Products Act*." The WHMIS identification system is specifically designed with the users of the product in mind.

This edition of the Building By-law identifies dangerous goods as products regulated by the TDGR or classified under the WHMIS. In order to harmonize these two nomenclatures for dangerous goods, class descriptors were developed taking into consideration both the TDGR and WHMIS classification systems. The proposed nomenclature introduces a descriptive approach to classifying dangerous goods, which is similar to the one proposed by the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) developed by the United Nations (UN). Canada has actively participated in the development of the GHS and has committed to its implementation through the TDGR and WHMIS regulations.

The Building By-law 2019 nomenclature takes a common sense approach that corresponds more closely to how people refer to dangerous goods on a daily basis, blending TDGR and WHMIS terminology without using nondescript numbers and letters as previously found in the Building By-law, TDGR and WHMIS.

Table A-1.4.1.2.(1)
UN, TDGR, WHMIS and Building By-law Class Descriptors for Dangerous Goods

UN	TDGR	WHMIS	Building By-law 2019
1	Explosives	Explosives	Explosives
2	Gases	Gases under pressure	Compressed gases
2.1	Flammable gases	Flammable gases; Flammable aerosols	Flammable gases; Flammable aerosols
2.2	Non-flammable, non-toxic gases	Gases under pressure	Non-flammable, non-toxic gases
2.2 (5.1)	–	Oxidizing gases	Oxidizing gases
2.3	Toxic gases	–	Toxic gases

3	Flammable liquids	Flammable liquids	Flammable liquids
4.1	Flammable solids	Flammable solids	Flammable solids
4.2	Substances liable to spontaneous combustion	Pyrophoric liquids; pyrophoric solids	Pyrophoric materials
4.3	Water-reactive substances	Substances and mixtures which, in contact with water, emit flammable gases	Water-reactive substances
5.1	Oxidizing substances	Oxidizing liquids; oxidizing solids	Oxidizers
5.2	Organic peroxides	Organic peroxides	Organic peroxides
6.1	Toxic substances	(1)	Toxic substances
6.2	Infectious substances	(1)	Infectious materials
7	Radioactive materials	Not covered by GHS	Radioactive materials
8	Corrosives	(2)	Corrosives
9	Miscellaneous products, substances, or organisms	(2)	Miscellaneous dangerous goods
–	–	Previously Class F	Dangerously reactive materials

Notes to Table A-1.4.1.2.(1):
(1) The WHMIS has various descriptors for this Class of products based on their toxicity.
(2) The WHMIS has various descriptors for this Class of products based on the nature of the danger presented by the product.

Designated Flood Plain
The Burrard Inlet, English Bay, False Creek and Fraser River flood plains are illustrated on Diagram A1 and the wave effect zones are illustrated on Diagram A2. See Figure A-1.4.1.2.(1)-C and Figure A-1.4.1.2.(1)-D.

The Still Creek flood plain is illustrated on Figure A-1.4.1.2.(1)-E.

Exit
Exits include doors or doorways leading directly into an exit stair or directly to the outside. In the case of an exit leading to a separate building, exits also include vestibules, walkways, bridges or balconies.

Farm Building
Farm buildings as defined in Article 1.4.1.2. include, but are not limited to, produce storage and packing facilities, livestock and poultry housing, milking centres, manure storage facilities, grain bins, silos, feed preparation centres, farm workshops, greenhouses, farm retail centres, and horse riding, exercise and training facilities. Farm buildings may be classed as low or high human occupancy, depending on the occupant load.
Examples of farm buildings likely to be classed as low human occupancy as defined in Article 1.2.1.2. of the National Farm Building Code of Canada are livestock and poultry housing, manure and machinery storage facilities and horse exercise and training facilities where no bleachers or viewing area are provided.
Examples of farm buildings that would be classed as other than low human occupancy include farm retail centres for feeds, horticultural and livestock produce, auction barns and show areas where bleachers or other

public facilities are provided. Farm work centres where the number of workers frequently exceeds the limit for low human occupancy will also be in this category.

It is possible to have areas of both high and low human occupancy in the same building provided that the structural safety and fire separation requirements for high human occupancy are met in the part thus designated.

Fire Separation
It is generally understood that the term “fire” refers to all products of combustion, including heat and smoke. Although a fire separation is not always required to have a fire-resistance rating, it should act as a barrier to the spread of smoke and fire until some type of response is initiated. If the fire-resistance rating of a fire separation is permitted to be waived on the basis of the presence of an automatic sprinkler system, it is nonetheless the intent of the By-law that the fire separation be constructed so that it will remain in place and act as a barrier against the spread of smoke until the sprinklers have actuated.

Flight

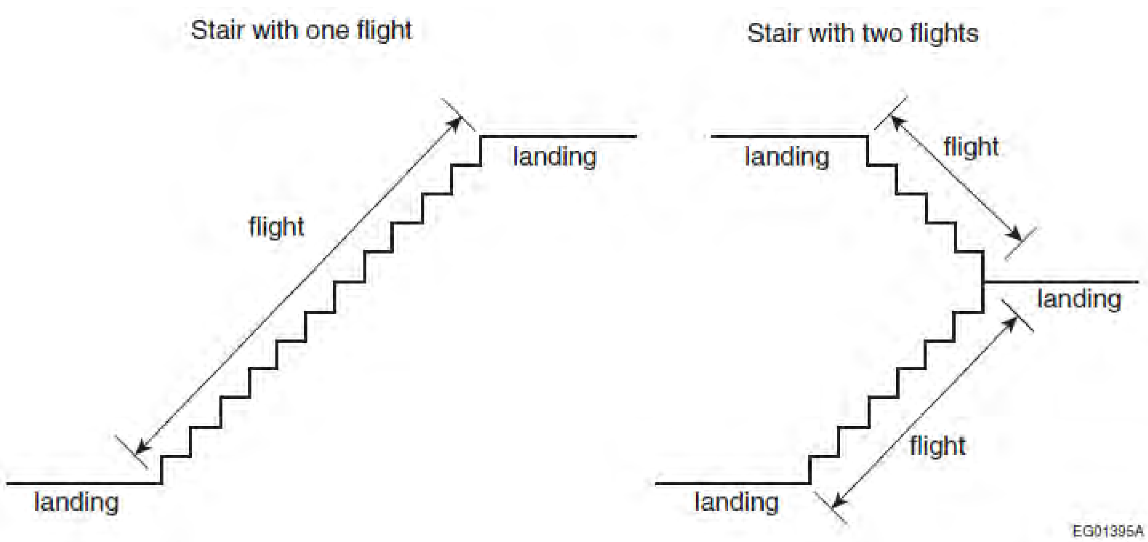


Figure A-1.4.1.2.(1)-A
Flight

Flood Construction Level Requirements
The Burrard Inlet, English Bay, False Creek and Fraser River flood plains are illustrated on Diagram A1 and the wave effect zones are illustrated on Diagram A2. See Figure A-1.4.1.2.(1)-C and Figure A-1.4.1.2.(1)-D.

The Still Creek flood construction levels are illustrated on Figure A-1.4.1.2.(1)-E.

Grade
Localized depressions that need not be considered in the determination of the elevation of grade include such features as vehicle and pedestrian entrances and other minor depressions that do not affect accessibility for firefighting or evacuation.

Heritage Building
Heritage buildings are buildings that are legally recognized by the Province or the City as having historic, architectural or cultural value the community. To qualify as a heritage building under the Vancouver Building By-law, a building must be:
• protected as heritage property by the Province under the Heritage Conservation Act or the Park Act;

• subject to a heritage designation bylaw pursuant to the Municipal Act or Vancouver Charter;
• listed in the Provincial heritage register or in an inventory of heritage buildings maintained for this purpose under section 20(1)(h) of the Heritage Conservation Act.
Despite this definition of Heritage Buildings, the Chief Building Official may accept a lesser standard.

Mechanically Vented
The definition of this term is intended to include all types of appliances and venting systems that rely entirely on fans to evacuate the products of combustion. Systems variously referred to as "forced draft," "power vented" and "induced draft" in standards and industry terminology may be covered by this definition. The key characteristic of such systems is that they are more resistant to depressurization-induced spillage of combustion products into the building in which they are housed because the combustion venting system downstream of the fan is "sealed," i.e. includes no draft hood or draft control device.

Post-disaster Building
There may be circumstances where the Chief Building Official would choose to exempt certain types of buildings or parts thereof from being designated as post-disaster buildings in order to permit them to be governed by Part 9 rather than by the rest of the By-law. Such is the case in the following examples: an ambulance that is stored at a volunteer's residence or a police station that is housed in a small shopping mall. The circumstances where such exemptions are permitted are intentionally limited by the definition of post-disaster building.

Public Corridor
A covered mall is considered to be a public corridor and, as such, is subject to the same requirements as a public corridor.

Rim Joist
In the field, rim joists may also be referred to as rim boards, headers or header joists.

Service Room
Typical examples of service rooms include boiler rooms, furnace rooms, incinerator rooms, garbage handling rooms and rooms to accommodate air-conditioning or heating appliances, pumps, compressors and electrical equipment. Rooms such as elevator machine rooms and common laundry rooms are not considered to be service rooms.

Solid Masonry Units
The net solid area of a masonry unit is calculated by determining the gross area of the bed face of the unit (L × T) and subtracting the cumulative areas of the hollow portions. As long as the total area of the hollow portions is 25% or less of the gross area, the unit is considered to be a solid masonry unit.

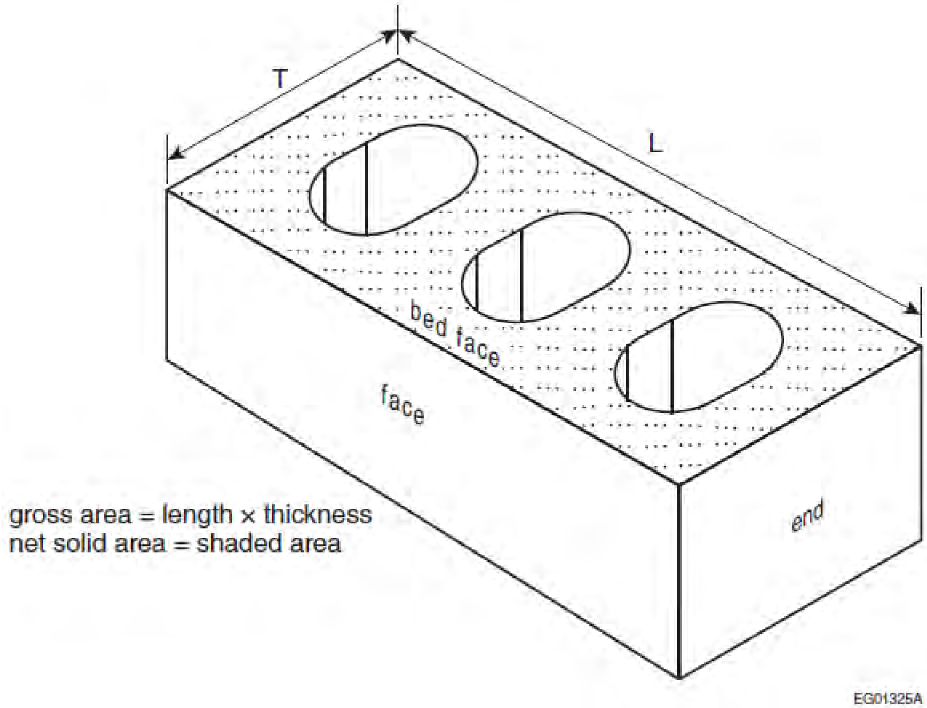


Figure A-1.4.1.2.(1)-B
Net solid area of masonry unit

Storage Garage

Entrances at which vehicles stop for a short time beneath an unenclosed canopy to pick up and drop off passengers are not considered as storage garages. As a subsidiary use, storage garages may also contain space for parking or storing other vehicles (bicycles, boat, etc.).

Suite

Tenancy in the context of the term "suite" applies to both rental and ownership tenure. In a condominium arrangement, for example, dwelling units are considered separate suites even though they are individually owned. In order to be of complementary use, a series of rooms that constitute a suite must be in reasonably close proximity to each other and have access to each other either directly by means of a common doorway or indirectly by a corridor, vestibule or other similar arrangement.

The term "suite" does not apply to rooms such as service rooms, common laundry rooms and common recreational rooms that are not leased or under a separate tenure in the context of the By-law. Similarly, the term "suite" is not normally applied in the context of buildings such as schools and hospitals, since the entire building is under a single tenure. However, a room that is individually rented is considered a suite. A warehousing unit in a mini-warehouse is a suite. A rented room in a nursing home could be considered as a suite if the room was under a separate tenure. A hospital bedroom on the other hand is not considered to be under a separate tenure, since the patient has little control of that space, even though he pays the hospital a per diem rate for the privilege of using the hospital facilities, which include the sleeping areas.

For certain requirements in the By-law, the expression "room or suite" is used (e.g., travel distance). This means that the requirement applies within the rooms of suites as well as to the suite itself and to rooms that may be located outside the suite. In other places the expression "suite, and rooms not located within a suite" is used (e.g., for the installation of smoke and heat detectors). This means that the requirement applies to individual suites as defined, but not to each room within the suite. The rooms "not within a suite" would include common laundry rooms, common recreational rooms and service rooms, which are not considered as tenant-occupied space.

Tapered Tread
The definition of tapered tread includes treads in curved stairs and treads in winder stairs, However, requirements for winders differ from those for other tapered treads. Requirements for tapered treads are found in Articles 3.3.1.16., 3.4.6.9., and 9.8.4.3. of Division B. Requirements for winders are found in Article 9.8.4.6. of Division B.

Treatment
The ability to evacuate unassisted implies that a person is capable of recognizing and responding to an emergency given their physical, cognitive and behavioural abilities, and able to move to a safe location without the assistance of another person. For example, such persons must be able to arise and walk, or transfer from a bed or chair to a means of mobility, and leave the building or move to a safe location on their own.

Treatment Occupancy
"Treatments" may include such things as surgery, intensive care, and emergency medical intervention. Treatment services differ from the services provided by care occupancies like personal care assistance or the administration of medication, and from those provided by business and personal services occupancies like dentistry or day procedures.

Illustrations for Defined Terms

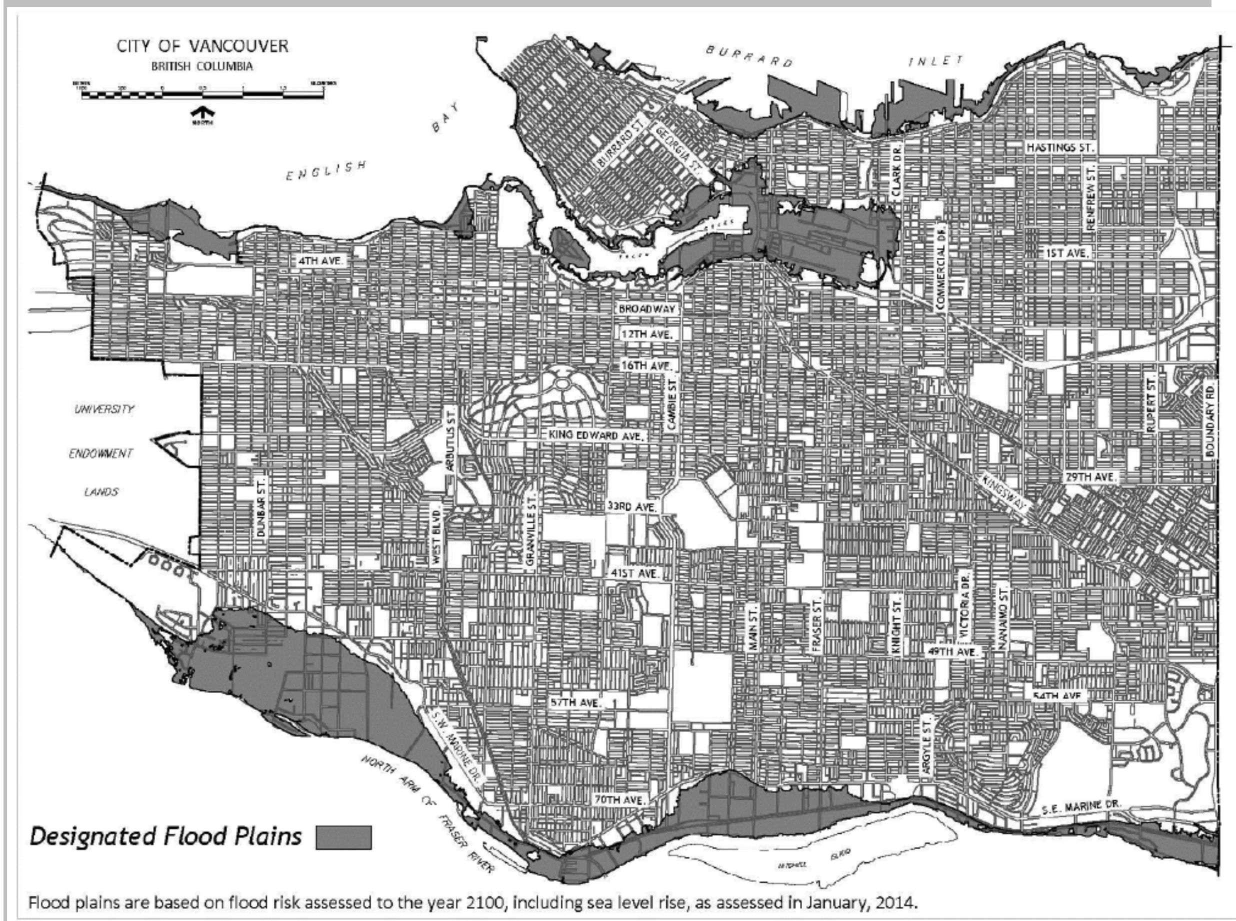


Figure A-1.4.1.2.(1)-C

Diagram A1: Burrard Inlet, English Bay, False Creek and Fraser River Flood Plains

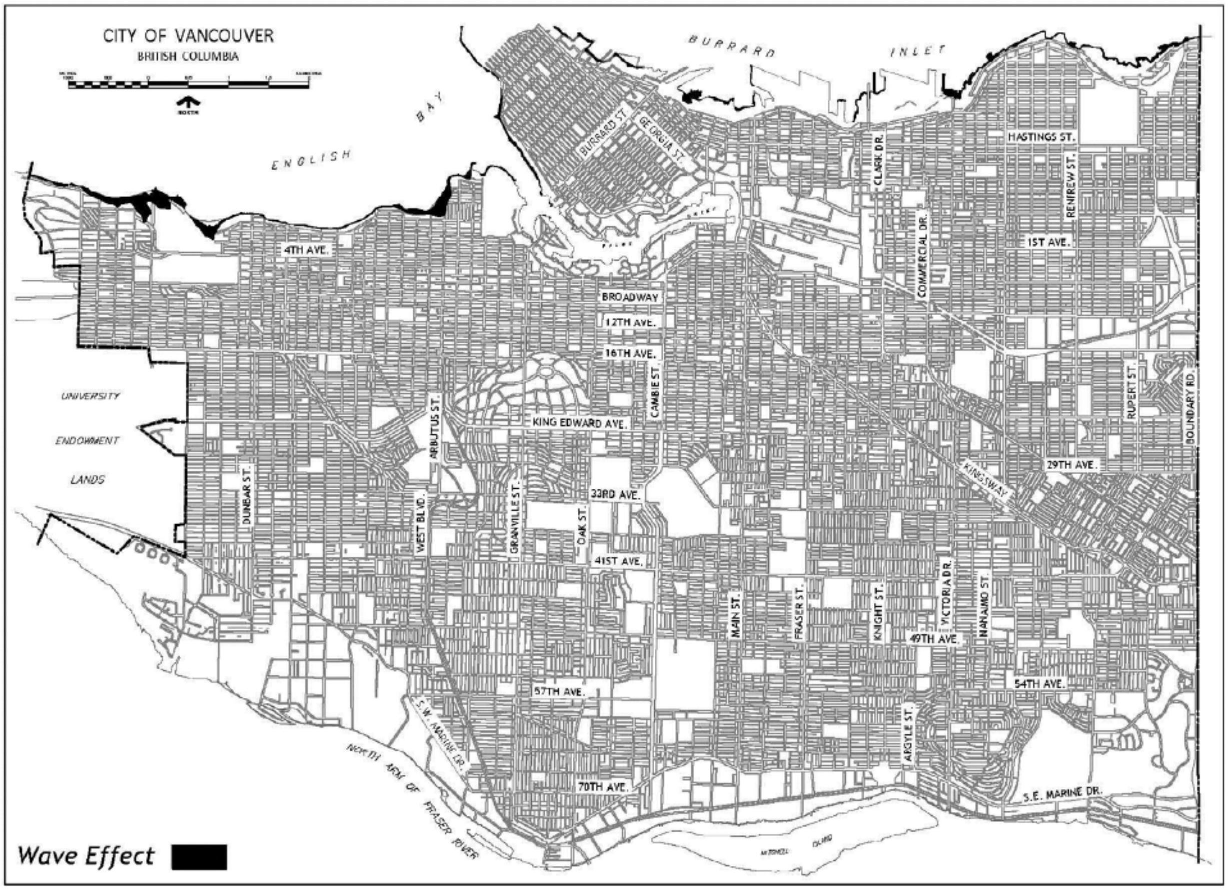


Figure A-1.4.1.2.(1)-D
Diagram A2: Burrard Inlet, English Bay, False Creek and Fraser River Flood Plain Wave Effect Zone

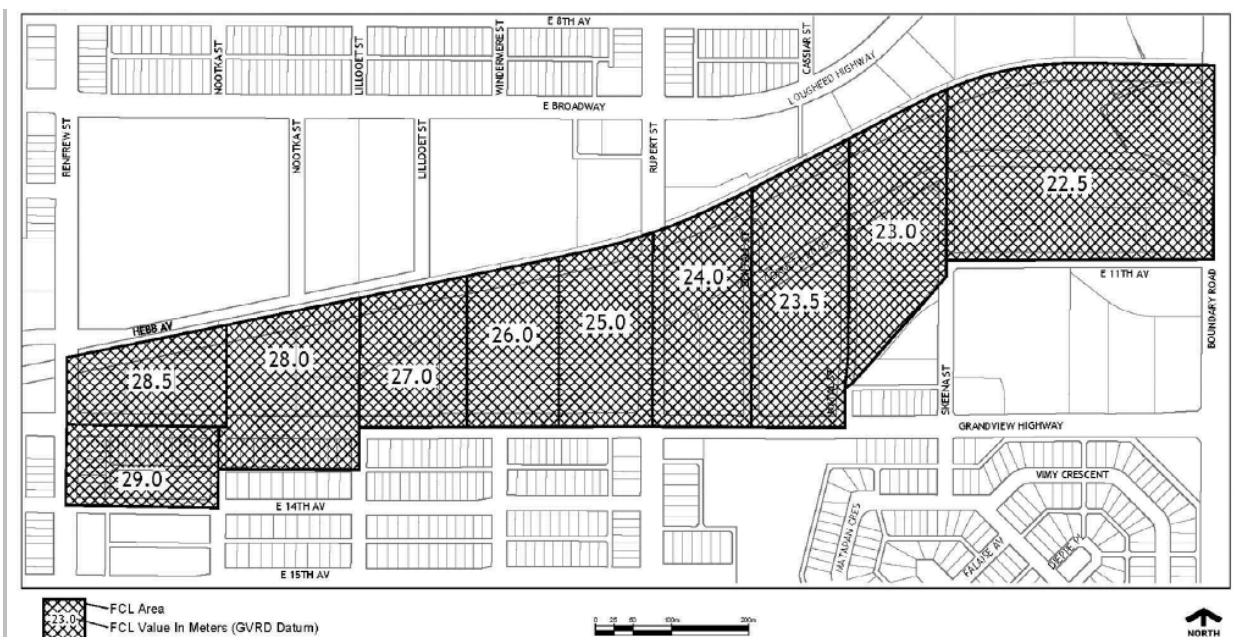


Figure A-1.4.1.2.(1)-E
Diagram B: Still Creek Flood Plain and Flood Construction Levels

A-1.5.1.1.(1) Application of Referenced Documents. Documents referenced in the Building By-law may contain provisions covering a wide range of issues, including issues that are unrelated to the objectives and functional statements stated in Parts 2 and 3 of Division A respectively; e.g. aesthetic issues such as colour-fastness or uniformity. Sentence 1.5.1.1.(1) is intended to make it clear that, whereas referencing a document in the By-law generally has the effect of making the provisions of that document part of the By-law, provisions that are unrelated to buildings or to the objectives and functional statements attributed to the provisions in Division B where the document is referenced are excluded.

Furthermore, many documents referenced in the By-law contain references to other documents, which may also, in turn, refer to other documents. These secondary and tertiary referenced documents may contain provisions that are unrelated to buildings or to the objectives and functional statements of the By-law: such provisions – no matter how far down the chain of references they occur – are not included in the intent of Sentence 1.5.1.1.(1).

Part 2
Objectives

Section 2.1. Application

2.1.1. Application

2.1.1.1. Application

1) This Part applies to all *buildings* covered in this By-law. (See Article 1.1.1.1.)

2.1.1.2. Application of Objectives

(See Note A-2.2.1.1.(1).)

1) Except as provided in Sentences (2) to (6), the objectives described in this Part apply
a) to all *buildings* covered in this By-law (See Article 1.1.1.1.), and
b) only to the extent that they relate to compliance with this By-law as required in Article 1.2.1.1.

2) Objective OS4, Resistance to Unwanted Entry, applies only to *dwelling units* or commonly accessible facilities serving multifamily dwelling units. (See Article 1.3.3.3.)

3) Objective OH3, Noise Protection, applies only to *dwelling units*.

4) Objective OH5, Hazardous Substances Containment, applies only to the extent defined in
a) Book II, (Plumbing Systems) of this By-law, and
b) the Fire By-law.

5) Objective OA, Accessibility (including Objectives OA1, Accessible Path of Travel, and OA2, Accessible Facilities), does not apply to
a) *dwelling units*, row houses, boarding houses, lodging houses and construction camps, except as required by
i) Article 3.8.2.12. of Division B, or
ii) Subsection 3.8.5. of Division B,
b) apartment and condominium *buildings* except to the extent described in Subsection 3.8.2. of Division B,
c) *high-hazard industrial occupancies*
d) *buildings* that are not intended to be occupied on a daily or full-time basis, including automatic telephone exchanges, pump houses and substations,
e) public toilet *buildings* described in Clause 3.8.2.1.(1)(e) of Division B, and
f) the *storeys* described in Clauses 3.8.2.1.(1)(f) and (g) of Division B.

6) Objective OE, Environment, applies only to
a) *buildings* of *residential occupancy* to which Part 9 of Division B applies,
b) *buildings* containing *business and personal services*, *mercantile* or *low-hazard industrial occupancies* to which Part 9 of Division B applies whose combined total *floor area* does not exceed 300 m^2, and
c) *buildings* containing a mix of the *residential* and non-*residential occupancies* described in Clauses (a) and (b).

(See also Article 1.3.3.3.)

Section 2.2. Objectives

2.2.1. Objectives

2.2.1.1. Objectives

1) The objectives of this By-law are as follows (See Note A-2.2.1.1.(1).):

OS Safety

An objective of this By-law is to limit the probability that, as a result of the design, construction or demolition of the *building*, a person in or adjacent to the *building* will be exposed to an unacceptable risk of injury.

OS1 Fire Safety

An objective of this By-law is to limit the probability that, as a result of the design or construction of the *building*, a person in or adjacent to the *building* will be exposed to an unacceptable risk of injury due to fire. The risks of injury due to fire addressed in this By-law are those caused by –

OS1.1 – fire or explosion occurring
OS1.2 – fire or explosion impacting areas beyond its point of origin
OS1.3 – collapse of physical elements due to a fire or explosion
OS1.4 – fire safety systems failing to function as expected
OS1.5 – persons being delayed in or impeded from moving to a safe place during a fire emergency

OS2 Structural Safety

An objective of this By-law is to limit the probability that, as a result of the design or construction of the *building*, a person in or adjacent to the *building* will be exposed to an unacceptable risk of injury due to structural failure. The risks of injury due to structural failure addressed in this By-law are those caused by –

OS2.1 – loads bearing on the *building* elements that exceed their *loadbearing* capacity
OS2.2 – loads bearing on the *building* that exceed the *loadbearing* properties of the supporting medium
OS2.3 – damage to or deterioration of *building* elements
OS2.4 – vibration or deflection of *building* elements
OS2.5 – instability of the *building* or part thereof
OS2.6 – collapse of the *excavation*

OS3 Safety in Use

An objective of this By-law is to limit the probability that, as a result of the design or construction of the *building*, a person in or adjacent to the *building* will be exposed to an unacceptable risk of injury due to hazards. The risks of injury due to hazards addressed in this By-law are those caused by –

OS3.1 – tripping, slipping, falling, contact, drowning or collision
OS3.2 – contact with hot surfaces or substances
OS3.3 – contact with energized equipment
OS3.4 – exposure to hazardous substances
OS3.5 – exposure to high levels of sound from fire alarm systems
OS3.6 – persons becoming trapped in confined spaces
OS3.7 – persons being delayed in or impeded from moving to a safe place during an emergency (See Note A-2.2.1.1.(1).)

OS4 Resistance to Unwanted Entry

An objective of this Cod By-law e is to limit the probability that, as a result of the design or construction of the *building*, a person in the *building* will be exposed to an unacceptable risk of injury due to the *building's* low level of resistance to unwanted entry (See Sentence 2.1.1.2.(2) for application limitation). The risks of injury due to unwanted entry addressed in this By-law are those caused by –

- OS4.1 – intruders being able to force their way through locked doors or windows
- OS4.2 – occupants being unable to identify potential intruders as such
- OS4.3 – intruders being able to force their way through physical security features

OS5 Safety at Construction and Demolition Sites

An objective of this By-law is to limit the probability that, as a result of the construction or demolition of the *building*, the public adjacent to a construction or demolition site will be exposed to an unacceptable risk of injury due to hazards. The risks of injury due to construction and demolition hazards addressed in this By-law are those caused by –

- OS5.1 – objects projected onto *public ways*
- OS5.2 – vehicular accidents on *public ways*
- OS5.3 – damage to or obstruction of *public ways*
- OS5.4 – water accumulated in *excavations*
- OS5.5 – entry into the site
- OS5.6 – exposure to hazardous substances and activities
- OS5.7 – loads bearing on a covered way that exceed its *loadbearing* capacity
- OS5.8 – collapse of the *excavation*
- OS5.9 – persons being delayed in or impeded from moving to a safe place during an emergency (See Note A-2.2.1.1.(1).)

OH Health

An objective of this By-law is to limit the probability that, as a result of the design or construction of the *building*, a person will be exposed to an unacceptable risk of illness.

OH1 Indoor Conditions

An objective of this By-law is to limit the probability that, as a result of the design or construction of the *building*, a person in the *building* will be exposed to an unacceptable risk of illness due to indoor conditions. The risks of illness due to indoor conditions addressed in this By-law are those caused by –

- OH1.1 – inadequate indoor air quality
- OH1.2 – inadequate thermal comfort
- OH1.3 – contact with moisture

OH2 Sanitation

An objective of this By-law is to limit the probability that, as a result of the design or construction of the *building*, a person in the *building* will be exposed to an unacceptable risk of illness due to unsanitary conditions. The risks of illness due to unsanitary conditions addressed in this By-law are those caused by –

- OH2.1 – exposure to human or domestic waste
- OH2.2 – consumption of contaminated water
- OH2.3 – inadequate facilities for personal hygiene
- OH2.4 – contact with contaminated surfaces
- OH2.5 – contact with vermin and insects

OH3 Noise Protection

An objective of this By-law is to limit the probability that, as a result of the design or construction of the *building*, a person in the *building* will be exposed to an unacceptable risk of illness due to high levels of sound originating in adjacent spaces in the *building* (See Sentence 2.1.1.2.(3) for application limitation). The risks of illness due to high levels of sound addressed in this By-law are those caused by –

OH3.1 – exposure to airborne sound transmitted through assemblies separating *dwelling units* from adjacent spaces in the *building*

OH4 Vibration and Deflection Limitation

An objective of this By-law is to limit the probability that, as a result of the design or construction of the *building*, a person in the *building* will be exposed to an unacceptable risk of illness due to high levels of vibration or deflection of *building* elements.

OH5 Hazardous Substances Containment

An objective of this By-law is to limit the probability that, as a result of the design or construction of the *building*, the public will be exposed to an unacceptable risk of illness due to the release of hazardous substances from the *building* (See Sentence 2.1.1.2.(4) for application limitation).

OA Accessibility

An objective of this By-law is to limit the probability that, as a result of the design or construction of the *building*, *persons with disabilities* will be unacceptably impeded from accessing or using the *building* or its facilities (See Sentence 2.1.1.2.(5) for application limitations).

OA1 Accessible Path of Travel

An objective of this By-law is to limit the probability that, as a result of the design or construction of the *building*, *persons with disabilities* will be unacceptably impeded from accessing the *building* or circulating within it (See Sentence 2.1.1.2.(5) for application limitations).

OA2 Accessible Facilities

An objective of this By-law is to limit the probability that, as a result of the design or construction of the *building*, *persons with disabilities* will be unacceptably impeded from using the *building's* facilities (See Sentence 2.1.1.2.(5) for application limitations).

OP Fire and Structural Protection of Buildings

An objective of this By-law is to limit the probability that, as a result of the design, construction or demolition of the *building*, the *building* or adjacent *buildings* will be exposed to an unacceptable risk of damage due to fire or structural insufficiency, or the *building* or part thereof will be exposed to an unacceptable risk of loss of use also due to structural insufficiency.

OP1 Fire Protection of the Building

An objective of this By-law is to limit the probability that, as a result of its design or construction, the *building* will be exposed to an unacceptable risk of damage due to fire. The risks of damage due to fire addressed in this By-law are those caused by –

OP1.1 – fire or explosion occurring

OP1.2 – fire or explosion impacting areas beyond its point of origin

OP1.3 – collapse of physical elements due to a fire or explosion

OP1.4 – fire safety systems failing to function as expected

OP2 Structural Sufficiency of the Building

An objective of this By-law is to limit the probability that, as a result of its design or construction, the *building* or part thereof will be exposed to an unacceptable risk of damage or loss of use due to structural failure or lack of structural serviceability. The risks of damage and of loss of use due to structural failure or lack of structural serviceability addressed in this By-law are those caused by –

OP2.1 – loads bearing on the *building* elements that exceed their *loadbearing* capacity

OP2.2 – loads bearing on the *building* that exceed the *loadbearing* properties of the supporting medium

OP2.3 – damage to or deterioration of *building* elements

OP2.4 – vibration or deflection of *building* elements

OP2.5 – instability of the *building* or part thereof

OP2.6 – instability or movement of the supporting medium

OP3 Protection of Adjacent Buildings from Fire

An objective of this By-law is to limit the probability that, as a result of the design or construction of the *building*, adjacent *buildings* will be exposed to an unacceptable risk of damage due to fire. The risks of damage to adjacent *buildings* due to fire addressed in this By-law are those caused by –

OP3.1 – fire or explosion impacting areas beyond the *building* of origin

OP4 Protection of Adjacent Buildings from Structural Damage

An objective of this By-law is to limit the probability that, as a result of the design, construction or demolition of the *building*, adjacent *buildings* will be exposed to an unacceptable risk of structural damage. The risks of structural damage to adjacent *buildings* addressed in this By-law are those caused by –

OP4.1 – settlement of the medium supporting adjacent *buildings*

OP4.2 – collapse of the *building* or portion thereof onto adjacent *buildings*

OP4.3 – impact of the *building* on adjacent *buildings*

OP4.4 – collapse of the *excavation*

OE Environment

An objective of this By-law is to limit the probability that, as a result of the design, construction or renovation of the *building* or of the *plumbing system*, the environment will be affected in an unacceptable manner.

OE1 Energy Efficiency and Water Use

An objective of this By-law is to limit the probability that, as a result of the design, construction or renovation of the *building*, the use of energy will be inefficient or the use of water will be excessive. The risks of inefficient energy use or excessive water use addressed in this By-law are those caused by –

OE1.1 – inefficient energy performance of *buildings* or *building* components

Notes to Part 2
Objectives

A-2.1.1.2.(6) Deleted.

A-2.2.1.1.(1) Objectives.

Listing of objectives

Any gaps in the numbering sequence of the objectives are due to the fact that there is a master list of objectives covering the principal By-law Documents – the Building By-law Book I: General, Building By-law Book II: Plumbing Systems, and the Fire By-law – but not all objectives are pertinent to all By-laws.

The building

Where the term "the building" is used in the wording of the objectives, it refers to the building for which compliance with the Building By-law is being assessed.

Emergency

The term "emergency" – in the context of safety in buildings – is often equated to the term "fire emergency;" however, the wording of objectives OS3.7 and OS5.9 makes it clear that the By-law addresses any type of emergency that would require the rapid evacuation of the building, such as a bomb threat or the presence of intruders.

Part 3
Functional Statements

Section 3.1. Application

3.1.1. Application

3.1.1.1. Application

1) This Part applies to all *buildings* covered in this By-law. (See Article 1.1.1.1.)

3.1.1.2. Application of Functional Statements

1) Except as provided in Sentences (2) to (4), the functional statements described in this Part apply

a) to all *buildings* covered in this By-law (See Article 1.1.1.1.), and

b) only to the extent that they relate to compliance with this By-law as required in Article 1.2.1.1.

2) Deleted.

3) Functional Statements F73 and F74 do not apply to

a) *dwelling units*, row houses, boarding houses, lodging houses and construction camps, except as required by

i) Article 3.8.2.12. of Division B, or

ii) Subsection 3.8.5. of Division B,

b) apartment and condominium *buildings* except to the extent described in Subsection 3.8.2. of Division B,

c) *high-hazard industrial occupancies*,

d) *buildings* that are not intended to be occupied on a daily or full-time basis, including automatic telephone exchanges, pump houses and substations,

e) public toilet *buildings* described in Clause 3.8.2.1.(1)(e) of Division B, and

f) the *storeys* described in Clauses 3.8.2.1.(1)(f) and (g) of Division B.

4) Deleted.

Section 3.2. Functional Statements

3.2.1. Functional Statements

3.2.1.1. Functional Statements

1) The objectives of this By-law are achieved by measures, such as those described in the acceptable solutions in Division B, that are intended to allow the *building* or its elements to perform the following functions (See Note A-3.2.1.1.(1).):

F01 To minimize the risk of accidental ignition.

F02 To limit the severity and effects of fire or explosions.

F03 To retard the effects of fire on areas beyond its point of origin.

F04 To retard failure or collapse due to the effects of fire.

F05 To retard the effects of fire on emergency egress facilities.

F06 To retard the effects of fire on facilities for notification, suppression and emergency response.

F10 To facilitate the timely movement of persons to a safe place in an emergency.

F11 To notify persons, in a timely manner, of the need to take action in an emergency.

F12 To facilitate emergency response.

F13 To notify emergency responders, in a timely manner, of the need to take action in an emergency.

F20 To support and withstand expected loads and forces.
F21 To limit or accommodate dimensional change.
F22 To limit movement under expected loads and forces.
F23 To maintain equipment in place during structural movement.
F30 To minimize the risk of injury to persons as a result of tripping, slipping, falling, contact, drowning or collision.
F31 To minimize the risk of injury to persons as a result of contact with hot surfaces or substances.
F32 To minimize the risk of injury to persons as a result of contact with energized equipment.
F33 To limit the level of sound of a fire alarm system.
F34 To resist or discourage unwanted access or entry.
F35 To facilitate the identification of potential intruders.
F36 To minimize the risk that persons will be trapped in confined spaces.
F40 To limit the level of contaminants.
F41 To minimize the risk of generation of contaminants.
F42 To resist the entry of vermin and insects.
F43 To minimize the risk of release of hazardous substances.
F44 To limit the spread of hazardous substances beyond their point of release.
F46 To minimize the risk of contamination of potable water.
F50 To provide air suitable for breathing.
F51 To maintain appropriate air and surface temperatures.
F52 To maintain appropriate relative humidity.
F53 To maintain appropriate indoor/outdoor air pressure differences.
F54 To limit drafts.
F55 To resist the transfer of air through environmental separators.
F56 To limit the transmission of airborne sound into a *dwelling unit* from spaces elsewhere in the *building* (See Sentence 3.1.1.2.(2) for application limitation).
F60 To control the accumulation and pressure of water on and in the ground.
F61 To resist the ingress of precipitation, water or moisture from the exterior or from the ground.
F62 To facilitate the dissipation of water and moisture from the *building*.
F63 To limit moisture condensation.
F70 To provide potable water.
F71 To provide facilities for personal hygiene.
F72 To provide facilities for the sanitary disposal of human and domestic wastes.
F73 To facilitate *access* to and in the *building* and its facilities by *persons with disabilities* (See Sentence 3.1.1.2.(3) for application limitation).
F74 To facilitate the use of the *building's* facilities by *persons with disabilities* (See Sentence 3.1.1.2.(3) for application limitation).
F75 To minimize obstacles for future modification to provide *access* (See Sentence 3.1.1.2.(4) for application limitation).
F80 To resist deterioration resulting from expected service conditions.
F81 To minimize the risk of malfunction, interference, damage, tampering, lack of use or misuse.
F82 To minimize the risk of inadequate performance due to improper maintenance or lack of maintenance.
F83 To control the amount of water a plumbing fixture will use.
F84 To control the flow of water to a plumbing fixture or outlet.
F85 To minimize thermal loss or gain.
F86 To minimize the use of energy for building systems.
F90 To limit the amount of uncontrolled air leakage through the *building* envelope.
F91 To limit the amount of uncontrolled air leakage through system components.
F92 To limit the amount of uncontrolled thermal transfer through the *building* envelope.
F93 To limit the amount of uncontrolled thermal transfer through system components.

F95 To limit the unnecessary demand and/or consumption of energy for heating and cooling.
F96 To limit the unnecessary demand and/or consumption of energy for service water heating.
F98 To limit the inefficiency of equipment.
F99 To limit the inefficiency of systems.
F100 To limit the unnecessary rejection of reusable waste energy.

Notes to Part 3
Functional Statements

A-3.2.1.1.(1) Listing of Functional Statements. The numbered functional statements are grouped according to functions that deal with closely related subjects. For example, the first group deals with fire risks, the second group deals with emergency egress and response, etc. There may be gaps in the numbering sequence for the following reasons:

- Each group has unused numbers which allows for the possible future creation of additional functional statements within any one group.
- There is a master list of functional statements covering the principal By-law Documents – the Building By-law Book I: General, Building By-law-Book II: Plumbing Systems, and the Fire By-law – but not all functional statements are pertinent to all By-laws.

Part 1
General

Section 1.1. General

1.1.1. Application

1.1.1.1. Application

1) This Part applies to all *buildings* covered in this By-law. (See Article 1.1.1.1. of Division A.)
2) When an existing *building* is altered and the alteration triggers upgrading as determined by this By-law, alternative provisions in Part 11 of Division B may be used instead of the requirements of this Part. (See Article 1.1.1.2. of Division A.)

1.1.2. Objectives and Functional Statements

1.1.2.1. Attributions to Acceptable Solutions

1) For the purpose of compliance with this By-law as required in Clause 1.2.1.1.(1)(b) of Division A, the objectives and functional statements attributed to the acceptable solutions in Division B shall be the objectives and functional statements identified in Sections 3.10., 4.5., 5.10., 6.4., 7.2., 8.3., 9.38. and 10.5. (See Note A-1.1.2.1.(1).)

1.1.3. Design Data

1.1.3.1. Climatic and Seismic Values

1) Except as required by Sentence 9.7.4.3.(2), the climatic and seismic values required for the design of *buildings* under this By-law shall be in conformance with the values established by the *Chief Building Official* or, in the absence of such data, with Sentence (2) and the climatic and seismic values in Appendix C. (See Note A-1.1.3.1.(1).)
2) The outside winter design temperatures determined from Appendix C shall be those listed for the January 2.5% values. (See Note A-1.1.3.1.(2).)

1.1.3.2. Depth of Frost Penetration

1) Depth of frost penetration shall be no less than 450 mm.

1.1.3.3. Soil Gas

1) Except as provided in Sentence (2), the geographical locations requiring rough-ins for a subfloor depressurization system conforming to Article 9.13.4.3 shall be those areas identified in Table C-4 in Appendix C.
2) In addition to those areas identified in Sentence (1), the Chief Building Official may identify additional geographical locations requiring rough-ins for a subfloor depressurization system conforming to Article 9.13.4.3. if data obtained by the Chief Building Official indicates the location is at an elevated risk of the presence of indoor radon levels exceeding Health Canada guidelines.

1.1.4. Fire Safety Plan

1.1.4.1. Fire Safety Plan

1) Fire safety plans shall conform to the Fire By-law.

Section 1.2. Terms and Abbreviations

1.2.1. Definitions of Words and Phrases

1.2.1.1. Non-defined Terms

1) Words and phrases used in Division B that are not included in the list of definitions in Article 1.4.1.2. of Division A shall have the meanings that are commonly assigned to them in the context in which they are used, taking into account the specialized use of terms by the various trades and professions to which the terminology applies.

2) Where objectives and functional statements are referred to in Division B, they shall be the objectives and functional statements described in Parts 2 and 3 of Division A.

3) Where acceptable solutions are referred to in Division B, they shall be the provisions stated in Parts 3 to 10.

1.2.1.2. Defined Terms

1) The words and terms in italics in Division B shall have the meanings assigned to them in Article 1.4.1.2. of Division A.

1.2.2. Symbols and Other Abbreviations

1.2.2.1. Symbols and Other Abbreviations

1) The symbols and other abbreviations in Division B shall have the meanings assigned to them in Article 1.4.2.1. of Division A and Article 1.3.2.1.

Section 1.3. Referenced Documents and Organizations

1.3.1. Referenced Documents

1.3.1.1. Effective Date

1) Unless otherwise specified herein, the documents referenced in this By-law shall include all amendments, revisions, reaffirmations, reapprovals, addenda and supplements effective to 30 June 2014.

1.3.1.2. Applicable Editions

1) Where documents are referenced in this By-law, they shall be the editions designated in Table 1.3.1.2.

Table 1.3.1.2.
Documents Referenced in Book I (General) of the Building By-law(1)
Forming Part of Sentence 1.3.1.2.(1)

Issuing Agency	Document Number(2)	Title of Document(3)	By-law Reference
AAMA	501-05	Test for Exterior Walls	A-5.9.3.
AAMA	501.1-05	Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure	A-5.9.3.
AAMA	501.2-09	Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems	A-5.9.3.
AAMA	501.4-09	Recommended Static Test Method for Evaluating Curtain Wall and	A-5.9.3.

		Storefront Systems Subjected to Seismic and Wind Induced Interstorey Drifts	
AAMA	501.5-07	Thermal Cycling of Exterior Walls	A-5.9.3. A-5.9.3.3.(1)
AAMA	501.6-09	Recommended Dynamic Test Method For Determining The Seismic Drift Causing Glass Fallout From A Wall System	A-4.1.8.18.(15) and (16)(c) A-5.9.3.
AAMA	1304-02	Voluntary Specification for Forced Entry Resistance of Side-Hinged Door Systems	9.7.5.2.(2)
ACGIH	28th Edition	Industrial Ventilation: A Manual of Recommended Practice for Design	A-6.3.1.6.
AHAM	ANSI/AHAM RAC-1-1982	Room Air Conditioners	Table 9.36.3.10.
AHRI	ANSI/AHRI 210/240-2008	Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment	Table 9.36.3.10.
AHRI	1060 (I-P)-2013	Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment	9.36.3.8.(4)
AISI	S201-12	North American Standard for Cold-Formed Steel Framing – Product Data	9.24.1.2.(1)
ANSI	A208.1-2009	Particleboard	9.23.15.2.(3) 9.29.9.1.(1) 9.30.2.2.(1)
ANSI/CSA	ANSI Z21.10.3-2013/ CSA 4.3-2013	Gas-Fired Water Heaters, Volume III, Storage Water Heaters With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous	10.2.2.12.(1)(d)
ANSI/CSA	ANSI Z83.8-2013/CSA 2.6-2013	Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters and Gas-Fired Duct Furnaces	10.2.2.14.(1)
ASCE	ASCE/SEI 7-10	Minimum Design Loads for Buildings and Other Structures	A-4.1.8.18.(15) and (16)(c)
ASCE	ASCE/SEI 8-02	Design of Cold-Formed Stainless Steel Structural Members	A-4.3.4.2.(1)
ASCE	ASCE/SEI 49-12	Wind Tunnel Testing for Buildings and Other Structures	4.1.7.12.(1)
ASHRAE	2013	ASHRAE Handbook – Fundamentals	A-10.2.2.6.
ASHRAE	Guideline 12-2000	Minimizing the Risk of Legionellosis Associated with Building Water Systems	6.3.2.15.(4) 6.3.2.16.(3)
ASHRAE	ANSI/ASHRAE 62-2001 (except Addendum n)	Ventilation for Acceptable Indoor Air Quality (except Addendum n)	6.3.1.1.(2) 10.2.2.2.(1)(b) 10.2.2.3. A-9.25.5.2.
ASHRAE	ANSI/ASHRAE 62.1-2007	Ventilation for Acceptable Indoor Air Quality	6.3.2.2.(1)
ASHRAE	ANSI/ASHRAE 90.1-2016	Energy Standard for Buildings Except Low-Rise Residential Buildings	10.2.2.2.(1) Table 10.2.2.5.A
ASHRAE	ANSI/ASHRAE 103-2007	Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers	Table 9.36.3.10.
ASHRAE	ANSI/ASHRAE 140-2011	Evaluation of Building Energy Analysis Computer Programs	9.36.5.4.(8) 9.36.6.4.(1)
ASME/CSA	ASME A17.1-2010/CSA B44-10	Safety Code for Elevators and Escalators	3.2.6.7.(2) 3.5.2.1.(3) 3.5.4.1.(3) 3.8.3.7.(1)

			3.5.4.2.(1) A-3.5.2.1.(1) 3.8.3.7.(1) Table 4.1.5.11. Table 4.1.8.18.
ASME	B18.6.1-1981	Wood Screws (Inch Series)	Table 5.9.1.1. 9.23.3.1.(3) A-9.23.3.1.(3)
ASTM	A 123/A 123M-13	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products	Table 5.9.1.1. Table 9.20.16.1.
ASTM	A 153/A 153M-09	Zinc Coating (Hot-Dip) on Iron and Steel Hardware	Table 5.9.1.1. Table 9.20.16.1.
ASTM	A 252-10	Welded and Seamless Steel Pipe Piles	4.2.3.8.(1)
ASTM	A 283/A 283M-13	Low and Intermediate Tensile Strength Carbon Steel Plates	4.2.3.8.(1)
ASTM	A 390-06	Zinc-Coated (Galvanized) Steel Poultry Fence Fabric (Hexagonal and Straight Line)	Table 9.10.3.1.-B
ASTM	A 653/A 653M-13	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process	Table 5.9.1.1. 9.3.3.2.(1)
ASTM	A 792/A 792M-10	Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process	9.3.3.2.(1)
ASTM	A 1008/A 1008M-13	Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable	4.2.3.8.(1)
ASTM	A 1011/A 1011M-14	Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength	4.2.3.8.(1)
ASTM	C 4-04	Clay Drain Tile and Perforated Clay Drain Tile	Table 5.9.1.1. 9.14.3.1.(1)
ASTM	C 27-98	Fireclay and High-Alumina Refractory Brick	9.21.3.4.(1)
ASTM	C 73-10	Calcium Silicate Brick (Sand-Lime Brick)	Table 5.9.1.1. 9.20.2.1.(1)
ASTM	C 126-13	Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units	Table 5.9.1.1. 9.20.2.1.(1)
ASTM	C 177-13	Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus	9.36.2.2.(1)
ASTM	C 212-14	Structural Clay Facing Tile	Table 5.9.1.1. 9.20.2.1.(1)
ASTM	C 260/C 260M-10a	Air-Entraining Admixtures for Concrete	9.3.1.8.(1)
ASTM	C 411-11	Hot-Surface Performance of High-Temperature Thermal Insulation	3.6.5.4.(4) 3.6.5.5.(1) 9.33.6.4.(4) 9.33.8.2.(2)
ASTM	C 412M-11	Concrete Drain Tile (Metric)	Table 5.9.1.1. 9.14.3.1.(1)
ASTM	C 444M-03	Perforated Concrete Pipe (Metric)	Table 5.9.1.1. 9.14.3.1.(1)

ASTM	C 494/C 494M-13	Chemical Admixtures for Concrete	9.3.1.8.(1)
ASTM	C 516-08	Vermiculite Loose Fill Thermal Insulation	A-9.25.2.4.(5)
ASTM	C 518-10	Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus	9.36.2.2.(1)
ASTM	C 553-13	Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications	Table 5.9.1.1.
ASTM	C 612-14	Mineral Fiber Block and Board Thermal Insulation	Table 5.9.1.1.
ASTM	C 700-13	Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated	Table 5.9.1.1. 9.14.3.1.(1)
ASTM	C 726-12	Mineral Wool Roof Insulation Board	Table 5.9.1.1. 9.25.2.2.(1)
ASTM	C 754-11	Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products	Table A-9.11.1.4.-A Table A-9.11.1.4.-B Table A-9.11.1.4.-C Table A-9.11.1.4.-D
ASTM	C 834-10	Latex Sealants	Table 5.9.1.1. 9.27.4.2.(2)
ASTM	C 840-13	Application and Finishing of Gypsum Board	Table 5.9.1.1.
ASTM	C 920-14	Elastomeric Joint Sealants	Table 5.9.1.1. 9.27.4.2.(2)
ASTM	C 954-11	Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness	9.24.1.4.(1)
ASTM	C 991-08e1	Flexible Fibrous Glass Insulation for Metal Buildings	Table 5.9.1.1.
ASTM	C 1002-07	Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs	Table 5.9.1.1. 9.24.1.4.(1) 9.29.5.7.(1)
ASTM	C 1177/C 1177M-13	Glass Mat Gypsum Substrate for Use as Sheathing	3.1.5.14.(6) 3.1.5.15.(4) Table 5.9.1.1. Table 9.23.17.2.-A A-9.27.13.2.(2)(a)
ASTM	C 1178/C 1178M-13	Coated Glass Mat Water-Resistant Gypsum Backing Panel	3.1.5.14.(6) 3.1.5.15.(4) Table 5.9.1.1. 9.29.5.2.(1)
ASTM	C 1184-13	Structural Silicone Sealants	Table 5.9.1.1. 9.27.4.2.(2)
ASTM	C 1193-13	Use of Joint Sealants	A-Table 5.9.1.1. A-9.27.4.2.(1)
ASTM	C 1299-03	Selection of Liquid-Applied Sealants	A-Table 5.9.1.1. A-9.27.4.2.(1)
ASTM	C 1311-10	Solvent Release Sealants	Table 5.9.1.1. 9.27.4.2.(2)
ASTM	C 1330-02	Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants	Table 5.9.1.1.

			9.27.4.2.(3)
ASTM	C 1363-11	Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus	A-5.9.4.1.(1) 9.36.2.2.(4)
ASTM	C 1396/C 1396M-14	Gypsum Board	3.1.5.14.(6) 3.1.5.15.(4) Table 5.9.1.1. Table 9.23.17.2.-A 9.29.5.2.(1) Table 9.29.5.3.
ASTM	C 1472-10	Calculating Movement and Other Effects When Establishing Sealant Joint Width	A-Table 5.9.1.1. A-9.27.4.2.(1)
ASTM	C 1658/C 1658M-13	Glass Mat Gypsum Panels	3.1.5.14.(6) Table 5.9.1.1.
ASTM	D 323-08	Vapor Pressure of Petroleum Products (Reid Method)	1.4.1.2.(1)[4]
ASTM	D 1037-12	Evaluating Properties of Wood-Base Fiber and Particle Panel Materials	A-9.23.15.2.(4)
ASTM	D 1143/D 1143M-07	Deep Foundations Under Static Axial Compressive Load	A-4.2.7.2.(2)
ASTM	D 1227-95	Emulsified Asphalt Used as a Protective Coating for Roofing	Table 5.9.1.1. 9.13.2.2.(2) 9.13.3.2.(2)
ASTM	D 2178/D 2178M-13a	Asphalt Glass Felt Used in Roofing and Waterproofing	Table 5.9.1.1.
ASTM	D 2898-10	Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing	3.1.4.8.(2) 3.1.5.5.(3) 3.1.5.24.(1) 3.2.3.7.(4) 9.10.14.5.(3) 9.10.15.5.(3)
ASTM	D 3019-08	Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, Asbestos-Fibered, and Non-Asbestos-Fibered	Table 5.9.1.1. 9.13.3.2.(2) Table 9.26.2.1.-B
ASTM	D 4479/D 4479M-07	Asphalt Roof Coatings – Asbestos-Free	Table 5.9.1.1. 9.13.2.2.(2) 9.13.3.2.(2) Table 9.26.2.1.-B
ASTM	D 4637/D 4637M-12	EPDM Sheet Used In Single-Ply Roof Membrane	Table 5.9.1.1. 9.13.3.2.(2) Table 9.26.2.1.-B
ASTM	D 4811/D 4811M-06	Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing	Table 5.9.1.1. 9.13.3.2.(2) Table 9.26.2.1.-B
ASTM	D 5456-10a	Evaluation of Structural Composite Lumber Products	3.1.11.7.(4)
ASTM	D 6878/D 6878M-11a	Thermoplastic Polyolefin Based Sheet Roofing	Table 5.9.1.1. 9.13.3.2.(2) Table 9.26.2.1.-B
ASTM	E 90-09	Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements	5.8.1.2.(1) 5.8.1.4.(1) 9.11.1.2.(1)
ASTM	E 96/E 96M-13	Water Vapor Transmission of Materials	5.5.1.2.(3)

			9.13.2.2.(2) 9.25.4.2.(1) 9.25.5.1.(1) 9.30.1.2.(1)
ASTM	E 283-04	Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen	5.9.3.4.(2) A-5.9.3.4.(2)
ASTM	E 330/E 330M-02	Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference	A-5.9.3.2.(1)
ASTM	E 331-00	Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference	5.9.3.5.(2) A-5.9.3.5.(2)
ASTM	E 336-11	Measurement of Airborne Sound Attenuation between Rooms in Buildings	5.8.1.2.(2) 5.8.1.4.(7) 9.11.1.2.(2) A-9.11.
ASTM	E 413-10	Classification for Rating Sound Insulation	A-1.4.1.2.(1)[4] 5.8.1.2.(1) 5.8.1.2.(2) 5.8.1.4.(7) 5.8.1.5.(3) 9.11.1.2.(1) 9.11.1.2.(2)
ASTM	E 492-09	Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine	A-9.11.
ASTM	E 547-00	Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference	5.9.3.5.(2) A-5.9.3.5.(2)
ASTM	E 597-95	Determining a Single Number Rating of Airborne Sound Insulation for Use in Multi-Unit Building Specifications	A-9.11.
ASTM	E 736-00	Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members	Table 9.10.3.1.-B
ASTM	E 779-10	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization	10.2.2.21.(1)
ASTM	E 783-02	Field Measurement of Air Leakage Through Installed Exterior Windows and Doors	A-5.9.2.3.(1) A-5.9.3.4.(2)
ASTM	E 1007-13b	Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures	A-9.11.
ASTM	E 1105-00	Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference	A-5.9.2.3.(1) A-5.9.3.5.(2)
ASTM	E 1300-12ae1	Standard Practice for Determining Load Resistance of Glass in Buildings	4.3.6.1.(1) 9.6.1.3.(1)
ASTM	E 2178-13	Air Permeance of Building Materials	5.4.1.2.(1)
ASTM	E 2190-10	Insulating Glass Unit Performance and Evaluation	Table 5.9.1.1. 9.6.1.2.(1)
ASTM	E 2357-11	Determining Air Leakage of Air Barrier Assemblies	9.36.2.9.(1) A-9.36.2.9.(1)
ASTM	F 842-01 or 04	Standard Test Methods for Measuring the Forced Entry Resistance of	9.7.5.1.(3)

		Sliding Door Assemblies, Excluding Glazing Impact	
ASTM	F 1667-13	Driven Fasteners: Nails, Spikes, and Staples	9.23.3.1.(1) 9.26.2.3.(1) 9.29.5.6.(1)
AWPA	M4-11	Care of Preservative-Treated Wood Products	4.2.3.2.(2)
BC	B.C. Reg. 100/2004	Electrical Safety Regulation	3.3.6.2.(4) 3.6.1.2.(1) 3.6.2.1.(6) 3.6.2.7.(1) 6.2.1.5.(1) 9.31.6.2.(2) 9.33.5.2.(1) 9.34.1.1.(1)
BC	B.C. Reg. 101/2004	Elevating Devices Safety Regulation	3.5.2.1.(1) 3.5.2.1.(2) Table 4.1.5.11. Table 4.1.8.18.
BC	B.C. Reg. 103/2004	Gas Safety Regulation	6.2.1.5.(1) 9.10.22.1.(1) 9.31.6.2.(2) 9.33.5.2.(1)
BC	B.C. Reg. 104/2004	Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation	6.2.1.5.(1) 9.31.6.2.(2) 9.33.5.2.(1)
BC	R.S.B.C. 1996 c.17	Architects Act	1.4.1.2.(1)(4)
BC	R.S.B.C. 1996 c.116	Engineers and Geoscientists Act	1.4.1.2.(1)(4)
BC	R.S.B.C. 1996 c.293	Mines Act	1.4.1.2.(1)(4)
BC	S.B.C. 1998 c.43	Strata Property Act	A-9.37.1.1.
BC	S.B.C. 2003 c.39	Safety Standards Act	6.2.1.5.(1) 6.2.1.5.(2) 9.31.6.2.(2) 9.33.5.2.(1) 9.33.5.2.(2)
BC	S.B.C. 2015	Building Act	2.2.1.1.(1)(4)
BNQ	BNQ 3624-115/2007	Polyethylene (PE) Pipe and Fittings – Flexible Pipes for Drainage – Characteristics and Test Methods	Table 5.9.1.1. 9.14.3.1.(1)
CCBFC	NRCC 35951	Guidelines for Application of Part 3 of the National Building Code of Canada to Existing Buildings	A-1.1.1.1.(1)(4)
CCBFC	NRCC 38730	Model National Energy Code of Canada for Houses 1997	10.2.2.3.
CCBFC	NRCC 38732	National Farm Building Code of Canada 1995	1.1.1.1.(4)(4) A-1.4.1.2.(1)(4) A-Table 4.1.2.1. A-5.1.2.1.(1)
CCBFC	NRCC 40383	User's Guide – NBC 1995, Fire Protection, Occupant Safety and Accessibility (Part 3)	A-1.1.1.1.(1)(4)
CCBFC	NRCC 43963	User's Guide – NBC 1995, Application of Part 9 to Existing Buildings	A-1.1.1.1.(1)(4)

CCBFC	NRCC 56191	National Energy Code of Canada for Buildings 2015	A-2.1.1.2.(6)[4] A-2.2.1.1.(1)[4] A-3.2.1.1.(1)[4] Table 3.10.1.1.(1) 10.2.2.1.(1) Table 10.2.3.3.-A Table 10.2.3.3.-B 10.2.3.4.(1) A-10.2.3.3.(2) A-10.2.3.4.(1) A-10.2.3.4.(2) A-10.2.3.4.(3) A-2.2.8.1.(1)[5]
CCBFC	NRCC 56194	User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)	A-1.1.1.1.(1)[4] A-4.1.1.3.(1) A-4.1.1.3.(2) A-4.1.2.1. A-4.1.2.1.(1) A-4.1.3. A-4.1.3.2.(2) A-4.1.3.2.(4) A-4.1.3.2.(5) A-4.1.3.3.(2) A-4.1.3.4.(1) A-4.1.3.5.(1) A-4.1.3.5.(3) A-4.1.3.6.(1) A-4.1.3.6.(2) A-4.1.3.6.(3) A-4.1.5.8. A-4.1.5.17. A-4.1.6.2. A-4.1.6.3.(2) A-4.1.6.4.(1) A-4.1.7.2.(1) and (2) A-4.1.7.3.(5)(c) A-4.1.7.3.(10) A-4.1.7.9.(1) A-4.1.8.2.(1) A-4.1.8.3.(4) A-4.1.8.3.(6) A-4.1.8.3.(7)(b) and (c) A-4.1.8.3.(8) A-4.1.8.4.(3) and Table 4.1.8.4.-A A-Table 4.1.8.5. A-Table 4.1.8.6. A-4.1.8.7.(1) A-4.1.8.9.(4) A-4.1.8.9.(5) A-4.1.8.10.(4) A-4.1.8.10.(5) A-4.1.8.10.(7) A-4.1.8.11.(3) A-4.1.8.12.(1)(a) A-4.1.8.12.(1)(b) A-4.1.8.12.(3) A-4.1.8.12.(4)(a) A-4.1.8.13.(4) A-4.1.8.15.(1) A-4.1.8.15.(3)

			A-4.1.8.15.(4) A-4.1.8.15.(5) A-4.1.8.15.(6) A-4.1.8.15.(7) A-4.1.8.15.(8) A-4.1.8.16.(1)
CCBFC	NRCC 56194	User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B) (continued)	A-4.1.8.16.(4) A-4.1.8.16.(6)(a) A-4.1.8.16.(7) A-4.1.8.16.(8)(a) A-4.1.8.16.(10) A-4.1.8.17.(1) A-4.1.8.18. A-4.1.8.18.(14) A-4.1.8.18.(15) and (16)(c) A-4.1.8.19.(3)(a) A-4.1.8.19.(4) A-4.1.8.21.(4)(a) A-4.1.8.21.(5) A-4.2.4.1.(3) A-4.2.4.1.(5) A-4.2.5.1.(1) A-4.2.6.1.(1) A-4.2.7.2.(1) A-4.3.6.1.(1) A-4.4.2.1.(1) A-5.1.4.2. A-5.2.2.2.(4) Appendix C
CGSB	CAN/CGSB-1.501-M89	Method for Permeance of Coated Wallboard	5.5.1.2.(2) 9.25.4.2.(5)
CGSB	CAN/CGSB-7.2-94	Adjustable Steel Columns	9.17.3.4.(1) A-9.17.3.4.
CGSB	CAN/CGSB-10.3-92	Air Setting Refractory Mortar	9.21.3.4.(2) 9.21.3.9.(1) 9.22.2.2.(2)
CGSB	CAN/CGSB-11.3-M87	Hardboard	Table 5.9.1.1. 9.27.9.1.(2) 9.29.7.1.(1) 9.30.2.2.(1)
CGSB	CAN/CGSB-11.5-M87	Hardboard, Precoated, Factory Finished, for Exterior Cladding	Table 5.9.1.1. 9.27.9.1.(1)
CGSB	CAN/CGSB-12.1-M90	Tempered or Laminated Safety Glass	3.3.1.19.(3) 3.4.6.15.(1) 3.4.6.15.(3) Table 5.9.1.1. 9.6.1.2.(1) 9.6.1.4.(1) 9.8.8.7.(1)
CGSB	CAN/CGSB-12.2-M91	Flat, Clear Sheet Glass	Table 5.9.1.1. 9.6.1.2.(1)
CGSB	CAN/CGSB-12.3-M91	Flat, Clear Float Glass	Table 5.9.1.1. 9.6.1.2.(1)

CGSB	CAN/CGSB-12.4-M91	Heat Absorbing Glass	Table 5.9.1.1. 9.6.1.2.(1)
CGSB	CAN/CGSB-12.8-97	Insulating Glass Units	Table 5.9.1.1. 9.6.1.2.(1)
CGSB	CAN/CGSB-12.10-M76	Glass, Light and Heat Reflecting	Table 5.9.1.1. 9.6.1.2.(1)
CGSB	CAN/CGSB-12.11-M90	Wired Safety Glass	3.3.1.19.(3) 3.4.6.15.(1) 3.4.6.15.(3) Table 5.9.1.1. 9.6.1.2.(1) 9.6.1.4.(1) 9.8.8.7.(1)
CGSB	CAN/CGSB-12.20-M89	Structural Design of Glass for Buildings	4.3.6.1.(1) 9.6.1.3.(1) A-9.6.1.3.(2)
CGSB	CAN/CGSB-19.22-M89	Mildew-Resistant Sealing Compound for Tubs and Tiles	9.29.10.5.(1)
CGSB	37-GP-9Ma-1983	Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing	Table 5.9.1.1. 9.13.3.2.(2) Table 9.26.2.1.-A
CGSB	CAN/CGSB-37.50-M89	Hot-Applied, Rubberized Asphalt for Roofing and Waterproofing	Table 5.9.1.1. 9.13.3.2.(2) Table 9.26.2.1.-B
CGSB	CAN/CGSB-37.51-M90	Application for Hot-Applied Rubberized Asphalt for Roofing and Waterproofing	9.26.15.1.(1)
CGSB	CAN/CGSB-37.54-95	Polyvinyl Chloride Roofing and Waterproofing Membrane	Table 5.9.1.1. 9.13.3.2.(2) Table 9.26.2.1.-B
CGSB	37-GP-55M-1979	Application of Sheet Applied Flexible Polyvinyl Chloride Roofing Membrane	9.26.16.1.(1)
CGSB	37-GP-56M-1985	Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing	Table 5.9.1.1. 9.13.3.2.(2) Table 9.26.2.1.-B
CGSB	CAN/CGSB-37.58-M86	Membrane, Elastomeric, Cold-Applied Liquid, for Non-Exposed Use in Roofing and Waterproofing	Table 5.9.1.1. 9.13.3.2.(2) Table 9.26.2.1.-B
CGSB	CAN/CGSB-41.24-95	Rigid Vinyl Siding, Soffits and Fascia	Table 5.9.1.1. 9.27.12.1.(1)
CGSB	CAN/CGSB-51.25-M87	Thermal Insulation, Phenolic, Faced	Table 9.23.17.2.-A 9.25.2.2.(1)
CGSB	51-GP-27M-1979	Thermal Insulation, Polystyrene, Loose Fill	9.25.2.2.(1)
CGSB	CAN/CGSB-51.32-M77	Sheathing, Membrane, Breather Type	Table 5.9.1.1. 9.20.13.9.(1) Table 9.26.2.1.-A 9.27.3.2.(1)
CGSB	CAN/CGSB-51.33-M89	Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction	Table 5.9.1.1. 9.25.4.2.(4)

CGSB	CAN/CGSB-51.34-M86	Vapour Barrier, Polyethylene Sheet for Use in Building Construction	Table 5.9.1.1. 9.13.2.2.(2) 9.18.6.2.(1) 9.25.3.2.(2) 9.25.3.6.(1) 9.25.4.2.(3)
CGSB	CAN/CGSB-51.71-2005	Depressurization Test	9.32.3.8.(7)
CGSB	CAN/CGSB-71.26-M88	Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems	A-9.23.4.2.(2) Table A-9.23.4.2.(2)-C
CGSB	CAN/CGSB-82.6-M86	Doors, Mirrored Glass, Sliding or Folding, Wardrobe	9.6.1.2.(2) A-9.6.1.2.(2)
CGSB	CAN/CGSB-93.1-M85	Sheet, Aluminum Alloy, Prefinished, Residential	Table 5.9.1.1. 9.27.11.1.(4) A-9.27.11.1.(3) and (4)
CGSB	CAN/CGSB-93.2-M91	Prefinished Aluminum Siding, Soffits, and Fascia, for Residential Use	3.2.3.6.(5) Table 5.9.1.1. 9.10.14.5.(8) 9.10.14.5.(12) 9.10.15.5.(7) 9.10.15.5.(11) 9.27.11.1.(3) A-9.27.11.1.(3) and (4)
CGSB	CAN/CGSB-93.3-M91	Prefinished Galvanized and Aluminum-Zinc Alloy Steel Sheet for Residential Use	Table 5.9.1.1. 9.27.11.1.(2)
CGSB	CAN/CGSB-93.4-92	Galvanized Steel and Aluminum-Zinc Alloy Coated Steel Siding, Soffits and Fascia, Prefinished, Residential	Table 5.9.1.1. 9.27.11.1.(1)
CGSB	CAN/CGSB-149.10-M86	Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method	9.36.5.10.(11) 9.36.6.5.(1) A-9.36.5.10.(11)
CISC/ICCA	2013	Crane-Supporting Steel Structures: Design Guide	A-4.1.3.2.(2)
CMHC	1993	Testing of Fresh Air Mixing Devices	A-9.32.3.4.
CMHC	1988	Air Permeance of Building Materials	Table A-9.25.5.1.(1)
CoV	2019	Fire By-law	1.1.1.1.(1)[(4)] 1.1.4.1.(1) 1.4.1.2.(1)[(4)] A-1.1.1.1.(1)[(4)] 2.1.1.2.(4)[(4)] A-2.2.1.1.(1)[(4)] A-3.2.1.1.(1)[(4)] 3.1.13.1.(1) 3.2.3.21.(1) 3.2.5.16.(1) 3.3.1.2.(1) 3.3.1.10.(1) 3.3.2.3.(1) 3.3.2.16.(1) 3.3.4.3.(4) 3.3.5.2.(1) 3.3.6.1.(1) 3.3.6.3.(1) 3.3.6.3.(2)

			3.3.6.4.(1) 3.3.6.4.(2) 3.3.6.6.(1) 3.7.3.1.(1) A-3.1.2.3.(1) A-3.2.4.6.(2) A-3.2.6. A-3.2.7.8.(3) A-3.3. A-3.3.1.7.(1) A-3.3.3.1.(1) A-3.3.6.1.(1) A-3.9.3.1.(1) 6.3.4.2.(3) 6.3.4.3.(1) 6.3.4.4.(1) 6.9.1.2.(1) 8.1.1.1.(3) 8.1.1.3.(1) 9.10.20.4.(1) 9.10.21.8.(1)
CoV	2019	Book II (Plumbing Systems) of the Building By-law	2.1.1.2.(4)(4) A-2.2.1.1.(1)(4) A-3.2.1.1.(1)(4) A-4.1.6.4.(3) 5.6.2.2.(2) 6.3.2.15.(3) 6.3.2.15.(5) 7.1.2.1.(1) 9.31.6.2.(1) 9.36.3.11.(2) 9.36.4.3.(2) A-9.36.5.8.(5) Appendix C
CoV	2017	City of Vancouver Energy Modelling Guidelines	10.2.2.5.
CSA	CSA 2.6/ ANSI Z83.8	Gas unit heaters, gas packaged heaters, gas utility heaters and gas-fired duct furnaces	10.2.2.14.
CSA	CSA 4.3/ANSI Z21.10.3	Gas Water Heaters Volume III, Storage Water Heaters, with Input Ratings above 75,000 Btu per hour, Circulating and Instantaneous	10.2.2.12.
CSA	CAN/CSA-6.19-01	Residential Carbon Monoxide Alarming Devices	6.9.3.1.(2) 9.32.4.2.(2) 9.32.4.2.(3)
CSA	A23.1-14	Concrete Materials and Methods of Concrete Construction	4.2.3.6.(1) 4.2.3.9.(1) Table 5.9.1.1. 9.3.1.1.(1) 9.3.1.1.(4) 9.3.1.3.(1) 9.3.1.4.(1)
CSA	A23.3-14	Design of Concrete Structures	Table 4.1.8.9. 4.3.3.1.(1) A-4.1.3.2.(4) A-4.1.8.16.(1) A-4.1.8.16.(4) A-4.3.3.1.(1)

CSA	A23.4-09	Precast Concrete – Materials and Construction	A-4.3.3.1.(1)
CSA	CAN/CSA-A82-14	Fired Masonry Brick Made from Clay or Shale	Table 5.9.1.1. 9.20.2.1.(1)
CSA	CAN/CSA-A82.27-M91	Gypsum Board	3.1.5.14.(6) 3.1.5.15.(4)
CSA	A82.30-M1980	Interior Furring, Lathing and Gypsum Plastering	9.29.4.1.(1)
CSA	A82.31-M1980	Gypsum Board Application	3.2.3.6.(5) 9.10.9.2.(4) 9.10.12.4.(3) 9.10.14.5.(8) 9.10.14.5.(12) 9.10.15.5.(7) 9.10.15.5.(11) 9.29.5.1.(2) Table 9.10.3.1.-A Table 9.10.3.1.-B
CSA	CAN3-A93-M82	Natural Airflow Ventilators for Buildings	Table 5.9.1.1. 9.19.1.2.(5)
CSA	A123.1-05/A123.5-05	Asphalt Shingles Made From Organic Felt and Surfaced with Mineral Granules/Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules	Table 5.9.1.1. Table 9.26.2.1.-B
CSA	CAN/CSA-A123.2-03	Asphalt-Coated Roofing Sheets	Table 5.9.1.1. 9.13.3.2.(2) Table 9.26.2.1.-B
CSA	A123.3-05	Asphalt Saturated Organic Roofing Felt	Table 5.9.1.1. Table 9.26.2.1.-B
CSA	CAN/CSA-A123.4-04	Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems	Table 5.9.1.1. 9.13.2.2.(2) 9.13.3.2.(2) Table 9.26.2.1.-B
CSA	A123.17-05	Asphalt Glass Felt Used in Roofing and Waterproofing	Table 5.9.1.1. 9.13.3.2.(2) Table 9.26.2.1.-B
CSA	CAN/CSA-A123.21-10	Dynamic Wind Uplift Resistance of Membrane-Roofing Systems	5.2.2.2.(4) A-5.2.2.2.(4)
CSA	A123.22-08	Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection	Table 9.26.2.1.-B
CSA	CAN3-A123.51-M85	Asphalt Shingle Application on Roof Slopes 1:3 and Steeper	Table 5.9.1.1. 9.26.1.3.(1)
CSA	CAN3-A123.52-M85	Asphalt Shingle Application on Roof Slopes 1:6 to Less Than 1:3	Table 5.9.1.1. 9.26.1.3.(1)
CSA	A165.1-14	Concrete Block Masonry Units	Table 5.9.1.1. 9.15.2.2.(1) 9.17.5.1.(1) 9.20.2.1.(1) 9.20.2.6.(1) Table A-9.11.1.4.-A Table A-9.11.1.4.-C

CSA	A165.2-14	Concrete Brick Masonry Units	Table 5.9.1.1. 9.20.2.1.(1)
CSA	A165.3-14	Prefaced Concrete Masonry Units	Table 5.9.1.1. 9.20.2.1.(1)
CSA	A179-14	Mortar and Grout for Unit Masonry	Table 5.9.1.1. 9.15.2.2.(3) 9.20.3.1.(1)
CSA	CAN/CSA-A220 Series-06	Concrete Roof Tiles	Table 5.9.1.1. Table 9.26.2.1.-B 9.26.17.1.(1)
CSA	A277-08	Procedure for Factory Certification of Buildings	A-1.1.1.1.(3)(4)
CSA	CAN/CSA-A324-M88	Clay Flue Liners	9.21.3.3.(1)
CSA	A370-14	Connectors for Masonry	A-9.21.4.5.(2)
CSA	A371-14	Masonry Construction for Buildings	Table 5.9.1.1. 9.15.2.2.(3) 9.20.3.2.(7) 9.20.15.2.(1)
CSA	CAN/CSA-A405-M87	Design and Construction of Masonry Chimneys and Fireplaces	9.21.3.5.(1) 9.22.1.4.(1) 9.22.5.2.(2)
CSA	AAMA/WDMA/CSA 101/I.S.2/A440-08 or AAMA/WDMA/CSA 101/I.S.2/A440-11	NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights	5.9.2.2.(1) A-5.3.1.2. 9.7.4.3.(1) 9.7.4.3.(2) 9.7.5.1.(1) 9.7.5.3.(1) 9.36.2.9.(3) A-9.7.4.2.(1)
CSA	A440S1-09 or A440S1-2017	Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights	5.9.2.2.(1) 5.9.2.2.(3) A-5.9.2.2. A-5.9.3.5.(3) 9.7.4.2.(1) 9.36.2.9.(3) A-9.7.4.2.(1)
CSA	A440.2-14/A440.3-14	Fenestration Energy Performance/User Guide to CSA A440.2-14, Fenestration Energy Performance	9.36.2.2.(3) A-Table 9.36.2.7.-A
CSA	A440.2-14	Fenestration Energy Performance	A-5.3.1.2. A-5.9.3.3.(1) A-9.7.4.2.(1)
CSA	A440.3-14	User Guide to CSA A440.2-14, Fenestration Energy Performance	A-5.3.1.2.
CSA	CAN/CSA-A440.4-07	Window, Door, and Skylight Installation	A-5.9.2.2
CSA	A660-10	Certification of Manufacturers of Steel Building Systems	4.3.4.3.(1)
CSA	A3001-13	Cementitious Materials for Use in Concrete	Table 5.9.1.1. 9.3.1.2.(1) 9.28.2.1.(1)
CSA	CAN/CSA-B72-M87	Installation Code for Lightning Protection Systems	3.6.1.3.(1)

CSA	B111-1974	Wire Nails, Spikes and Staples	9.23.3.1.(1) 9.26.2.3.(1) 9.29.5.6.(1) A-Table 9.23.3.5.-B
CSA	B139-09	Installation Code for Oil-Burning Equipment	6.2.1.5.(1) 9.31.6.2.(2) 9.33.5.2.(1)
CSA	B140.12-03	Oil-Burning Equipment: Service Water Heaters for Domestic Hot Water, Space Heating, and Swimming Pools	Table 9.36.4.2.
CSA	CAN/CSA-B182.1-11	Plastic Drain and Sewer Pipe and Pipe Fittings	Table 5.9.1.1. 9.14.3.1.(1)
CSA	CAN/CSA-B211-00	Energy Efficiency of Oil-Fired Storage Tank Water Heaters	Table 9.36.4.2.
CSA	B212-00	Energy Utilization Efficiencies of Oil-Fired Furnaces and Boilers	Table 9.36.3.10.
CSA	B214-12	Installation Code for Hydronic Heating Systems	6.2.1.1.(1) 9.33.4.2.(1) A-9.36.3.4.(1)
CSA	B355-09	Lifts for Persons with Physical Disabilities	3.5.4.1.(3) 3.8.3.7.(1)
CSA	B365-10	Installation Code for Solid-Fuel-Burning Appliances and Equipment	6.2.1.5.(1) 9.22.10.2.(1) 9.31.6.2.(2) 9.33.5.2.(1) 9.33.5.3.(1) A-9.33.1.1.(2) A-9.33.5.3.
CSA	B415.1-10	Solid-Fuel-Burning Heating Appliances	10.2.2.16.
CSA	B651-12	Accessible Design for the Built Environment	3.8.3.1.(1) Table 3.8.3.1. A-3.8.3.1.(1)
CSA	C22.2 No. 0.3-09	Test Methods for Electrical Wires and Cables	3.1.4.3.(1) 3.1.4.3.(3) 3.1.5.21.(1) 3.1.5.21.(3) 9.34.1.5.(1)
CSA	C22.2 No. 113-10	Fans and Ventilators	10.2.3.17.(3)
CSA	C22.2 No. 141-10	Emergency Lighting Equipment	3.2.7.4.(2) 3.4.5.1.(3) 9.9.11.3.(3) 9.9.12.3.(7)
CSA	CAN/CSA-C22.2 No. 150-M89	Microwave Ovens	A-9.10.22.
CSA	C22.2 No. 211.0-03	General Requirements and Methods of Testing for Nonmetallic Conduit	3.1.5.23.(1)
CSA	CAN/CSA-C22.2 No. 262-04	Optical Fiber Cable and Communication Cable Raceway Systems	3.1.5.23.(1)
CSA	CAN/CSA-C191-04	Performance of Electric Storage Tank Water Heaters for Domestic Hot Water Service	10.2.2.12.
CSA	CAN/CSA-C260-M90	Rating the Performance of Residential Mechanical Ventilating Equipment	9.32.3.5.(2)

			9.32.3.5.(5) 9.32.3.6.(2)
CSA	C282-2015	Emergency Electrical Power Supply for Buildings	3.2.7.5.(1)
CSA	C368.1-14	Energy Performance of Room Air Conditioners	Table 9.36.3.10.
CSA	CAN/CSA-C439-09	Rating the Performance of Heat/Energy-Recovery Ventilators	9.32.3.10.(4) 9.32.3.10.(5) 10.2.2.X. A-9.36.3.9.(3)
CSA	C448 Series-13	Design and Installation of Earth Energy Systems	9.33.5.2.(1)
CSA	C656-14	Split-System and Single-Package Air Conditioners and Heat Pumps	Table 9.36.3.10.
CSA	CAN/CSA-C745-03	Energy Efficiency of Electric Storage Tank Water Heaters and Heat Pump Water Heaters	Table 9.36.4.2.
CSA	CAN/CSA-C746-06	Rating Large and Single Packaged Vertical Air Conditioners and Heat Pumps	Table 9.36.3.10.
CSA	C748-13	Direct-Expansion (DX) Ground-Source Heat Pumps	Table 9.36.3.10.
CSA	CAN/CSA-C749-07	Performance of Dehumidifiers	Table 9.36.3.10.
CSA	C828-13	Thermostats Used with Individual Room Electric Space Heating Devices	9.36.3.6.(3)
CSA	CAN/CSA-C13256-1-01	Water-Source Heat Pumps – Testing and Rating for Performance – Part 1: Water-to-Air and Brine-to-Air Heat Pumps (Adopted ISO 13256-1:1998, with Canadian Deviations)	Table 9.36.3.10.
CSA	CAN/CSA-C13256-2-01	Water-Source Heat Pumps – Testing and Rating for Performance – Part 2: Water-to-Water and Brine-to-Water Heat Pumps (Adopted ISO 13256-2:1998, with Canadian Deviations)	Table 9.36.3.10.
CSA	F280-12	Determining the Required Capacity of Residential Space Heating and Cooling Appliances	9.33.5.1.(1) A-9.36.3.2.(1) A-9.36.5.15.(5)
CSA	CAN/CSA-F326-M91	Residential Mechanical Ventilation Systems	9.32.3.1.(1) 10.2.3.17.(3) A-9.32.3.1.(1) A-9.32.3.5. A-9.32.3.7. A-9.32.3.8. A-9.33.6.13.
CSA	G30.18-09	Carbon Steel Bars for Concrete Reinforcement	9.3.1.1.(4)
CSA	G40.21-13	Structural Quality Steel	4.2.3.8.(1) Table 5.9.1.1. 9.23.4.3.(2)
CSA	G401-14	Corrugated Steel Pipe Products	Table 5.9.1.1. 9.14.3.1.(1)
CSA	CAN/CSA-O80 Series-08	Wood Preservation	3.1.4.5.(1) 4.2.3.2.(1) 4.2.3.2.(2) Table 5.9.1.1.
CSA	CAN/CSA-O80.1-08	Specification of Treated Wood	9.3.2.9.(5)
CSA	CAN/CSA-O80.2-08	Processing and Treatment	4.2.3.2.(1)

CSA	CAN/CSA-O80.3-08	Preservative Formulations	4.2.3.2.(1)
CSA	O80.15-97	Preservative Treatment of Wood for Building Foundation Systems, Basements, and Crawl Spaces by Pressure Processes	4.2.3.2.(1)
CSA	O86-14	Engineering Design in Wood	Table 4.1.8.9. 4.3.1.1.(1) A-5.1.4.1.(6)(b) and (c) A-9.15.2.4.(1) A-9.23.4.2.
CSA	O112.9-10	Evaluation of Adhesives for Structural Wood Products (Exterior Exposure)	Table 9.10.3.1.-B
CSA	O112.10-08	Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure)	Table 9.10.3.1.-B
CSA	O118.1-08	Western Red Cedar Shakes and Shingles	Table 5.9.1.1. Table 9.26.2.1.-B 9.27.7.1.(1)
CSA	O118.2-08	Eastern White Cedar Shingles	Table 5.9.1.1. Table 9.26.2.1.-B 9.27.7.1.(1)
CSA	O121-08	Douglas Fir Plywood	Table 5.9.1.1. 9.23.15.2.(1) 9.23.16.2.(1) Table 9.23.17.2.-A 9.27.8.1.(1) 9.30.2.2.(1) Span Table 9.23.12.3.-A Span Table 9.23.12.3.-C
CSA	CAN/CSA-O122-06	Structural Glued-Laminated Timber	Span Table 9.23.4.2.-K Span Table 9.23.12.3.-D
CSA	CAN/CSA-O132.2 Series-90	Wood Flush Doors	9.7.4.3.(4)
CSA	O141-05	Softwood Lumber	Table 5.9.1.1. 9.3.2.6.(1) A-9.3.2.1.(1)
CSA	O151-09	Canadian Softwood Plywood	Table 5.9.1.1. 9.23.15.2.(1) 9.23.16.2.(1) Table 9.23.17.2.-A 9.27.8.1.(1) 9.30.2.2.(1) Span Table 9.23.12.3.-A Span Table 9.23.12.3.-C
CSA	O153-13	Poplar Plywood	Table 5.9.1.1. 9.23.15.2.(1) 9.23.16.2.(1) Table 9.23.17.2.-A 9.27.8.1.(1) 9.30.2.2.(1)
CSA	O177-06	Qualification Code for Manufacturers of Structural Glued-Laminated Timber	4.3.1.2.(1) Span Table 9.23.4.2.-K Span Table 9.23.12.3.-D
CSA	O325-07	Construction Sheathing	Table 5.9.1.1.

			Table 9.23.13.6. 9.23.15.2.(1) 9.23.15.4.(2) 9.23.16.2.(1) 9.23.16.3.(2) 9.29.9.1.(2) 9.29.9.2.(5) Span Table 9.23.12.3.-A Span Table 9.23.12.3.-C
CSA	O437.0-93	OSB and Waferboard	Table 5.9.1.1. 9.23.15.2.(1) 9.23.15.4.(2) 9.23.16.2.(1) 9.23.16.3.(2) Table 9.23.17.2.-A 9.27.10.1.(1) 9.29.9.1.(2) 9.30.2.2.(1) A-9.23.15.4.(2) Span Table 9.23.12.3.-A Span Table 9.23.12.3.-C
CSA	CSA P.2-07	Testing Method for Measuring the Annual Fuel Utilization Efficiency of Residential Gas-Fired Furnaces and Boilers	10.2.2.13.
CSA	CAN/CSA-P.3-04	Measuring Energy Consumption and Determining Efficiencies of Gas-Fired Storage Water Heaters	10.2.2.12.
CSA	CAN/CSA-P.7-10	Measuring Energy Loss of Gas-Fired Instantaneous Water Heaters	10.2.2.12.
CSA	S6-14	Canadian Highway Bridge Design Code	A-Table 4.1.5.3. A-Table 4.1.5.9.
CSA	S16-14	Design of Steel Structures	Table 4.1.8.9. 4.3.4.1.(1) A-4.1.5.11. A-Table 4.1.8.9. A-4.3.4.1.(1)
CSA	S37-13	Antennas, Towers, and Antenna-Supporting Structures	4.1.6.15.(1) 4.1.7.11.(1)
CSA	S136-12	North American Specification for the Design of Cold-Formed Steel Structural Members (using the Appendix B provisions applicable to Canada)	4.1.8.1.(5) Table 4.1.8.9. 4.3.4.2.(1)
CSA	CAN/CSA-S157-05/S157.1-05	Strength Design in Aluminum/Commentary on CSA S157-05, Strength Design in Aluminum	4.3.5.1.(1)
CSA	S269.1-1975	Falsework for Construction Purposes	4.1.1.3.(4)
CSA	CAN/CSA-S269.2-M87	Access Scaffolding for Construction Purposes	4.1.1.3.(4)
CSA	CAN/CSA-S269.3-M92	Concrete Formwork	4.1.1.3.(4)
CSA	S304-14(6)	Design of Masonry Structures	Table 4.1.8.9. 4.3.2.1.(1) A-5.1.4.1.(6)(b) and (c)
CSA	S307-M1980	Load Test Procedure for Wood Roof Trusses for Houses and Small Buildings	9.23.14.11.(5)
CSA	S350-M1980	Code of Practice for Safety in Demolition of Structures	8.1.1.3.(1)

CSA	S367-12	Air-, Cable-, and Frame-Supported Membrane Structures	4.4.1.1.(1)
CSA	S406-14	Permanent Wood Foundations for Housing and Small Buildings	9.15.2.4.(1) 9.16.5.1.(1) A-9.15.2.4.(1)
CSA	S413-14	Parking Structures	4.4.2.1.(1)
CSA	S478-95	Guideline on Durability in Buildings	A-5.1.4.2.
CSA	CAN/CSA-S832-06	Seismic Risk Reduction of Operational and Functional Components (OFCs) of Buildings	A-Table 4.1.8.18.
CSA	Z32-2015	Electrical Safety and Essential Electrical Systems in Health Care Facilities	3.2.7.3.(4) 3.2.7.6.(1) A-3.2.7.6.(1)
CSA	Z240 MH Series	Manufactured Homes	1.1.1.1.(2)(4) A-1.1.1.1.(2)(4)
CSA	Z240.2.1-09	Structural Requirements for Manufactured Homes	A-1.1.1.1.(2)(4) 9.12.2.2.(6) 9.15.1.3.(1)
CSA	Z240.10.1-08	Site Preparation, Foundation, and Anchorage of Manufactured Homes	A-1.1.1.1.(2)(4) 9.15.1.3.(1) 9.23.6.3.(1)
CSA	CAN/CSA-Z317.2-10	Special Requirements for Heating, Ventilation, and Air-Conditioning (HVAC) Systems in Health Care Facilities	6.2.1.1.(1) 6.3.2.15.(1)
CSA	Z662-11 Package	Oil and Gas Pipeline Systems/CSA Z662-11, Commentary on Oil and Gas Pipeline Systems	3.2.3.22.(1)
CSA	Z7396.1-12	Medical Gas Pipeline Systems – Part 1: Pipelines for Medical Gases, Medical Vacuum, Medical Support Gases, and Anaesthetic Gas Scavenging Systems	3.7.3.1.(1)
CTI	STD-201RS-04	Certification of Water-Cooling Tower Thermal Performance	Table 9.36.3.10.
CWC	BPS No. 1-2000	Moisture and Wood-Frame Buildings	A-5.6.2.1.
CWC	1997	Introduction to Wood Building Technology	A-9.27.3.8.(4)
CWC	2000	Wood Reference Handbook	A-9.27.3.8.(4)
CWC	2009	The Span Book	A-9.23.4.2.
CWC	2014	Engineering Guide for Wood Frame Construction	9.4.1.1.(1) 9.23.13.1.(2) 9.23.13.2.(2) 9.23.13.3.(2) A-9.4.1.1. A-9.23.13.1.
DOE	10 CFR, Part 430-2011	Energy, Energy Conservation Program for Consumer Products	Table 9.36.4.2.
DOE	10 CFR, Part 431-2011	Energy, Energy Efficiency Program for Certain Commercial and Industrial Equipment	Table 9.36.4.2.
ECC	2013	EIFS Practice Manual	A-5.9.4.1.(1) A-9.27.13.1.(1)
EPA	40 CFR, Part 60-2008	Protection of Environment, Standards of Performance for New Stationary Sources	Table 9.36.3.10.

EPA	625/R-92/016 (1994)	Radon Prevention in the Design and Construction of Schools and Other Large Buildings	A-5.4.1.1. 6.2.1.1.(1)
FEMA	450-1-2003	NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures	A-4.1.8.18.(15) and (16)(c)
FEMA	P-750-2009	NEHRP Recommended Seismic Provisions for New Buildings and Other Structures	A-4.1.8.18.(15) and (16)(c)
FLL	2008	Guidelines for the Planning, Construction and Maintenance of Green Roofing	A-5.6.1.2.(2)
FM Approvals	2008	Approval Standard for Quick Response Storage Sprinklers for Fire Protection	A-3.2.5.12.(7)
FPI	Project 43-10C-024 (1988)	Deflection Serviceability Criteria for Residential Floors	A-9.23.4.2.(2)
FPI/RDH	SP-53-2013	Guide for Designing Energy-Efficient Building Enclosures for Wood-Frame Multi-Unit Residential Buildings in Marine to Cold Climate Zones in North America	A-5.6.2.1.
HC	H46-2/90-156E	Exposure Guidelines for Residential Indoor Air Quality	A-6.3.1.6. A-9.25.5.2.
HC	2007	Radon: A Guide for Canadian Homeowners	A-5.4.1.1. A-6.2.1.1. A-9.13.4.3.
HC	R.S.C., 1985, c. H-3	Hazardous Products Act	A-1.4.1.2.(1)(4) A-9.25.2.2.(2)
HC	Hazardous Products Act, Part II	Workplace Hazardous Materials Information System (WHMIS)	A-1.4.1.2.(1)(4) A-3.3.1.2.(1)
HC	SOR/2015–17	Hazardous Products Regulations	1.4.1.2.(1)(4) A-3.3.1.2.(1)
HC	2004	Fungal Contamination in Public Buildings: Health Effects and Investigation Methods	A-5.5.1.1.
HC	2008	Guide for Radon Measurements in Public Buildings (Schools, Hospitals, Care Facilities, Detention Centres)	A-5.4.1.1. A-6.2.1.1.
HC	2008	Guide for Radon Measurements in Residential Dwellings (Homes)	A-9.13.4.3.
HPVA	ANSI/HPVA HP-1-2009	Hardwood and Decorative Plywood	Table 5.9.1.1. 9.27.8.1.(1) 9.30.2.2.(1)
HRAI	SAR-G1	HRAI Digest 2005	6.2.1.1.(1) 9.32.2.3.(4) 9.32.3.2.(1) 9.33.4.1.(1) A-9.36.3.2.(1) A-9.36.3.2.(2) A-9.36.3.4.(1)
HVI	HVI Publication 911	Certified Home Ventilating Products Directory	A-9.36.3.9.(3)
HVI	HVI Publication 915-2013	Loudness Testing and Rating Procedure	9.32.3.10.(2) Table 9.32.3.10.-B
HVI	HVI Publication 916-2013	Airflow Test Procedure	9.32.3.5.(2) 9.32.3.6.(2)

ICC	400-2012	Design and Construction of Log Structures	9.36.2.2.(5) A-9.36.2.2.(5)
IEC	60268-16:2011	Sound System Equipment – Part 16: Objective Rating of Speech Intelligibility by Speech Transmission Index	A-3.2.4.22.(1)(b)
ISO	3864-1:2002	Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs and safety markings	3.4.5.1.(2) 9.9.11.3.(2)
ISO	7010:2003	Graphical symbols – Safety colours and safety signs – Registered safety signs	3.4.5.1.(2) A-3.4.5.1.(2)(c) 9.9.11.3.(2)
ISO	7240-19:2007	Fire Detection and Alarm Systems – Part 19: Design, Installation, Commissioning and Service of Sound Systems for Emergency Purposes	A-3.2.4.22.(1)(b)
ISO	7731:2003(E)	Ergonomics – Danger signals for public and work areas – Auditory danger signals	A-3.2.4.22.(1)(b)
ISO	8201:1987(E)	Acoustics – Audible emergency evacuation signal	3.2.4.18.(2) A-3.2.4.18.(2)
ISO	10848:2006	Acoustics - Laboratory Measurement of the Flanking Transmission of Airborne and Impact Sound Between Adjoining Rooms	5.8.1.4.(2) 5.8.1.4.(3) 5.8.1.5.(2) 5.8.1.5.(3)
ISO	15712-1:2005	Building Acoustics – Estimation of Acoustic Performance of Buildings From the Performance of Elements – Part 1: Airborne Sound Insulation Between Rooms	5.8.1.4.(1) 5.8.1.4.(2) 5.8.1.4.(4) 5.8.1.4.(5) 5.8.1.4.(6) 5.8.1.5.(1) 5.8.1.5.(2) 5.8.1.5.(5) 5.8.1.5.(6)
NEMA	SB 50-2008	Emergency Communications Audio Intelligibility Applications Guide	A-3.2.4.22.(1)(b)
NFPA	2010 Edition	Fire Protection Guide to Hazardous Materials	A-6.9.1.2.(1)
NFPA	2008	Fire Protection Handbook, Twentieth Edition	A-3.2.2.2.(1) A-3.6.2.7.(5)
NFPA	13-2013	Installation of Sprinkler Systems	3.1.9.1.(4) 3.2.4.8.(2) 3.2.4.15.(1) 3.2.5.12.(1) 3.3.2.14.(3) A-3.1.11.5.(3) A-3.2.4.9.(3)(f) A-3.2.5.12.(1) A-3.2.5.12.(6) A-3.2.5.12.(7) A-3.2.5.13.(1) A-3.2.8.2.(3) 9.10.9.6.(11) 2.2.7.1.(1)[5]
NFPA	13D-2013	Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes	3.2.4.1.(2) 3.2.5.12.(3) A-3.2.5.12.(2) A-3.2.5.12.(6) A-3.2.5.12.(7)

			A-3.2.5.13.(1) 9.10.18.2.(3)
NFPA	13R-2013	Installation of Sprinkler Systems in Low-Rise Residential Occupancies	3.2.5.12.(2) A-3.2.5.12.(2) A-3.2.5.12.(6) A-3.2.5.12.(7) A-3.2.5.13.(1)
NFPA	14-2013	Installation of Standpipe and Hose Systems	3.2.5.9.(1) 3.2.5.10.(1) 2.2.7.1.(1)[5]
NFPA	20-2013	Installation of Stationary Pumps for Fire Protection	3.2.4.9.(4) 3.2.5.18.(1) A-3.2.4.9.(3)(f)
NFPA	30-2012	Flammable and Combustible Liquids Code	A-6.9.1.2.(1)
NFPA	30A-2012	Motor Fuel Dispensing Facilities and Repair Garages	A-6.9.1.2.(1)
NFPA	32-2011	Drycleaning Plants	A-6.9.1.2.(1)
NFPA	33-2011	Spray Application Using Flammable or Combustible Materials	A-6.9.1.2.(1)
NFPA	34-2011	Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids	A-6.9.1.2.(1)
NFPA	35-2011	Manufacture of Organic Coatings	A-6.9.1.2.(1)
NFPA	36-2013	Solvent Extraction Plants	A-6.9.1.2.(1)
NFPA	40-2011	Storage and Handling of Cellulose Nitrate Film	A-6.9.1.2.(1)
NFPA	51-2013	Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes	A-6.9.1.2.(1)
NFPA	51A-2012	Acetylene Cylinder Charging Plants	A-6.9.1.2.(1)
NFPA	55-2013	Compressed Gases and Cryogenic Fluids Code	A-6.9.1.2.(1)
NFPA	61-2013	Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities	A-6.9.1.2.(1)
NFPA	68-2013	Explosion Protection by Deflagration Venting	3.3.6.4.(2) A-3.6.2.7.(5) A-6.9.1.2.(1)
NFPA	69-2014	Explosion Prevention Systems	A-3.6.2.7.(5) A-6.9.1.2.(1)
NFPA	72-2013	National Fire Alarm and Signaling Code	A-3.2.4.22.(1)(b)
NFPA	80-2013	Fire Doors and Other Opening Protectives	3.1.8.5.(2) 3.1.8.12.(2) 3.1.8.16.(1) 3.1.9.1.(5) A-3.1.8.1.(2) A-3.2.8.2.(3) 9.10.9.6.(13) 9.10.13.1.(1)
NFPA	80A-2012	Protection of Buildings from Exterior Fire Exposures	A-3
NFPA	82-2014	Incinerators and Waste and Linen Handling Systems and Equipment	6.2.2.1.(1)

			9.10.10.5.(2)
NFPA	85-2011	Boiler and Combustion Systems Hazards Code	A-6.9.1.2.(1)
NFPA	86-2011	Ovens and Furnaces	A-6.9.1.2.(1)
NFPA	88A-2011	Parking Structures	A-6.9.1.2.(1)
NFPA	91-2010	Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids	6.3.4.3.(1) A-6.9.1.2.(1)
NFPA	96-2014	Ventilation Control and Fire Protection of Commercial Cooking Operations	3.2.4.8.(2) 3.6.3.5.(1) A-3.3.1.2.(2) A-3.6.3.5. 6.3.1.7.(1) A-6.9.1.2.(1) A-9.10.1.4.(1)
NFPA	101-2012	Life Safety Code	3.3.2.1.(2) 3.3.2.1.(3) A-3.3.2.1.(2)
NFPA	105-2013	Smoke Door Assemblies and Other Opening Protectives	3.1.8.5.(3) 3.1.8.5.(7)
NFPA	204-2012	Smoke and Heat Venting	A-6.9.1.2.(1)
NFPA	211-2013	Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances	6.3.3.2.(2) 6.3.3.3.(1)
NFPA	303-2011	Marinas and Boatyards	A-6.9.1.2.(1)
NFPA	307-2011	Construction and Fire Protection of Marine Terminals, Piers, and Wharves	A-6.9.1.2.(1)
NFPA	409-2011	Aircraft Hangars	A-6.9.1.2.(1)
NFPA	415-2013	Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways	A-6.9.1.2.(1)
NFPA	484-2012	Combustible Metals	A-6.9.1.2.(1)
NFPA	654-2013	Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids	A-6.9.1.2.(1)
NFPA	655-2012	Prevention of Sulfur Fires and Explosions	A-6.9.1.2.(1)
NFPA	664-2012	Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities	A-6.9.1.2.(1)
NFPA	1142-2007	Standard on Water Supplies for Suburban and Rural Fire Fighting	A-3.2.5.7.(1)
NFPA	1710-2010	Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments	A-3.2.3.1.(8)
NFRC	100-2010	Determining Fenestration Product U-factors	9.36.2.2.(3)
NFRC	200-2010	Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence	9.36.2.2.(3)
NLGA	2014	Standard Grading Rules for Canadian Lumber	9.3.2.1.(1) A-9.3.2.1.(1) Table A-9.3.2.1.(1)-A

			A-Table 9.3.2.1. A-9.3.2.8.(1) A-9.23.10.4.(1)
NLGA	SPS-1-2013	Fingerjoined Structural Lumber	Table 9.10.3.1.-A A-9.23.10.4.(1)
NLGA	SPS-3-2013	Fingerjoined “Vertical Stud Use Only” Lumber	Table 9.10.3.1.-A A-9.23.10.4.(1)
NRC-IRC	CBD 222	Airtight Houses and Carbon Monoxide Poisoning	A-9.33.1.1.(2)
NRC-IRC	CBD 230	Applying Building Codes to Existing Buildings	A-1.1.1.1.(1)[(4)]
NRC-IRC	CBD 231	Moisture Problems in Houses	A-9.25.3.1.(1)
NRC-IRC	1988	Performance and Acceptability of Wood Floors – Forintek Studies	A-9.23.4.2.(2)
NRCA	2005	The NRCA Waterproofing Manual	A-5.6.2.1.
NRCA	2011	The NRCA Roofing Manual: Membrane Roof Systems	A-5.6.2.1.
NRCA	2nd Edition, 2009	Vegetative Roof Systems Manual	A-5.6.1.2.(2)
NRCan	R.S.C., 1985, c. E-17	Explosives Act	3.3.6.2.(3)
NRC Const.	2005	A Guide for the Wind Design of Mechanically Attached Flexible Membrane Roofs	A-5.2.2.2.(4)
NRC Const.	RR-331-2013	Guide to Calculating Airborne Sound Transmission in Buildings	A-5.8.1.4.
NYCDH	2008	Guidelines on Assessment and Remediation of Fungi in Indoor Environments	A-5.5.1.1.
OMMAH	2012	2012 Building Code Compendium, Volume 2, Supplementary Standard SB-7, Guards for Housing and Small Buildings	A-9.8.8.2.
SMACNA	ANSI/SMACNA 006-2006	HVAC Duct Construction Standards – Metal and Flexible	9.33.6.5.(2) A-9.36.3.2.(2)
SMACNA	2012	Architectural Sheet Metal Manual, Seventh Edition	A-5.6.2.1.
SPRI	ANSI/GRHC/SPRI VR-1-2011	Investigating Resistance to Root Penetration on Vegetative Roofs	5.6.1.2.(2)
SPRI	ANSI/SPRI WD-1-2008	Wind Design Standard Practice for Roofing Assemblies	A-5.2.2.2.(4)
TC	SOR/96-433	Canadian Aviation Regulations – Part III	4.1.5.13.(1)
TC	SOR/2008-34	Transportation of Dangerous Goods Regulations (TDGR)	1.4.1.2.(1)[(4)] A-1.4.1.2.(1)[(4)] A-3.3.1.2.(1)
TIAC	2013	Mechanical Insulation Best Practices Guide	A-6.3.2.5.
TPIC	2014	Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses (Limit States Design)	9.23.14.11.(6)
TWC	1993	Details of Air Barrier Systems for Houses	Table A-9.25.5.1.(1)
TWC	1995	High-Rise Residential Construction Guide	A-5.6.2.1.
UL	ANSI/UL 300-2005	Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment	6.9.1.3.(1)
UL	731-1995	Oil-Fired Unit Heaters	Table 9.36.3.10.

UL	ANSI/UL-1784-04	Air Leakage Tests of Door Assemblies and Other Opening Protectives	3.1.8.4.(4)
ULC	CAN/ULC-S101-14	Fire Endurance Tests of Building Construction and Materials	3.1.5.7.(2) 3.1.5.14.(5) 3.1.5.14.(6) 3.1.5.15.(3) 3.1.5.15.(4) 3.1.7.1.(1) 3.1.11.7.(1) 3.2.3.8.(1) 3.2.6.5.(6) A-3.1.5.14.(5)(d) A-3.2.6.5.(6)(b) 9.10.16.3.(1) Table 9.10.3.1.-B
ULC	CAN/ULC-S102-10	Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies	3.1.5.24.(1) 3.1.12.1.(1) Table 9.23.17.2.-A 9.29.5.2.(1)
ULC	CAN/ULC-S102.2-10	Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies	3.1.12.1.(2) 3.1.13.4.(1)
ULC	CAN/ULC-S102.3-07	Fire Test of Light Diffusers and Lenses	3.1.13.4.(1)
ULC	CAN/ULC-S102.4-10	Test for Fire and Smoke Characteristics of Electrical Wiring, Cables and Non-Metallic Raceways	3.1.4.3.(2) 3.1.5.21.(2) 3.1.5.23.(2)
ULC	CAN/ULC-S104-10	Fire Tests of Door Assemblies	3.1.8.4.(1) 3.2.6.5.(3)
ULC	CAN/ULC-S105-09	Fire Door Frames Meeting the Performance Required by CAN/ULC-S104	9.10.13.6.(1)
ULC	CAN4-S106-M80	Fire Tests of Window and Glass Block Assemblies	3.1.8.4.(1)
ULC	CAN/ULC-S107-10	Fire Tests of Roof Coverings	3.1.15.1.(1)
ULC	CAN/ULC-S109-03	Flame Tests of Flame-Resistant Fabrics and Films	3.1.6.5.(1) 3.1.16.1.(1) 3.6.5.2.(2) 3.6.5.3.(1) 9.33.6.3.(1)
ULC	CAN/ULC-S110-13	Test for Air Ducts	3.6.5.1.(2) 3.6.5.1.(5) 9.33.6.2.(2) 9.33.6.2.(4)
ULC	CAN/ULC-S111-13	Fire Tests for Air Filter Units	6.3.2.13.(1) 9.33.6.14.(1)
ULC	CAN/ULC-S112-10	Fire Test of Fire Damper Assemblies	3.1.8.4.(1) A-3.2.6.6.(1)
ULC	CAN/ULC-S112.1-10	Leakage Rated Dampers for Use in Smoke Control Systems	3.1.8.4.(3) 6.3.2.7.(3)
ULC	CAN/ULC-S112.2-07	Fire Test of Ceiling Firestop Flap Assemblies	3.6.4.3.(2) 9.10.13.14.(1)
ULC	CAN/ULC-S113-07	Wood Core Doors Meeting the Performance Required by CAN/ULC-S104 for Twenty Minute Fire Rated Closure Assemblies	9.10.13.2.(1) A-9.10.9.3.(2)

			A-9.10.13.2.(1)
ULC	CAN/ULC-S114-05	Test for Determination of Non-Combustibility in Building Materials	1.4.1.2.(1)[4]
ULC	CAN/ULC-S115-11	Fire Tests of Firestop Systems	3.1.5.19.(3) 3.1.9.1.(1) 3.1.9.1.(2) 3.1.9.1.(3) 3.1.9.4.(1) 3.1.9.5.(4) 9.10.9.6.(2) 9.10.9.7.(3)
ULC	CAN/ULC-S124-06	Test for the Evaluation of Protective Coverings for Foamed Plastic	3.1.5.15.(2) A-3.1.5.14.(5)(d)
ULC	CAN/ULC-S126-06	Test for Fire Spread Under Roof-Deck Assemblies	3.1.14.1.(1) 3.1.14.2.(1)
ULC	CAN/ULC-S134-13	Fire Test of Exterior Wall Assemblies	3.1.5.5.(1) 9.10.14.5.(2) 9.10.15.5.(2) 9.10.15.5.(3)
ULC	ULC-S135-04	Test Method for the Determination of Combustibility Parameters of Building Materials Using an Oxygen Consumption Calorimeter (Cone Calorimeter)	3.1.5.1.(2)
ULC	CAN/ULC-S138-06	Test for Fire Growth of Insulated Building Panels in a Full-Scale Room Configuration	3.1.5.7.(1) 3.1.5.7.(3)
ULC	CAN/ULC-S139-12	Fire Test for Evaluation of Integrity of Electrical Power, Data and Optical Fibre Cables	3.2.7.10.(2) 3.2.7.10.(3)
ULC	CAN/ULC-S143-09	Fire Tests for Non-Metallic Electrical and Optical Fibre Cable Raceway Systems	3.1.5.23.(1)
ULC	CAN/ULC-S144-12	Fire Resistance Test – Grease Duct Assemblies	3.6.3.5.(2) A-3.6.3.5.
ULC	ULC-S332-93	Burglary Resisting Glazing Material	A-9.7.5.2.(1)
ULC	ULC-S505-1974	Fusible Links for Fire Protection Service	3.1.8.10.(2)
ULC	CAN/ULC-S524-14	Installation of Fire Alarm Systems	3.1.8.11.(3) 3.1.8.14.(3) 3.2.4.5.(1) 3.2.4.19.(4) 3.2.4.20.(8) 3.2.4.20.(13) 9.10.19.4.(3) 9.10.19.6.(2) A-3.2.4.7.(4) A-3.2.4.18.(8) and (9) A-3.2.4.20.(8)
ULC	CAN/ULC-S526-07	Visible Signal Devices for Fire Alarm Systems, Including Accessories	3.2.4.19.(4) 3.2.4.19.(5) A-3.2.4.19.(2)
ULC	CAN/ULC-S531-14	Standard for Smoke Alarms	3.2.4.20.(2) 3.3.2.17.(4) 9.10.19.1.(1) 9.37.2.19.(1)

ULC	CAN/ULC-S537-13	Verification of Fire Alarm Systems	3.2.4.5.(2)
ULC	CAN/ULC-S540-13	Residential Fire and Life Safety Warning Systems: Installation, Inspection, Testing and Maintenance	3.2.4.21.(1) 9.10.19.8.(1)
ULC	CAN/ULC-S553-14	Installation of Smoke Alarms	3.2.4.20.(11) 9.10.19.3.(2)
ULC	CAN/ULC-S561-13	Installation and Services for Fire Signal Receiving Centres and Systems	3.2.4.7.(4) A-3.2.4.7.(4)
ULC	CAN/ULC-S572-10	Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems	3.4.5.1.(3) 3.4.5.1.(4) 9.9.11.3.(3) 9.9.11.3.(4) A-3.4.5.1.(4)
ULC	CAN/ULC-S610-M87	Factory-Built Fireplaces	9.22.8.1.(1)
ULC	ULC-S628-93	Fireplace Inserts	9.22.10.1.(1)
ULC	CAN/ULC-S629-M87	650°C Factory-Built Chimneys	9.33.10.2.(1)
ULC	CAN/ULC-S639-M87	Steel Liner Assemblies for Solid-Fuel Burning Masonry Fireplaces	9.22.2.3.(1)
ULC	CAN/ULC-S701-11	Thermal Insulation, Polystyrene, Boards and Pipe Covering	Table 5.9.1.1. 9.15.4.1.(1) Table 9.23.17.2.-A 9.25.2.2.(1) Table A-9.36.2.4.(1)-D
ULC	CAN/ULC-S702-09	Mineral Fibre Thermal Insulation for Buildings	Table 5.9.1.1. A-5.9.1.1.(1) Table 9.23.17.2.-A 9.25.2.2.(1) Table A-9.36.2.4.(1)-D
ULC	CAN/ULC-S703-09	Cellulose Fibre Insulation for Buildings	Table 5.9.1.1. 9.25.2.2.(1) Table A-9.36.2.4.(1)-D
ULC	CAN/ULC-S704-11	Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced	Table 5.9.1.1. Table 9.23.17.2.-A 9.25.2.2.(1) Table A-9.36.2.4.(1)-D
ULC	CAN/ULC-S705.1-01	Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Material – Specification	Table 5.9.1.1. 9.25.2.2.(1) Table A-9.36.2.4.(1)-D
ULC	CAN/ULC-S705.2-05	Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Application	Table 5.9.1.1. 9.25.2.5.(1)
ULC	CAN/ULC-S706-09	Wood Fibre Insulating Boards for Buildings	Table 5.9.1.1. 9.23.16.7.(3) Table 9.23.17.2.-A 9.25.2.2.(1) 9.29.8.1.(1)
ULC	CAN/ULC-S710.1-11	Thermal Insulation – Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification	Table 5.9.1.1. 9.36.2.10.(6)
ULC	CAN/ULC-S711.1-11	Thermal Insulation – Bead-Applied Two Component Polyurethane Air Sealant Foam, Part 1: Material Specification	Table 5.9.1.1. 9.36.2.10.(6)

ULC	CAN/ULC-S712.1-10	Thermal Insulation – Light Density, Open Cell Spray Applied Semi-Rigid Polyurethane Foam – Material Specification	Table A-9.36.2.4.(1)-D
ULC	CAN/ULC-S716.1-12	Exterior Insulation and Finish Systems (EIFS) – Materials and Systems	5.9.4.1.(1) A-5.9.4.1.(1) 9.27.13.1.(1) 9.27.13.2.(1) A-9.27.13.2.(2)(a)
ULC	CAN/ULC-S716.2-12	Exterior Insulation and Finish Systems (EIFS) – Installation of EIFS Components and Water Resistive Barrier	A-5.9.4.1.(1) 9.27.13.3.(1)
ULC	CAN/ULC-S716.3-12	Exterior Insulation and Finish System (EIFS) – Design Application	A-5.9.4.1.(1) 9.27.13.3.(1)
ULC	CAN/ULC-S741-08	Air Barrier Materials – Specification	5.4.1.2.(1) 9.36.2.10.(1)
ULC	CAN/ULC-S742-11	Air Barrier Assemblies – Specification	9.36.2.9.(1) A-9.36.2.9.(1) A-9.36.2.10.(5)(b)
ULC	CAN/ULC-S770-09	Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams	Table A-9.36.2.4.(1)-D
ULC	CAN/ULC-S1001-11	Integrated Systems Testing of Fire Protection and Life Safety Systems	3.2.9.1.(1) A-3.2.9.1.(1) 9.10.1.2.(1)
ULC	ULC/ORD-C199P-2002	Combustible Piping for Sprinkler Systems	3.2.5.13.(2) 3.2.5.13.(5)
ULC	ULC/ORD-C1254.6-1995	Fire Testing of Restaurant Cooking Area Fire Extinguishing System Units	6.9.1.3.(1)
USACE	Version 3-2012	Air Leakage Test Protocol for Building Envelopes	10.2.2.21.(1)
U.S. Congress		National Appliance Energy Conservation Act of 1987	Table 9.36.4.2. Table 9.36.5.16.
WCLIB	No. 17 (2004)	Standard Grading Rules	A-Table 9.3.2.1.
WWPA	2011	Western Lumber Grading Rules	A-Table 9.3.2.1.

Notes to Table 1.3.1.2.:

(1) See Table D-1.1.2. in Appendix D for the list of standards referenced therein.
(2) Some documents may have been reaffirmed or reapproved. Check with the applicable issuing agency for up-to-date information.
(3) Some titles have been abridged to omit superfluous wording.
(4) By-law reference is in Division A.
(5) By-law reference is in Division C.
(6) Notwithstanding the effective date stated in Sentence 1.3.1.1.(1), the August 2014 edition of CSA S304 is referenced as it better meets the intent of the By-law.

1.3.2. Organizations

1.3.2.1. Abbreviations of Proper Names

1) The abbreviations of proper names in this By-law shall have the meanings assigned to them in this Article.

AAMA American Architectural Manufacturers Association (www.aamanet.org)
ACGIH American Conference of Governmental Industrial Hygienists (www.acgih.org)
AHAM Association of Home Appliance Manufacturers (www.aham.org)
AHRI Air-Conditioning, Heating and Refrigeration Institute (www.ahrinet.org)
AISI American Iron and Steel Institute (www.steel.org)

ANSI American National Standards Institute (www.ansi.org)
ASCE American Society of Civil Engineers (www.asce.org)
ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers (www.ashrae.org)
ASME American Society of Mechanical Engineers (www.asme.org)
ASTM American Society for Testing and Materials International (www.astm.org)
AWPA American Wood Protection Association (www.awpa.com)
BIA Brick Industry Association (www.bia.org)
BNQ Bureau de normalisation du Québec (www.bnq.qc.ca)
CAN National Standard of Canada designation (The number or name following the CAN designation represents the agency under whose auspices the standard is issued.)
CAN3 designates CSA
CAN4 designates ULC
CCBFC Canadian Commission on Building and Fire Codes (see NRC)
CCME Canadian Council of Ministers of the Environment (www.ccme.ca)
CGSB Canadian General Standards Board (www.tpsgc-pwgsc.gc.ca/ongc-cgsb/index-eng.html)
CHC Canadian Hydronics Council (www.ciph.com)
CISC Canadian Institute of Steel Construction (www.cisc.ca)
CMHC Canada Mortgage and Housing Corporation (www.cmhc.ca)
CoV City of Vancouver (www.vancouver.ca)
CRCA Canadian Roofing Contractors' Association (www.roofingcanada.com)
CSA CSA Group (www.csagroup.org)
CTI Cooling Technology Institute (www.cti.org)
CWC Canadian Wood Council (www.cwc.ca)
DOE Department of Energy (www.energy.gov)
EC Environment Canada (www.ec.gc.ca)
ECC EIFS Council of Canada (www.eifscouncil.org)
EPA Environmental Protection Agency (U.S.) (www.epa.gov)
FEMA Federal Emergency Management Agency (www.fema.gov)
FLL German Landscape Research, Development and Construction Society (www.fll.de/shop/english-publications.html)
FPI FPInnovations – Wood Products (formerly FCC – Forintek Canada Corporation) (www.fpinnovations.ca)
GRHC Green Roofs for Healthy Cities (www.greenroofs.org)
HC Health Canada (www.hc-sc.gc.ca)
HPVA Hardwood Plywood & Veneer Association (www.hpva.org)
HRAI Heating, Refrigeration and Air Conditioning Institute of Canada (www.hrai.ca)
HVI Home Ventilating Institute (www.hvi.org)
ICC International Code Council (www.iccsafe.org)
IEC International Electrotechnical Commission (www.iec.ch)
ISO International Organization for Standardization (www.iso.org)
NBC National Building Code of Canada 2015
NCMA National Concrete Masonry Association (www.ncma.org)
NECB National Energy Code of Canada for Buildings 2015
NEMA National Electrical Manufacturers Association (www.nema.org)
NFPA National Fire Protection Association (www.nfpa.org)
NFRC National Fenestration Rating Council (www.nfrc.org)
NLGA National Lumber Grades Authority (www.nlga.org)
NRC National Research Council of Canada (Ottawa, Ontario K1A 0R6; www.nrc-cnrc.gc.ca)
NRCA National Roofing Contractors Association (www.nrca.net)
NRCan Natural Resources Canada (www.nrcan.gc.ca)

NRC Const. NRC Construction (see NRC) (www.nrc.gc.ca/construction)
NRC-IRC National Research Council, Institute for Research in Construction (former name of NRC Construction)
NYCDH New York City Department of Health and Mental Hygiene (www.nyc.gov/health)
OMMAH Ontario Ministry of Municipal Affairs and Housing (www.mah.gov.on.ca)
SMACNA Sheet Metal and Air Conditioning Contractors' National Association (www.smacna.org)
SPRI Single Ply Roofing Industry (www.spri.org)
TC Transport Canada (www.tc.gc.ca)
TECA Thermal Environmental Comfort Association (www.teca.ca)
TIAC Thermal Insulation Association of Canada (www.tiac.ca)
TPIC Truss Plate Institute of Canada (www.tpic.ca)
TWC Tarion Warranty Corporation (formerly Ontario New Home Warranty Program) (www.tarion.com)
UL Underwriters Laboratories Inc. (www.ul.com)
ULC ULC Standards (canada.ul.com/ulcstandards)
USACE United States Army Corps of Engineers (www.erdc.usace.army.mil/Locations/CERL)
WCLIB West Coast Lumber Inspection Bureau (www.wclib.org)
WWPA Western Wood Products Association (www.wwpa.org)

Notes to Part 1
General

A-1.1.2.1.(1) Objectives and Functional Statements Attributed to Acceptable Solutions. The objectives and functional statements attributed to each By-law provision are listed in a table following the provisions in each Part.

Many provisions in Division B serve as modifiers of or pointers to other provisions, or serve other clarification or explanatory purposes. In most cases, no objectives and functional statements have been attributed to such provisions, which therefore do not appear in the above-mentioned tables.

For provisions that serve as modifiers of or pointers to other referenced provisions and that do not have any objectives and functional statements attributed to them, the objectives and functional statements that should be used are those attributed to the provisions they reference.

A-1.1.3.1.(1) Climatic and Seismic Values. Climatic values for municipalities not listed in Appendix C may be obtained by contacting the Meteorological Service of Canada, Environment Canada, 4905 Dufferin Street, Toronto, Ontario M3H 5T4; www.climate.weather.gc.ca.

Seismic values for municipalities not listed in Appendix C can be obtained at www.earthquakescanada.nrcan.gc.ca or by writing to the Geological Survey of Canada at 7 Observatory Crescent, Ottawa, Ontario K1A 0Y3, or at P.O. Box 6000, Sidney, B.C. V8L 4B2.

A-1.1.3.1.(2) Winter Design Temperatures. The 2.5% values referred to in Sentence 1.1.3.1.(2) are the least restrictive temperatures that can be used. A designer may choose to use the 1% values given in Appendix C, which are in excess of the By-law minimums but are considered acceptable.

Part 3
Fire Protection, Occupant Safety and Accessibility

Section 3.1. General

3.1.1. Scope and Definitions

3.1.1.1. Scope

1) The scope of this Part shall be as described in Subsection 1.3.3. of Division A.

3.1.1.2. Defined Words

1) Words that appear in italics are defined in Article 1.4.1.2. of Division A.

3.1.1.3. Use of Term Storage Tank

1) For the purposes of this Part, the term “storage tank” shall mean a vessel for *flammable liquids* or *combustible liquids* having a capacity of more than 230 L and designed to be installed in a fixed location.

3.1.1.4. Fire Protection Information

1) Information to be submitted regarding major components of fire protection shall conform to the requirements of Subsection 2.2.3. of Division C.

3.1.2. Classification of Buildings or Parts of Buildings by Major Occupancy

(See Note A-3.1.2.)

3.1.2.1. Classification of Buildings

1) Except as permitted by Articles 3.1.2.3. to 3.1.2.6., every *building* or part thereof shall be classified according to its *major occupancy* as belonging to one of the Groups or Divisions described in Table 3.1.2.1. (See Note A-3.1.2.1.(1).)

2) A *building* intended for use by more than one *major occupancy* shall be classified according to all *major occupancies* for which it is used or intended to be used.

Table 3.1.2.1.
Major Occupancy Classification
Forming Part of Sentences 3.1.2.1.(1) and 3.1.2.2.(1)

Group	Division	Description of *Major Occupancies*
A	1	*Assembly occupancies* intended for the production and viewing of the performing arts
A	2	*Assembly occupancies* not elsewhere classified in Group A
A	3	*Assembly occupancies* of the arena type
A	4	*Assembly occupancies* in which occupants are gathered in the open air
B	1	*Detention occupancies*
B	2	*Treatment occupancies*

B	3	*Care occupancies*
C	–	*Residential occupancies*
D	–	*Business and personal services occupancies*
E	–	*Mercantile occupancies*
F	1	*High-hazard industrial occupancies*
F	2	*Medium-hazard industrial occupancies*
F	3	*Low-hazard industrial occupancies*

3.1.2.2. Occupancies of Same Classification

1) Any *building* is deemed to be occupied by a single *major occupancy*, notwithstanding its use for more than one *major occupancy*, provided that all *occupancies* are classified as belonging to the same Group classification or, where the Group is divided into Divisions, as belonging to the same Division classification described in Table 3.1.2.1.

3.1.2.3. Arena-Type Buildings

1) An arena-type *building* intended for occasional use for trade shows and similar exhibition purposes shall be classified as a Group A, Division 3 *occupancy*. (See Note A-3.1.2.3.(1).)

3.1.2.4. Police Stations

1) A police station with detention quarters is permitted to be classified as a Group B, Division 2 *major occupancy* provided the station is not more than 1 *storey* in *building height* and 600 m^2 in *building area*.

3.1.2.5. Convalescent, Children's Custodial, and Residential Care Homes

1) Convalescent homes and children's custodial homes are permitted to be classified as *residential occupancies* within the application of Part 3, provided that occupants are ambulatory and live as a single housekeeping unit in a *suite* with sleeping accommodation for not more than 10 persons.

2) A care facility accepted for residential use pursuant to provincial legislation, a community care facility or a group residence, is permitted to be classified as a *residential occupancy*, provided

a) occupants live as a single housekeeping unit in a *dwelling unit* with sleeping accommodation for not more than 10 persons,

b) smoke alarms are installed in conformance with Article 3.2.4.20.,

c) emergency lighting is provided in conformance with Subsection 3.2.7., and

d) the *building* is *sprinklered* throughout.

3.1.2.6. Group A, Division 2, Low Occupant Load

1) A *suite* of Group A, Division 2 *assembly occupancy*, except a *child care facility*, is permitted to be classified as a Group D, *business and personal services occupancy* provided

a) the number of persons in the *suite* does not exceed 30, and

b) except as permitted by Sentence (2), the suite is separated from the remainder of the building by a fire separation having a fire-resistance rating of not less than 1 hr.

2) The *fire separation* required by Sentence (1) need not have a *fire-resistance rating* where the *suite* is located in a *building* that is *sprinklered* throughout.

3) A permanent sign, with lettering not less than 50 mm high with a 12 mm stroke, indicating the lesser of the *occupant load* for the *suite* or 30 persons, shall be posted in a conspicuous location near the *suite*'s principal entrance.

3.1.2.7. Storage of Combustible Fibres

1) Buildings or parts thereof used for the storage of baled *combustible fibres* shall be classified as *medium-hazard industrial occupancies*.

3.1.2.8. Child Care Facilities

(See Note A-3.1.2.8.)

1) A *child care facility* shall be classified as either a Group C or Group A Division 2 *major occupancy* as determined by this Article provided

a) except as permitted by Clause (d), the fire safety requirements for the *major occupancy* determined from Table 3.1.2.8. have been met,

b) all additional requirements in this By-law for new construction and the determined *major occupancy* have been met,

c) for *existing buildings*, the upgrade requirements in Clause 11.4.2.1.(1)(g) have been met, and

d) temporary *child care facilities* need not be *sprinklered* in accordance with Table 3.1.2.8. when provided with at least two *means of egress*

i) directly to the exterior,

ii) where it is not required to travel up or down more than 1 storey, and

iii) located so that one doorway could provide egress from the *child care facility* if the other doorway becomes inaccessible to the occupants due to a fire.

(See also Article 3.3.2.17.)

Table 3.1.2.8.
Major Occupancy* Classification and Fire Safety Requirements for *Child Care Facilities
Forming part of Sentence 3.1.2.5.(3)

Age of *Children* (months)	Number of *Children*	*Major Occupancy* Permitted	Sprinklers	Fire Alarm	Smoke Detection(2) and CO Alarms	*Fire Separation* from Remainder of Building	Emergency Lighting
< 30	> 8	A2	*Building*	Required	Required	2 h	Required
	3 – 8	C	*Suite* Only	Required	Required	2 h	Required
		C(1)	*Suite* Only	Not Required	Required	No	Yes
≥ 30	> 8	A2	*Building*	Required	Required	1 h	Required
	3 – 8	C	*Suite* Only	Required	Required	1 h	Required
		C(1)	Not Required	Not Required	Required	No	Yes

Notes to Table 3.1.2.8.:
(1) Applies to residential *buildings* with no more than 2 principal *dwelling units* or *row houses*
(2) Smoke detection shall include smoke detectors where the building is provided with a fire alarm system, and smoke alarms where required by Article 3.2.4.20.

3.1.2.9. Retail Food Facility

1) A retail food facility is permitted to be classified as a Group E *major occupancy* provided it is designed to accommodate not more than 16 persons consuming food or drink.

3.1.3. Multiple Occupancy Requirements

3.1.3.1. Separation of Major Occupancies

1) Except as permitted by Sentences (2) and (3), *major occupancies* shall be separated from adjoining *major occupancies* by *fire separations* having *fire-resistance ratings* conforming to Table 3.1.3.1.

2) In a *building* not more than 3 *storeys* in *building height*, if not more than 2 *dwelling units* are contained together with a Group E *major occupancy*, the *fire-resistance rating* of the *fire separation* between the 2 *major occupancies* need not be more than 1 h.

3) In a *building* conforming to the requirements of Articles 3.2.8.2. to 3.2.8.8., the requirements of Sentence (1) for *fire separations* between *major occupancies* do not apply at the vertical plane around the perimeter of an opening through the horizontal *fire separation*.

Table 3.1.3.1.
Major Occupancy Fire Separations[1]
Forming Part of Sentence 3.1.3.1.(1)

Major Occupancy	Minimum Fire-Resistance Rating of *Fire Separation*, h												
	Adjoining *Major Occupancy*												
	A-1	**A-2**	**A-3**	**A-4**	**B-1**	**B-2**	**B-3**	**C[7]**	**D**	**E**	**F-1**	**F-2**	**F-3**
A-1	–	1	1	1	2	2	2	1	1	2	[2]	2	1
A-2	1	–	1	1	2	2	2	1[3]	1[4]	2	[2]	2	1
A-3	1	1	–	1	2	2	2	1	1	2	[2]	2	1
A-4	1	1	1	–	2	2	2	1	1	2	[2]	2	1
B-1	2	2	2	2	–	2	2	2	2	2	[2]	2	2
B-2	2	2	2	2	2	–	1	2	2	2	[2]	2	2
B-3	2	2	2	2	2	1	–	1	2	2	[2]	2	2
C[7]	1	1[3]	1	1	2	2	1	–	1	2[5]	[2]	2[6]	1
D	1	1[4]	1	1	2	2	2	1	–	–	3	–	–
E	2	2	2	2	2	2	2	2[5]	–	–	3	–	–
F-1	[2]	[2]	[2]	[2]	[2]	[2]	[2]	[2]	3	3	–	2	2
F-2	2	2	2	2	2	2	2	2[6]	–	–	2	–	–
F-3	1	1	1	1	2	2	2	1	–	–	2	–	–

Notes to Table 3.1.3.1.:

(1) [1] Section 3.3. contains requirements for the separation of *occupancies* and tenancies that are in addition to the requirements for the separation of *major occupancies.*

(2) [2] See Sentence 3.1.3.2.(1).

[3] Where the *building* is constructed in accordance with Article 3.2.2.50., a *fire separation* with a 2 h *fire-resistance rating* is required between the Group C and Group A, Division 2 *major occupancies*.

[4] Where the *building* is constructed in accordance with Article 3.2.2.58., a *fire separation* with a 2 h *fire-resistance rating* is required between the

Group D and Group A, Division 2 *major occupancies*.
(5) See Sentence 3.1.3.1.(2).
(6) See Sentence 3.1.3.2.(2).
(7) See Article 3.2.1.7.

3.1.3.2. Prohibition of Occupancy Combinations

1) No *major occupancy* of Group F, Division 1 shall be contained within a *building* with any *occupancy* classified as Group A, B or C.
2) Except as provided in Article 3.1.3.4. and Subsection 11.4.5., not more than one *suite* of *residential occupancy* shall be contained within a *building* classified as a Group F, Division 2 *major occupancy*.
3) Reserved.
4) Reserved.
5) Reserved.

3.1.3.3. Artist Live/Work - Class A Artist Studio

1) A *building* containing *artist studio — class A* and residential quarters integrated with the studio for the use of artists occupying the studio may be designed as a Group C *major occupancy* provided

a) the *building* is *sprinklered* in conformance with NFPA 13, and
b) structural floor loads are based on a light *industrial occupancy*, with a minimum *live load* of 3.6 kPa and, where the *floor areas* are designated for residential use only, such as sleeping lofts, dinettes and bathrooms, with a minimum *live load* of 1.9 kPa.

3.1.3.4. Artist Live/Work - Class B Artist Studio

1) A *building* containing *artist studio — class B* and residential quarters integrated with the studio for the use of artists occupying the studio may be permitted provided

a) the *construction* requirements of Subsection 3.2.2. are based on the most restrictive requirements arising from the evaluation of the *building* as both a Group F Division 2 *occupancy* and a Group C *occupancy*,
b) the spatial separation requirements of the *building* are based on Table 3.2.3.1.D for a Group F, Division 2 occupancy,
c) the fire alarm is based on Group C *occupancy* requirements and where a fire alarm is required, *smoke detectors* are installed in corridors and stair shafts as required in Article 3.2.4.11.,
d) *smoke alarms* are provided in individual *suites* as required in Article 3.2.4.20.,
e) the *building* is *sprinklered* in conformance with NFPA 13 to a minimum Ordinary Hazard Group 1 classification,
f) standpipes are based on residential Group C *occupancy* requirements,
g) accessible design is based on Group C *occupancy* requirements, and
h) structural floor loads are based on a *light industrial occupancy*, with a minimum *live load* of 3.6 kPa and, i) where *floor areas* are designated for residential use only, such as sleeping lofts, dinettes and bathrooms, with a minimum *live load* of 1.9 kPa.

2) Light and ventilation requirements can be borrowed from the working studio area.
3) Where a portion of the studio such as a dinette or sleeping loft is used solely as living space, *exit* travel distances from these spaces may be based on a Group C residential *occupancy*.

3.1.3.5. Training School

1) A *building* or portion of a *building* containing a training school is permitted to be considered as a Group D major occupancy provided

a) the *suite* area is not more than 46 m^2, and
b) the total *occupant load* of the *suite* is not more than 10.

3.1.3.6. Industrial Flex Space

1) An *industrial flex space* use is permitted in a new *building* containing a Group C *major occupancy* provided

a) the total floor area of each *industrial flex space* unit or a single tenant *industrial flex space* is not more than 500 m^2,
b) the *industrial flex space* shall be located on the first *storey* and completely independent of the Group C portion of the *building*, including the *exit* system,
c) the ventilation systems for individual *industrial flex spaces* shall be completely separate and independent from each other and from the residential portion of the *building*,
d) a horizontal *fire separation* of concrete *construction* having a *fire-resistance rating* of no less than 2 hours shall be provided between the *industrial flex space* and the Group C *occupancy*,
e) vertical *fire separations* between *industrial flex space* units and any Group C portion of the *building* shall be of concrete or masonry *construction* having a *fire-resistance rating* of not less than 2 hours,
f) the Group C portion of the *building* shall be separated from the *industrial flex space* portion of the *building* by *construction* having a STC rating of not less than 55,
g)the penetrations between the horizontal f*ire separation* in Clause (c) shall be FT rated,
h) the *industrial flex space* units shall be *sprinklered* in conformance with NFPA 13 to a minimum Ordinary Hazard Group 2 classification using only quick response heads and no reduction in design area,
i) the automatic *sprinkler system* noted in Clause (h) shall be a single system supplying the entire *building*, and shall be designed so that the *industrial flex spaces* as a whole and the Group C *occupancy* floors as a whole are supplied by separate water supply lines,
j) each individual *industrial flex space* unit shall have a minimum of two egress doors regardless of the unit size,
k) the principal egress door serving each *industrial flex space* unit shall *exit* directly to the street,
l) except for the principal exit door in Clause (k), all other *exit* or egress doors shall lead to a lane or to an independent corridor leading to a public thoroughfare serving only the *industrial flex space* portion of the *building* and shall be separated from the remainder of the *building* by a concrete or masonry *fire separation* having a *fire-resistance rating* of not less than 2 hours,
m) the *industrial flex spaces* shall be provided with two unisex water closets, notwithstanding the requirement of Section 3.7 of Division B, and
n) one of the washrooms serving the *industrial flex space* shall comply with the requirements of Section 3.8 of Division B.

2) An *industrial flex space* use is not permitted in an *existing building*.

3.1.4. Combustible Construction

3.1.4.1. Combustible Materials Permitted

1) A *building* permitted to be of *combustible construction* is permitted to be constructed of *combustible* materials, with or without *noncombustible* components. (See Note A-3.1.4.1.(1).)
2) The *flame-spread rating* on any exposed surface of foamed plastic insulation, and on any surface that would be exposed by cutting through the insulation in any direction, shall be not more than 500.

3.1.4.2. Protection of Foamed Plastics

(See Note A-3.1.4.2.)
1) Except as permitted in Sentence (2), foamed plastics that form part of a wall or ceiling assembly in *combustible construction* shall be protected from adjacent spaces in the *building*, other than adjacent concealed spaces within *attic or roof spaces*, crawl spaces, and wall and ceiling assemblies,

a) by one of the interior finishes described in Subsections 9.29.4. to 9.29.9.,
b) provided the *building* does not contain a Group A, Group B or Group C *major occupancy*, by sheet metal

i) mechanically fastened to the supporting assembly independent of the insulation,
ii) not less than 0.38 mm thick, and
iii) with a melting point not below 650°C, or

c) by any thermal barrier that meets the requirements of Sentence 3.1.5.15.(2). (See Note A-3.1.4.2.(1)(c).)

(See Note A-3.1.4.2.(1).)

2) A walk-in cooler or freezer consisting of factory-assembled wall, floor or ceiling panels containing foamed plastics is permitted in a *building* permitted to be of *combustible construction*, provided the panels

a) are protected on both sides by sheet metal not less than 0.38 mm thick having a melting point not less than 650°C,
b) do not contain an air space, and
c) when a sample panel with an assembled joint typical of field installation is subjected to the applicable test described in Subsection 3.1.12., have a *flame-spread rating* not more than that permitted for the space in which they are located or the space that they bound, as applicable.

(See Note A-3.1.4.2.(2) and 3.1.5.7.(3).)

3) The *flame-spread rating* of doors containing foamed plastics shall comply with Sentences 3.1.13.2.(1) to (3).

3.1.4.3. Wires and Cables

1) Except as required by Article 3.6.4.3., optical fibre cables and electrical wires and cables with *combustible* insulation, jackets or sheathes that are installed in a *building* permitted to be of *combustible construction* shall

a) not convey flame or continue to burn for more than 1 min when tested in conformance with the Vertical Flame Test (FT1 rating) in CSA C22.2 No. 0.3, “Test Methods for Electrical Wires and Cables”, or
b) be located in
i) totally enclosed *noncombustible* raceways, (See Note A-3.1.4.3.(1)(b)(i).)
ii) masonry walls,
iii) concrete slabs, or
iv) totally enclosed non-metallic raceways conforming to Clause 3.1.5.23.(1)(b).

(See Note A-3.1.4.3.(1).)

2) Except as permitted in Article 3.6.4.3., optical fibre cables and electrical wires and cables with *combustible* insulation, jackets or sheathes that are used for the transmission of voice, sound or data and are installed in a *plenum* in a *building* permitted to be of *combustible construction* shall exhibit the following characteristics when tested in conformance with CAN/ULC-S102.4, “Standard Method of Test for Fire and Smoke Characteristics of Electrical Wiring, Cables and Non-Metallic Raceways,” (FT6 rating):

a) a horizontal flame distance of not more than 1.5 m,
b) an average optical smoke density of not more than 0.15, and
c) a peak optical smoke density of not more than 0.5.

(See Note A-3.1.4.3.(2).)

3) Deleted.

4) Deleted.

3.1.4.4. Non-metallic Raceways

1) Totally enclosed non-metallic raceways used in a *plenum* in a *building* permitted to be of *combustible construction* shall meet the requirements of Clause 3.1.5.23.(1)(a).

3.1.4.5. Fire-Retardant-Treated Wood

1) If *fire-retardant-treated wood* is specified in this Part, the wood shall

a) be pressure impregnated with fire-retardant chemicals in conformance with CAN/CSA-O80 Series, “Wood Preservation,” and

b) have a *flame-spread rating* not more than 25.

3.1.4.6. Heavy Timber Construction Alternative

1) If *combustible construction* is permitted and is not required to have a *fire-resistance rating* more than 45 min, *heavy timber construction* is permitted to be used.
2) If *heavy timber construction* is permitted, it shall conform to Article 3.1.4.7.

3.1.4.7. Heavy Timber Construction

1) Wood elements in *heavy timber construction* shall be arranged in heavy solid masses and with essentially smooth flat surfaces to avoid thin sections and sharp projections.
2) Except as permitted by Sentences (3) to (6) and (12), the minimum dimensions of wood elements in *heavy timber construction* shall conform to Table 3.1.4.7.

Table 3.1.4.7.
Heavy Timber Dimensions
Forming Part of Sentence 3.1.4.7.(2)

Supported Assembly	Structural Element	Solid Sawn (width × depth), mm × mm	Glued-Laminated (width × depth), mm × mm	Round (diam), mm
Roofs only	Columns	140 × 191	130 × 190	180
	Arches supported on the tops of walls or abutments	89 × 140	80 × 152	–
	Beams, girders and trusses	89 × 140	80 × 152	–
	Arches supported at or near the floor line	140 × 140	130 × 152	–
Floors, floors plus roofs	Columns	191 × 191	175 × 190	200
	Beams, girders, trusses and arches	140 × 241 or	130 × 228 or	–
		191 × 191	175 × 190	

3) Where splice plates are used at splices of roof arches supported on the tops of walls or abutments, roof trusses, roof beams and roof girders in *heavy timber construction*, they shall be not less than 64 mm thick.
4) Floors in *heavy timber construction* shall be of glued-laminated or solid sawn plank not less than
a) 64 mm thick, splined or tongued and grooved, or
b) 38 mm wide and 89 mm deep set on edge and well spiked together.
5) Floors in *heavy timber construction* shall be laid
a) so that no continuous line of end joints will occur except at points of support, and covered with
i) tongued and grooved flooring not less than 19 mm thick laid crosswise or diagonally, or
ii) tongued and grooved phenolic-bonded plywood, strandboard or waferboard not less than 12.5 mm thick, and
b) not closer than 15 mm to the walls to provide for expansion, with the gap covered at the top or bottom.
6) Roofs in *heavy timber construction* shall be of tongued and grooved phenolic-bonded plywood, strandboard or waferboard not less than 28 mm thick, or glued-laminated or solid sawn plank that is
a) not less than 38 mm thick, splined or tongued and grooved, or

b) not less than 38 mm wide and 64 mm deep set on edge and laid so that no continuous line of end joints will occur except at the points of support.

7) Wood columns in *heavy timber construction* shall be continuous or superimposed throughout all *storeys*.

8) Superimposed wood columns in *heavy timber construction* shall be connected by

a) reinforced concrete or metal caps with brackets,

b) steel or iron caps with pintles and base plates, or

c) timber splice plates fastened to the columns by metal connectors housed within the contact faces.

9) Where beams and girders in *heavy timber construction* enter masonry, wall plates, boxes of the self-releasing type or hangers shall be used.

10) Wood girders and beams in *heavy timber construction* shall be closely fitted to columns, and adjoining ends shall be connected by ties or caps to transfer horizontal loads across the joints.

11) In *heavy timber construction*, intermediate wood beams used to support a floor shall be supported on top of the girders or on metal hangers into which the ends of the beams are closely fitted.

12) Roof arches supported on the top of walls or abutments, roof trusses, roof beams and roof girders in *heavy timber construction* are permitted to be not less than 64 mm wide provided

a) where two or more spaced members are used, the intervening spaces are

i) blocked solidly throughout, or

ii) tightly closed by a continuous wood cover plate not less than 38 mm thick secured to the underside of the members, or

b) the underneath of the roof deck or sheathing is *sprinklered*.

3.1.4.8. Exterior Cladding

1) The exterior cladding on each exterior wall of *buildings* conforming to Article 3.2.2.50. or 3.2.2.58. shall consist of

a) noncombustible cladding, or

b) a wall assembly that satisfies the criteria of Clause 3.1.5.5.(1)(b).

(See Note A-3.1.4.8.(1).) (See also Notes A-3.1.5.5.(1)(b)(i) and A-3.1.5.5.(1)(b)(ii).)

2) A wall assembly conforming to Clause (1)(b) that includes *combustible* cladding made of *fire-retardant-treated wood* shall be tested for fire exposure after the cladding has been subjected to the accelerated weathering test specified in ASTM D 2898, “Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.”

3) The solution described in Clause (1)(b) is not permitted where an *exposing building face* is required by Article 3.2.3.7. to have *noncombustible* cladding.

3.1.5. Noncombustible Construction

3.1.5.1. Noncombustible Materials

(See Note A-3.1.4.1.(1).)

1) Except as permitted by Sentences (2) to (4) and Articles 3.1.5.2. to 3.1.5.24., 3.1.13.4. and 3.2.2.16., a *building* or part of a *building* required to be of *noncombustible construction* shall be constructed with *noncombustible* materials. (See also Subsection 3.1.13. for the requirements regarding the *flame-spread rating* of interior finishes.)

2) Notwithstanding the definition of *noncombustible* materials stated in Article 1.4.1.2. of Division A, a material is permitted to be used in *noncombustible construction* provided that, when tested in accordance with ULC-S135, “Test Method for the Determination of Combustibility Parameters of Building Materials Using an Oxygen Consumption Calorimeter (Cone Calorimeter),” at a heat flux of 50 kW/m^2,

a) its average total heat release is not more than 3 MJ/m^2,

b) its average total smoke extinction area is not more than 1.0 m^2, and

c) the test duration is extended beyond the time stipulated in the referenced standard until it is clear that there is no further release of heat or smoke.

3) If a material referred to in Sentence (2) consists of a number of discrete layers and testing reveals that the surface layer or layers protect the underlying layers such that complete combustion of the underlying layers does not occur, the test shall be repeated by removing the outer layers sequentially until all layers have been exposed during testing, or until complete combustion has occurred.
4) The acceptance criteria for a material tested in accordance with Sentence (3) shall be based on the cumulative emissions from all layers, which must not exceed the criteria stated in Clauses (2)(a) and (b).

3.1.5.2. Minor Combustible Components
1) The following minor *combustible* components are permitted in a *building* required to be of *noncombustible construction*:
a) paint (See also Clause 3.1.13.1.(2)(b).),
b) self-adhesive tapes, mastics and caulking materials, including foamed plastic air sealants, applied to provide a seal between the major components of exterior wall construction, (See also Article 3.6.4.3. for limits on the use of *combustible* materials in *plenum* spaces),
c) fire stops and *fire blocks* conforming to Sentence 3.1.9.1.(1) and Article 3.1.11.7.,
d) tubing for pneumatic controls provided it has an outside diameter of not more than 10 mm,
e) adhesives, *vapour barriers* and sheathing papers,
f) electrical outlet and junction boxes,
g) wood blocking within wall assemblies intended for the attachment of handrails, fixtures, and similar items mounted on the surface of the wall, and
h) similar minor components.

3.1.5.3. Combustible Roofing Materials
1) Combustible roof covering that has an A, B, or C classification determined in conformance with Subsection 3.1.15. is permitted on a *building* required to be of *noncombustible construction*.
2) Combustible roof sheathing and roof sheathing supports installed above a concrete deck are permitted on a *building* required to be of *noncombustible construction* provided
a) the concrete deck is not less than 50 mm thick,
b) the height of the roof space above the deck is not more than 1 m,
c) the roof space is divided into compartments by *fire blocks* in conformance with Article 3.1.11.5.,
d) openings through the concrete deck other than for *noncombustible* roof drains and plumbing piping are protected by masonry or concrete shafts
i) constructed as *fire separations* having a *fire-resistance rating* not less than 1 h, and
ii) extending from the concrete deck to not less than 150 mm above the adjacent roof sheathing,
e) the perimeter of the roof is protected by a *noncombustible* parapet extending from the concrete deck to not less than 150 mm above the adjacent sheathing, and
f) except as permitted by Clause (d), the roof space does not contain any *building* services.
3) Combustible cant strips, roof curbs, nailing strips and similar components used in the installation of roofing are permitted on a *building* required to be of *noncombustible construction*.
4) Wood nailer facings to parapets, not more than 600 mm high, are permitted on a *building* required to be of *noncombustible construction*, if the facings and any roof membranes covering the facings are protected by sheet metal.

3.1.5.4. Combustible Glazing and Skylights
1) Combustible skylight assemblies are permitted in a *building* required to be of *noncombustible construction* if the assemblies have a *flame-spread rating* not more than
a) 150 provided the assemblies
i) have an individual area not more than 9 m^2,

ii) have an aggregate horizontal projected area of the openings through the ceiling not more than 25% of the area of the ceiling of the room or space in which they are located, and

iii) are spaced not less than 2.5 m from adjacent assemblies and from required *fire separations*, or

b) 75 provided the assemblies

i) have an individual area not more than 27 m^2,

ii) have an aggregate horizontal projected area of the openings through the ceiling not more than 33% of the area of the ceiling of the room or space in which they are located, and

iii) are spaced not less than 1.2 m from adjacent assemblies and from required *fire separations*.

(See Note A-3.1.5.4.(1).)

2) Combustible vertical glazing installed no higher than the second *storey* is permitted in a *building* required to be of *noncombustible construction*.

3) Except as permitted by Sentence (4), the combustible vertical glazing permitted by Sentence (2) shall have a *flame-spread rating* not more than 75.

4) The *flame-spread rating* of combustible glazing is permitted to be not more than 150 if the aggregate area of glazing is not more than 25% of the wall area of the *storey* in which it is located, and

a) the glazing is installed in a *building* not more than 1 *storey* in *building height*,

b) the glazing in the *first storey* is separated from the glazing in the second *storey* in accordance with the requirements of Article 3.2.3.17. for opening protection, or

c) the *building* is *sprinklered* throughout.

5) Combustible window sashes and frames are permitted in a *building* required to be of *noncombustible construction* provided

a) each window in an exterior wall face is an individual unit separated by *noncombustible* wall construction from every other opening in the wall,

b) windows in exterior walls in contiguous *storeys* are separated by not less than 1 m of *noncombustible construction*, and

c) the aggregate area of openings in an exterior wall face of a *fire compartment* is not more than 40% of the area of the wall face.

3.1.5.5. Combustible Cladding on Exterior Walls

(See Note A-3.1.5.5.)

1) Except as provided in Sentences (2) and (3), *combustible* cladding is permitted to be used on an exterior wall assembly in a *building* required to be of *noncombustible construction*, provided

a) the *building* is

i) not more than 3 *storeys* in *building height*, or

ii) sprinklered throughout, and

b) when tested in accordance with CAN/ULC-S134, “Fire Test of Exterior Wall Assemblies,” the wall assembly satisfies the following criteria for testing and conditions of acceptance (See Note A-3.1.5.5.(1)(b).):

i) flaming on or in the wall assembly does not spread more than 5 m above the opening (See Note A-3.1.5.5.(1)(b)(i).), and

ii) the heat flux during the flame exposure on the wall assembly is not more than 35 kW/m^2 measured at 3.5 m above the opening (See Note A-3.1.5.5.(1)(b)(ii).).

2) Except as permitted by Articles 3.2.3.10. and 3.2.3.11., where the *limiting distance* in Tables 3.2.3.1.-B to 3.2.3.1.-E permits an area of *unprotected openings* of not more than 10% of the *exposing building face*, the construction requirements of Table 3.2.3.7. shall be met.

3) A wall assembly permitted by Sentence (1) that includes *combustible* cladding of *fire-retardant-treated wood* shall be tested for fire exposure after the cladding has been subjected to an accelerated weathering test as specified in ASTM D 2898, “Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.”

3.1.5.6. Combustible Components in Exterior Walls

(See Note A-3.1.5.6.)

1) Combustible components, other than those permitted by Article 3.1.5.5., are permitted to be used in an exterior wall assembly of a *building* required to be of *noncombustible construction*, provided

a) the *building* is

i) not more than 3 *storeys* in *building height*, or

ii) sprinklered throughout, and

b) the wall assembly

i) meets the requirements of Clause 3.1.5.5.(1)(b), or

ii) is protected by masonry or concrete cladding not less than 25 mm thick (See Note A-3.1.5.5.(1)(b).).

3.1.5.7. Factory-Assembled Panels

1) Except as provided in Sentence (2), factory-assembled wall and ceiling panels containing foamed plastic insulation with a *flame-spread rating* not more than 500 are permitted to be used in a *building* required to be of *noncombustible construction*, provided

a) the *building*

i) is *sprinklered*,

ii) is not more than 18 m high, measured from *grade* to the underside of the roof, and

iii) does not contain a Group A, Group B, or Group C *major occupancy*, and

b) the panels

i) do not contain an air space,

ii) when tested in accordance with CAN/ULC-S138, “Test for Fire Growth of Insulated Building Panels in a Full-Scale Room Configuration,” meet the criteria defined therein, and

iii) when a sample panel with an assembled joint typical of field installation is subjected to the applicable test described in Subsection 3.1.12., have a *flame-spread rating* not more than that permitted for the room or space that they bound.

2) Factory-assembled exterior wall panels containing thermosetting foamed plastic insulation are permitted to be used in a *building* required to be of *noncombustible construction*, provided

a) the *building*

i) is not more than 18 m high, measured from *grade* to the underside of the roof, and

ii) does not contain a Group B or Group C *major occupancy*, and

b) the wall panels

i) do not contain an air space,

ii) are protected on both sides by sheet steel not less than 0.38 mm thick,

iii) remain in place for not less than 10 min when tested in conformance with CAN/ULC-S101, “Fire Endurance Tests of Building Construction and Materials,” where the exposed surface includes typical vertical and horizontal joints, and

iv) when a sample panel with an assembled joint typical of field installation is subjected to the applicable test described in Subsection 3.1.12., have a *flame-spread rating* not more than that permitted for the room or space that they bound.

3) A walk-in cooler or freezer consisting of factory-assembled wall, floor or ceiling panels containing foamed plastic insulation with a *flame-spread rating* not more than 500 is permitted to be used in a *building* required to be of *noncombustible construction*, provided

a) the *building* is *sprinklered*, and

b) the panels

i) are protected on both sides by sheet metal not less than 0.38 mm thick with a melting point not less than 650°C,

ii) do not contain an air space,
iii) when tested in accordance with CAN/ULC-S138, "Test for Fire Growth of Insulated Building Panels in a Full-Scale Room Configuration," meet the criteria defined therein, and
iv) when a sample panel with an assembled joint typical of field installation is subjected to the applicable test described in Subsection 3.1.12., have a *flame-spread rating* not more than that permitted for the space in which they are located or the space that they bound, as applicable.

(See Note A-3.1.4.2.(2) and 3.1.5.7.(3).)

3.1.5.8. Nailing Elements

1) Wood nailing elements attached directly to or set into a continuous *noncombustible* backing for the attachment of interior finishes are permitted in a *building* required to be of *noncombustible construction* provided the concealed space created by the wood elements is not more than 50 mm thick.

3.1.5.9. Combustible Millwork

1) Combustible millwork, including interior trim, doors and door frames, show windows together with their frames, aprons and backing, handrails, shelves, cabinets and counters, is permitted in a *building* required to be of *noncombustible construction*.

3.1.5.10. Combustible Flooring Elements

1) Combustible stage flooring supported on *noncombustible* structural members is permitted in a *building* required to be of *noncombustible construction*.

2) Wood members more than 50 mm but not more than 300 mm high applied directly to or set into a *noncombustible* floor slab are permitted for the construction of a raised platform in a *building* required to be of *noncombustible construction* provided the concealed created are divided into compartments by *fire blocks* in conformance with Sentence 3.1.11.3.(2).

3) The floor system for the raised platform referred to in Sentence (2) is permitted to include a *combustible* subfloor and *combustible* finished flooring.

4) Combustible finished flooring is permitted in a *building* required to be of *noncombustible construction*.

3.1.5.11. Combustible Stairs in Dwelling Units

1) Combustible stairs are permitted in a *dwelling unit* in a *building* required to be of *noncombustible construction*.

3.1.5.12. Combustible Interior Finishes

1) Except as permitted in Sentences (2) and (3), *combustible* interior wall and ceiling finishes referred to in Clause 3.1.13.1.(2)(b) that are not more than 1 mm thick are permitted in a *building* required to be of *noncombustible construction*.

2) Combustible interior wall finishes, other than foamed plastics, that are not more than 25 mm thick are permitted in a *building* required to be of *noncombustible construction*, provided they have a *flame-spread rating* not more than 150 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction.

3) Except as provided in Sentence (4), *combustible* interior ceiling finishes, other than foamed plastics, that are not more than 25 mm thick are permitted in a *building* required to be of *noncombustible construction*, provided they have a *flame-spread rating* not more than 25 on any exposed surface or on any surface that would be exposed by cutting through the material in any direction, except that not more than 10% of the ceiling area within each *fire compartment* is permitted to have a *flame-spread rating* not more than 150.

4) Combustible interior ceiling finishes made of *fire-retardant-treated wood* are permitted in a *building* required to be of *noncombustible construction*, provided they are not more than 25 mm thick or are exposed *fire-retardant-treated wood* battens.

3.1.5.13. Gypsum Board

1) Gypsum board with a tightly adhering paper covering not more than 1 mm thick is permitted in a *building* required to be of *noncombustible construction* provided the *flame-spread rating* on the surface is not more than 25.

3.1.5.14. Combustible Insulation

(See Notes A-3.1.4.2. and A-3.1.4.2.(1).)

1) Foamed plastic insulation shall conform to Article 3.1.5.15.

2) Combustible insulation with a *flame-spread rating* not more than 25 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, is permitted in a *building* required to be of *noncombustible construction*.

3) Combustible insulation is permitted to be installed above roof decks, outside of *foundation* walls below ground level, and beneath concrete slabs-on-ground of *building*s required to be of *noncombustible construction*.

4) Except as provided in Sentences (5) and (6), *combustible* insulation with a *flame-spread rating* more than 25 but not more than 500 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, is permitted in a *building* required to be of *noncombustible construction*, provided the insulation is protected from adjacent space in the *building*, other than adjacent concealed spaces within wall assemblies, by a thermal barrier consisting of

- a) not less than 12.7 mm thick gypsum board mechanically fastened to a supporting assembly independent of the insulation,
- b) lath and plaster, mechanically fastened to a supporting assembly independent of the insulation,
- c) masonry, or
- d) concrete.

5) Combustible insulation with a *flame-spread rating* more than 25 but not more than 500 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, is permitted in the exterior walls of a *building* required to be of *noncombustible construction* that is not *sprinklered* and is more than 18 m high, measured from *grade* to the underside of the roof, provided the insulation is protected from adjacent space in the *building*, other than adjacent concealed spaces within wall assemblies, by a thermal barrier consisting of

- a) gypsum board not less than 12.7 mm thick, mechanically fastened to a supporting assembly independent of the insulation and with all joints either backed or taped and filled,
- b) lath and plaster, mechanically fastened to a supporting assembly independent of the insulation,
- c) masonry or concrete not less than 25 mm thick, or
- d) any thermal barrier that, when tested in conformance with CAN/ULC-S101, “Fire Endurance Tests of Building Construction and Materials,” will not develop an average temperature rise more than 140°C or a maximum temperature rise more than 180°C at any point on its unexposed face within 10 min (See Note A-3.1.5.14.(5)(d).) (See also Article 3.2.3.7.).

6) Combustible insulation with a *flame-spread rating* more than 25 but not more than 500 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, is permitted in the interior walls, within ceilings and within roof assemblies of a *building* required to be of *noncombustible construction* that is not *sprinklered* and is more than 18 m high, measured from *grade* to the underside of the roof, provided the insulation is protected from adjacent space in the *building*, other than adjacent concealed spaces within wall assemblies, by a thermal barrier consisting of

- a) Type X gypsum board not less than 15.9 mm thick, mechanically fastened to a supporting assembly independent of the insulation and with all joints either backed or taped and filled, conforming to
  - i) ASTM C 1177/C 1177M, “Glass Mat Gypsum Substrate for Use as Sheathing,”
  - ii) ASTM C 1178/C 1178M, “Coated Glass Mat Water-Resistant Gypsum Backing Panel,”
  - iii) ASTM C 1396/C 1396M, “Gypsum Board,”
  - iv) ASTM C 1658/C 1658M, “Glass Mat Gypsum Panels,” or

v) CAN/CSA-A82.27-M, “Gypsum Board,”

b) non-*loadbearing* masonry or concrete not less than 50 mm thick,

c) loadbearing masonry or concrete not less than 75 mm thick, or

d) any thermal barrier that, when tested in conformance with CAN/ULC-S101, “Fire Endurance Tests of Building Construction and Materials,”

i) does not develop an average temperature rise more than 140°C or a maximum temperature rise more than 180°C at any point on its unexposed face within 20 min, and

ii) remains in place for not less than 40 min.

3.1.5.15. Foamed Plastic Insulation

(See Notes A-3.1.4.2. and A-3.1.4.2.(1).)

1) Foamed plastic insulation is permitted to be installed above roof decks, outside of *foundation* walls below ground level, and beneath concrete slabs-on-ground of a *building* required to be of *noncombustible construction*.

2) Except as provided in Sentences (3) and (4), foamed plastic insulation with a *flame-spread rating* not more than 500 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, is permitted in a *building* required to be of *noncombustible construction*, provided the insulation is protected from adjacent space in the *building*, other than adjacent concealed spaces within wall assemblies, by a thermal barrier consisting of

a) not less than 12.7 mm thick gypsum board mechanically fastened to a supporting assembly independent of the insulation,

b) lath and plaster, mechanically fastened to a supporting assembly independent of the insulation,

c) masonry,

d) concrete, or

e) any thermal barrier that meets the requirements of classification B when tested in conformance with CAN/ULC-S124, “Test for the Evaluation of Protective Coverings for Foamed Plastic.”

3) Foamed plastic insulation with a *flame-spread rating* more than 25 but not more than 500 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, is permitted in the exterior walls of a *building* required to be of *noncombustible construction* that is not *sprinklered* and is more than 18 m high, measured from *grade* to the underside of the roof, provided the insulation is protected from adjacent space in the *building*, other than adjacent concealed spaces within wall assemblies, by a thermal barrier consisting of

a) gypsum board not less than 12.7 mm thick, mechanically fastened to a supporting assembly independent of the insulation and with all joints either backed or taped and filled,

b) lath and plaster, mechanically fastened to a supporting assembly independent of the insulation,

c) masonry or concrete not less than 25 mm thick, or

d) any thermal barrier that, when tested in conformance with CAN/ULC-S101, “Fire Endurance Tests of Building Construction and Materials,” does not develop an average temperature rise more than 140°C or a maximum temperature rise more than 180°C at any point on its unexposed face within 10 min (See Note A-3.1.5.14.(5)(d).) (See also Article 3.2.3.7.).

4) Foamed plastic insulation with a *flame-spread rating* more than 25 but not more than 500 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, is permitted in the interior walls, within ceilings and within roof assemblies of a *building* required to be of *noncombustible construction* that is not *sprinklered* and is more than 18 m high, measured from *grade* to the underside of the roof, provided the insulation is protected from adjacent space in the *building*, other than adjacent concealed spaces within wall assemblies, by a thermal barrier consisting of

a) Type X gypsum board not less than 15.9 mm thick, mechanically fastened to a supporting assembly independent of the insulation and with all joints either backed or taped and filled, conforming to

i) ASTM C 1177/C 1177M, “Glass Mat Gypsum Substrate for Use as Sheathing,”

ii) ASTM C 1178/C 1178M, “Coated Glass Mat Water-Resistant Gypsum Backing Panel,”

iii) ASTM C 1396/C 1396M, “Gypsum Board,” or
iv) CAN/CSA-A82.27-M, “Gypsum Board,”

b) non-*loadbearing* masonry or concrete not less than 50 mm thick,
c) loadbearing masonry or concrete not less than 75 mm thick, or
d) any thermal barrier that, when tested in conformance with CAN/ULC-S101, “Fire Endurance Tests of Building Construction and Materials,”

i) does not develop an average temperature rise more than 140°C or a maximum temperature rise more than 180°C at any point on its unexposed face within 20 min, and
ii) remains in place for not less than 40 min.

3.1.5.16. Combustible Elements in Partitions

1) Except as permitted by Sentence (2), solid lumber *partitions* not less than 38 mm thick and wood framing in *partitions* located in a *fire compartment* not more than 600 m² in area are permitted to be used in a *building* required to be of *noncombustible construction* in a *floor area* that is not *sprinklered* throughout provided the *partitions*

a) are not required *fire separations*, and
b) are not located in a *care*, *treatment* or *detention occupancy*.

2) Partitions installed in a *building* of *noncombustible construction* are permitted to contain wood framing provided

a) the *building* is not more than 3 *storeys* in *building height*,
b) the *partitions* are not located in a *care*, *treatment* or *detention occupancy*, and
c) the *partitions* are not installed as enclosures for *exits* or *vertical service spaces*.

3) Solid lumber *partitions* not less than 38 mm thick and *partitions* that contain wood framing are permitted to be used a) in a *building* required to be of *noncombustible construction* provided

a) the *building* is *sprinklered* throughout, and
b) the *partitions* are not

i) located in a *care*, *treatment* or *detention occupancy*,
ii) installed as enclosures for *exits* or *vertical service spaces*, or
iii) used to satisfy the requirements of Clause 3.2.8.1.(1)(a).

3.1.5.17. Storage Lockers in Residential Buildings

1) Storage lockers in storage rooms are permitted to be constructed of wood in a *building* of *residential occupancy* required to be of *noncombustible construction*.

3.1.5.18. Combustible Ducts

1) Except as required by Sentence 3.6.4.3.(1), *combustible* ducts, including *plenums* and duct connectors, are permitted to be used in a *building* required to be of *noncombustible construction* provided these ducts and duct connectors are used only in horizontal runs.

2) Combustible duct linings, duct coverings, duct insulation, vibration isolation connectors, duct tape, pipe insulation and pipe coverings are permitted to be used in a *building* required to be of *noncombustible construction* provided they conform to the appropriate requirements of Subsection 3.6.5.

3) In a *building* required to be of *noncombustible construction*, *combustible* ducts need not comply with the requirements of Sentences 3.6.5.1.(1) and (2) provided the ducts are

a) part of a duct system conveying only ventilation air, and
b) contained entirely within a *dwelling unit*.

3.1.5.19. Combustible Piping Materials

1) Except as permitted by Clause 3.1.5.2.(1)(d) and Sentences (2) and (3), *combustible* piping and tubing and associated adhesives are permitted to be used in a *building* required to be of *noncombustible construction* provided that, except when concealed in a wall or concrete floor slab, they

a) have a *flame-spread rating* not more than 25, and

b) if used in a *building* described in Subsection 3.2.6., have a smoke developed classification not more than 50.

2) Combustible sprinkler piping is permitted to be used within a *sprinklered floor area* in a *building* required to be of *noncombustible construction*. (See also Article 3.2.5.13.)

3) Polypropylene pipes and fittings are permitted to be used for drain, waste and vent piping for the conveyance of highly corrosive materials and for piping used to distribute distilled or dialyzed water in laboratory and hospital facilities in a *building* required to be of *noncombustible construction*, provided

a) the *building* is *sprinklered* throughout,

b) the piping is not located in a vertical shaft, and

c) piping that penetrates a *fire separation* is sealed at the penetration by a *fire stop* that has an FT rating not less than the *fire-resistance rating* of the *fire separation* when subjected to the fire test method in CAN/ULC-S115, "Fire Tests of Firestop Systems," with a pressure differential of 50 Pa between the exposed and unexposed sides, with the higher pressure on the exposed side.

3.1.5.20. Combustible Plumbing Fixtures

1) Combustible plumbing fixtures, including wall and ceiling enclosures that form part of the plumbing fixture, are permitted in a *building* required to be of *noncombustible construction* provided they are constructed of material having a *flame-spread rating* and smoke developed classification not more than that permitted for the wall surface of the room or space in which they are installed.

3.1.5.21. Wires and Cables

1) Except as required by Sentence (2) and Article 3.1.5.22., optical fibre cables and electrical wires and cables with *combustible* insulation, jackets or sheathes are permitted in a *building* required to be of *noncombustible construction*, provided

a) the wires and cables exhibit a vertical char of not more than 1.5 m when tested in conformance with the Vertical Flame Test – Cables in Cable Trays (FT4 rating) in CSA C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables," except as otherwise required by Sentence 3.6.4.3.(1),

b) the wires and cables are located in

i) totally enclosed *noncombustible* raceways (See Note A-3.1.4.3.(1)(b)(i).),

ii) masonry walls,

iii) concrete slabs,

iv) a *service room* separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h, or

v) totally enclosed non-metallic raceways conforming to Clause 3.1.5.23.(1)(b), or

c) the wires and cables are communication cables used at the service entry to a *building* and are not more than 3 m long.

(See Note A-3.1.5.21.(1).)

2) Except as permitted in Article 3.6.4.3., optical fibre cables and electrical wires and cables with *combustible* insulation, jackets or sheathes that are used for the transmission of voice, sound or data and are not located in totally enclosed *noncombustible* raceways are permitted to be installed in a *plenum* in a *building* required to be of *noncombustible construction*, provided the wires and cables exhibit a horizontal flame distance of not more than 1.5 m, an average optical smoke density of not more than 0.15, and a peak optical smoke density of not more than 0.5 when tested in conformance with CAN/ULC-S102.4, "Standard Method of Test for Fire and Smoke Characteristics of Electrical Wiring, Cables and Non-Metallic Raceways," (FT6 rating).

3) Deleted.

4) Deleted.

3.1.5.22. Combustible Travelling Cables for Elevators

1) Combustible travelling cables are permitted on elevating devices in a *building* required to be of *noncombustible construction*.

3.1.5.23. Non-metallic Raceways

1) Except as required in Sentence (2), subject to the limits on the size of elements that penetrate *fire separations* as stated in Sentence 3.1.9.3.(2), within a *fire compartment* of a *building* required to be of *noncombustible construction*, totally enclosed non-metallic raceways not more than 175 mm in outside diameter, or of an equivalent rectangular area, are permitted to be used to enclose optical fibre cables and electrical wires and cables, provided

a) where the wires and cables in the raceways meet or exceed the requirements of Clause 3.1.5.21.(1)(a), the non-metallic raceways meet the requirements for at least an FT4 rating in

i) CAN/CSA-C22.2 No. 262, "Optical Fiber Cable and Communication Cable Raceway Systems," or

ii) CAN/ULC-S143, "Fire Tests for Non-Metallic Electrical and Optical Fibre Cable Raceway Systems," and

b) where the wires and cables in the raceways do not meet or exceed the requirements of Clause 3.1.5.21.(1)(a), the non-metallic raceways exhibit a vertical char of not more than 1.5 m when tested in conformance with the Vertical Flame Test (FT4) – Conduit or Tubing on Cable Tray in Clause 6.16 of CSA C22.2 No. 211.0, "General Requirements and Methods of Testing for Nonmetallic Conduit."

2) Totally enclosed non-metallic raceways used in a *plenum* in a *building* required to be of *noncombustible construction* shall exhibit a horizontal flame distance of not more than 1.5 m, an average optical smoke density of not more than 0.15, and a peak optical smoke density of not more than 0.5 when tested in conformance with CAN/ULC-S102.4, "Standard Method of Test for Fire and Smoke Characteristics of Electrical Wiring, Cables and Non-Metallic Raceways," (FT6 rating).

3.1.5.24. Decorative Wood Cladding

1) On *buildings* required to be of *noncombustible construction*, decorative wood cladding is permitted to be used on the exterior fascias and soffits of marquees or canopies on the *building* face of a *storey* having direct access to a *street* or access route, provided the wood cladding is *fire-retardant-treated wood* that has been conditioned in conformance with ASTM D 2898, "Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing," before being tested in accordance with CAN/ULC-S102, "Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies."

3.1.6. Tents and Air-Supported Structures

(See Note A-3.1.6.)

3.1.6.1. Means of Egress

1) Tents and *air-supported structures* shall conform to Sections 3.3. and 3.4.

3.1.6.2. Restrictions

1) An *air-supported structure* shall not be located above the *first storey* on any *building*.

2) An *air-supported structure* shall not be used for Groups B, C, or Group F, Division 1 *major occupancies* or for classrooms.

3) An *air-supported structure* shall be designed as open floor space without interior walls, *mezzanines*, intermediate floors or similar construction.

3.1.6.3. Clearance to Other Structures

1) Except as permitted by Sentences (2), (3) and (4), every tent and *air-supported structure* shall conform to Subsection 3.2.3.

2) Tents and *air-supported structures*

a) shall not be erected closer than 3 m to other structures on the same property except as permitted by Sentences (3) and (4), and

b) shall be sufficiently distant from one another to provide an area to be used as a means of emergency egress.

3) Tents and *air-supported structures* not occupied by the public

a) need not be separated from one another, and

b) are permitted to be erected less than 3 m from other structures on the same property provided this spacing does not create a hazard to the public.

4) Tents not more than 120 m^2 in ground area, located on fair grounds or similar open spaces, need not be separated from one another provided this does not create a hazard to the public.

3.1.6.4. Clearance to Flammable Material

1) The ground enclosed by a tent or *air-supported structure* and not less than 3 m of ground outside the structure shall be cleared of all flammable material or vegetation that will spread fire.

3.1.6.5. Flame Resistance

1) Every tent and *air-supported structure* and all tarpaulins and decorative materials used in connection with these structures shall conform to CAN/ULC-S109, "Flame Tests of Flame-Resistant Fabrics and Films."

3.1.6.6. Emergency Air Supply

1) An *air-supported structure* used as a place of assembly for more than 200 persons shall have either

a) an automatic emergency engine-generator set capable of powering one blower continuously for 4 h, or

b) a supplementary blower powered by an automatic internal combustion engine.

3.1.6.7. Electrical Systems

1) The electrical system and equipment in a tent or *air-supported structure*, including electrical fuses and switches, shall be inaccessible to the public.

2) Cables on the ground in areas used by the public in a tent or *air-supported structure* shall be placed in trenches or protected by covers to prevent damage from traffic.

3.1.7. Fire-Resistance Ratings

3.1.7.1. Determination of Ratings

1) Except as permitted by Sentence (2) and Articles 3.1.7.2. and 3.6.3.5., the rating of a material, assembly of materials or a structural member that is required to have a *fire-resistance rating*, shall be determined on the basis of the results of tests conducted in conformance with CAN/ULC-S101, "Fire Endurance Tests of Building Construction and Materials."

2) A material, assembly of materials or a structural member is permitted to be assigned a *fire-resistance rating* on the basis of Appendix D.

3) A ceiling assembly is permitted to be assigned a *fire-resistance rating* on the basis of Assembly Number R1 in Table A-9.10.3.1.-B.

4) A ceiling membrane is permitted to be assigned a *fire-resistance rating* on the basis of Assembly Number M1 or M2 in Table A-9.10.3.1.-B.

3.1.7.2. Exception for Exterior Walls

1) The limit on the rise of temperature on the unexposed surface of an assembly as required by the tests referred to in Sentence 3.1.7.1.(1) shall not apply to an exterior wall that has a *limiting distance* of 1.2 m or more, provided correction is made for radiation from the unexposed surface in accordance with Sentence 3.2.3.1.(9).

3.1.7.3. Exposure Conditions for Rating

1) Floor, roof and ceiling assemblies shall be rated for exposure to fire on the underside.

2) Firewalls and interior vertical *fire separations* shall be rated for exposure to fire on each side.
3) Exterior walls shall be rated for exposure to fire from inside the *building*.

3.1.7.4. Minimum Fire-Resistance Rating

1) The use of materials or assemblies having a greater *fire-resistance rating* than required shall impose no obligation to exceed in whole or in part the minimum *fire-resistance ratings* required by this Part.

3.1.7.5. Rating of Supporting Construction

1) Except as permitted by Sentence (2) and by Articles 3.2.2.20. to 3.2.2.90. for mixed types of construction, all *loadbearing* walls, columns and arches in the *storey* immediately below a floor or roof assembly required to have a *fire-resistance rating* shall have a *fire-resistance rating* not less than that required for the supported floor or roof assembly.
2) Loadbearing walls, columns and arches supporting a *service room* or *service space* need not conform to Sentence (1).
3) Except for *noncombustible* roof assemblies required by Clauses 3.2.2.50.(2)(c) and 3.2.2.58.(2)(c), if an assembly is required to be of *noncombustible construction* and have a *fire-resistance rating*, it shall be supported by *noncombustible construction*.

3.1.8. Fire Separations and Closures

3.1.8.1. General Requirements

1) Any wall, *partition* or floor assembly required to be a *fire separation* shall
- a) except as permitted by Sentence (2), be constructed as a continuous element, and
- b) as required in this Part, have a *fire-resistance rating* as specified (See Note A-3.1.8.1.(1)(b).).

2) Openings in a *fire separation* shall be protected with *closures*, shafts or other means in conformance with Articles 3.1.8.4. to 3.1.8.19. and Subsections 3.1.9. and 3.2.8. (See Note A-3.1.8.1.(2).)

3.1.8.2. Combustible Construction Support

1) Combustible construction that abuts on or is supported by a *noncombustible fire separation* shall be constructed so that its collapse under fire conditions will not cause the collapse of the *fire separation*.

3.1.8.3. Continuity of Fire Separations

1) Except as permitted by Sentence 3.6.4.2.(2), a *horizontal service space* or other concealed space located above a required vertical *fire separation*, including the walls of a vertical shaft, shall be divided at the *fire separation* by an equivalent *fire separation* within the *service space*.
2) The *fire separation* required by Sentence (1) shall terminate so that smoke-tight joints are provided where it abuts on or intersects
- a) a floor,
- b) a roof slab, or
- c) a roof deck.

3) Except as required by Subsection 3.6.3. for a shaft penetrating a roof assembly, a shaft, including an *exit* enclosure, that penetrates a *fire separation*, shall
- a) extend through any *horizontal service space* or any other concealed space, and
- b) terminate so that smoke-tight joints are provided where the shaft abuts on or intersects
  - i) a floor,
  - ii) a roof slab, or
  - iii) a roof deck.

4) The continuity of a *fire separation* shall be maintained where it abuts another *fire separation*, a floor, a ceiling, a roof, or an exterior wall assembly. (See Note A-3.1.8.3.(4).)

3.1.8.4. Determination of Ratings and Classifications

1) Except as permitted by Sentences (2) and 3.1.8.16.(1), the *fire-protection rating* of a *closure* shall be determined in accordance with

a) CAN/ULC-S104, “Fire Tests of Door Assemblies,”

b) CAN4-S106-M, “Fire Tests of Window and Glass Block Assemblies,” or

c) CAN/ULC-S112, “Fire Test of Fire Damper Assemblies.”

(See Articles 3.1.8.17. to 3.1.8.19. for additional requirements for *closures*.)

2) Except as permitted by Sentence 3.1.8.12.(1), the *fire-protection rating* of a *closure* shall conform to Table 3.1.8.4. for the required *fire-resistance rating* of the *fire separation*.

3) The leakage rate of smoke dampers and combination smoke/*fire dampers* shall

a) be determined in accordance with the applicable provisions in CAN/ULC-S112.1, “Leakage Rated Dampers for Use in Smoke Control Systems,” and

b) conform to Class I, II or III of that standard.

4) The leakage rate of a door assembly shall be determined in accordance with ANSI/UL-1784, “Air Leakage Tests of Door Assemblies and Other Opening Protectives.”

Table 3.1.8.4.
Fire-Protection Rating of Closures
Forming Part of Sentences 3.1.8.4.(2) and 3.1.9.1.(1)

Fire-Resistance Rating **of** *Fire Separation*	**Minimum** *Fire-Protection Rating* **of** *Closure*
45 min	45 min
1 h	45 min
1.5 h	1 h
2 h	1.5 h
3 h	2 h
4 h	3 h

3.1.8.5. Installation of Closures

1) Except where *fire dampers*, window assemblies and glass block are used as *closures*, *closures* of the same *fire-protection rating* installed on opposite sides of the same opening are deemed to have a *fire-protection rating* equal to the sum of the *fire-protection ratings* of the *closures*. (See Note A-3.1.8.1.(2).)

2) Except as otherwise specified in this Part, every door, *fire damper*, window assembly or glass block used as a *closure* in a required *fire separation* shall be installed in conformance with NFPA 80, “Fire Doors and Other Opening Protectives.” (See Note A-3.1.8.1.(2).)

3) Except as otherwise specified in this Part, every smoke damper or combination smoke/*fire damper* used as a *closure* in a required *fire separation* shall be installed in conformance with NFPA 105, “Smoke Door Assemblies and Other Opening Protectives.”

4) If a door is installed such that it could damage the integrity of a *fire separation* if its swing is unrestricted, door stops shall be installed to prevent the damage.

5) Protective guarding devices shall be

a) provided where necessary to prevent damage to the mechanical components of doors in *fire separations*, and

b) installed so as not to interfere with the proper operation of the doors.

6) A leakage-rated door assembly complying with Sentence 3.1.8.4.(4) shall be installed in

a) fire separations in protected *floor areas* referred to in Clause 11.3.7.1.(1)(b),

b) fire separations in *care* or *treatment occupancies* referred to in Sentence 3.3.3.5.(4),

c) except as provided in Sentence (8), *fire separations* of *public corridors* serving *dwelling units* in *storeys* that are not *sprinklered*, and

d) firewalls that are a *horizontal exit* referred to in Sentence 3.3.3.5.(3).

7) Leakage-rated door assemblies required by Sentence (6) shall be installed in accordance with NFPA 105, "Smoke Door Assemblies and Other Opening Protectives."

8) A leakage-rated door assembly need not be installed where a *dwelling unit* served by a *public corridor* has

a) a second and separate *means of egress*, or

b) an open-air balcony that is sized to accommodate the number of occupants for which the *dwelling unit* is intended.

9) A *closure* installed as part of a vertical *fire separation* within connecting construction described in Clause 1.3.3.4.(3)(b) of Division A, shall be protected by a dedicated water curtain that

a) consists of quick response sprinklers with a nominal k-factor of 5.6 of the upright or pendant type on each side,

b) is located such that

i) the water curtain sprinklers are between 150 mm and 300 mm horizontally from the interior face of the opening,

ii) the water curtain sprinklers are located and not more than 3.6 m vertically above the floor immediately below and within 300 mm of the ceiling per the manufacturers listing for the quick response sprinkler head and NFPA 13,

iii) if the opening is 1.8 m or less in width, have one sprinkler head installed at the center of the opening with no more than 0.9 m horizontally from the edge of the opening,

iv) if the opening is more than 1.8 m in width, have multiple sprinkler heads installed at 1.8 m on center with no more than 0.9 m horizontally from the edge of the opening, and

c) have sprinkler heads protected from spray and from cold solder effects from adjacent sprinklers (floor area or water curtain sprinkler heads) by means of baffles in accordance with NFPA 13, and be hydraulically designed to

i) discharge water at a minimum flow rate of 1.13 L/s (18 usgpm),

ii) sprinklers will be supplied on a separate zone, and

iii) be included in the most hydraulically demanding design area for the adjacent floor area sprinklers plus the inside and outside hose stream allowance per NFPA 13.

3.1.8.6. Maximum Openings

1) The size of an opening in an interior *fire separation* required to be protected with a *closure* shall be not more than 11 m^2, with no dimension more than 3.7 m, if a *fire compartment* on either side of the *fire separation* is not *sprinklered*.

2) The size of an opening in an interior *fire separation* required to be protected with a *closure* shall be not more than 22 m^2, with no dimension more than 6 m, provided the *fire compartments* on both sides of the *fire separation* are *sprinklered*.

3.1.8.7. Location of Fire Dampers and Smoke Dampers

1) Except as provided in Article 3.1.8.8., a *fire damper* having a *fire-protection rating* conforming to Sentence 3.1.8.4.(2) shall be installed in conformance with Article 3.1.8.10. in ducts or air-transfer openings that penetrate an assembly required to be a *fire separation*.

2) Except as provided in Article 3.1.8.9., a smoke damper or a combination smoke/*fire damper* shall be installed in conformance with Article 3.1.8.11. in ducts or air-transfer openings that penetrate an assembly required to be a *fire separation*, where the *fire separation*

a) separates a *public corridor*,

b) contains an egress door referred to in Sentence 3.4.2.4.(2),

c) serves an *assembly*, *care*, *treatment*, *detention* or *residential occupancy*, or

d) is installed to meet the requirements of Clause 11.3.7.1.(1)(b) or Sentence 3.3.3.5.(4).

3.1.8.8. Fire Dampers Waived

1) Except as provided in Sentence (2), the requirement for *fire dampers* stated in Sentence 3.1.8.7.(1) is permitted to be waived for

a) ducts that serve commercial cooking equipment (See also Article 6.3.1.7.),

b) continuous *noncombustible* ducts having a melting point above 760°C that penetrate a vertical *fire separation* required by Sentence 3.3.1.1.(1) between *suites* of *assembly*, *mercantile*, *low-hazard industrial*, *medium-hazard industrial* or *high-hazard industrial occupancy*,

c) ducts or air-transfer openings that penetrate a vertical *fire separation* not required to have a *fire-resistance rating*, or

d) noncombustible ducts or air-transfer openings that penetrate a horizontal *fire separation* not required to have a *fire-resistance rating*.

2) The requirement for *fire dampers* stated in Sentence 3.1.8.7.(1) is permitted to be waived for *noncombustible* branch ducts having a melting point above 760°C that penetrate a *fire separation*,

a) provided the ducts

i)have a cross-sectional area not more than 0.013 m^2 and serve only air-conditioning units or combined air-conditioning and heating units discharging air not more than 1.2 m above the floor, or

ii) extend not less than 500 mm inside *exhaust duct* risers that are under negative pressure and in which the airflow is upward as required by Article 3.6.3.4., or

b) where the *fire separation* separates a *vertical service space* from the remainder of the *building*, provided each individual duct exhausts directly to the outdoors at the top of the *vertical service space*.

3.1.8.9. Smoke Dampers Waived

1) Except as provided in Sentence (2), the requirement for smoke dampers or combination smoke/*fire dampers* stated in Sentence 3.1.8.7.(2) is permitted to be waived for ducts

a) that serve commercial cooking equipment (See also Article 6.3.1.7.),

b) in which all inlet and outlet openings serve not more than one *fire compartment*, or

c) that penetrate a vertical *fire separation* referred to in Clause 11.3.7.1.(1)(b) or in Sentence 3.3.3.5.(4), provided

i) the movement of air is continuous, and

ii) the configuration of the air-handling system prevents the recirculation of exhaust or return air under fire emergency conditions.

2) The requirement for smoke dampers or combination smoke/*fire dampers* stated in Sentence 3.1.8.7.(2) is permitted to be waived for *noncombustible* branch ducts having a melting point above 760°C that penetrate a *fire separation*,

a) provided the ducts

i) have a cross-sectional area not more than 0.013 m^2 and serve only air-conditioning units or combined air-conditioning and heating units discharging air not more than 1.2 m above the floor,

ii) extend not less than 500 mm inside *exhaust duct* risers that are under negative pressure and in which the airflow is upward as required by Article 3.6.3.4., or

iii) are required to function as part of a smoke control system, or

b) where the *fire separation* separates a *vertical service space* from the remainder of the *building*, provided each individual duct exhausts directly to the outdoors at the top of the *vertical service space*.

3.1.8.10. Installation of Fire Dampers

1) A *fire damper* shall be installed in the plane of the *fire separation* so as to stay in place should the duct become dislodged during a fire. (See Note A-3.1.8.10.(1).)

2) A *fire damper* shall be arranged so as to close automatically upon the operation of a fusible link conforming to ULC-S505, “Fusible Links for Fire Protection Service,” or other heat-actuated or smoke-actuated device.

3) A heat-actuated device referred to in Sentence (2) shall

a) be located where it is readily affected by an abnormal rise in temperature in the duct, and

b) have a temperature rating approximately 30°C above the maximum temperature that would exist in the system, whether it is in operation or shut down.

4) A *fire damper* tested in the vertical or horizontal position shall be installed in the position in which it was tested.

5) A tightly fitted access door shall be installed for each *fire damper* to provide access for the inspection of the damper and the resetting of the release device. (See Note A-3.1.8.10.(5).)

3.1.8.11. Installation of Smoke Dampers

1) Where smoke dampers are used as a *closure* in an air-transfer opening, they shall be installed in the plane of the *fire separation*.

2) Where combination smoke/*fire dampers* are used as a *closure* in a duct, they shall be installed within 610 mm of the plane of the *fire separation*, provided there is no inlet or outlet opening between the *fire separation* and the damper.

3) Except as required by a smoke control system, smoke dampers and combination smoke/*fire dampers* shall be configured so as to close automatically upon a signal from an adjacent *smoke detector* located as described in CAN/ULC-S524, “Installation of Fire Alarm Systems,” within 1.5 m horizontally of the duct or air-transfer opening in the *fire separation*

a) on both sides of the air-transfer opening, or

b) in the duct downstream of the smoke damper or combination smoke/*fire damper*.

4) Smoke dampers or combination smoke/*fire dampers* shall be installed in the vertical or horizontal position in which they were tested.

5) A tightly fitted access door shall be installed for each smoke damper and combination smoke/*fire damper* to provide access for their inspection and the resetting of the release device. (See Note A-3.1.8.10.(5).)

3.1.8.12. Twenty-Minute Closures

1) A door assembly having a *fire-protection rating* not less than 20 min is permitted to be used as a *closure* in

a) a *fire separation* not required to have a *fire-resistance rating* more than 1 h, located between

i) a *public corridor* and a *suite*,

ii) a corridor and adjacent sleeping rooms, or

iii) a corridor and adjacent classrooms, offices and libraries in Group A, Division 2 *major occupancies*, or

b) a *fire separation* not required to have a *fire-resistance rating* more than 45 min, located in a *building* not more than 3 *storeys* in *building height*.

2) The requirements for *noncombustible* sills and *combustible* floor coverings in NFPA 80, “Fire Doors and Other Opening Protectives,” do not apply to a door described in Sentence (1).

3) A door described in Sentence (1) shall have clearances of not more than 6 mm at the bottom and not more than 3 mm at the sides and top.

3.1.8.13. Self-closing Devices

1) Except as permitted by Sentence (2), every door in a *fire separation*, other than doors to freight elevators and dumbwaiters, shall be equipped with a self-closing device designed to return the door to the closed position after each use.

2) A self-closing device need not be provided on a door that is located between

a) a classroom and a corridor providing *access to exit* from the classroom in a *building* that is not more than 3 *storeys* in *building height*,

b) a *public corridor* and an adjacent room of *business and personal services occupancy* in a *building* that is not more than 3 *storeys* in *building height* provided the door is not located in a dead-end portion of the corridor,
c) a patients' sleeping room and a corridor serving the patients' sleeping room, provided the room and corridor are within a *fire compartment* in a hospital or nursing home with *treatment* that complies with the requirements of Article 3.3.3.5., or
d) a patients' sleeping room and an adjacent room that serves the patients' sleeping room, provided these rooms are within a *fire compartment* in a hospital or nursing home with *treatment* that complies with the requirements of Article 3.3.3.5.

3.1.8.14. Hold-Open Devices

1) Except as provided in Sentences 3.1.8.10.(2) and 3.1.8.11.(3), a hold-open device is permitted to be used on a *closure* in a required *fire separation*, other than on an *exit* stair door in a *building* more than 3 *storeys* in *building height* and on a door for a vestibule required by Article 3.3.5.7., provided the device is designed to release the *closure* in conformance with this Article.
2) Except as provided in Sentences (5) and (6), where the *building* is provided with a fire alarm system, a hold-open device permitted by Sentence (1) shall release
a) in a single-stage system, upon any signal from the fire alarm system, and
b) in a 2-stage system,
i) upon any *alert signal* from the fire alarm system, or
ii) upon actuation of any adjacent *smoke detectors*.
3) Where the *building* is provided with a fire alarm system, a hold-open device permitted by Sentence (1) shall release upon a signal from a *smoke detector* connected to the fire alarm system and located as described in CAN/ULC-S524, "Installation of Fire Alarm Systems," where the hold-open device is used on
a) an *exit* door,
b) a door opening into a *public corridor*,
c) an egress door referred to in Sentence 3.4.2.4.(2),
d) a *closure* serving an *assembly*, *care*, *treatment*, *detention*, or *residential occupancy*,
e) a door in a *fire separation* referred to in Clause 11.3.7.1.(1)(b) or Sentence 3.3.3.5.(4), or
f) a door required to function as part of a smoke control system.
4) Where the *building* is not provided with a fire alarm system, a hold-open device permitted by Sentence (1) shall release upon a signal from a *smoke alarm* located on each side of the *fire separation* at ceiling level within 1.5 m horizontally of the *closure* opening in the *fire separation*, where the hold-open device is used on *closures* described in Clauses (3)(a) to (e).
5) Where a hold-open device is used on *closures* other than those described in Sentences (3) and (4), it is permitted to be released upon actuation of a heat-actuated device.
6) A hold-open device used on a door located between a corridor used by the public and an adjacent sleeping room in a *treatment occupancy* need not release automatically as stated in Sentence (2).

3.1.8.15. Door Latches

1) Except as permitted by Article 3.3.3.5., a swing-type door in a *fire separation* shall be equipped with a positive latching mechanism designed to hold the door in the closed position after each use.

3.1.8.16. Wired Glass and Glass Block

1) Except as permitted by Articles 3.1.8.18. and 3.1.8.19. for the separation of *exits*, an opening in a *fire separation* having a *fire-resistance rating* not more than 1 h is permitted to be protected with fixed wired glass assemblies or glass blocks installed in conformance with NFPA 80, "Fire Doors and Other Opening Protectives."
2) Wired glass assemblies permitted by Sentence (1) and described in Appendix D are permitted to be used as *closures* in vertical *fire separations* without being tested in accordance with Sentence 3.1.8.4.(1).

3) Glass blocks permitted by Sentence (1) shall be installed in accordance with Subsection 4.3.2. and reinforced with steel reinforcement in each horizontal joint.

3.1.8.17. Temperature Rise Limit for Doors

1) Except as permitted by Article 3.1.8.19., the maximum temperature rise on the opaque portion of the unexposed side of a door used as a *closure* in a *fire separation* in a location shown in Table 3.1.8.17. shall conform to the Table when tested in conformance with Sentence 3.1.8.4.(1).

Table 3.1.8.17.
Restrictions on Temperature Rise and Glazing for Closures
Forming Part of Articles 3.1.8.17. and 3.1.8.18.

Location	Minimum Required *Fire-Protection Rating* of Door	Maximum Temperature Rise on Opaque Portion of Unexposed Side of Door, °C	Maximum Area of Wired Glass in Door, m^2	Maximum Aggregate Area of Glass Block and Wired Glass Panels not in a Door, m^2
Between a dead-end corridor and an adjacent *occupancy* where the corridor provides the only *access to exit* and is required to have a *fire-resistance rating*	Less than 45 min	No limit	No limit	No limit
	45 min	250 after 30 min	0.0645	0.0645
Between an *exit* enclosure and the adjacent *floor area* in a *building* not more than 3 *storeys* in *building height*	All ratings	No limit	0.8	0.8
Between an *exit* enclosure and the adjacent *floor area* (except as permitted above)	45 min	250 after 30 min	0.0645	0.0645
	1.5 h	250 after 1 h	0.0645	0.0645
	2 h	250 after 1 h	0.0645	0.0645
In a *firewall*	1.5 h	250 after 30 min	0.0645	0
	3 h	250 after 1 h	0	0

3.1.8.18. Area Limits for Wired Glass and Glass Block

1) Except as permitted by Article 3.1.8.19., the maximum area of wired glass in a door used in the locations shown in Table 3.1.8.17. shall conform to the Table. (See Note A-3.1.8.18.(1).)
2) Except as permitted by Article 3.1.8.19., the maximum area of glass block and wired glass panels not in a door, used in the locations shown in Table 3.1.8.17., shall conform to the Table.

3.1.8.19. Temperature Rise and Area Limits Waived

1) The temperature rise limits and glass area limits required by Articles 3.1.8.17. and 3.1.8.18. are waived for a *closure* between an *exit* enclosure and an enclosed vestibule or corridor, provided

a) the vestibule or corridor is separated from the remainder of the *floor area* by a *fire separation* having a *fire-resistance rating* not less than 45 min,

b) the *fire separation* required by Clause (a) contains no wired glass or glass block within 3 m of the *closure* into the *exit* enclosure, and
c) the vestibule or corridor contains no *occupancy*.
(See Note A-3.1.8.19.(1).)

3.1.9. Penetrations in Fire Separations and Fire-Rated Assemblies
(See Note A-3.1.9.)

3.1.9.1. Fire Stops
1) Except as provided in Sentences (2) to (5) and Article 3.1.9.4., penetrations of a *fire separation* or a membrane forming part of an assembly required to have a *fire-resistance rating* shall be
a) sealed by a *fire stop* that, when subjected to the fire test method in CAN/ULC-S115, "Fire Tests of Firestop Systems," has an F rating not less than the *fire-protection rating* required for *closures* in the *fire separation* in conformance with Table 3.1.8.4.,
b) cast in place (See Note A-3.1.9.1.(1)(b).), or
c) tightly fitted (See Note A-3.1.9.1.(1)(c).).
(See also Article 3.1.9.5. for requirements regarding penetrations by *combustible* drain, waste and vent piping.)
2) Penetrations of a *firewall* or a horizontal *fire separation* that is required to have a *fire-resistance rating* in conformance with Article 3.2.1.2. shall be sealed at the penetration by a *fire stop* that, when subjected to the fire test method in CAN/ULC-S115, "Fire Tests of Firestop Systems," has an FT rating not less than the *fire-resistance rating* for the *fire separation*.
3) Penetrations of a *fire separation* in conformance with Sentence 3.6.4.2.(2) shall be sealed by a *fire stop* that, when subjected to the fire test method in CAN/ULC-S115, "Fire Tests of Firestop Systems," has an FT rating not less than the *fire-resistance rating* for the *fire separation* of the assembly.
4) Sprinklers are permitted to penetrate a *fire separation* or a membrane forming part of an assembly required to have a *fire-resistance rating* without having to meet the *fire stop* requirements of Sentences (1) to (3), provided the annular space created by the penetration of a fire sprinkler is covered by a metal escutcheon plate in accordance with NFPA 13, "Installation of Sprinkler Systems."
5) Unless specifically designed with a *fire stop*, *fire dampers* are permitted to penetrate a *fire separation* or a membrane forming part of an assembly required to have a *fire-resistance rating* without having to meet the *fire stop* requirements of Sentences (1) to (3), provided the *fire damper* is installed in conformance with NFPA 80, "Fire Doors and Other Opening Protectives."

3.1.9.2. Combustibility of Service Penetrations
1) Except as permitted by Articles 3.1.9.3. and 3.1.9.5., pipes, ducts, electrical outlet boxes, totally enclosed raceways or other similar service equipment that penetrate an assembly required to have a *fire-resistance rating* shall be *noncombustible*, unless the assembly was tested incorporating that service equipment. (See Note A-3.1.9.2.(1).)

3.1.9.3. Penetration by Wires, Cables and Outlet Boxes
1) Optical fibre cables and electrical wires and cables in totally enclosed *noncombustible* raceways are permitted to penetrate an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2.
2) Except as permitted by Sentence (3), totally enclosed non-metallic raceways conforming to Article 3.1.5.23., optical fibre cables, and electrical wires and cables, single or grouped, with *combustible* insulation, jackets or sheathes that conform to the requirements of Clause 3.1.5.21.(1)(a) and that are not installed in totally enclosed *noncombustible* raceways are permitted to penetrate an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2., provided the overall diameter of the single or grouped wires or cables, or the raceways is not more than 25 mm.

3) Single conductor metal sheathed cables with *combustible* jacketing that are more than 25 mm in overall diameter are permitted to penetrate a *fire separation* required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2., provided the cables are not grouped and are spaced a minimum of 300 mm apart.
4) Combustible totally enclosed raceways that are embedded in a concrete floor slab are permitted in an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2., provided the concrete cover between the raceway and the bottom of the slab is not less than 50 mm.
5) Combustible outlet boxes are permitted in an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2., provided the opening through the membrane into the box is not more than 0.016 m^2.

3.1.9.4. Penetration by Outlet Boxes

(See Note A-3.1.9.4.)
1) Except as provided in Sentence (2), outlet boxes are permitted to penetrate the membrane of an assembly required to have a *fire-resistance rating*, provided they are sealed at the penetration by a *fire stop* that has an FT rating not less than the *fire-resistance rating* of the *fire separation* when subjected to the fire test method in CAN/ULC-S115, “Fire Tests of Firestop Systems.”
2) Except as provided in Sentences 3.1.9.1.(2) and (3), *noncombustible* outlet boxes that penetrate a vertical *fire separation* or a membrane forming part of an assembly required to have a *fire-resistance rating* need not be sealed at the penetration with a *fire stop*, provided

- a) they do not exceed
  - i) 0.016 m^2 in area, and
  - ii) an aggregate area of 0.065 m^2 in any 9.3 m^2 of surface area, and
- b) the annular space between the membrane and the *noncombustible* electrical outlet boxes does not exceed 3 mm.

3) In addition to the requirements of Sentence (2), outlet boxes on opposite sides of a vertical *fire separation* having a *fire-resistance rating* shall be separated by

- a) a horizontal distance of not less than 600 mm, or
- b) a *fire block* conforming to Article 3.1.11.7.

3.1.9.5. Combustible Piping Penetrations

1) Combustible sprinkler piping is permitted to penetrate a *fire separation* provided the *fire compartments* on each side of the *fire separation* are *sprinklered*.
2) Combustible water distribution piping is permitted to penetrate a *fire separation* that is required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2., provided the piping is protected at the penetration with a *fire stop* in conformance with Sentence (4).
3) Except as permitted by Sentences (4) to (5), *combustible* piping shall not be used in a drain, waste and vent piping system if any part of that system penetrates

- a) a *fire separation* required to have a *fire-resistance rating*, or
- b) a membrane that forms part of an assembly required to have a *fire-resistance rating*.

4) Combustible drain, waste and vent piping is permitted to penetrate a *fire separation* required to have a *fire-resistance rating* or a membrane that forms part of an assembly required to have a *fire-resistance rating*, provided

- a) the piping is sealed at the penetration by a *fire stop* that has an F rating not less than the *fire-resistance rating* required for the *fire separation* when subjected to the fire test method in CAN/ULC-S115, “Fire Tests of Firestop Systems,” with a pressure differential of 50 Pa between the exposed and unexposed sides, with the higher pressure on b) the exposed side, and
- b) the piping is not located in a *vertical service space*.

5) Combustible drain, waste and vent piping is permitted on one side of a vertical *fire separation* provided it is not located in a *vertical service space*.
6) Combustible piping for central vacuum systems is permitted to penetrate a *fire separation* provided the installation conforms to the requirements that apply to *combustible* drain, waste and vent piping specified in Sentence (4).

3.1.9.6. Openings for Ducts through a Membrane Ceiling
1) A membrane ceiling forming part of an assembly assigned a *fire-resistance rating* on the basis of Appendix D or Sentence 3.1.7.1.(4) is permitted to be penetrated by openings leading into ducts within the ceiling space, provided

a) the ducts are sheet steel, and
b) the number of openings and their protection conform to the requirements of Appendix D.

3.1.9.7. Plenums
1) A ceiling assembly used as a *plenum* shall conform to Article 3.6.4.3.

3.1.10. Firewalls

3.1.10.1. Prevention of Firewall Collapse
1) Except as permitted by Sentence (2), the connections and supports for structural framing members that are connected to or supported on a *firewall* and have a *fire-resistance rating* less than that required for the *firewall*, shall be designed so that the failure of the framing systems during a fire will not affect the integrity of the *firewall* during the fire.
2) Sentence (1) does not apply to a *firewall* consisting of two separate wall assemblies each tied to its respective *building* frame but not to each other, provided each wall assembly is

a) a *fire separation* having one half of the *fire-resistance rating* required for the *firewall* by Sentences 3.1.10.2.(1) and (2), and
b) designed so that the collapse of one wall assembly will not cause collapse of the other.

3) A *firewall* is permitted to be supported on the structural frame of a *building* of *noncombustible construction* provided the supporting frame has a *fire-resistance rating* not less than that required for the *firewall*.
4) Piping, ducts and totally enclosed *noncombustible* raceways shall be installed so that their collapse will not cause collapse of the *firewall*.

3.1.10.2. Rating of Firewalls
1) A *firewall* that separates a *building* or *buildings* with *floor areas* containing a Group E or a Group F, Division 1 or 2 *major occupancy* shall be constructed as a *fire separation* of *noncombustible construction* having a *fire-resistance rating* not less than 4 h, except that where the upper portion of a *firewall* separates *floor areas* containing other than Group E or Group F, Division 1 or 2 *major occupancies*, the *fire-resistance rating* of the upper portion of the *firewall* is permitted to be not less than 2 h.
2) A *firewall* that separates a *building* or *buildings* with *floor areas* containing *major occupancies* other than Group E or Group F, Division 1 or 2 shall be constructed as a *fire separation* of *noncombustible construction* having a *fire-resistance rating* not less than 2 h.
3) Except as permitted by Sentence (4), the required *fire-resistance rating* of a *firewall*, except for *closures*, shall be provided by masonry or concrete.
4) A *firewall* permitted to have a *fire-resistance rating* not more than 2 h need not be constructed of masonry or concrete, provided

a) the assembly providing the *fire-resistance rating* is protected against damage that would compromise the integrity of the assembly, and
b) the design conforms to Article 4.1.5.17.

(See Note A-3.1.10.2.(4).)

3.1.10.3. Continuity of Firewalls

1) A *firewall* shall extend from the ground continuously through, or adjacent to, all *storeys* of a *building* or *buildings* so separated, except that a *firewall* located above a *basement storage garage* conforming to Article 3.2.1.2. is permitted to commence at the floor assembly immediately above the *storage garage*. (See also Sentence 3.1.10.1.(3).)

2) A *firewall* is permitted to terminate on the underside of a reinforced concrete roof slab, provided

a) the roof slab on both sides of the *firewall* has a *fire-resistance rating* not less than

i) 1 h if the *firewall* is required to have a *fire-resistance rating* not less than 2 h, or

ii) 2 h if the *firewall* is required to have a *fire-resistance rating* not less than 4 h, and

b) there are no concealed spaces within the roof slab in that portion immediately above the *firewall*.

3.1.10.4. Parapets

1) Except as permitted by Sentences (2) and 3.1.10.3.(2), a *firewall* shall extend above the roof surface to form a parapet not less than

a) 150 mm high for a *firewall* required to have a *fire-resistance rating* not less than 2 h, and

b) 900 mm high for a *firewall* required to have a *fire-resistance rating* not less than 4 h.

2) A *firewall* that separates 2 *buildings* with roofs at different elevations need not extend above the upper roof surface to form a parapet, provided the difference in elevation between the roofs is more than 3 m.

3.1.10.5. Maximum Openings

1) Openings in a *firewall* shall conform to the size limits described in Article 3.1.8.6. and the aggregate width of openings shall be not more than 25% of the entire length of the *firewall*.

3.1.10.6. Exposure Protection for Adjacent Walls

1) The requirements of Article 3.2.3.14. shall apply to the external walls of 2 *buildings* that meet at a *firewall* at an angle less than 135°.

3.1.10.7. Combustible Projections

1) Combustible material shall not extend across the end of a *firewall* but is permitted to extend across a roof above a *firewall* that is terminated in conformance with Sentence 3.1.10.3.(2).

2) If *buildings* are separated by a *firewall*, *combustible* projections on the exterior of one *building*, including balconies, platforms, canopies, eave projections and stairs, that extend outward beyond the end of the *firewall*, shall not be permitted within 2.4 m of *combustible* projections and window or door openings of the adjacent *building*. (See also Article 3.2.3.6.)

3.1.11. Fire Blocks in Concealed Spaces

3.1.11.1. Separation of Concealed Spaces

1) Concealed spaces in interior wall, ceiling and crawl spaces shall be separated from concealed spaces in exterior walls and *attic or roof spaces* by *fire blocks* conforming to Article 3.1.11.7.

3.1.11.2. Fire Blocks in Wall Assemblies and Vertical Concealed Spaces

1) Except as permitted by Sentence (2), *fire blocks* conforming to Article 3.1.11.7. shall be provided to block off concealed spaces within a wall assembly and concealed vertical spaces forming part of wood-frame *buildings*

a) at every floor level,

b) at every ceiling level where the ceiling forms part of an assembly required to have a *fire-resistance rating*, and

c) so that the maximum horizontal dimension is not more than 20 m and the maximum vertical dimension is not more than 3 m.

2) Fire blocks conforming to Sentence (1) are not required, provided

a) the wall space or concealed vertical space is filled with insulation,

b) the exposed construction materials and any insulation within the wall space or concealed vertical space are *noncombustible*,

c) the exposed materials within the wall space or concealed vertical space, including insulation but not including wiring, piping or similar services, have a *flame-spread rating* not more than 25 on any exposed surface, or on any surface that would be exposed by cutting through the material in any direction, and *fire blocks* are installed so that the vertical distance between them is not more than 10 m, or

d) the insulated wall assembly contains not more than one concealed air space, and the horizontal thickness of that air space is not more than 25 mm.

3.1.11.3. Fire Blocks between Nailing and Supporting Elements

1) In a *building* required to be of *noncombustible construction*, a concealed space in which there is an exposed ceiling finish with a *flame-spread rating* more than 25 shall be provided with *fire blocks* conforming to Article 3.1.11.7. between wood nailing elements so that the maximum area of the concealed space is not more than 2 m^2.

2) In a *building* required to be of *noncombustible construction*, *fire blocks* conforming to Article 3.1.11.7. shall be provided in the concealed spaces created by the wood members permitted by Sentence 3.1.5.10.(2) so that the maximum area of a concealed space is not more than 10 m^2.

3.1.11.4. Fire Blocks between Vertical and Horizontal Spaces

1) Fire blocks conforming to Article 3.1.11.7. shall be provided

a) at all interconnections between concealed vertical and horizontal spaces in interior coved ceilings, drop ceilings and soffits in which the exposed construction materials within the space have a *flame-spread rating* more than 25, and

b) at the end of each run and at each floor level in concealed spaces between stair stringers in which the exposed construction materials within the space have a *flame-spread rating* more than 25.

3.1.11.5. Fire Blocks in Horizontal Concealed Spaces

1) Except for crawl spaces conforming to Sentence 3.1.11.6.(1) and as required in Sentence (3), horizontal concealed spaces within a floor assembly or roof assembly of *combustible construction*, in which sprinklers are not installed, shall be separated by construction conforming to Article 3.1.11.7. into compartments

a) not more than 600 m^2 in area with no dimension more than 60 m if the exposed construction materials within the space have a *flame-spread rating* not more than 25, and

b) not more than 300 m^2 in area with no dimension more than 20 m if the exposed construction materials within the space have a *flame-spread rating* more than 25.

(See Note A-3.1.11.5.(1).)

2) A concealed space in an exterior cornice, a mansard-style roof, a balcony or a canopy in which exposed construction materials within the space have a *flame-spread rating* more than 25, shall be separated by construction conforming to Article 3.1.11.7.

a) at locations where the concealed space extends across the ends of required vertical *fire separations*, and

b) so that the maximum dimension in the concealed space is not more than 20 m.

3) Except as provided in Sentence (4), in *buildings* or parts thereof conforming to Article 3.2.2.50. or 3.2.2.58., horizontal concealed spaces within a floor assembly or roof assembly of *combustible* construction shall be separated by construction conforming to Article 3.1.11.7. into compartments that are

a) not more than 600 m^2 in area with no dimension more than 60 m, if the exposed construction materials within the space have a *flame-spread rating* not more than 25, and
b) not more than 300 m^2 in area with no dimension more than 20 m, if the exposed construction materials within the space have a *flame-spread rating* more than 25.

(See Note A-3.1.11.5.(3).)

4) Fire blocks conforming to Sentence (3) are not required where the horizontal concealed space within the floor or roof assembly is entirely filled with *noncombustible* insulation such that any air gap between the top of the insulation and the floor or roof deck does not exceed 50 mm.

3.1.11.6. Fire Blocks in Crawl Spaces

1) A crawl space that is not considered as a *basement* by Article 3.2.2.9. and in which sprinklers are not installed, shall be separated by construction conforming to Article 3.1.11.7. into compartments not more than 600 m^2 in area with no dimension more than 30 m.

3.1.11.7. Fire Block Materials

1) Except as permitted by Sentences (2) to (4) and (7), *fire blocks* shall remain in place and prevent the passage of flames for not less than 15 min when subjected to the standard fire exposure in CAN/ULC-S101, "Fire Endurance Tests of Building Construction and Materials."

2) Gypsum board not less than 12.7 mm thick and sheet steel not less than 0.38 mm thick need not be tested in conformance with Sentence (1), provided all joints have continuous support.

3) In a *building* required to be of *noncombustible construction*, wood nailing elements described in Article 3.1.5.8. need not be tested in conformance with Sentence (1).

4) In a *building* permitted to be of *combustible construction*, in a *combustible* roof system permitted by Sentence 3.1.5.3.(2), and in a raised platform permitted by Sentence 3.1.5.10.(2), *fire blocks* are permitted to be

a) solid lumber or a structural composite lumber product conforming to ASTM D 5456, "Evaluation of Structural Composite Lumber Products," not less than 38 mm thick,
b) phenolic bonded plywood, waferboard, or oriented strandboard not less than 12.5 mm thick with joints supported, or
c) two thicknesses of lumber or a structural composite lumber product conforming to ASTM D 5456, "Evaluation of Structural Composite Lumber Products," each not less than 19 mm thick with joints staggered, where the width or height of the concealed space requires more than one piece of lumber or structural composite lumber product not less than 38 mm thick to block off the space.

5) Openings through materials referred to in Sentences (1) to (4) shall be protected to maintain the integrity of the construction.

6) Where materials referred to in Sentences (1) to (4) are penetrated by construction elements or by service equipment, a *fire stop* shall be used to seal the penetration. (See Note A-3.1.11.7.(6).)

7) In *buildings* permitted to be of *combustible construction*, semi-rigid fibre insulation board produced from glass, rock or slag is permitted to be used to block the vertical space in a double stud wall assembly formed at the intersection of the floor assembly and the walls, provided the width of the vertical space does not exceed 25 mm and the insulation board

a) has a density not less than 45 kg/m^3,
b) is securely fastened to one set of studs,
c) extends from below the bottom of the top plates in the lower *storey* to above the top of the bottom plate in the upper *storey*, and
d) completely fills the portion of the vertical space between the headers and between the wall plates.

(See Note A-3.1.11.7.(7).)

3.1.12. Flame-Spread Rating and Smoke Developed Classification

3.1.12.1. Determination of Ratings

1) Except as required by Sentence (2) and as permitted by Sentence (3), the *flame-spread rating* and smoke developed classification of a material, assembly, or structural member shall be determined on the basis of not less than three tests conducted in conformance with CAN/ULC-S102, "Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies."

2) The *flame-spread rating* and smoke developed classification of a material or assembly shall be determined on the basis of not less than three tests conducted in conformance with CAN/ULC-S102.2, "Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies," if the material or assembly

a) is designed for use in a relatively horizontal position with only its top surface exposed to air,
b) cannot be tested in conformance with Sentence (1) without the use of supporting material that is not representative of the intended installation, or
c) is thermoplastic.

3) A material, assembly, or structural member is permitted to be assigned a *flame-spread rating* and smoke developed classification on the basis of Appendix D.

3.1.13. Interior Finish

3.1.13.1. Interior Finishes, Furnishings and Decorative Materials

1) Except as otherwise provided by this Subsection, interior finishes, furnishings and decorative materials shall conform to Section 2.3. of Division B of the Fire By-law.

2) Interior finish material shall include any material that forms part of the interior surface of a floor, wall, *partition* or ceiling, including

a) interior cladding of plaster, wood or tile,
b) surfacing of fabric, paint, plastic, veneer or wallpaper,
c) doors, windows and trim,
d) lighting elements such as light diffusers and lenses forming part of the finished surface of the ceiling, and
e) carpet material that overlies a floor that is not intended as the finished floor.

3.1.13.2. Flame-Spread Rating

1) Except as otherwise required or permitted by this Subsection, the *flame-spread rating* of interior wall and ceiling finishes, including glazing and skylights, shall be not more than 150 and shall conform to Table 3.1.13.2.

Table 3.1.13.2.
Flame-Spread Ratings
Forming Part of Sentence 3.1.13.2.(1)

Occupancy, **Location or Element**	**Maximum** *Flame-Spread Rating* **for Walls and Ceilings**	
	Sprinklered	**Not** *Sprinklered*
Group A, Division 1 *occupancies*, including doors, skylights, glazing and light diffusers and lenses	150	75
Group B *occupancies*	150	75
Exits(1)	25	25
Lobbies described in Sentence 3.4.4.2.(2)	25	25

Covered vehicular passageways, except for roof assemblies of *heavy timber construction in the passageways*	25	25
Vertical service spaces	25	25

Notes to Table 3.1.13.2.:
(1) See Articles 3.1.13.8. and 3.1.13.10.

2) Except as permitted by Sentence (3), doors, other than those in Group A, Division 1 *occupancies*, need not conform to Sentence (1) provided they have a *flame-spread rating* not more than 200. (See Note A-3.1.13.2.(2).)
3) Doors within a *dwelling unit* need not conform to Sentences (1) and (2).
4) Up to 10% of the total wall area and 10% of the total ceiling area of a wall or ceiling finish that is required by Sentence (1) to have a *flame-spread rating* less than 150 is permitted to have a *flame-spread rating* not more than 150, except that up to 25% of the total wall area of lobbies described in Sentence 3.4.4.2.(2) is permitted to have a *flame-spread rating* not more than 150.
5) Except in the case of Group A, Division 1 *occupancies*, *combustible* doors, skylights, glazing and light diffusers and lenses shall not be considered in the calculation of wall and ceiling areas described in Sentence (4).

3.1.13.3. Bathrooms in Residential Suites
1) The *flame-spread rating* of interior wall and ceiling finishes for a bathroom within a *suite* of *residential occupancy* shall be not more than 200.

3.1.13.4. Light Diffusers and Lenses
1) The *flame-spread rating* of *combustible* light diffusers and lenses in all *occupancies* other than Group A, Division 1 is permitted to be more than the *flame-spread rating* limits required elsewhere in this Subsection, provided the light diffusers and lenses
a) have a *flame-spread rating* not more than 250 and a smoke developed classification not more than 600 when tested in conformance with CAN/ULC-S102.2, "Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies,"
b) fall to the bottom of the test apparatus before igniting when tested in conformance with CAN/ULC-S102.3, "Fire Test of Light Diffusers and Lenses,"
c) are not prevented from falling from the ceiling by construction located beneath the elements, and
d) are not used in a corridor that is required to be separated from the remainder of the *building* by a *fire separation* or in an *exit* shaft unless individual diffusers or lenses are not more than 1 m^2 in area and are not less than 1.2 m apart.

3.1.13.5. Skylights
1) Individual *combustible* skylights in a corridor that is required to be separated from the remainder of the *building* by a *fire separation* shall be not more than 1 m^2 in area and not less than 1.2 m apart.

3.1.13.6. Corridors
1) Except as permitted by Sentences (2) and (3), the *flame-spread rating* shall be not more than 75 for the interior wall finish of
a) a *public corridor*,
b) a corridor used by the public in an *assembly occupancy*, or
c) a corridor serving classrooms.
2) The *flame-spread rating* for corridors specified in Sentence (1) is permitted to be waived, provided the *flame-spread rating* is not more than

a) 25 on the upper half of the wall, and
b) 150 on the lower half of the wall.

3) Where the *floor area* is *sprinklered* throughout, the *flame-spread ratings* for corridors specified in Sentences (1) and (2) shall be not more than 150.

4) The *flame-spread ratings* specified in Sentences (1), (2) and (3) apply to *occupancies* in the corridor as well as to the corridor itself.

5) Except as provided in Sentence (6), the interior ceiling finish of corridors and *occupancies* referred to in Sentences (1) and (4) shall have a *flame-spread rating* not more than 25.

6) Where the *floor area* is *sprinklered* throughout, the *flame-spread rating* of the interior ceiling finish of corridors and *occupancies* referred to in Sentences (1) and (4) shall be not more than 150.

3.1.13.7. High Buildings

1) Except as permitted by Sentences (2) to (4), the interior wall, ceiling and floor finishes in a *building* regulated by the provisions of Subsection 3.2.6. shall conform to the *flame-spread rating* requirements in Articles 3.1.13.2. and 3.1.13.11. and to the *flame-spread rating* and smoke developed classification values in Table 3.1.13.7.

Table 3.1.13.7
Flame-Spread Rating and Smoke Developed Classification in High Buildings
Forming Part of Sentence 3.1.13.7.(1)

Location or Element	Maximum *Flame-Spread Rating*			Maximum Smoke Developed Classification		
	Wall Surface	Ceiling Surface(1)	Floor Surface	Wall Surface	Ceiling Surface(1)	Floor Surface
Exit stairways, vestibules to *exit* stairs and lobbies described in Sentence 3.4.4.2.(2)	25	25	25	50	50	50
Corridors not within *suites*	(2)	(2)	300	100	50	500
Elevator cars	75	75	300	450	450	450
Elevator vestibules	25	25	300	100	100	300
Service spaces and *service rooms*	25	25	25	50	50	50
Other locations and elements	(2)	(2)	No Limit	300	50	No Limit

Notes to Table 3.1.13.7.:
(1) See Article 3.1.13.4. for lighting elements.
(2) Other requirements of this Part apply.

2) Except for a *building* of Group B *major occupancy* and elevator cars, the *flame-spread rating* and smoke developed classification of interior wall, floor and ceiling finishes need not conform to the values in Table 3.1.13.7., provided the *building* is *sprinklered*.

3) Trim and millwork in an *exit* stairway, a vestibule to an *exit* stairway, a lobby described in Sentence 3.4.4.2.(2), or a corridor not within a *suite* need not conform to the *flame-spread rating* and smoke developed classification requirements of Sentence (1) provided they have

a) a *flame-spread rating* not more than 150,
b) a smoke developed classification not more than 300, and
c) an aggregate area not more than 10% of the area of the wall or ceiling on which they occur.

4) A door serving an *exit* stairway, a vestibule to an *exit* stairway, a lobby described in Sentence 3.4.4.2.(2), or a corridor not within a *suite* need not conform to the *flame-spread rating* and smoke developed classification requirements of Sentence (1) provided

a) it has a *flame-spread rating* not more than 200,

b) it has a smoke developed classification not more than 300, and

c) the aggregate area of all doors is not more than 10% of the area of the wall in which they are located.

3.1.13.8. Noncombustible Construction

1) In a *building* required to be of *noncombustible construction*,

a) the *flame-spread ratings* required by Subsection 3.1.5. shall apply in addition to the requirements in this Subsection, and

b) the *flame-spread ratings* for *exits* in this Subsection shall also apply to any surface in the *exit* that would be exposed by cutting through the material in any direction, except that this requirement does not apply to doors, *heavy timber construction* in a *sprinklered building* and *fire-retardant-treated wood*.

3.1.13.9. Underground Walkways

1) Except for paint, the interior wall and ceiling finishes of an underground *walkway* shall be of *noncombustible* materials.

3.1.13.10. Exterior Exit Passageway

1) The wall and ceiling finishes of an exterior *exit* passageway that provides the only *means of egress* from the rooms or *suites* it serves, including the soffit beneath and the *guard* on the passageway, shall have a *flame-spread rating* not more than 25, except that a *flame-spread rating* not more than 150 is permitted for up to 10% of the total wall area and for up to 10% of the total ceiling area.

3.1.13.11. Elevator Cars

1) The wall and ceiling surfaces of elevator cars shall have a *flame-spread rating* not more than 75.

2) The wall, ceiling and floor surfaces of elevator cars shall have a smoke developed classification not more than 450.

3.1.14. Roof Assemblies

3.1.14.1. Fire-Retardant-Treated Wood Roof Systems

1) If a *fire-retardant-treated wood* roof system is used to comply with the requirements of Subsection 3.2.2., the roof deck assembly shall meet the conditions of acceptance of CAN/ULC-S126, "Test for Fire Spread Under Roof-Deck Assemblies."

2) Supports for the roof deck assembly referred to in Sentence (1) shall consist of

a) fire-retardant-treated wood,

b) heavy timber construction,

c) noncombustible construction, or

d) a combination thereof.

3.1.14.2. Metal Roof Deck Assemblies

1) Except as permitted by Sentence (2), a metal roof deck assembly shall meet the conditions of acceptance of CAN/ULC-S126, "Test for Fire Spread Under Roof-Deck Assemblies," if

a) it supports a *combustible* material above the deck that could propagate a fire beneath the roof deck assembly, and

b) the deck is used to comply with the requirements of Sentences 3.2.2.25.(2), 3.2.2.32.(2), 3.2.2.60.(2), 3.2.2.66.(2), 3.2.2.76.(2) and 3.2.2.83.(2) for *noncombustible construction*.

2) The requirements of Sentence (1) are waived provided

a) the *combustible* material above the roof deck is protected by not less than 12.7 mm thick gypsum board, mechanically fastened to a supporting assembly if located beneath the roof deck, or by a thermal barrier conforming to one of Clauses 3.1.5.15.(2)(c) to (e) that is located

i) on the underside of the *combustible* material, or

ii) beneath the roof deck,

b) the *building* is *sprinklered* throughout, or

c) the roof assembly has a *fire-resistance rating* not less than 45 min.

3.1.14.3. Overhead Skylight Glazing

1) All skylights shall be glazed with wired glass, laminated safety glass or *combustible* glazing, which is anchored to the skylight frame and to the *building* structure. (See Note A-3.1.14.3.)

3.1.14.4. Green Roof Assemblies

1) A *green roof assembly* is permitted in *combustible* and *noncombustible construction* if

a) the *green roof assembly* is designed and constructed in conformance with ANSI/SPRI VF-1 “External Fire Design Standard for Vegetative Roofs”,

b) gravity loads on the *building* structure are determined by ASTM E2397-11 “Standard Practice for Determination of Dead Loads and Live Loads Associated with Vegetative (Green) Roof Systems”,

c) the *green roof assembly* is designed and constructed with a root barrier,

d) the *green roof assembly* is designed and constructed with water retention materials to support vegetative growth, and

e) the drainage layer of the *green roof assembly* is designed to accommodate rainwater harvesting and conforms to f) ASTM E2398-11 “Standard Test Method for Water Capture and Media Retention of Geocomposite Drain Layers for Vegetative (Green) Roof Systems”.

2) In addition to the requirements in Sentence (1), the roof assembly which supports a *green roof assembly* shall conform with Subsection 3.1.15., except for Part 9 *buildings*.

3) In addition to the requirements in Sentence (1), the roof assembly which supports a *green roof assembly* shall conform with Part 5.

3.1.15. Roof Covering

3.1.15.1. Roof Covering Classification

1) A roof covering classification shall be determined in conformance with CAN/ULC-S107, “Fire Tests of Roof Coverings.”

3.1.15.2. Roof Coverings

1) Except as provided in Sentences (2) and (3), every roof covering shall have a Class A, B or C classification as determined in accordance with Article 3.1.15.1.

2) A roof covering is not required to have a Class A, B or C classification for

a) a tent,

b) an *air-supported structure*,

c) a *building* of Group A, Division 2 *occupancy* not more than 2 *storeys* in *building height* and not more than 1 000 m^2 in *building area* provided the roof covering is underlaid with *noncombustible* material, or

d) a steel *building* system referred to in Article 4.3.4.3., provided the roof covering consists of brick, masonry, concrete, metal sheets or metal shingles.

3) Except as provided in Sentence (4), roof coverings on *buildings* conforming to Article 3.2.2.50. or 3.2.2.58. shall have a Class A classification where the roof height is greater than 25 m measured from the floor of the *first storey* to the highest point of the roof.

4) Where *buildings* conforming to Article 3.2.2.50. or 3.2.2.58. include non-contiguous roof assemblies at different elevations, the roof coverings referred to in Sentence (3) are permitted to be evaluated separately to determine the roof covering classification required.

3.1.16. Fabrics

3.1.16.1. Fabric Canopies and Marquees

1) Fabrics used as part of an awning, canopy or marquee that is located within or attached to a *building* of any type of construction shall conform to CAN/ULC-S109, “Flame Tests of Flame-Resistant Fabrics and Films.”

3.1.17. Occupant Load

3.1.17.1. Occupant Load Determination

1) The *occupant load* of a *floor area* or part of a *floor area* shall be based on

a) the number of seats in an *assembly occupancy* having fixed seats,

b) 2 persons per sleeping room in a *dwelling unit*, or

c) the number of persons for which the area is designed, but not less than that determined from Table 3.1.17.1. for *occupancies* other than those described in Clauses (a) and (b), unless it can be shown that the area will be occupied by fewer persons.

2) If a *floor area* or part thereof has been designed for an *occupant load* other than that determined from Table 3.1.17.1., a permanent sign indicating that *occupant load* shall be posted in a conspicuous location.

Table 3.1.17.1.
Occupant Load
Forming Part of Article 3.1.17.1.

Type of Use of *Floor Area* or Part Thereof	Area per person, m^2
Assembly uses	
space with fixed seats	(1)
space with non-fixed seats	0.75
stages for theatrical performances	0.75
space with non-fixed seats and tables	0.95
standing space	0.40
stadia and grandstands	0.60
bowling alleys, pool and billiard rooms	9.30
classrooms	1.85
school shops and vocational rooms	9.30
reading or writing rooms or lounges	1.85

dining, beverage and cafeteria space	1.20
laboratories in schools	4.60
Exercise rooms without equipment	1.40(4)
Exercise rooms with equipment	4.60(4)
Care, *treatment* or detention uses	
suites	(2)
care, *treatment* and sleeping room areas	10.00
detention quarters	11.60
Residential uses	
dwelling units	(2)
dormitories	4.60
Business and personal services uses	
personal services shops	4.60
offices	9.30
Mercantile uses	
basements and *first storeys*	3.70
second *storeys* having a principal entrance from a pedestrian thoroughfare or a parking area	3.70
other *storeys*	5.60
Industrial uses	
manufacturing or process rooms	4.60
storage garages	46.00
storage spaces (warehouse)	28.00
aircraft hangars	46.00
Other uses	

cleaning and repair goods	4.60
kitchens	9.30
storage	46.00
public corridors intended for *occupancies* in addition to pedestrian travel	3.70(3)

Notes to Table 3.1.17.1.:
(1) See Clause 3.1.17.1.(1)(a).
(2) See Clause 3.1.17.1.(1)(b) (apply values for *dwelling units* to *suites* of *care occupancy*).
(3) See Note A-3.3.
(4) See Note A-3.1.17.1.

3) For the purposes of this Article, *mezzanines*, tiers and balconies shall be regarded as part of the *floor area*.
4) If a room or group of rooms is intended for different *occupancies* at different times, the value to be used from Table 3.1.17.1. shall be the value which gives the greatest number of persons for the *occupancies* concerned.

Section 3.2. Building Fire Safety

3.2.1. General

3.2.1.1. Exceptions in Determining Building Height

1) A roof-top enclosure shall not be considered as a *storey* in calculating the *building height* if the roof-top enclosure is
a) provided for elevator machinery, a stairway or a *service room*, and
b) used for no purpose other than for service to the *building*.
(See Note A-3.2.1.1.(1).)
2) Space under tiers of seats in a *building* of the arena type shall not be considered as adding to the *building height* provided the space is used only for dressing rooms, concession stands and similar purposes incidental to the *major occupancy* of the *building*.
3) Except as required by Sentence (5), the space above a *mezzanine* need not be considered as a *storey* in calculating the *building height*, provided
a) not less than 60% of the horizontal plane separating the *mezzanine* from the room or floor space in which it is located is open, and
b) except as permitted in Sentences (7) and 3.3.2.13.(3), the space above the *mezzanine* is used as an open area without *partitions* or subdividing walls higher than 1 070 mm above the *mezzanine* floor.
(See Note A-3.2.1.1.(3).)
4) Except as required by Sentence (5), the space above a *mezzanine* need not be considered as a *storey* in calculating the *building height*, provided
a) the aggregate area of *mezzanines* that are not superimposed and do not meet the conditions of Sentence (3) does not exceed 10% of the *floor area* in which they are located, and
b) the area of a *mezzanine* in a *suite* does not exceed 10% of the area of that *suite*.
(See Note A-3.2.1.1.(4).)
5) Except as permitted by Sentence (6), each level of *mezzanine* that is partly or wholly superimposed above the first level of *mezzanine* shall be considered as a *storey* in calculating the *building height*.

6) Platforms intended solely for periodic inspection and elevated maintenance catwalks need not be considered as floor assemblies or *mezzanines* for the purpose of calculating *building height*, provided

a) they are not used for storage, and

b) they are constructed with *noncombustible* materials, unless the *building* is permitted to be of *combustible construction*.

7) The space above a *mezzanine* conforming to Sentence (3) is permitted to include an enclosed space whose area does not exceed 10% of the horizontal plane separating the *mezzanine* from the room or floor space in which the *mezzanine* is located, provided the enclosed space does not obstruct visual communication between the open space above the *mezzanine* and the room in which it is located. (See Figure A-3.2.1.1.(3)-D.)

8) A *service space* in which facilities are included to permit a person to enter and to undertake maintenance and other operations pertaining to *building* services from within the *service space* need not be considered a *storey* if it conforms to Articles 3.2.5.14. and 3.3.1.24., and Sentences 3.2.4.18.(10), 3.2.7.3.(2), 3.3.1.3.(7), 3.4.2.4.(3) and 3.4.4.4.(9). (See Note A-3.2.1.1.(8).)

3.2.1.2. Storage Garage Considered as a Separate Building

1) A *basement* used primarily as a *storage garage* is permitted to be considered as a separate *building* for the purposes of Subsection 3.2.2. and Sentences 3.2.5.12.(2) and (3), provided the floor and roof assemblies above the *basement* and the exterior walls of the *basement* above the adjoining ground level are constructed as *fire separations* of *noncombustible construction* having a *fire-resistance rating* not less than 2 h and protected in conformance with Clause 3.1.10.2.(4)(a), except as permitted by Sentence (2). (See Notes A-3.1.10.2.(4) and A-3.2.5.12.(2).)

2) The exterior wall of a *basement* that is required to be a *fire separation* with a *fire-resistance rating* in accordance with Sentence (1) is permitted to be penetrated by openings that are not protected by *closures* provided

a) the *storage garage* is *sprinklered* throughout,

b) every opening in the exterior wall is separated from *storeys* above the opening by a projection of the floor or roof assembly above the *basement*, extending not less than

i) 1 m beyond the exterior face of the *storage garage* if the upper *storeys* are required to be of *noncombustible construction*, or

ii) 2 m beyond the exterior face of the *storage garage* if the upper *storeys* are permitted to be of *combustible construction*, or

c) the exterior walls of any *storeys* located above the floor or roof assembly referred to in Sentence (1) are recessed behind the outer edge of the assembly by not less than

i) 1 m if the upper *storeys* are required to be of *noncombustible construction*, or

ii) 2 m if the upper *storeys* are permitted to be of *combustible construction*.

3) The floor or roof assembly projection referred to in Clause (2)(b) shall have a *fire-resistance rating* not less than 2 h and shall have no openings within the projection.

3.2.1.3. Roof Considered as a Wall

1) For the purposes of this Section any part of a roof that is pitched at an angle of 60° or more to the horizontal and is adjacent to a space intended for *occupancy* within a *building* shall be considered as part of an exterior wall of the *building*.

3.2.1.4. Floor Assembly over Basement

1) Except as permitted by Sentence 3.2.2.47.(3), 3.2.2.48.(3), 3.2.2.49.(3), 3.2.2.51.(3), 3.2.2.52.(3), 3.2.2.53.(3) or 3.2.2.54.(3), a floor assembly immediately above a basement shall be constructed as a *fire separation* having a *fire-resistance rating* conforming to the requirements of Articles 3.2.2.20. to 3.2.2.90. for a floor assembly, but not less than 45 min.

2) All *loadbearing* walls, columns and arches supporting a floor assembly immediately above a *basement* shall have a *fire-resistance rating* not less than that required by Sentence (1) for the floor assembly.

3.2.1.5. Fire Containment in Basements

1) In a *building* in which an automatic sprinkler system is not required to be installed by Article 3.2.2.18., every *basement* shall

a) be *sprinklered* throughout, or

b) be subdivided into *fire compartments* not more than 600 m^2 in area by a *fire separation* having a *fire-resistance rating* not less than that required for the floor assembly immediately above the *basement*.

2) Deleted.

3.2.1.6. Mezzanines

1) The floor assembly of a *mezzanine* that is required to be considered as a *storey* in calculating the *building height* shall be constructed in conformance with the *fire separation* requirements for floor assemblies stated in Articles 3.2.2.20. to 3.2.2.90.

3.2.1.7. Fire Containment in Combustible Buildings

1) All Group C *major occupancies* in a *building* of *combustible construction* greater than 2 *storeys* in *building height* shall be separated from all other *major occupancies* except as prohibited in Article 3.1.3.2. and except as permitted in Sentence (2) and (3), by a *fire separation* with at least a 2 h *fire-resistance rating* constructed of

a) concrete,

b) masonry, or

c) in a *sprinklered building*, encapsulated mass timber construction in accordance with Sentence (4) or (5).

2) The *fire-resistance rating* required in Sentence (1) is permitted to be 1.5 h for a *storage garage*.

3) The *fire separation* of every *exit*, elevator and vertical service shaft that penetrates a concrete, masonry, or encapsulated mass timber floor assembly as required in Sentence (1) shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* determined by Sentences (1) or (2) for

a) the floor assembly above the *storey*, or

b) the floor assembly below the *storey*, if there is no floor assembly above.

4) Where a *building* of *combustible construction* greater than 2*storeys* in *building height* contains an *occupancy* other than Group C or Group D on the second or third *storey* that is required to be constructed in accordance with Sentences 3.2.2.50.(5) or 3.2.2.58.(4), the *building* shall

a) be *sprinklered*,

b) be divided into at least two horizontal *fire compartments* on each *storey* containing a *major occupancy* other than Group C or Group D which are

i) not more than 1000 m^2 in area, and

ii) constructed as *fire separations* with at least a 2 h *fire-resistance rating*,

c) *exit* stairs serving *storeys* above the third *storey* shall be constructed as *fire separations* with at least a 2 h *fire-resistance rating*, and

d) each *fire compartment* required by Clause (b) shall be served by at least one *exit* stair.

(See Note A-3.2.1.7.(4))

5) Encapsulated mass timber construction as identified in Sentence (1)(c) and in *fire separations* required by Sentence (4) shall consist of structural mass timber elements, including beams, columns, arches, and wall, floor and roof assemblies encapsulated in a continuous fire-resistive membrane and (See Note A-3.2.1.7.(5).)

a) be arranged in heavy solid masses containing no concealed spaces,

b) have essentially smooth flat surfaces with no thin sections or sharp projections,

c) timber elements shall conform to the minimum dimensions stated in Table 3.2.1.7.(5),

d) adhesives used in structural mass timber elements provided in accordance with Clause (1)(c) that are constructed of cross-laminated timber shall conform to the elevated temperature performance requirements in ANSI/APA PRG 320 "Standard for Performance-Rated Cross-Laminated Timber.",
e) the exposed surfaces of structural timber elements conforming to clause (d) shall be protected from adjacent spaces in the *building*, including adjacent concealed spaces within wall, floor and roof assemblies, by a fire-resistive membrane consisting of a minimum of two layers of 5/8" thickness type 'X' or two layers of 1/2" thickness type 'C' gypsum board, or gypsum-concrete topping and concrete not less than 38 mm thick when installed on the upper side of a mass timber floor or roof assembly, and
(See Note A-3.2.1.7.(5).)
f) gypsum board membranes shall be installed with staggered joints, and mechanically fastened directly to the mass timber elements with fasteners spaced not more than 300 mm o.c. and 20 mm to 38 mm from the boards' edges.

Table 3.2.1.7.(5)
Minimum Dimensions of Structural Mass Timber Elements in Encapsulated Mass Timber Construction
Forming Part of Clause 3.2.1.7.(5)(c)

Structural Wood Elements	Minimum Thickness (mm)	Minimum Width x Depth (mm x mm)
Walls that are *fire separations* or exterior walls	96	-
Walls that require a *fire-resistance rating*, but are not *fire separations* (2-sided exposure)	192	-
Floor and roofs (1-sided exposure)	96	-
Beams, columns and arches (2- or 3-sided fire exposure)	-	192 x 192
Beams, columns and arches (4-sided fire exposure)	-	224 x 224

Note to Table 3.2.1.7.(5):
(1) See Note A-Table 3.2.1.7.(5)

3.2.2. Building Size and Construction Relative to Occupancy

3.2.2.1. Application

1) Except as permitted by Article 3.2.2.3., a *building* shall be constructed in conformance with this Subsection to prevent fire spread and collapse caused by the effects of fire. (See Subsection 3.1.3. for *fire separations* between *major occupancies*.)

3.2.2.2. Special and Unusual Structures

1) A structure that cannot be identified with the characteristics of a *building* in Articles 3.2.2.20. to 3.2.2.90. shall be protected against fire spread and collapse in conformance with good fire protection engineering practice. (See Note A-3.2.2.2.(1).) (See also Notes A-3 and A-3.2.5.12.(1).)

3.2.2.3. Exceptions to Structural Fire Protection

1) Fire protection is not required for
a) steel lintels above openings not more than 2 m wide in *loadbearing* walls and not more than 3 m wide in non-*loadbearing* walls,

b) steel lintels above openings more than 2 m wide in *loadbearing* walls and more than 3 m wide in non-*loadbearing* walls provided the lintels are supported at intervals of not more than 2 m by structural members with the required *fire-resistance rating*,
c) the bottom flanges of shelf angles and plates that are not a part of the structural frame,
d) steel members for framework around elevator hoistway doorways, steel for the support of elevator and dumbwaiter d) guides, counterweights and other similar equipment, that are entirely enclosed in a hoistway and are not a part of the structural frame of the *building*,
e) steel members of stairways and escalators that are not a part of the structural frame of a *building*,
f) steel members of porches, exterior balconies, exterior stairways, fire escapes, cornices, marquees and other similar appurtenances, provided they are outside an exterior wall of a *building*, and
g) loadbearing steel or concrete members wholly or partly outside a *building* face in a *building* not more than 4 *storeys* in *building height* and classified as Group A, B, C, D or F, Division 3 *major occupancy* provided the members are
i) not less than 1 m away from any *unprotected opening* in an exterior wall, or
ii) shielded from heat radiation in the event of a fire within the *building* by construction that will provide the same degree of protection that would be necessary if the member was located inside the *building*, with the protection extending on either side of the member a distance equal to the projection of the member from the face of the wall.

(See also Article 3.2.3.9.)

3.2.2.4. Buildings with Multiple Major Occupancies

1) The requirements restricting fire spread and collapse for a *building* of a single *major occupancy* classification are provided in this Subsection according to its *building height* and *building area*.
2) If a *building* contains more than one *major occupancy*, classified in more than one Group or Division, the requirements of this Subsection concerning *building* size and construction relative to *major occupancy* shall apply according to Articles 3.2.2.5. to 3.2.2.8.

3.2.2.5. Applicable Building Height and Area

1) In determining the fire safety requirements of a *building* in relation to each of the *major occupancies* contained therein, the *building height* and *building area* of the entire *building* shall be used.

3.2.2.6. Multiple Major Occupancies

1) Except as permitted by Articles 3.2.2.7. and 3.2.2.8., and Sentences 3.2.2.50.(5) and 3.2.2.58.(4) in a *building* containing more than one *major occupancy*, the requirements of this Subsection for the most restricted *major occupancy* contained shall apply to the whole *building*.

3.2.2.7. Superimposed Major Occupancies

1) Except as provided in Article 3.2.2.8., Sentence 3.2.2.18.(2), and Sentences 3.2.2.50.(5) and 3.2.2.58.(4), in a *building* in which one *major occupancy* is located entirely above another *major occupancy*, the requirements in this Subsection for each portion of the *building* containing a *major occupancy* shall apply to that portion as if the entire *building* were of that *major occupancy*.
2) If one *major occupancy* is located above another *major occupancy*, the *fire-resistance rating* of the floor assembly between the *major occupancies* shall be determined on the basis of the requirements of this Subsection for the lower *major occupancy*. (See also Article 3.1.3.1.) (See Note A-3.2.2.7.(2).)
3) Reserved.
4) Reserved.

3.2.2.8. Exceptions for Major Occupancies

1) In a *building* in which the aggregate area of all *major occupancies* in a particular Group or Division is not more than 10% of the *floor area* of the *storey* in which they are located, these *major occupancies* need not be considered as *major occupancies* for the purposes of this Subsection, provided they are not classified as Group F, Division 1 or 2 *occupancies*.

3.2.2.9. Crawl Spaces

1) For the purposes of Articles 3.1.11.6., 3.2.1.4. and 3.2.1.5., a crawl space shall be considered as a *basement* if it is

a) more than 1.8 m high between the lowest part of the floor assembly and the ground or other surface below,
b) used for any *occupancy*,
c) used for the passage of *flue pipes*, or
d) used as a *plenum* in *combustible construction*.

2) A floor assembly immediately above a crawl space is not required to be constructed as a *fire separation* and is not required to have a *fire-resistance rating* provided the crawl space is not required to be considered as a *basement* by Sentence (1).

3.2.2.10. Streets

1) Every *building* shall face a *street* located in conformance with the requirements of Articles 3.2.5.4. and 3.2.5.5. for access routes.
2) For the purposes of Subsections 3.2.2. and 3.2.5. an access route conforming to Subsection 3.2.5. is permitted to be considered as a *street*.
3) A *building* conforming to Article 3.2.2.50. or 3.2.2.58. is considered to face 1 *street* where not less than 10% of the *building* perimeter is located within 15 m of a *street* or *streets*.
4) A *building* is considered to face 2 *streets* provided not less than 50% of the *building* perimeter is located within 15 m of the *street* or *streets*.
5) A *building* is considered to face 3 *streets* provided not less than 75% of the *building* perimeter is located within 15 m of the *street* or *streets*.
6) Enclosed spaces, tunnels, bridges and similar structures, even though used for vehicular or pedestrian traffic, are not considered as *streets* for the purpose of this Part.

3.2.2.11. Exterior Balconies

1) An exterior balcony shall be constructed in accordance with the type of construction required by Articles 3.2.2.20. to 3.2.2.90., as applicable to the *occupancy* classification of the *building*.

3.2.2.12. Exterior Passageways

1) An elevated exterior passageway used as part of a *means of egress* shall conform to the requirements of Articles 3.2.2.20. to 3.2.2.90. for *mezzanines*.

3.2.2.13. Occupancy on Roof

1) A portion of a roof that supports an *occupancy* shall be constructed in conformance with the *fire separation* requirements of Articles 3.2.2.20. to 3.2.2.90. for floor assemblies, and not the *fire-resistance rating* for roof assemblies.

3.2.2.14. Roof-Top Enclosures

1) A roof-top enclosure for elevator machinery or for a *service room* shall be constructed in accordance with the type of construction required by Articles 3.2.2.20. to 3.2.2.90.
2) A roof-top enclosure for elevator machinery or for a *service room*, not more than one *storey* high, is not required to have a *fire-resistance rating*.
3) A roof-top enclosure for a stairway shall be constructed in accordance with the type of construction required by Articles 3.2.2.20. to 3.2.2.90.

4) A roof-top enclosure for a stairway need not have a *fire-resistance rating* nor be constructed as a *fire separation*.

3.2.2.15. Storeys below Ground

1) If a *building* is erected entirely below the adjoining finished ground level and does not extend more than one *storey* below that ground level, the minimum precautions against fire spread and collapse shall be the same as are required for *basements* under a *building* of 1 *storey* in *building height* having the same *occupancy* and *building area*.

2) If any portion of a *building* is erected entirely below the adjoining finished ground level and extends more than one *storey* below that ground level, the following minimum precautions against fire spread and collapse shall be taken (See Note A-3.2.2.15.(2).)

a) the *basements* shall be *sprinklered* throughout,

b) a floor assembly below the ground level shall be constructed as a *fire separation* with a *fire-resistance rating* not less than

i) 3 h if the *basements* are used as Group E or Group F, Division 1 or 2 *occupancies*, or

ii) 2 h if the *basements* are not used as Group E or Group F, Division 1 or 2 *occupancies*, and

c) all *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the construction that they support.

3) Deleted.

3.2.2.16. Heavy Timber Roof Permitted

1) Unless otherwise permitted by Articles 3.2.2.20. to 3.2.2.90., a roof assembly in a *building* up to 2 *storeys* in *building height* is permitted to be of *heavy timber construction* regardless of *building area* or type of construction required, provided the *building* is *sprinklered* throughout.

2) If Sentence (1) permits a roof assembly to be of *heavy timber construction*, structural members in the *storey* immediately below the roof assembly are permitted to be of *heavy timber construction*.

3.2.2.17. Arena-Type Building Roof Assembly

1) The requirements for a roof assembly to have a *fire-resistance rating* are permitted to be waived for a gymnasium, a swimming pool, an arena, or a rink if no part of the roof assembly is less than 6 m above the main floor or balcony and the roof carries no loads other than normal roof loads, including permanent access walks, and ventilating, sound and lighting equipment, except that the restriction concerning minimum distance shall not apply to

a) an inclined and stepped floor ascending from the main floor which is used for seating purposes only, or

b) a balcony used for seating purposes only.

3.2.2.18. Automatic Sprinkler System Required

1) Except as required by Sentence (2) and (3), an automatic sprinkler system conforming to the requirements of Articles 3.2.4.7., 3.2.4.8., 3.2.4.9. and 3.2.5.12. shall be installed throughout a *building* regulated by one or more of Articles 3.2.2.20., 3.2.2.21., 3.2.2.22., 3.2.2.23., 3.2.2.24., 3.2.2.26., 3.2.2.27., 3.2.2.29., 3.2.2.31., 3.2.2.33., 3.2.2.36., 3.2.2.37., 3.2.2.38., 3.2.2.39., 3.2.2.40., 3.2.2.41., 3.2.2.42., 3.2.2.43., 3.2.2.44., 3.2.2.45., 3.2.2.46., 3.2.2.47., 3.2.2.48., 3.2.2.50., 3.2.2.51., 3.2.2.54., 3.2.2.55., 3.2.2.57., 3.2.2.58., 3.2.2.59., 3.2.2.61., 3.2.2.63., 3.2.2.64., 3.2.2.65., 3.2.2.67., 3.2.2.69., 3.2.2.70., 3.2.2.71., 3.2.2.72., 3.2.2.74., 3.2.2.75., 3.2.2.77., 3.2.2.79., 3.2.2.80., 3.2.2.82., 3.2.2.84., 3.2.2.86. and 3.2.2.88.

2) If a *storey* in a *building* or a *floor area* is required to have an automatic sprinkler system installed throughout in accordance with one or more of Articles 3.2.2.20. to 3.2.2.90. or Section 3.3., the automatic sprinkler system shall also be installed throughout all lower *storeys* in the *building* notwithstanding

permission in Articles 3.2.2.20. to 3.2.2.90. to construct one or more of those *storeys* without installing automatic sprinkler protection.
(See Note A-3.2.2.18.(2).)

3) Except for *buildings* described in Sentence 1.3.3.6.(2) of Division A, all newly constructed *buildings* shall be provided with an automatic *sprinkler system* designed and installed in accordance with Article 3.2.5.12.

4) Where an *assembly occupancy* is located in a *basement*, the *basement* shall be *sprinklered* throughout.

3.2.2.19. Buildings Containing Impeded Egress Zones

1) A *building* containing an *impeded egress zone* and conforming to the appropriate requirements of Articles 3.2.2.20. to 3.2.2.90. is not required to conform to the requirements of Articles 3.2.2.36. and 3.2.2.37. for a Group B, Division 1 *major occupancy* provided

a) the *building* is *sprinklered* throughout,
b) it is not more than 1 *storey* in *building height*,
c) it does not include
    i) a *contained use area*,
    ii) sleeping accommodation,
    iii) a *high-hazard industrial occupancy*, or
    iv) a *mercantile occupancy*,
d) the *building area* is not more than 6 400 m^2 if the *building* includes a *medium-hazard industrial occupancy*,
e) the *impeded egress zone* does not extend beyond the boundaries of the *fire compartment* in which it is located, and
f) the *occupant load* of the *impeded egress zone* is not more than 100.

3.2.2.20. Group A, Division 1, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.21. and 3.2.2.22., a *building* classified as Group A, Division 1 shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,
b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,
c) mezzanines shall have a *fire-resistance rating* not less than 1 h, and
d) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.21. Group A, Division 1, One Storey, Limited Area, Sprinklered

1) A *building* classified as Group A, Division 1 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 1 *storey* in *building height*,
c) it has less than 40% of the area of the *building* as 2 *storeys* for the purpose of
    i) development of productions, including preparation of scenery and costumes and rehearsal of performers,
    ii) organization of performers, scenery and sound equipment,
    iii) preparation by performers for a performance,
    iv) managerial functions, or
    v) toilets, rest rooms and similar public facilities,
d) it has no *occupancy* above or below the auditorium other than one which serves it or is dependent on it,
e) it is not more than 600 m^2 in *building area*, and

f) the *occupant load* is not more than 600.

2) The *building* referred to in Sentence (1) is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations*

i) with a *fire-resistance rating* not less than 45 min, or

ii) of *heavy timber construction*, and

b) loadbearing walls, columns and arches shall

i) have a *fire-resistance rating* not less than that required for the supported assembly, or

ii) be of *heavy timber construction*.

3.2.2.22. Group A, Division 1, One Storey, Sprinklered

1) A *building* classified as Group A, Division 1 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 1 *storey* in *building height*,

c) no part of an auditorium floor is more than 5 m above or below *grade*,

d) no *occupancy* is above or below the auditorium other than one which serves it or is dependent on it, and

e) the *occupant load* of the auditorium floor is not more than 300.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly, or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,

b) mezzanines shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

c) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*, and

d) loadbearing walls, columns and arches supporting a *fire separation* shall have a *fire-resistance rating* not less than that required for the *fire separation*.

3.2.2.23. Group A, Division 2, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.24. to 3.2.2.28., a *building* classified as Group A, Division 2 shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building shall be sprinklered* throughout,

b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,

c) mezzanines shall have a *fire-resistance rating* not less than 1 h, and

d) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.24. Group A, Division 2, up to 6 Storeys, Any Area, Sprinklered

1) A *building* classified as Group A, Division 2, that is not limited by *building area*, is permitted to conform to Sentence (2), provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout, and

b) it is not more than 6 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,
b) mezzanines shall have a *fire-resistance rating* not less than 1 h, and
c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.25. Group A, Division 2, up to 2 Storeys

1) A *building* classified as Group A, Division 2 is permitted to conform to Sentence (2) provided
a) it is not more than 2 *storeys* in *building height*, and
b) it has a *building area* not more than the value in Table 3.2.2.25.

Table 3.2.2.25.
Maximum Building Area, Group A, Division 2, up to 2 Storeys
Forming Part of Sentence 3.2.2.25.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	1 600	2 000	2 400
2	800	1 000	1 200

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min,
b) mezzanines shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,
c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, except that in a *building* not more than 1 *storey* in *building height*, the *fire-resistance rating* is permitted to be waived provided the *roof assembly* is constructed as a *fire-retardant-treated wood* roof system conforming to Article 3.1.14.1., and the *building area* is not more than
i) 800 m^2 if facing one *street*,
ii) 1 000 m^2 if facing 2 *streets*, or
iii) 1 200 m^2 if facing 3 *streets*, and
d) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall
i) have a *fire-resistance rating* not less than 45 min, or
ii) be of *noncombustible construction*.

3.2.2.26. Group A, Division 2, up to 2 Storeys, Increased Area, Sprinklered

1) A *building* classified as Group A, Division 2 is permitted to conform to Sentence (2) provided
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 2 *storeys* in *building height*, and
c) it has a *building area* not more than
i) 4 800 m^2 if 1 *storey* in *building height*, or
ii) 2 400 m^2 if 2 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min,
b) mezzanines shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, and
c) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall
i) have a *fire-resistance rating* not less than 45 min, or
ii) be of *noncombustible construction*.

3.2.2.27. Group A, Division 2, up to 2 Storeys, Sprinklered

1) A *building* classified as Group A, Division 2 is permitted to be of *combustible construction* or *noncombustible construction*, used singly or in combination, provided
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 2 *storeys* in *building height*, and
c) it has a *building area* not more than
i) 2 400 m^2 if 1 *storey* in *building height* with no *basement*,
ii) 1 200 m^2 if 1 *storey* in *building height*, or
iii) 600 m^2 if 2 *storeys* in *building height*.

3.2.2.28. Group A, Division 2, One Storey

1) A *building* classified as Group A, Division 2 is permitted to be of *combustible construction* or *noncombustible construction*, used singly or in combination, provided
a) it is not more than 1 *storey* in *building height*, and
b) except as permitted by Sentence (2), it has a *building area* not more than
i) 400 m^2 if facing one *street*,
ii) 500 m^2 if facing 2 *streets*, or
iii) 600 m^2 if facing 3 *streets*.

2) In a *building* referred to in Sentence (1) without a *basement*, the *building area* limits of Sentence (1) are permitted to be doubled provided a *fire separation* with a *fire-resistance rating* not less than 1 h is used to separate the *building* into *fire compartments*, each one of which does not exceed the limits of Clause (1)(b).

3.2.2.29. Group A, Division 3, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.30. to 3.2.2.34., a *building* classified as Group A, Division 3 shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,
b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,
c) mezzanines shall have a *fire-resistance rating* not less than 1 h, and
d) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.30. Group A, Division 3, up to 2 Storeys

1) A *building* classified as Group A, Division 3 is permitted to conform to Sentence (2) provided
a) it is not more than 2 *storeys* in *building height*, and
b) it has a *building area* not more than the value in Table 3.2.2.30.

Table 3.2.2.30.
Maximum Building Area, Group A, Division 3, up to 2 Storeys

Forming Part of Sentence 3.2.2.30.(1)

No. of ***Storeys***	**Maximum Area, m²**		
	Facing 1 ***Street***	**Facing 2** ***Streets***	**Facing 3** ***Streets***
1	4 000	5 000	6 000
2	2 000	2 500	3 000

2) Except as permitted by Clauses (c) and (d), the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) mezzanines shall have a *fire-resistance rating* not less than 1 h,

c) roof assemblies shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *heavy timber construction*, and

d) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly, except that arches and structural members within the *storey* immediately below a roof assembly are permitted to be of *heavy timber construction*.

3) If intended for occasional use for trade shows and similar exhibition purposes, a *building* referred to in Sentence (1) that is more than 1 500 m² in *building area* shall be *sprinklered* throughout.

3.2.2.31. Group A, Division 3, up to 2 Storeys, Sprinklered

1) A *building* classified as Group A, Division 3 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 2 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 12 000 m² if 1 *storey* in *building height*, or

ii) 6 000 m² if 2 *storeys* in *building height*.

2) Except as permitted by Clause (c) and Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) mezzanines shall have a *fire-resistance rating* not less than 1 h, and

c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly, except that arches are permitted to be of *heavy timber construction*.

3.2.2.32. Group A, Division 3, One Storey, Increased Area

1) A *building* classified as Group A, Division 3 is permitted to conform to Sentence (2) provided

a) it is not more than 1 *storey* in *building height*, and

b) it has a *building area* not more than

i) 2 400 m² if facing one *street*,

ii) 3 000 m² if facing 2 *streets*, or

iii) 3 600 m² if facing 3 *streets*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) mezzanines shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

b) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, except that the *fire-resistance rating* is permitted to be waived provided the roof assembly is constructed as a *fire-retardant-treated wood* roof system conforming to Article 3.1.14.1., and the *building area* is not more than

i) 1 200 m^2 if facing one *street*,

ii) 1 500 m^2 if facing 2 *streets*, or

iii) 1 800 m^2 if facing 3 *streets*, and

c) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3) If intended for occasional use for trade shows and similar exhibition purposes, a *building* referred to in Sentence (1) that is more than 1 500 m^2 in *building area* shall be *sprinklered* throughout.

3.2.2.33. Group A, Division 3, One Storey, Sprinklered

1) A *building* classified as Group A, Division 3 is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 1 *storey* in *building height*, and

c) it has a *building area* not more than 7 200 m^2.

3.2.2.34. Group A, Division 3, One Storey

1) A *building* classified as Group A, Division 3 is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination provided

a) it is not more than 1 *storey* in *building height*, and

b) it has a *building area* not more than

i) 1 000 m^2 if facing one *street*,

ii) 1 250 m^2 if facing 2 *streets*, or

iii) 1 500 m^2 if facing 3 *streets*.

3.2.2.35. Group A, Division 4

1) Except as permitted by Sentences (2) and (3), a *building* classified as Group A, Division 4 shall be of *noncombustible construction*.

2) Roof assemblies and supporting arches and columns are permitted to be of *heavy timber construction*.

3) A *building* classified as Group A, Division 4 is permitted to be of *combustible construction* provided

a) the *occupant load* is less than 1 500, and

b) the *building* has a *limiting distance* not less than 6 m.

4) Sprinklers shall be installed in all spaces below tiers of seats in a *building* classified as Group A, Division 4 if those spaces are used for *occupancy*. (See Note A-3.2.2.35.(4).)

3.2.2.36. Group B, Division 1, Any Height, Any Area, Sprinklered

1) Except as permitted by Article 3.2.2.37., a *building* classified as Group B, Division 1 shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,

b) floor assemblies shall be *fire separation*s with a *fire-resistance rating* not less than 2 h,

c) mezzanines shall have a *fire-resistance rating* not less than 1 h, and

d) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.37. Group B, Division 1, up to 3 Storeys, Sprinklered

1) A *building* classified as Group B, Division 1 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 3 *storeys* in *building height*, and

c) it has a *building area*

i) that is not limited if the *building* is not more than 1 *storey* in *building height*,

ii) not more than 12 000 m^2 if 2 *storeys* in *building height*, or

iii) not more than 8 000 m^2 if 3 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) mezzanines shall have a *fire-resistance rating* not less than 1 h, and

c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.38. Group B, Division 2, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.39. to 3.2.2.41., a *building* classified as Group B, Division 2 shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,

b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,

c) mezzanines shall have a *fire-resistance rating* not less than 1 h, and

d) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.39. Group B, Division 2, up to 3 Storeys, Sprinklered

1) A *building* classified as Group B, Division 2 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 3 *storeys* in *building height*, and

c) it has a *building area*

i) that is not limited if the *building* is not more than 1 *storey* in *building height*,

ii) not more than 12 000 m^2 if 2 *storeys* in *building height*, or

iii) not more than 8 000 m^2 if 3 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) mezzanines shall have a *fire-resistance rating* not less than 1 h, and

c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.40. Group B, Division 2, up to 2 Storeys, Sprinklered

1) A *building* classified as Group B, Division 2 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 2 *storeys* in *building height*, and
c) it has a *building area* not more than
i) 2 400 m² if 1 *storey* in *building height*, or
ii) 1 600 m² if 2 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,
b) mezzanines shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, and
c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.41. Group B, Division 2, One Storey, Sprinklered

1) A *building* classified as Group B, Division 2 is permitted to be of *combustible construction* or *noncombustible construction*, used singly or in combination, provided
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 1 *storey* in *building height*, and
c) it has a *building area* not more than 500 m².

3.2.2.42. Group B, Division 3, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.43. to 3.2.2.46., a *building* classified as Group B, Division 3 shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,
b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,
c) mezzanines shall have a *fire-resistance rating* not less than 1 h, and
d) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.43. Group B, Division 3, up to 3 Storeys (Noncombustible), Sprinklered

1) A *building* classified as Group B, Division 3 is permitted to conform to Sentence (2) provided
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 3 *storeys* in *building height*, and
c) it has a *building area*
i) that is not limited if the *building* is not more than 1 *storey* in *building height*,
ii) not more than 12 000 m² if 2 *storeys* in *building height*, or
iii) not more than 8 000 m² if 3 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and
a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,
b) mezzanines shall have a *fire-resistance rating* not less than 1 h, and
c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.44. Group B, Division 3, up to 3 Storeys, Sprinklered

1) A *building* classified as Group B, Division 3 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 3 *storeys* in *building height*, and
c) it has a *building area* not more than
i) 5 400 m^2 if 1 *storey* in *building height*,
ii) 2 700 m^2 if 2 *storeys* in *building height*, or
iii) 1 800 m^2 if 3 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction*, used singly or in combination, and
a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,
b) mezzanines shall have a *fire-resistance rating* not less than 1 h, and
c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.45. Group B, Division 3, up to 2 Storeys, Sprinklered

1) A *building* classified as Group B, Division 3 is permitted to conform to Sentence (2) provided
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 2 *storeys* in *building height*, and
c) it has a *building area* not more than
i) 2 400 m^2 if 1 *storey* in *building height*, or
ii) 1 600 m^2 if 2 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction*, used singly or in combination, and
a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,
b) mezzanines shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, and
c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.46. Group B, Division 3, One Storey, Sprinklered

1) A *building* classified as Group B, Division 3 is permitted to be of *combustible construction* or *noncombustible construction*, used singly or in combination, provided
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 1 *storey* in *building height*, and
c) it has a *building area* not more than 600 m^2.

3.2.2.47. Group C, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.48. to 3.2.2.54., a *building* classified as Group C shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,
b) except as permitted by Sentence (3), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,
c) mezzanines shall have a *fire-resistance rating* not less than 1 h, and
d) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including floors over *basements*, which are entirely contained within these *dwelling units*, shall have a *fire-resistance rating* not less than 1 h but need not be constructed as *fire separations*.

3.2.2.48. Group C, up to 6 Storeys, Sprinklered, Noncombustible Construction

1) A *building* classified as Group C is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 6 *storeys* in *building height*, and

c) it has a *building area*

i) that is not limited if the *building* is not more than 2 *storeys* in *building height*,

ii) not more than 12 000 m^2 if 3 *storeys* in *building height*,

iii) not more than 9 000 m^2 if 4 *storeys* in *building height*,

iv) not more than 7 200 m^2 if 5 *storeys* in *building height*, or

v) not more than 6 000 m^2 if 6 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentence (3), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) mezzanines shall have a *fire-resistance rating* not less than 1 h, and

c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including floors over *basements*, which are entirely contained within these *dwelling units*, shall have a *fire-resistance rating* not less than 1 h but need not be constructed as *fire separations*.

3.2.2.49. Group C, up to 3 Storeys, Noncombustible Construction

1) A *building* classified as Group C is permitted to conform to Sentence (2) provided

a) it is not more than 3 storeys in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.49.

Table 3.2.2.49.
Maximum Building Area, Group C, up to 3 Storeys
Forming Part of Sentence 3.2.2.49.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	not limited	not limited	not limited
2	6 000	not limited	not limited
3	4 000	5 000	6 000

2) The *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentence (3), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) mezzanines shall have a *fire-resistance rating* not less than 1 h,

c) roof assemblies shall have a *fire-resistance rating* not less than 1 h, and

d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including floors over *basements*, which are entirely contained within these *dwelling units*, shall have a *fire-resistance rating* not less than 1 h but need not be constructed as *fire separations*.

3.2.2.50. Group C, up to 6 Storeys, Sprinklered

1) A *building* classified as Group C is permitted to conform to Sentence (2), provided

a) it is *sprinklered* throughout,

b) it is not more than 6 *storeys* in *building height*,

c) it has a height not more than 18 m measured between the floor of the *first storey* and the uppermost floor level that does not serve a rooftop enclosure for elevator machinery, a stairway or a *service room* used only for service to the *building*, and

d) it has a *building area* not more than

i) 9 000 m^2 if 1 *storey* in *building height*,

ii) 4 500 m^2 if 2 *storeys* in *building height*,

iii) 3 000 m^2 if 3 *storeys* in *building height*,

iv) 2 250 m^2 if 4 *storeys* in *building height*,

v) 1 800 m^2 if 5 *storeys* in *building height*, or

vi) 1 500 m^2 if 6 *storeys* in *building height*.

2) *Buildings* referred to in Sentence (1) are permitted to be of *combustible construction* or *noncombustible construction*, used singly or in combination, and

a) except as provided in Sentence (3), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) roof assemblies shall have a *fire-resistance rating* not less than 1 h,

c) except as provided in Sentence (4), where the roof assembly has a height greater than 25 m measured from the floor of the *first storey* to the highest point of the roof assembly, the roof assembly shall be constructed of *noncombustible construction* or *fire-retardant-treated wood* conforming to Article 3.1.4.5.,

d) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

e) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including those over *basements*, that are entirely contained within these *dwelling units* shall have a *fire-resistance rating* not less than 1 h but need not be constructed as *fire separations*.

4) Where *buildings* conforming to Sentence (2) include non-contiguous roof assemblies at different elevations, the roof assemblies are permitted to be evaluated separately to determine which ones are required to be constructed in accordance with Clause (2)(c).

5) Group A, Division 2 *major occupancies*, Group E *major occupancies* and *storage garages* located in a *building* or part of a *building* within the scope of this Article are permitted to be constructed in accordance with this Article provided

a) the Group A, Division 2 *major occupancy*, and Group E *major occupancy* is located below the third *storey*, and

b) the *storage garage* is located below the fourth *storey* (See also Sentence 4.4.2.1.(1).).

(See Note A-3.2.2.50.(5) and 3.2.2.58.(4).) (See also Article 3.2.1.7)

3.2.2.51. Group C, up to 4 Storeys, Sprinklered

1) A *building* classified as Group C is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 4 *storeys* in *building height*, and
c) it has a *building area* not more than
i) 7 200 m² if 1 *storey* in *building height*,
ii) 3 600 m² if 2 *storeys* in *building height*,
iii) 2 400 m² if 3 *storeys* in *building height*, or
iv) 1 800 m² if 4 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) except as permitted by Sentences (3) and (4), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,
b) mezzanines shall have a *fire-resistance rating* not less than 1 h, and
c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including floors over *basements*, which are entirely contained within these *dwelling units*, shall have a *fire-resistance rating* not less than 1 h but need not be constructed as *fire separations*.

4) In a *building* in which there is no *dwelling unit* above another *dwelling unit*, the *fire-resistance rating* for floor assemblies entirely within the *dwelling unit* is waived.

3.2.2.52. Group C, up to 3 Storeys, Increased Area

1) A *building* classified as Group C is permitted to conform to Sentence (2) provided
a) it is not more than 3 *storeys* in *building height*, and
b) it has a *building area* not more than the value in Table 3.2.2.52.

Table 3.2.2.52.
Maximum Building Area, Group C, up to 3 Storeys, Increased Area
Forming Part of Sentence 3.2.2.52.(1)

No. of *Storeys*	Maximum Area, m²		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	2 400	3 000	3 600
2	1 200	1 500	1 800
3	800	1 000	1 200

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) except as permitted by Sentences (3) and (4), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,
b) mezzanines shall have a *fire-resistance rating* not less than 1 h,
c) roof assemblies shall have a *fire-resistance rating* not less than 1 h, and
d) loadbearing walls, columns, and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including floors over *basements*, which are entirely contained within these *dwelling units*, shall have a *fire-resistance rating* not less than 1 h but need not be constructed as *fire separations*.

4) In a *building* in which there is no *dwelling unit* above another *dwelling unit*, the *fire-resistance rating* for floor assemblies entirely within the *dwelling unit* is waived.

3.2.2.53. Group C, up to 3 Storeys

1) A *building* classified as Group C is permitted to conform to Sentence (2) provided

a) it is not more than 3 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.53.

Table 3.2.2.53.
Maximum Building Area, Group C, up to 3 Storeys
Forming Part of Sentence 3.2.2.53.(1)

No. of ***Storeys***	**Maximum Area, m^2**		
	Facing 1 ***Street***	**Facing 2** ***Streets***	**Facing 3** ***Streets***
1	1 800	2 250	2 700
2	900	1 125	1 350
3	600	750	900

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) except as permitted by Sentences (3) and (4), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,

b) mezzanines shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, and

c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including floors over *basements*, which are entirely contained within these *dwelling units*, shall have a *fire-resistance rating* not less than 45 min but need not be constructed as *fire separations*.

4) In a *building* in which there is no *dwelling unit* above another *dwelling unit*, the *fire-resistance rating* for floor assemblies entirely within the *dwelling unit* is waived.

3.2.2.54. Group C, up to 3 Storeys, Sprinklered

1) A *building* classified as Group C is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 3 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 5 400 m^2 if 1 *storey* in *building height*,

ii) 2 700 m^2 if 2 *storeys* in *building height*, or

iii) 1 800 m^2 if 3 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) except as permitted by Sentences (3) and (4), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,

b) mezzanines shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, and *c) loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including floors over *basements*, which are entirely contained within these *dwelling units*, shall have a *fire-resistance rating* not less than 45 min but need not be constructed as *fire separations*.

4) In a *building* in which there is no *dwelling unit* above another *dwelling unit*, the *fire-resistance rating* for floor assemblies entirely within the *dwelling unit* is waived.

3.2.2.55. Group D, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.56. to 3.2.2.63., a *building* classified as Group D shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,
b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,
c) mezzanines shall have a *fire-resistance rating* not less than 1 h, and
d) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.56. Group D, up to 6 Storeys

1) A *building* classified as Group D is permitted to conform to Sentence (2) provided

a) it is not more than 6 *storeys* in *building height*, and
b) it has a *building area* not more than the value in Table 3.2.2.56.

Table 3.2.2.56.
Maximum Building Area, Group D, up to 6 Storeys
Forming Part of Sentence 3.2.2.56.(1)

No. of *Storeys*	Maximum Area, m²		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	not limited	not limited	not limited
2	7 200	not limited	not limited
3	4 800	6 000	7 200
4	3 600	4 500	5 400
5	2 880	3 600	4 320
6	2 400	3 000	3 600

2) The *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,
b) mezzanines shall have a *fire-resistance rating* not less than 1 h,
c) roof assemblies shall have a *fire-resistance rating* not less than 1 h, except that in a *building* not more than 1 *storey* in *building height* this requirement is waived, and
d) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.57. Group D, up to 6 Storeys, Sprinklered, Noncombustible Construction

1) A *building* classified as Group D is permitted to conform to Sentence (2) provided
- a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
- b) it is not more than 6 *storeys* in *building height*, and
- c) it has a *building area*
  - i) that is not limited if the *building* is not more than 2 *storeys* in *building height*,
  - ii) not more than 14 400 m^2 if 3 *storeys* in *building height*,
  - iii) not more than 10 800 m^2 if 4 *storeys* in *building height*,
  - iv) not more than 8 640 m^2 if 5 *storeys* in *building height*, or
  - v) not more than 7 200 m^2 if 6 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and
- a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,
- *b) mezzanines* shall have a *fire-resistance rating* not less than 1 h, and
- *c) loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.58. Group D, up to 6 Storeys, Sprinklered

1) A *building* classified as Group D is permitted to conform to Sentence (2), provided
- a) it is *sprinklered* throughout,
- b) it is not more than 6 *storeys* in *building height*,
- c) it has a height not more than 18 m measured between the floor of the *first storey* and the uppermost floor level that does not serve a rooftop enclosure for elevator machinery, a stairway or a *service room* used only for service to the *building*, and
- d) it has a *building area* not more than
  - i) 18 000 m^2 if 1 *storey* in *building height*,
  - ii) 9 000 m^2 if 2 *storeys* in *building height*,
  - iii) 6 000 m^2 if 3 *storeys* in *building height*,
  - iv) 4 500 m^2 if 4 *storeys* in *building height*,
  - v) 3 600 m^2 if 5 *storeys* in *building height*, or
  - vi) 3 000 m^2 if 6 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction*, used singly or in combination, and
- a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,
- b) roof assemblies shall have a *fire-resistance rating* not less than 1 h,
- c) except as provided in Sentence (3), where the roof assembly has a height greater than 25 m measured from the floor of the *first storey* to the highest point of the roof assembly, the roof assembly shall be constructed of *noncombustible construction* or *fire-retardant-treated wood* conforming to Article 3.1.4.5.,
- *d) mezzanines* shall have a *fire-resistance rating* not less than 1 h, and
- *e) loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) Where *buildings* conforming to Sentence (2) include non-contiguous roof assemblies at different elevations, the roof assemblies are permitted to be evaluated separately to determine which ones are required to be constructed in accordance with Clause (2)(c).

4) Group A, Division 2 *major occupancies*, Group E *major occupancies*, Group F, Division 2 and 3 *major occupancies* and *storage garages* located in a *building* or part of a *building* within the scope of this Article are permitted to be constructed in accordance with this Article provided
- a) the Group A, Division 2 *major occupancy*, and Group E *major occupancy*, and Group F, Division 2 and 3 *major occupancy* is located below the third *storey*, and

b) the *storage garage* is located below the fourth *storey* (See also Sentence 4.4.2.1.(1).).
(See Note A-3.2.2.50.(5) and 3.2.2.58.(4).) (See also Article 3.2.1.7)

3.2.2.59. Group D, up to 4 Storeys, Sprinklered

1) A *building* classified as Group D is permitted to conform to Sentence (2) provided
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 4 *storeys* in *building height*, and
c) it has a *building area* not more than 3 600 m^2.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,
b) mezzanines shall have a *fire-resistance rating* not less than 1 h, and
c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.60. Group D, up to 3 Storeys

1) A *building* classified as Group D is permitted to conform to Sentence (2) provided
a) it is not more than 3 *storeys* in *building height*, and
b) it has a *building area* not more than the value in Table 3.2.2.60.

Table 3.2.2.60.
Maximum Building Area, Group D, up to 3 Storeys
Forming Part of Sentence 3.2.2.60.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	4 800	6 000	7 200
2	2 400	3 000	3 600
3	1 600	2 000	2 400

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min,
b) mezzanines shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,
c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, except that in a *building* not more than 1 *storey* in *building height*, the *fire-resistance rating* is permitted to be waived provided the roof assembly is constructed as a *fire-retardant-treated wood* roof system conforming to Article 3.1.14.1. and the *building area* is not more than
i) 2 400 m^2 if facing one *street*,
ii) 3 000 m^2 if facing 2 *streets*, or
iii) 3 600 m^2 if facing 3 *streets*, and
d) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall
i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.61. Group D, up to 3 Storeys, Sprinklered

1) A *building* classified as Group D is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 3 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 14 400 m² if 1 *storey* in *building height*,

ii) 7 200 m² if 2 *storeys* in *building height*, or

iii) 4 800 m² if 3 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min,

b) mezzanines shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, and

c) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.62. Group D, up to 2 Storeys

1) A *building* classified as Group D is permitted to conform to Sentence (2) provided

a) it is not more than 2 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.62.

Table 3.2.2.62.
Maximum Building Area, Group D, up to 2 Storeys
Forming Part of Sentence 3.2.2.62.(1)

No. of *Storeys*	Maximum Area, m²		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	1 000	1 250	1 500
2	800	1 000	1 200

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min, and

b) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.63. Group D, up to 2 Storeys, Sprinklered

1) A *building* classified as Group D is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 2 *storeys* in *building height*, and
c) it has a *building area* not more than
i) 3 000 m^2 if 1 *storey* in *building height*, or
ii) 2 400 m^2 if 2 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min, and
b) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall
i) have a *fire-resistance rating* not less than 45 min, or
ii) be of *noncombustible construction*.

3.2.2.64. Group E, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.65. to 3.2.2.69., a *building* classified as Group E shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,
b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,
c) mezzanines shall have a *fire-resistance rating* not less than 1 h, and
d) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.65. Group E, up to 4 Storeys, Sprinklered

1) A *building* classified as Group E is permitted to conform to Sentence (2) provided
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 4 *storeys* in *building height*, and
c) it has a *building area* not more than 1 800 m^2.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,
b) mezzanines shall have a *fire-resistance rating* not less than 1 h, and
c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.66. Group E, up to 3 Storeys

1) A *building* classified as Group E is permitted to conform to Sentence (2) provided
a) it is not more than 3 *storeys* in *building height*, and
b) it has a *building area* not more than the value in Table 3.2.2.66.

Table 3.2.2.66.
Maximum Building Area, Group E, up to 3 Storeys
Forming Part of Sentence 3.2.2.66.(1)

No. of ***Storeys***	**Maximum Area, m^2**		
	Facing 1 ***Street***	**Facing 2** ***Streets***	**Facing 3** ***Streets***

1	1 500	1 500	1 500
2	1 200	1 500	1 500
3	800	1 000	1 500

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,

b) mezzanines shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

c) roof assemblies shall have a *fire-resistance rating* not less than 45 min, except that in a *building* not more than 1 *storey* in *building height*, the *fire-resistance rating* is permitted to be waived provided the roof assembly is of *noncombustible construction* or is constructed as a *fire-retardant-treated wood* roof system conforming to Article 3.1.14.1.,

d) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*, and

e) loadbearing walls, columns and arches supporting a *fire separation* shall have a *fire-resistance rating* not less than that required for the *fire separation*.

3.2.2.67. Group E, up to 3 Storeys, Sprinklered

1) A *building* classified as Group E is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 3 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 7 200 m^2 if 1 *storey* in *building height*,

ii) 3 600 m^2 if 2 *storeys* in *building height*, or

iii) 2 400 m^2 if 3 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,

b) mezzanines shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

c) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*, and

d) loadbearing walls, columns and arches supporting a *fire separation* shall have a *fire-resistance rating* not less than that required for the *fire separation*.

3.2.2.68. Group E, up to 2 Storeys

1) A *building* classified as Group E is permitted to conform to Sentence (2) provided

a) it is not more than 2 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.68.

Table 3.2.2.68.
Maximum Building Area, Group E, up to 2 Storeys
Forming Part of Sentence 3.2.2.68.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	1 000	1 250	1 500
2	600	750	900

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min, and
b) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.69. Group E, up to 2 Storeys, Sprinklered

1) A *building* classified as Group E is permitted to conform to Sentence (2) provided
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 2 *storeys* in *building height*, and
c) it has a *building area* not more than
i) 3 000 m^2 if 1 *storey* in *building height*, or
ii) 1 800 m^2 if 2 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min, and
b) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.70. Group F, Division 1, up to 4 Storeys, Sprinklered

1) Except as permitted by Articles 3.2.2.71. to 3.2.2.73., a *building* classified as Group F, Division 1 shall conform to Sentence (2) provided
a) it is not more than 4 *storeys* in *building height*, and
b) it has a *building area* not more than
i) 9 000 m^2 if 1 *storey* in *building height*,
ii) 4 500 m^2 if 2 *storeys* in *building height*,
iii) 3 000 m^2 if 3 *storeys* in *building height*, or
iv) 2 250 m^2 if 4 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,
b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,
c) mezzanines shall have a *fire-resistance rating* not less than 1 h, and
d) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.71. Group F, Division 1, up to 3 Storeys, Sprinklered

1) A *building* classified as Group F, Division 1 is permitted to conform to Sentence (2) provided except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

a) it is not more than 3 *storeys* in *building height*, and

b) it has a *building area* not more than

i) 3 600 m^2 if 1 *storey* in *building height*,

ii) 1 800 m^2 if 2 *storeys* in *building height*, or

iii) 1 200 m^2 if 3 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min, and

b) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.72. Group F, Division 1, up to 2 Storeys, Sprinklered

1) A *building* classified as Group F, Division 1 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 2 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 2 400 m^2 if 1 *storey* in *building height*, or

ii) 1 200 m^2 if 2 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min, and

b) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.73. Group F, Division 1, One Storey

1) A *building* classified as Group F, Division 1 is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination provided

a) it is not more than 1 *storey* in *building height*, and

b) it has a *building area* not more than 800 m^2.

3.2.2.74. Group F, Division 2, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.75. to 3.2.2.79., a *building* classified as Group F, Division 2 shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,

b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,

c) mezzanines shall have a *fire-resistance rating* not less than 1 h, and

d) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.75. Group F, Division 2, up to 4 Storeys, Increased Area, Sprinklered

1) A *building* classified as Group F, Division 2 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 4 *storeys* in *building height*, and
c) it has a *building area* not more than
i) 18 000 m^2 if 1 *storey* in *building height*,
ii) 9 000 m^2 if 2 *storeys* in *building height*,
iii) 6 000 m^2 if 3 *storeys* in *building height*, or
iv) 4 500 m^2 if 4 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and
a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,
b) mezzanines shall have a *fire-resistance rating* not less than 1 h, and
c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.76. Group F, Division 2, up to 3 Storeys

1) A *building* classified as Group F, Division 2 is permitted to conform to Sentence (2) provided
a) it is not more than 3 *storeys* in *building height*, and
b) it has a *building area* not more than the value in Table 3.2.2.76.

Table 3.2.2.76.
Maximum Building Area, Group F, Division 2, up to 3 Storeys
Forming Part of Sentence 3.2.2.76.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	1 500	1 500	1 500
2	1 500	1 500	1 500
3	1 070	1 340	1 500

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,
b) mezzanines shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,
c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, except that in a *building* not more than 1 *storey* in *building height*, the *fire-resistance rating* is permitted to be waived provided that the roof assembly is constructed as a *fire-retardant-treated wood* roof system conforming to Article 3.1.14.1.,
d) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall
i) have a *fire-resistance rating* not less than 45 min, or
ii)) be of *noncombustible construction*, and
e) loadbearing walls, columns and arches supporting a *fire separation* shall have a *fire-resistance rating* not less than that required for the *fire separation*.

3.2.2.77. Group F, Division 2, up to 4 Storeys, Sprinklered

1) A *building* classified as Group F, Division 2 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 4 *storeys* in *building height*, and
c) it has a *building area* not more than
i) 9 600 m² if 1 *storey* in *building height*,
ii) 4 800 m² if 2 *storeys* in *building height*,
iii) 3 200 m² if 3 *storeys* in *building height*, or
iv) 2 400 m² if 4 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,
b) mezzanines shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,
c) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall
i) have a *fire-resistance rating* not less than 45 min, or
ii) be of *noncombustible construction*, and
d) loadbearing walls, columns and arches supporting a *fire separation* shall have a *fire-resistance rating* not less than that required for the *fire separation*.

3.2.2.78. Group F, Division 2, up to 2 Storeys

1) A *building* classified as Group F, Division 2 is permitted to conform to Sentence (2) provided
a) it is not more than 2 *storeys* in *building height*, and
b) it has a *building area* not more than the value in Table 3.2.2.78.

Table 3.2.2.78.
Maximum Building Area, Group F, Division 2, up to 2 Storeys
Forming Part of Sentence 3.2.2.78.(1)

No. of *Storeys*	Maximum Area, m²		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	1 000	1 250	1 500
2	600	750	900

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min, and
b) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall
i) have a *fire-resistance rating* not less than 45 min, or
ii) be of *noncombustible construction*.

3.2.2.79. Group F, Division 2, up to 2 Storeys, Sprinklered

1) A *building* classified as Group F, Division 2 is permitted to conform to Sentence (2) provided
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 2 *storeys* in *building height*, and
c) it has a *building area* not more than

i) 4 500 m^2 if 1 *storey* in *building height*, or
ii) 1 800 m^2 if 2 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min, and
b) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall
i) have a *fire-resistance rating* not less than 45 min, or
ii) be of *noncombustible construction*.

3.2.2.80. Group F, Division 3, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.81. to 3.2.2.90., a *building* classified as Group F, Division 3 shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,
b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h, except that floor assemblies are permitted to be *fire separations* with a *fire-resistance rating* not less than 1 h in a *storage garage* with all *storeys* constructed as *open-air storeys*,
c) mezzanines shall have a *fire-resistance rating* not less than 1 h, and
d) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.81. Group F, Division 3, up to 6 Storeys

1) A *building* classified as Group F, Division 3 is permitted to conform to Sentence (2) provided

a) it is not more than 6 storeys in *building height*, and
b) it has a *building area* not more than the value in Table 3.2.2.81.

Table 3.2.2.81.
Maximum Building Area, Group F, Division 3, up to 6 Storeys
Forming Part of Sentence 3.2.2.81.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	not limited	not limited	not limited
2	7 200	9 000	10 800
3	4 800	6 000	7 200
4	3 600	4 500	5 400
5	2 880	3 600	4 320
6	2 400	3 000	3 600

2) The *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) mezzanines shall have a *fire-resistance rating* not less than 1 h,
c) roof assemblies shall have a *fire-resistance rating* not less than 1 h, and
d) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.82. Group F, Division 3, up to 6 Storeys, Sprinklered

1) A *building* classified as Group F, Division 3 is permitted to conform to Sentence (2) provided
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 6 *storeys* in *building height*, and
c) it has a *building area*
i) that is not limited if the *building* is not more than 1 *storey* in *building height*,
ii) not more than 21 600 m^2 if 2 *storeys* in *building height*,
iii) not more than 14 400 m^2 if 3 *storeys* in *building height*,
iv) not more than 10 800 m^2 if 4 *storeys* in *building height*,
v) not more than 8 640 m^2 if 5 *storeys* in *building height*, or
vi) not more than 7 200 m^2 if 6 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and
a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,
b) mezzanines shall have a *fire-resistance rating* not less than 1 h, and
c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.83. Group F, Division 3, up to 4 Storeys

1) A *building* classified as Group F, Division 3 is permitted to conform to Sentence (2) provided
a) it is not more than 4 *storeys* in *building height*, and
b) it has a *building area* not more than the value in Table 3.2.2.83.

Table 3.2.2.83.
Maximum Building Area, Group F, Division 3, up to 4 Storeys
Forming Part of Sentence 3.2.2.83.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	4 800	6 000	7 200
2	2 400	3 000	3 600
3	1 600	2 000	2 400
4	1 200	1 500	1 800

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min,
b) mezzanines shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, except that in a *building* not more than 1 *storey* in *building height*, the *fire-resistance rating* is permitted to be waived provided the roof assembly is constructed as a *fire-retardant-treated wood* roof system conforming to Article 3.1.14.1., and the *building area* is not more than

i) 2 400 m^2 if facing one *street*,

ii) 3 000 m^2 if facing 2 *streets*, or

iii) 3 600 m^2 if facing 3 *streets*, and

d) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii)be of *noncombustible construction*.

3.2.2.84. Group F, Division 3, up to 4 Storeys, Sprinklered

1) A *building* classified as Group F, Division 3 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 4 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 14 400 m^2 if 1 *storey* in *building height*,

ii) 7 200 m^2 if 2 *storeys* in *building height*,

iii) 4 800 m^2 if 3 *storeys* in *building height*, or

iv) 3 600 m^2 if 4 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min,

b) mezzanines shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, and

c) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.85. Group F, Division 3, up to 2 Storeys

1) A *building* classified as Group F, Division 3 is permitted to conform to Sentence (2) provided

a) it is not more than 2 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.85.

Table 3.2.2.85.
Maximum Building Area, Group F, Division 3, up to 2 Storeys
Forming Part of Sentence 3.2.2.85.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	1 600	2 000	2 400
2	800	1 000	1 200

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min, and
b) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall
i) have a *fire-resistance rating* not less than 45 min, or
ii) be of *noncombustible construction*.

3.2.2.86. Group F, Division 3, up to 2 Storeys, Sprinklered

1) A *building* classified as Group F, Division 3 is permitted to conform to Sentence (2) provided
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 2 *storeys* in *building height*, and
c) it has a *building area* not more than
i) 7 200 m^2 if 1 *storey* in *building height*, or
ii) 2 400 m^2 if 2 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min, and
b) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall
i) have a *fire-resistance rating* not less than 45 min, or
ii) be of *noncombustible construction*.

3.2.2.87. Group F, Division 3, One Storey

1) A *building* classified as Group F, Division 3 is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination provided
a) it is not more than 1 *storey* in *building height*, and
b) it has a *building area* not more than
i) 5 600 m^2 if facing one *street*,
ii) 7 000 m^2 if facing 2 *streets*, or
iii) 8 400 m^2 if facing 3 *streets*.

3.2.2.88. Group F, Division 3, One Storey, Sprinklered

1) A *building* classified as Group F, Division 3 is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination provided
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 1 *storey* in *building height*, and
c) it has a *building area* not more than 16 800 m^2.

3.2.2.89. Group F, Division 3, One Storey, Any Area, Low Fire Load Occupancy

1) A *building* classified as Group F, Division 3 is permitted to conform to Sentence (2) provided it is
a) not more than 1 *storey* in *building height*,
b) used solely for low *fire load occupancies* such as
i) power generating plants, or
ii) plants for the manufacture or storage of *noncombustible* materials, and
c) not limited in *building area*.

2) The *building* referred to in Sentence (1) shall be of *noncombustible construction*.

3.2.2.90. Group F, Division 3, Storage Garages up to 22 m High

1) A *building* used as a *storage garage* with all *storeys* constructed as *open-air storeys* and having no other *occupancy* above it is permitted to have its floor, wall, ceiling and roof assemblies constructed without a *fire-resistance rating* provided it is

a) of *noncombustible construction*,
b) not more than 22 m high, measured between *grade* and the ceiling level of the top *storey*,
c) not more than 10 000 m^2 in *building area*, and
d) designed so that every portion of each *floor area* is within 60 m of an exterior wall opening.

3.2.3. Spatial Separation and Exposure Protection

(See Note A-3.2.3.)

3.2.3.1. Limiting Distance and Area of Unprotected Openings

1) Except as permitted by Articles 3.2.3.10. to 3.2.3.12., the area of *unprotected openings* in an *exposing building face* for the applicable *limiting distance* shall be not more than the value determined in accordance with

a) Table 3.2.3.1.-B or 3.2.3.1.-C for an *exposing building face* conforming to Article 3.2.3.2. of a *building* or *fire compartment* which is not *sprinklered*, or
b) Table 3.2.3.1.-D or 3.2.3.1.-E for an *exposing building face* conforming to Article 3.2.3.2. of a *sprinklered fire compartment* that is part of a *building* which is *sprinklered* in conformance with Section 3.2.

(See Note A-3.)
(See also Article 3.1.6.3.)

2) The area of the *unprotected openings* in an *exposing building face* shall be the aggregate area of *unprotected openings* expressed as a percentage of the area of the *exposing building face* in Table 3.2.3.1.-B, 3.2.3.1.-C, 3.2.3.1.-D or 3.2.3.1.-E. (See Sentence 3.2.3.2.(1).)

3) For the purpose of determining the type of construction and cladding and the *fire-resistance rating* of an exterior wall,

a) the *exposing building face* shall be taken as the projection of the exterior wall onto a vertical plane located so that no portion of the exterior wall of the *building* or of a *fire compartment*, if the *fire compartment* complies with the requirements of Article 3.2.3.2., is between the vertical plane and the line to which the *limiting distance* is measured, and
b) the area of *unprotected opening*s shall be determined from Table 3.2.3.1.-B, 3.2.3.1.-C, 3.2.3.1.-D or 3.2.3.1.-E.

4) For the purpose of determining the actual percentage of *unprotected openings* permitted in an exterior wall, the location of the *exposing building face* is permitted to be taken at a vertical plane located so that there are no *unprotected openings* between the vertical plane and the line to which the *limiting distance* is measured. (See Note A-3.2.3.1.(4).)

5) Except for *buildings* that are *sprinklered*, where the *limiting distance* is 2 m or less, individual *unprotected openings* in an *exposing building face* shall be no greater than

a) the area stated in Table 3.2.3.1.-A, or
b) where the *limiting distance* is equal to or greater than 1.2 m, the area calculated by

$$\text{Area} = 0.24\,(2 \times LD - 1.2)^2$$

where

Area = area of the *unprotected opening*, and
LD = *limiting distance*.

Table 3.2.3.1.-A
Maximum Concentrated Area of Unprotected Openings
Forming Part of Sentence 3.2.3.1.(5)

Limiting Distance, m	Maximum Area of Individual *Unprotected Openings*, m^2
1.2	0.35
1.5	0.78
2.0	1.88

6) The spacing between individual *unprotected openings* described in Sentence (5) that serve a single room or space described in Sentence (7) shall not be less than

a) 2 m horizontally of another *unprotected opening* that is on the same *exposing building face* and serves the single room or space, or

b) 2 m vertically of another *unprotected opening* that serves the single room or space, or another room or space on the same *storey*.

7) For the purpose of Sentence (6), "single room or space" shall mean

a) two or more adjacent spaces having a full-height separating wall extending less than 1.5 m from the interior face of the exterior wall, or

b) two or more stacked spaces that are on the same *storey*.

8) A *limiting distance* equal to half the actual *limiting distance* shall be used as input to Tables 3.2.3.1.-B and 3.2.3.1.-C, where

a) the time from receipt of notification of a fire by the fire department until the arrival of the first fire department vehicle at the *building* exceeds 10 min in 10% or more of all fire department calls to the *building*, and

b) any *storey* in the *building* is not *sprinklered*.

(See Notes A-3.2.3.1.(8) and A-3.2.3.)

9) If the surface temperature on the unexposed surface of a wall assembly exceeds the temperature limit of a standard fire test as permitted by Article 3.1.7.2., an allowance shall be made for the radiation from the hot unexposed wall surface by adding an equivalent area of *unprotected opening* to the area of actual openings as follows:

$$A_C = A + (A_F \times F_{EO})$$

where

A_C = corrected area of *unprotected openings* including actual and equivalent openings,

A = actual area of *unprotected openings*,

A_F = area of exterior surface of the *exposing building face*, exclusive of openings, on which the temperature limit of the standard test is exceeded, and

F_{EO} = an equivalent opening factor derived from the following expression:

$$F_{EO} = \frac{(T_U + 273)^4}{(T_E + 273)^4}$$

T_U = average temperature in degrees Celsius of the unexposed wall surface at the time the required *fire-resistance rating* is reached under test conditions,

T_E = 892°C for a *fire-resistance rating* not less than 45 min, 927°C for a *fire-resistance rating* not less than 1 h, and 1 010°C for a *fire-resistance rating* not less than 2 h.

10) Unless a *closure* used to protect an opening in an *exposing building face* has a protective performance equivalent to that required for the wall assembly in which it is located, an equivalent area of *unprotected opening*, determined in accordance with the procedures of Sentence (9) shall be added to the greater of

a) the actual area of *unprotected openings*, or

b) the corrected area of *unprotected openings*.

Table 3.2.3.1.-B
Unprotected Opening Limits for a Building or Fire Compartment that is not Sprinklered Throughout
Forming Part of Article 3.2.3.1.

Exposing Building Face		**Area of** *Unprotected Opening* **for Groups A, C, D, and F, Division 3** *Occupancies*, **%**																									
Max. Area, m^2	**Ratio (L/H or H/L)(1)**	*Limiting Distance*, **m**																									
		0	**1.2**	**1.5**	**2.0**	**2.5**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**16**	**18**	**20**	**25**	**30**	**35**	**40**	**45**	**50**
	Less than 3 : 1	0	8	10	18	29	46	91	100																		
10	3 : 1 to 10 : 1	0	8	12	21	33	50	96	100																		
	over 10 : 1	0	11	18	32	48	68	100																			
	Less than 3 : 1	0	7	9	14	22	33	63	100																		
15	3 : 1 to 10 : 1	0	8	10	17	25	37	67	100																		
	over 10 : 1	0	10	15	26	39	53	87	100																		
	Less than 3 : 1	0	7	9	12	18	26	49	81	100																	
20	3 : 1 to 10 : 1	0	8	10	15	21	30	53	85	100																	
	over 10 : 1	0	9	14	23	33	45	72	100																		
	Less than 3 : 1	0	7	8	11	16	23	41	66	98	100																
25	3 : 1 to 10 : 1	0	8	9	13	19	26	45	70	100																	
	over 10 : 1	0	9	13	21	30	39	62	90	100																	
	Less than 3 : 1	0	7	8	11	15	20	35	56	83	100																
30	3 : 1 to 10 : 1	0	7	9	12	17	23	39	61	88	100																
	over 10 : 1	0	8	12	19	27	36	56	79	100																	

	Less than 3 : 1	0	7	8	10	13	17	28	44	64	89	100															
40	3 : 1 to 10 : 1	0	7	8	11	15	20	32	48	69	93	100															
	over 10 : 1	0	8	11	17	24	31	47	66	88	100																
	Less than 3 : 1	0	7	8	9	12	15	24	37	53	72	96	100														
50	3 : 1 to 10 : 1	0	7	8	10	14	18	28	41	57	77	100															
	over 10 : 1	0	8	10	15	21	28	41	57	76	97	100															
	Less than 3 : 1	0	7	8	9	11	14	21	32	45	62	81	100														
60	3 : 1 to 10 : 1	0	7	8	10	13	16	25	36	49	66	85	100														
	over 10 : 1	0	8	10	14	20	25	38	51	67	85	100															
	Less than 3 : 1	0	7	7	8	10	12	18	26	36	48	62	79	98	100												
80	3 : 1 to 10 : 1	0	7	8	9	11	14	21	29	40	52	67	84	100													
	over 10 : 1	0	8	9	13	17	22	32	44	56	70	86	100														
	Less than 3 : 1	0	7	7	8	9	11	16	22	30	40	51	65	80	97	100											
100	3 : 1 to 10 : 1	0	7	8	9	11	13	18	25	34	44	56	69	84	100												
	over 10 : 1	0	7	9	12	16	20	29	39	49	61	74	89	100													
	Less than 3 : 1	0	7	7	8	9	10	13	17	22	29	37	46	56	67	79	93	100									
150	3 : 1 to 10 : 1	0	7	7	8	10	11	15	20	26	33	41	50	60	71	84	97	100									
	over 10 : 1	0	7	8	11	13	17	24	31	39	48	57	68	79	91	100											
	Less than 3 : 1	0	7	7	7	8	9	10	13	16	20	25	30	36	43	51	59	68	87	100							
250	3 : 1 to 10 : 1	0	7	7	8	9	10	12	15	19	24	28	34	40	47	55	63	72	92	100							
	over 10 : 1	0	7	8	9	11	14	19	24	30	36	43	50	57	65	73	82	92	100								
	Less than 3 : 1	0	7	7	7	8	8	9	11	14	16	20	24	28	33	38	44	50	64	81	99	100					

350	3 : 1 to 10 : 1	0	7	7	8	8	9	11	13	16	19	23	27	32	37	42	48	55	69	85	100						
	over 10 : 1	0	7	8	9	10	12	16	21	25	30	36	41	47	53	59	66	73	88	100							
	Less than 3 : 1	0	7	7	7	7	8	9	10	12	14	16	19	22	25	29	33	37	47	59	71	100					
500	3 : 1 to 10 : 1	0	7	7	7	8	8	10	12	14	16	19	22	25	29	33	37	41	52	63	76	100					
	over 10 : 1	0	7	7	8	9	11	14	18	22	25	30	34	38	43	48	53	58	70	82	96	100					
	Less than 3 : 1	0	7	7	7	7	7	8	9	9	10	12	13	14	16	18	20	22	27	33	39	58	82	100			
1 000	3 : 1 to 10 : 1	0	7	7	7	7	8	9	10	11	12	14	15	17	19	21	23	26	31	37	43	63	86	100			
	over 10 : 1	0	7	7	8	8	9	11	13	16	19	21	24	27	30	33	36	39	46	53	60	82	100				
	Less than 3 : 1	0	7	7	7	7	7	7	8	8	9	9	10	11	12	13	14	15	17	20	23	33	44	58	74	93	100
2 000	3 : 1 to 10 : 1	0	7	7	7	7	7	8	8	9	10	11	12	13	14	15	16	17	20	23	27	37	49	63	79	97	100
	over 10 : 1	0	7	7	7	8	8	9	11	12	14	16	18	19	21	23	25	27	32	36	40	53	66	82	99	100	

Notes to Table 3.2.3.1.-B:
Apply whichever ratio is greater.
L = Length of *exposing building face*
H = Height of *exposing building face*

Table 3.2.3.1.-C
Unprotected Opening Limits for a Building or Fire Compartment that is not Sprinklered Throughout
Forming Part of Article 3.2.3.1.

Exposing Building Face		**Area of** *Unprotected Openings* **for Groups E and F, Division 1 and 2** *Occupancies*, **%**																													
Max. Area, m²	**Ratio (L/H or H/L)(1)**	*Limiting Distance*, **m**																													
		0	**1.2**	**1.5**	**2.0**	**2.5**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**16**	**18**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**
	Less than 3 : 1	0	4	5	9	15	23	46	77	100																					
10	3 : 1 to 10 : 1	0	4	6	10	17	25	48	79	100																					
	over 10 : 1	0	5	9	16	24	34	58	91	100																					
	Less	0	4	5	7	11	16	32	53	79	100																				

	than 3 : 1																														
15	3 : 1 to 10 : 1	0	4	5	8	13	18	34	55	82	100																				
	over 10 : 1	0	5	8	13	19	26	43	66	93	100																				
	Less than 3 : 1	0	4	4	6	9	13	25	40	61	85	100																			
20	3 : 1 to 10 : 1	0	4	5	7	11	15	27	43	63	87	100																			
	over 10 : 1	0	5	7	11	17	22	36	53	74	99	100																			
	Less than 3 : 1	0	4	4	6	8	11	20	33	49	69	92	100																		
25	3 : 1 to 10 : 1	0	4	5	7	9	13	22	35	51	71	94	100																		
	over 10 : 1	0	4	6	10	15	20	31	45	62	82	100																			
	Less than 3 : 1	0	4	4	5	7	10	18	28	42	58	77	100																		
30	3 : 1 to 10 : 1	0	4	4	6	9	12	20	30	44	60	80	100																		
	over 10 : 1	0	4	6	10	14	18	28	40	54	71	91	100																		
	Less than 3 : 1	0	4	4	5	6	8	14	22	32	44	59	76	94	100																
40	3 : 1 to 10 : 1	0	4	4	6	8	10	16	24	34	47	61	78	97	100																
	over 10 : 1	0	4	5	8	12	15	23	33	44	57	72	89	100																	
	Less than 3 : 1	0	4	4	5	6	7	12	18	26	36	48	61	76	93	100															
50	3 : 1 to 10 : 1	0	4	4	5	7	9	14	20	29	38	50	63	79	95	100															
	over 10 : 1	0	4	5	8	11	14	21	29	38	48	61	74	90	100																

	Less than 3 : 1	0	4	4	4	5	7	11	16	23	31	40	52	64	78	94	100														
60	3 : 1 to 10 : 1	0	4	4	5	6	8	12	18	25	33	43	54	66	81	96	100														
	over 10 : 1	0	4	5	7	10	13	19	26	34	43	53	64	77	92	100															
	Less than 3 : 1	0	4	4	4	5	6	9	13	18	24	31	40	49	60	71	84	98	100												
80	3 : 1 to 10 : 1	0	4	4	5	6	7	10	15	20	26	33	42	51	62	74	86	100													
	over 10 : 1	0	4	5	6	9	11	16	22	28	35	43	52	62	73	85	98	100													
	Less than 3 : 1	0	4	4	4	5	5	8	11	15	20	26	32	40	48	58	68	79	100												
100	3 : 1 to 10 : 1	0	4	4	4	5	6	9	13	17	22	28	35	42	51	60	70	81	100												
	over 10 : 1	0	4	4	6	8	10	14	19	25	31	37	44	52	61	71	81	92	100												
	Less than 3 : 1	0	4	4	4	4	5	6	8	11	14	18	23	28	33	40	46	54	70	89	100										
150	3 : 1 to 10 : 1	0	4	4	4	5	6	8	10	13	16	20	25	30	36	42	49	56	73	92	100										
	over 10 : 1	0	4	4	5	7	8	12	16	20	24	29	34	39	46	52	59	67	84	100											
	Less than 3 : 1	0	4	4	4	4	4	5	7	8	10	12	15	18	22	25	29	34	44	55	68	100									
250	3 : 1 to 10 : 1	0	4	4	4	4	5	6	8	10	12	14	17	20	24	27	32	36	46	57	70	100									
	over 10 : 1	0	4	4	5	6	7	9	12	15	18	21	25	28	32	37	41	46	56	68	81	100									
	Less than 3 : 1	0	4	4	4	4	4	5	6	7	8	10	12	14	16	19	22	25	32	40	49	77	100								
350	3 : 1 to 10 : 1	0	4	4	4	4	4	5	7	8	10	12	14	16	18	21	24	27	34	43	52	79	100								
	over	0	4	4	4	5	6	8	10	13	15	18	21	23	26	30	33	36	44	53	62	90	100								

	10 : 1																														
	Less than 3 : 1	0	4	4	4	4	4	4	5	6	7	8	9	11	13	14	16	19	24	29	36	55	78	100							
500	3 : 1 to 10 : 1	0	4	4	4	4	4	5	6	7	8	9	11	13	14	16	18	21	26	31	38	57	80	100							
	over 10 : 1	0	4	4	4	5	5	7	9	11	13	15	17	19	21	24	26	29	35	41	48	68	92	100							
	Less than 3 : 1	0	4	4	4	4	4	4	4	5	5	6	6	7	8	9	10	11	14	16	20	29	41	55	71	89	100				
1 000	3 : 1 to 10 : 1	0	4	4	4	4	4	4	5	5	6	7	8	9	10	11	12	13	15	18	22	31	43	57	73	91	100				
	over 10 : 1	0	4	4	4	4	5	6	7	8	9	11	12	13	15	16	18	20	23	26	30	41	53	68	84	100					
	Less than 3 : 1	0	4	4	4	4	4	4	4	4	4	5	5	5	6	6	7	7	9	10	12	16	22	29	37	46	56	68	80	94	100
2 000	3 : 1 to 10 : 1	0	4	4	4	4	4	4	4	5	5	5	6	6	7	7	8	9	10	12	13	18	24	31	39	49	59	70	83	96	100
	over 10 : 1	0	4	4	4	4	4	5	5	6	7	8	9	10	11	12	13	14	16	18	20	26	33	41	50	59	70	81	94	100	

Notes to Table 3.2.3.1.-C:
Apply whichever ratio is greater.
L = Length of *exposing building face*
H = Height of *exposing building face*

Table 3.2.3.1.-D
Unprotected Opening Limits for a Building or Fire Compartment that is Sprinklered Throughout
Forming Part of Article 3.2.3.1.

Exposing Building Face	**Area of *Unprotected Opening* for Groups A, B, C, D and F, Division 3 *Occupancies*, %**											
Max. Area, m²	***Limiting Distance*, m**											
	0	**1.2**	**1.5**	**2.0**	**2.5**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
10	0	16	24	42	66	100						
15	0	16	20	34	50	74	100					
20	0	16	20	30	42	60	100					
25	0	16	18	26	38	52	90	100				
30	0	14	18	24	34	46	78	100				
40	0	14	16	22	30	40	64	96	100			

50	0	14	16	20	28	36	56	82	100			
60	0	14	16	20	26	32	50	72	98	100		
80	0	14	16	18	22	28	42	58	80	100		
100	0	14	16	18	22	26	36	50	68	88	100	
150 or more	0	14	14	16	20	22	30	40	52	66	82	100

Table 3.2.3.1.-E
Unprotected Opening Limits for a Building or Fire Compartment that is Sprinklered Throughout
Forming Part of Article 3.2.3.1.

Exposing Building Face	**Area of *Unprotected Opening* for Groups E and F, Division 1 and 2 *Occupancies*, %**																	
Max. Area, m²	***Limiting Distance*, m**																	
	0	**1.2**	**1.5**	**2.0**	**2.5**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
10	0	8	12	20	34	50	96	100										
15	0	8	10	16	26	36	68	100										
20	0	8	10	14	22	30	54	86	100									
25	0	8	10	14	18	26	44	70	100									
30	0	8	8	12	18	24	40	60	88	100								
40	0	8	8	12	16	20	32	48	68	94	100							
50	0	8	8	10	14	18	28	40	58	76	100							
60	0	8	8	10	12	16	24	36	50	66	86	100						
80	0	8	8	10	12	14	20	30	40	52	66	84	100					
100	0	8	8	8	10	12	18	26	34	44	56	70	84	100				
150	0	8	8	8	10	12	16	20	26	32	40	50	60	72	84	98	100	
200 or more	0	8	8	8	8	10	14	18	22	28	34	42	50	60	68	80	92	100

3.2.3.2. Area of Exposing Building Face

1) Except as permitted by Sentences (2) and (3), the area of an *exposing building face* shall be calculated as the total area of an exterior wall facing in one direction on any side of a *building* measured from the finished ground level to the uppermost ceiling.

2) If a *building* is divided by *fire separations* into *fire compartments*, the area of *exposing building face* is permitted to be calculated for each *fire compartment* provided the *fire separations* have a *fire-resistance rating* not less than 45 min.

3) In a *building* that is *sprinklered* throughout and contains an *interconnected floor space*, the area of the *exposing building face* for the *interconnected floor space* is permitted to be determined by considering each *storey* as a separate *fire compartment* notwithstanding openings through the floor assemblies.

3.2.3.3. Wall Enclosing Attic or Roof Space

1) An exterior wall enclosing an *attic or roof space* and located above an *exposing building face*, shall be constructed in conformance with the requirements for the *exposing building face*.

3.2.3.4. Party Wall

1) A *party wall* shall be constructed as a *firewall*. (See Note A-3.2.3.4.(1).)

3.2.3.5. Wall with Limiting Distance Less Than 1.2 m

1) Openings in a wall that has a *limiting distance* less than 1.2 m shall be protected by *closures* whose *fire-protection rating* is in conformance with the *fire-resistance rating* required for the wall.
2) Wired glass or glass block shall not be used for a *closure* referred to in Sentence (1).

3.2.3.6. Combustible Projections

1) Except for a *building* containing one or 2 *dwelling units* only, *combustible* projections on the exterior of a wall that could expose an adjacent *building* to fire spread and are more than 1 m above ground level, including balconies, platforms, canopies and stairs, shall not be permitted within
- a) 1.2 m of a property line or the centre line of a *public way*, or
- b) 2.4 m of a *combustible* projection on another *building* on the same property.

2) Except as provided in Sentence (4), where the *exposing building face* has a *limiting distance* of not more than 0.45 m, projecting roof soffits shall not be constructed above the *exposing building face*. (See Note A-3.2.3.6.(2).)
3) Except as provided in Sentence (4), where the *exposing building face* has a *limiting distance* of more than 0.45 m, the face of roof soffits shall not project to less than 0.45 m from the property line. (See Note A-3.2.3.6.(2).)
4) The face of a roof soffit is permitted to project to the property line, where it faces a street, lane or public thoroughfare. (See Note A-9.10.14.5.(11) and 9.10.15.5.(10).)
5) Where roof soffits project to less than 1.2 m from the centre line of a lane or public thoroughfare, or from an imaginary line between two *buildings* or *fire compartments* on the same property, they shall
- a) have no openings, and
- b) be protected by
  - i) not less than 0.38 mm thick sheet steel,
  - ii) unvented aluminum conforming to CAN/CGSB-93.2-M, “Prefinished Aluminum Siding, Soffits, and Fascia, for Residential Use,”
  - iii) not less than 12.7 mm thick gypsum soffit board or gypsum ceiling board installed according to CSA A82.31-M, “Gypsum Board Application,”
  - iv) not less than 11 mm thick plywood,
  - v) not less than 12.5 mm thick OSB or waferboard, or
  - vi) not less than 11 mm thick lumber.

6) For *buildings* of *combustible construction*, materials installed to provide the required protection of soffits may be covered with a *combustible* or *noncombustible* finish material.

3.2.3.7. Construction of Exposing Building Face

1) Except as provided in Sentences (3) and (4), and Articles 3.2.3.10. and 3.2.3.11., the *fire-resistance rating*, construction and cladding for *exposing building faces* of *buildings* or *fire compartments* of Group A, B, C, D or Group F, Division 3 *occupancy* classification shall comply with Table 3.2.3.7.
2) Except as provided in Sentences (3) and (4) and Article 3.2.3.10., the *fire-resistance rating*, construction and cladding for *exposing building faces* of *buildings* or *fire compartments* of Group E or Group F, Division 1 or 2 *occupancy* classification shall comply with Table 3.2.3.7.

Table 3.2.3.7.
Minimum Construction Requirements for Exposing Building Faces
Forming Part of Sentences 3.2.3.7.(1) and (2)

Occupancy **Classification of** *Building* **or** *Fire Compartment*	**Maximum Area of** *Unprotected Openings* **Permitted, % of** *Exposing Building Face* **Area**	**Minimum Required** *Fire-Resistance Rating*	**Type of Construction Required**	**Type of Cladding Required**
Group A, B, C, D, or Group F, Division 3	0 to 10	1 h	*Noncombustible*	*Noncombustible*
	> 10 to 25	1 h	*Combustible* or *Noncombustible*	*Noncombustible*
	> 25 to 50	45 min	*Combustible* or *Noncombustible*	*Noncombustible*
	> 50 to < 100	45 min	*Combustible* or *Noncombustible*	*Combustible* or *Noncombustible*(1)
Group E, or Group F, Division 1 or 2	0 to 10	2 h	*Noncombustible*	*Noncombustible*
	> 10 to 25	2 h	*Combustible* or *Noncombustible*	*Noncombustible*
	> 25 to 50	1 h	*Combustible* or *Noncombustible*	*Noncombustible*
	> 50 to < 100	1 h	*Combustible* or *Noncombustible*	*Combustible* or *Noncombustible*(1)

Notes to Table 3.2.3.7.:
(1) See also Article 3.1.4.8. for additional requirements for exterior cladding on *buildings* conforming to Article 3.2.2.50. and Article 3.2.2.58.

3) Except as provided in Article 3.1.4.8., the requirement in Table 3.2.3.7. for *noncombustible* cladding for *buildings* or *fire compartments* where the maximum permitted area of *unprotected openings* is more than 10% of the *exposing building face* is permitted to be waived for exterior wall assemblies that comply with Article 3.1.5.5.

4) Except as provided in Article 3.1.4.8., the requirement in Table 3.2.3.7. for *noncombustible* cladding for *buildings* or *fire compartments* where the maximum permitted area of *unprotected openings* is more than 25% but not more than 50% of the *exposing building face* is permitted to be waived where

a) the *limiting distance* is greater than 5 m,

b) the *building* or *fire compartment* and all *combustible* attic and roof spaces are *sprinklered* throughout,

c) the cladding

i) conforms to Subsections 9.27.6., 9.27.7., 9.27.8., 9.27.9. or 9.27.10.,

ii) is installed without furring members, or on furring not more than 25 mm thick, over gypsum sheathing at least 12.7 mm thick or over masonry, and

iii) after conditioning in conformance with ASTM D 2898, “Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing,” has a flame-spread rating not greater than 25 on the exterior face when tested in accordance with Sentence 3.1.12.1.(1),

d) the cladding
i) conforms to Subsection 9.27.12.,
ii) is installed with or without furring members over gypsum sheathing at least 12.7 mm thick or over masonry,
iii) has a *flame-spread rating* not greater than 25 when tested in accordance with Sentence 3.1.12.1.(2), and
iv) does not exceed 2 mm in thickness exclusive of fasteners, joints and local reinforcements, or
the exterior wall assembly complies with Article 3.1.5.5.

5) The construction requirements for the *exposing building face* stated in Sentences (1) and (2) shall be satisfied before increasing the *unprotected opening* area as permitted by Sentence 3.2.3.12.(1).

3.2.3.8. Protection of Exterior Building Face

1) Except as permitted by Sentence (3) and in addition to the requirements of Sentences 3.2.3.7.(1) and (2) and where the maximum permitted area of *unprotected openings* is greater than 10% of the *exposing building face*, foamed plastic insulation used in an exterior wall of a *building* more than 3 *storeys* in *building height* shall be protected on its exterior surface by
a) concrete or masonry not less than 25 mm thick, or
b) noncombustible material that complies with the criteria for testing and the conditions of acceptance stated in Sentence (2) when tested in conformance with CAN/ULC-S101, "Fire Endurance Tests of Building Construction and Materials."

2) The criteria for testing and the conditions of acceptance for a wall assembly to satisfy the requirements of Clause (1)(b) are that
a) the fire exposed area of the wall assembly shall be not less than 9.3 m^2 and have no dimension less than 2.75 m,
b) the exposed surface shall include typical vertical and horizontal joints,
c) the test shall be continued for not less than 15 min and the standard time/temperature curve of the referenced standard shall be followed,
d) the *noncombustible* protective material must remain in place and no through openings should develop that are visible when viewed normal to the face of the material, and
e) the *noncombustible* protective material should not disintegrate in a manner that would permit fire to propagate along the surface of the test assembly.

3) The requirements of Sentence (1) are waived for wall assemblies that comply with the requirements of Article 3.1.5.5. (See Note A-3.1.4.1.(1).)

3.2.3.9. Protection of Structural Members

1) Structural members, including beams, columns and arches, that are placed wholly or partly outside the exterior face of a *building* and are less than 3 m from the property line or the centre line of a public thoroughfare shall be protected from exterior fire exposure by fire protection having a *fire-resistance rating* not less than that required for their protection from interior fire exposure, as stated in Articles 3.2.2.20. to 3.2.2.90., but not less than 1 h.

2) Structural members of *heavy timber construction*, including beams, columns and arches, that are placed wholly or partly outside the exterior face of a *building* and are 3 m or more from the property line or the centre line of a public thoroughfare need not be covered with *noncombustible* cladding.

3.2.3.10. Unlimited Unprotected Openings

1) An *exposing building face* in a *storage garage* with all *storeys* constructed as *open-air storeys* is permitted to have unlimited *unprotected openings* provided it has a *limiting distance* not less than 3 m.

2) The *exposing building face* of a *storey* that faces a *street* and is at the same level as the *street* is permitted to have unlimited *unprotected openings* if the *limiting distance* is not less than 9 m.

3.2.3.11. Low Fire Load, One Storey Building

1) An *exposing building face* of a *building* of *low-hazard industrial occupancy* conforming to Article 3.2.2.89. is permitted to be of *noncombustible construction* without a *fire-resistance rating* provided

a) it is not a *loadbearing* wall, and

b) the *limiting distance* is not less than 3 m.

3.2.3.12. Area Increase for Unprotected Openings

1) Except as required by Sentence 3.2.3.7.(5), the maximum area of *unprotected openings* in any *exposing building face* of an unsprinklered *building* is permitted to be doubled if the openings are glazed with

a) glass block conforming to the requirements of Article 3.1.8.16., or

b) wired glass assemblies conforming to D-2.3.15. in Appendix D.

3.2.3.13. Protection of Exit Facilities

1) Except as required by Sentence (3) and as permitted by Sentence 3.4.4.3.(1), if the plane of an exterior wall of an *exit* enclosure forms an angle less than 135° with the plane of an exterior wall of the *building* it serves, and an opening in the exterior wall of the *exit* enclosure could be exposed to fire from an opening in the exterior wall of the *building*, the opening in either the exterior wall of the *exit* or the exterior wall of the *building* shall be protected in conformance with the requirements of Sentence (4) where the opening in the exterior wall of the *building* is within 3 m horizontally and

a) less than 10 m below an opening in the exterior wall of the *exit*, or

b) less than 2 m above an opening in the exterior wall of the *exit*.

(See Note A-3.2.3.14.(1).)

2) If an unenclosed exterior *exit* stair, ramp, or confined path of travel could be exposed to fire from an opening in the exterior wall of the *building* it serves, the opening in the exterior wall of the *building* shall be protected in conformance with the requirements of Sentence (4) where the opening in the exterior wall of the *building* is within 3 m horizontally and

a) less than 10 m below the *exit* stair, ramp, or confined path of travel, or

b) less than 5 m above the *exit* stair, ramp, or confined path of travel.

3) Except as permitted by Sentence 3.4.4.3.(1), if an exterior *exit* door in one *fire compartment* is within 3 m horizontally of an opening in another *fire compartment* and the exterior walls of these *fire compartments* intersect at an exterior angle of less than 135°, the opening shall be protected in conformance with the requirements of Sentence (4).

4) The opening protection referred to in Sentences (1), (2) and (3) shall consist of

a) glass block conforming to the requirements of Article 3.1.8.16.,

b) a wired glass assembly conforming to D-2.3.15. in Appendix D,

c) a *closure* conforming to the requirements of Subsection 3.1.8. and Articles 3.2.3.1. and 3.2.3.14., or

d) a dedicated sprinkler water curtain in accordance with Sentence (5).

5) An opening provided with a dedicated sprinkler water curtain for opening protection as permitted in Clause (4)(d) shall

a) be provided with tempered or laminated safety glass glazed openings where windows are provided.

b) be provided with quick response sprinklers with a nominal k-factor of 5.6 of the upright or pendant type

c) be located such that

i) the water curtain sprinklers are between 150 mm and 300 mm horizontally from the interior face of the opening,

ii) located and not more than 3.6 m vertically above the floor immediately below and within 300 mm of the ceiling per the manufacturers listing for the quick response sprinkler head and NFPA 13,

iii) if the opening is 1.8 m or less in width, have one sprinkler head installed at the center of the opening with no more than 0.9 m horizontally from the edge of the opening,

iv) if the opening is more than 1.8 m in width, have multiple sprinkler heads installed at 1.8 m on center with no more than 0.9 m horizontally from the edge of the opening,

d) have sprinkler heads protected from spray and from cold solder effects from adjacent sprinklers (floor area or water curtain sprinkler heads) by means of baffles in accordance with NFPA 13, and be hydraulically designed to

i) discharge water at a minimum flow rate of 1.13 L/s (18 usgpm),

ii) sprinklers will be supplied off the floor area sprinkler system, and

iii) be included in the most hydraulically demanding design area for the adjacent floor area sprinklers plus the inside and outside hose stream allowance per NFPA 13.

3.2.3.14. Wall Exposed to Another Wall

1) Except as required by Sentences (3) and 3.2.3.13.(1) or as permitted by Sentence 3.2.3.19.(4), if an *unprotected opening* in an exterior wall of a *fire compartment* is exposed to an *unprotected opening* in the exterior wall of another *fire compartment*, and the planes of the 2 walls are parallel or at an angle less than 135°, measured from the exterior of the *building*, the *unprotected openings* in the 2 *fire compartments* shall be separated by a distance not less than D_o where

$$D_o = 2D - (\theta/90 \times D)$$

but in no case less than 1 m, and

D = the greater required *limiting distance* for the *exposing building faces* of the 2 *fire compartments*, and

θ = the angle made by the intersecting planes of the *exposing building faces* of the 2 *fire compartments* (in the case where the exterior walls are parallel and face each other, θ = 0°).

(See Note A-3.2.3.14.(1).)

2) The exterior wall of each *fire compartment* referred to in Sentence (1) within the distance, D_o, shall have a *fire-resistance rating* not less than that required for the interior vertical *fire separation* between the *fire compartment* and the remainder of the *building*.

3) Sentence (1) does not apply to *unprotected openings* of *fire compartments* within a *building* that is *sprinklered* throughout, but shall apply to

a) unprotected openings of *fire compartments* on opposite sides of a *firewall*, and

b) exposure from *unprotected openings* of a *fire compartment* that is not protected by an automatic *sprinkler system*.

3.2.3.15. Wall Exposed to Adjoining Roof

1) Except as permitted by Sentence 3.2.3.19.(4), if a wall in a *building* is exposed to a fire hazard from an adjoining roof of a separate *fire compartment* that is not *sprinklered* in the same *building*, and the exposed wall contains windows within 3 *storeys* vertically and 5 m horizontally of the roof, the roof shall contain no skylights within 5 m of the exposed wall.

3.2.3.16. Protection of Soffits

1) Except as permitted by Sentences (3) and (4), where there is a common *attic or roof space* above more than 2 *suites* of *residential occupancy* or above more than 2 patients' sleeping rooms, and the common *attic or roof space* projects beyond the exterior wall of the *building*, the soffit, and any opening in the soffit or other surface of the projection located within 2 500 mm of a window or door opening, shall be protected by

a) noncombustible material

i) not less than 0.38 mm thick, and

ii) having a melting point not below 650°C,

b) plywood not less than 11 mm thick,

c) strandboard or waferboard not less than 12.5 mm thick, or

d) lumber not less than 11 mm thick.

2) The soffit protection required by Sentence (1) shall extend the full width of the opening and to not less than 1 200 mm on either side of it, and shall apply to all openings through the soffit within this limit.
3) If an eave overhang is completely separated from the remainder of the *attic or roof space* by the use of *fire blocks*, the requirements of Sentence (1) do not apply.
4) The protection required by Sentence (1) for projections is permitted to be omitted if
a) the *fire compartments* behind the window and door openings are *sprinklered* in accordance with Article 3.2.5.12., and
b) all rooms, including closets and bathrooms, having openings in the wall beneath the soffit are *sprinklered*, notwithstanding exceptions permitted in the standards referenced in Article 3.2.5.12. for the installation of automatic sprinkler systems.

3.2.3.17. Canopy Protection for Vertically Separated Openings

1) Except as permitted by Sentences (2) and (3), if a *storey* classified as a Group E or Group F, Division 1 or 2 *major occupancy* is required to be separated from the *storey* above by a *fire separation*,
a) every opening in the exterior wall of the lower *storey* that is located vertically below an opening in the *storey* above shall be separated from the *storey* above by a canopy projecting not less than 1 m from the face of the *building* at the intervening floor level, and
b) the canopy required by Clause (a) shall have a *fire-resistance rating* not less than that required for the floor assembly but need not be more than 1 h, except as required elsewhere in this Subsection.
2) Except as permitted by Sentence (3), the canopy required by Sentence (1) is permitted to be omitted if the exterior wall of the upper *storey* is recessed not less than 1 m behind the exterior wall containing the opening in the lower *storey*.
3) The requirements of Sentences (1) and (2) are permitted to be waived if the *building* is *sprinklered* throughout.

3.2.3.18. Covered Vehicular Passageway

1) A covered vehicular passageway designed as a receiving or shipping area shall be separated from every *building* or part of a *building* adjoining it by a *fire separation* having a *fire-resistance rating* not less than 1.5 h.
2) A covered vehicular passageway constructed below *grade* shall be of *noncombustible construction*.

3.2.3.19. Walkway Between Buildings

1) Except as required by Sentence 3.2.3.20.(2), if *buildings* are connected by a *walkway*, each *building* shall be separated from the *walkway* by a *fire separation* with a *fire-resistance rating* not less than 45 min.
2) Except as permitted by Sentence (3), a *walkway* connected to a *building* required to be of *noncombustible construction* shall also be of *noncombustible construction*.
3) A *walkway* connected to a *building* required to be of *noncombustible construction* is permitted to be of *heavy timber construction* provided
a) not less than 50% of the area of any enclosing perimeter walls is open to the outdoors, and
b) the *walkway* is at ground level.
4) A *walkway* of *noncombustible construction* used only as a pedestrian thoroughfare need not conform to the requirements of Articles 3.2.3.14. and 3.2.3.15.
5) A *walkway* between *buildings* shall be not more than 9 m wide.

3.2.3.20. Underground Walkway

1) An underground *walkway* shall not be designed or used for any purpose other than pedestrian travel unless
a) the purpose is acceptable to the *authority having jurisdiction*, and
b) sprinklers are installed in any space in the *walkway* containing an *occupancy*.

2) Buildings connected by an underground *walkway* shall be separated from the *walkway* by a *fire separation* with a *fire-resistance rating* not less than 1 h.
3) An underground *walkway* shall be of *noncombustible construction* suitable for an underground location.
4) In an underground *walkway*

a) smoke barrier doors shall be installed at intervals of not more than 100 m, or
b) the travel distance from the door of an adjacent room or space to the nearest *exit* shall be not more than one and a half times the least allowable travel distance to an *exit* for any of the adjacent *occupancies* as permitted by Sentence 3.4.2.5.(1).

5) An underground *walkway* between *buildings* shall be not more than 9 m wide.

3.2.3.21. Storage and Process Equipment Located Outdoors

1) Location of outdoor storage and outdoor process equipment in relation to *buildings* shall conform to Parts 3 and 4 of Division B of the Fire By-law.

3.2.3.22. Installation of Service Lines Under Buildings

1) When a *building* is erected over existing buried flammable gas mains, such service lines shall be encased in gas-tight conduits in conformance with CSA Z662 Package, “Oil and Gas Pipeline Systems/CSA Z662-11, Commentary on Oil and Gas Pipeline Systems.”

3.2.4. Fire Alarm and Detection Systems

(See Note A-3.2.4.)

3.2.4.1. Determination of Requirement for a Fire Alarm System

1) Except as permitted in Sentences (2), (3), (5), (6) and (7), a fire alarm system shall be installed in *buildings* in which an automatic sprinkler system is required by this Part.
2) Buildings in which a sprinkler system is installed in accordance with NFPA 13D, “Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes,” need not comply with Sentence (1).
3) Buildings that contain fewer than 9 sprinklers conforming to Sentence 3.2.5.12.(4) need not comply with Sentence (1).
4) Except as permitted by Sentences (5) to (7) and Sentence 3.2.4.2.(4), a fire alarm system shall be installed in a *building* that is not *sprinklered* throughout and that contains

a) a *contained use area*,
b) an *impeded egress zone*,
c) more than 3 *storeys*, including the *storeys* below the *first storey*,
d) a total *occupant load* more than 300, other than in open air seating areas,
e) an *occupant load* more than 150 above or below the *first storey*, other than in open air seating areas,
f) a school, college, or child *care* facility, including a daycare facility for children, with an *occupant load* more than 40,
g) a licensed beverage establishment or a licensed restaurant, with an *occupant load* more than 150,
h) a *low-hazard industrial occupancy* with an *occupant load* more than 75 above or below the *first storey*,
i) a *medium-hazard industrial occupancy* with an *occupant load* more than 75 above or below the *first storey*,
j) a *residential occupancy* with sleeping accommodation for more than 10 persons,
k) a *high-hazard industrial occupancy* with an *occupant load* more than 25, or
l) an *occupant load* more than 300 below an open air seating area.

5) Where each *dwelling unit* in an apartment *building* has direct access to an exterior *exit* facility leading to ground level, a fire alarm system is not required if

a) not more than 4 *dwelling units* share a common *means of egress*, or

b) the *building* is not more than 3 *storeys* in *building height*.

6) A fire alarm system is not required in a hotel or motel 3 *storeys* or less in *building height* provided each *suite* has direct access to an exterior *exit* facility leading to ground level.

7) A fire alarm system is not required in a *storage garage* conforming to Article 3.2.2.90. that is contained in a *building* that is not *sprinklered* provided there are no other *occupancies* in the *building*.

3.2.4.2. Continuity of Fire Alarm System

1) Except as permitted by Sentence (6), if there are openings through a *firewall*, other than those for piping, tubing, wiring and totally enclosed *noncombustible* raceways, the requirements in this Subsection shall apply to the *floor areas* on both sides of the *firewall* as if they were in the same *building*.

2) Except as permitted by Sentence (4), if a *building* contains more than one *major occupancy* and a fire alarm system is required, a single system shall serve all *occupancies*.

3) Except as permitted by Sentence (4), if a fire alarm system is required in any portion of a *building*, it shall be installed throughout the *building*.

4) Except as required by Sentence (5), the requirements in this Subsection are permitted to be applied to each portion of a *building* not more than 3 *storeys* in *building height*, in which a vertical *fire separation* having a *fire-resistance rating* not less than 1 h separates the portion from the remainder of the *building* as if it were a separate *building*, provided there are no openings through the *fire separation*, other than those for piping, tubing, wiring and totally enclosed *noncombustible* raceways.

5) The permission in Sentence (4) to consider separated portions of a *building* as separate *buildings* does not apply to *service rooms* and storage rooms.

6) Buildings interconnected by *walkways* permitted in Articles 3.2.3.19. and 3.2.3.20. or by vestibules provided in conformance with Article 3.2.6.3. shall be treated as separate *buildings* for the purpose of fire alarm installation required by this Subsection.

3.2.4.3. Types of Fire Alarm Systems

1) A fire alarm system shall be

a) a single-stage system in a Group F, Division 1 *occupancy*,

b) except as permitted in Clause (c), a 2-stage system in a Group B *occupancy*,

c) a single- or 2-stage system in a Group B, Division 3 *occupancy* where the *building* is 3 *storeys* or less in *building height*, and

d) a single- or 2-stage system in all other cases.

3.2.4.4. Description of Fire Alarm Systems

1) A single stage fire alarm system shall, upon the operation of any manual station, waterflow detecting device, or *fire detector*, cause an *alarm signal* to sound on all audible signal devices in the system. (See Note A-3.2.4.4.(1).)

2) A 2-stage fire alarm system shall

a) cause an *alert signal* to sound upon the operation of any manual station, waterflow detecting device, or *fire detector*,

b) automatically cause an *alarm signal* to sound if the *alert signal* is not acknowledged within 5 min of its initiation, and

c) have manual stations, each of which is equipped so that the use of a key or other similar device causes an *alarm signal* to sound that continues to sound upon removal of the key or similar device from the manual station (See Note A-3.2.4.4.(2)(c).).

(See Note A-3.2.4.4.(2).)

3) A 2-stage fire alarm system is permitted to be zone so that, upon the operation of any manual station, waterflow detecting device, or *fire detector*,

a) a coded *alert signal* is sounded indicating the zone of alarm initiation,

b) the coded *alert signal* is repeated in its entirety not less than 4 times, and

c) a continuous *alert signal* is sounded upon completion of the coded signals referred to in Clause (b) and Sentence (4).

4) If a second manual station, waterflow detecting device, or *fire detector* is operated in a fire alarm system with zone coding as permitted by Sentence (3), in a zone other than that for which the first *alert signal* was sounded, the coded *alert signal* for the first zone shall be completed before the coded *alert signal* for the second zone is repeated not less than 4 times.

3.2.4.5. Installation and Verification of Fire Alarm Systems

1) Fire alarm systems, including the voice communication capability where provided, shall be installed in conformance with CAN/ULC-S524, "Installation of Fire Alarm Systems."

2) Fire alarm systems shall be verified in conformance with CAN/ULC-S537, "Verification of Fire Alarm Systems," to ensure they are operating satisfactorily.

3.2.4.6. Silencing of Alarm Signals

1) A fire alarm system shall be designed so that when an *alarm signal* is actuated, it cannot be silenced automatically before a period of time has elapsed that is not less than

a) 5 min for a *building* not required to be equipped with an annunciator, and

b) 20 min for any other *building*.

2) Except as permitted by Sentence 3.2.4.18.(7) and Sentences 3.2.4.22.(2) and (3), a fire alarm system shall not incorporate manual silencing switches other than those installed inside the fire alarm control unit. (See Note A-3.2.4.6.(2).)

3) A manual silencing switch, accessible only to authorized personnel, shall be installed inside of the annunciator described in Sentence 3.2.4.8.(1). (See Note A-3.2.4.6.(3).)

3.2.4.7. Signals to Fire Department

1) A single stage fire alarm system installed in a *building* of *assembly occupancy* that has an *occupant load* more than 300 shall be designed to notify the fire department, in conformance with Sentence (4), that an *alarm signal* has been initiated.

2) A fire alarm system that includes waterflow-indicating devices shall be designed to notify the fire department in conformance with Sentence (4) when an alarm is initiated.

3) A 2-stage fire alarm system shall be designed to notify the fire department, in conformance with Sentence (4), that an *alert signal* has been initiated.

4) Notification of the fire department, as required by Sentences (1), (2) and (3), shall be provided in conformance with CAN/ULC-S561, "Installation and Services for Fire Signal Receiving Centres and Systems."

(See Note A-3.2.4.7.(4).)

5) Where a single stage fire alarm system is installed in a *building* that is not *sprinklered* throughout and Sentence (1) does not apply, a legible notice that is not easily removed shall be affixed to the wall near each manual station stating

a) that the fire department is to be notified in the event of a fire emergency, and

b) the emergency telephone number for the municipality or for the fire department (See Note A-3.2.4.7.(5)(b).).

6) Helicopter landing areas on roofs shall be provided with telephone extensions or means to notify the fire department.

3.2.4.8. Annunciator and Zone Indication

1) Except as permitted by Sentences (3) to (5), an annunciator shall be installed in close proximity to a *building* entrance that faces a *street* or an access route for fire department vehicles that complies with Sentence 3.2.5.5.(1).

2) Except as permitted by Sentences (6), (8), (9) and (10), the annunciator required by Sentence (1) shall have separate zone indication of the actuation of the alarm initiating devices, *smoke detectors, heat detectors*, manual stations and waterflow detecting devices, in each

a) *floor area* so that the area of coverage for each zone in a *building* that is not *sprinklered* is not more than 2 000 m^2,

b) *floor area* so that the area of coverage for each zone is neither

i) more than one *storey*, nor

ii) more than the system area limits specified in NFPA 13, "Installation of Sprinkler Systems,"

c) shaft required to be equipped with *smoke detectors*,

d) air-handling system required to be equipped with *smoke detectors*,

e) fire extinguishing system required by NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations,"

f) *contained use area*,

g) *impeded egress zone*,

h) *fire compartment* required by Sentence 3.3.3.5.(2), and

i) *floor area* required to be equipped with *smoke detector* or detectors as required by Clause 3.2.4.11.(1)(h) to

i) initiate an alert signal in a 2 stage system or an alarm signal in a single stage system, and

ii) indicate the actuation of each device separately on the fire alarm system annunciator.

(See Note A-3.2.4.8.(2).)

3) An annunciator need not be provided for a fire alarm system if not more than one zone indicator is required by Sentence (2).

4) If an annunciator is not installed as part of a fire alarm system in conformance with Sentence (1), a visual and audible trouble signal device shall be provided inside the main entrance of the *building*.

5) The requirements of Sentence (1) are waived in a *building*

a) in which an automatic sprinkler system is not installed,

b) that has an aggregate area for all *storeys* of not more than 2 000 m^2, and

c) that is not more than 3 *storeys* in *building height*.

6) The area limits of Clause (2)(a) are waived for an interior undivided open space used as an arena, a rink, or a swimming pool provided that other spaces in the *building* that are separated from the open space are individually zoned in accordance with the requirements of Sentence (2).

7) A fire alarm control unit installed in close proximity to a *building* entrance that faces a *street* or an access route for fire department vehicles that complies with Sentence 3.2.5.5.(1) is deemed to satisfy the requirement for an annunciator, provided all indicators required for an annunciator or trouble signal device are included on the control unit.

8) If a fire alarm system is required in *row housing* or in residential *buildings* where the egress of the *dwelling units* conforms to Sentence 3.3.4.4.(3) and the *building* is no more than 4 *storeys* in *building height*, the *building* shall be provided with

a) a single electrically supervised fire alarm system for the entire *building*,

b) at least one sprinkler zone for each block of *row housing* or each residential block,

c) a *sprinkler system* which is monitored by the fire alarm system and an off-site monitoring service,

d) a strobe light located outside the principal entrance of each *dwelling unit* and connected to an internal smoke alarm within the *dwelling unit*, and

e) an exterior audible signal activated by the fire alarm system.

9) In a multi-level residential *suite*, where a single egress door is provided and the egress door opens directly into a *public corridor* or an exterior *exit* passageway or onto a street, a separate zone for sprinkler water flow detecting devices on each *storey* is not required provided

a) the actuation of a sprinkler waterflow detecting device in the *suite* shall be zoned at the *public corridor* or exterior *exit* passageway floor level, and

b) a strobe light is installed and maintained outside the *suite* entrance of the *dwelling unit*, and connected to an internal *smoke alarm* within the *dwelling unit*.

10) A separate zone for waterflow detecting devices is not required for a shaft described in Clause 3.2.4.9.(2)(c).

11) The annunciator required by Sentence (1) shall have indicator lamps for the separate zone indications required by Sentence (2). (See Note A-3.2.4.8.(11).)

3.2.4.9. Electrical Supervision

1) Electrical supervision shall be provided for a fire alarm system.

2) If a fire alarm system in a *building* is required to have an annunciator by Sentence 3.2.4.8.(1), except for hose valves, all valves controlling water supplies in a standpipe system shall be equipped with an electrically supervised switch for transmitting a trouble signal to the annunciator in the event of movement of the valve handle.

3) An automatic sprinkler system shall be electrically supervised to indicate a trouble supervisory signal on the *building* fire alarm system annunciator for each of the following:

a) movement of a valve handle that controls the supply of water to sprinklers,
b) loss of excess water pressure required to prevent false alarms in a wet pipe system,
c) loss of air pressure in a dry pipe system,
d) loss of air pressure in a pressure tank,
e) a significant change in water level in any water storage container used for firefighting purposes,
f) loss of power to any automatically starting fire pump (See Note A-3.2.4.9.(3)(f).), and
g) a temperature approaching the freezing point in any dry pipe valve enclosure or water storage container used for firefighting purposes.

4) A fire pump shall be electrically supervised as stipulated in NFPA 20, “Installation of Stationary Pumps for Fire Protection.”

5) Except as permitted by Sentence (6), a radio antenna system shall perform a self-test at least twice daily and shall be electrically supervised to indicate a trouble signal on the *building* fire alarm system annunciator for:

a) loss of power to any head-end equipment, and
b) fundamental failure of a self-test.

6) Electrical supervision of a radio antenna system in a *building* in which a fire alarm system is not installed shall be provided by an *acceptable* method.

7) A trouble signal indicating the nature of the trouble in accordance with Sentence (3) and (5) shall be transmitted to a Fire Signal Receiving Centre conforming to CAN/ULC-S561, “Installation and Services for Fire Signal Receiving Centres and Systems” as provided for in Sentence 3.2.4.7.(4).

3.2.4.10. Fire Detectors

1) Fire detectors required by this By-law shall be connected to the fire alarm system.

2) Except as permitted by Sentence (3), if a fire alarm system is required in a *building* that is not *sprinklered*, *fire detectors* shall be installed in the following spaces:

a) storage rooms not within *dwelling units*,
b) service rooms not within *dwelling units*,
c) janitors’ rooms,
d) rooms in which hazardous substances are to be used or stored (See Note A-3.3.1.2.(1).),
e) elevator hoistways and dumbwaiter shafts, and
f) laundry rooms in *buildings* of *residential occupancy*, but not those within *dwelling units*.

3) Fire detectors required by Sentence (2) need not be provided within *floor areas* that are *sprinklered*.

4) Fire detectors required by Sentence (2) shall be installed in elevator hoistways and dumbwaiter shafts where a sprinkler system is not installed within the hoistway or shaft.

3.2.4.11. Smoke Detectors

1) If a fire alarm system is installed, *smoke detectors* shall be installed in

a) except as permitted in Sentence (2), each sleeping room and each corridor serving as part of a *means of egress* from sleeping rooms in portions of a *building* classified as a Group B *major occupancy*,
b) each room in a *contained use area* and corridors serving those rooms,
c) each corridor in portions of a *building* classified as a Group A, Division 1 *major occupancy*,
d) each *public corridor* in portions of a *building* classified as a Group C *major occupancy*,
e) each *exit* stair shaft other than those serving only a Group A, Division 4 *major occupancy* or an open *storage garage*,
f) the vicinity of draft stops required by Article 3.2.8.6.,
g) elevator machine rooms, and
h) each *floor area* in front of the elevator or elevators as required by Sentence 3.2.6.4.(5).

(See Note A-3.2.4.11.(1).)

2) Smoke detectors need not be installed in sleeping rooms and in corridors serving the sleeping rooms within a *suite* of *care occupancy* where *smoke alarms* are installed in accordance with Article 3.2.4.20.

3) Smoke detectors required in the sleeping rooms of a *care*, *treatment* or *detention occupancy* shall, upon actuation, provide an audible and visible signal to staff serving those rooms so that the room or location containing the actuated *smoke detector* can be easily identified. (See Note A-3.2.4.11.(3).)

4) Smoke detectors required in Clause (1)(g) shall, upon actuation, recall the elevators served by the elevator machine room in which the *smoke detector* is installed.

5) Except as permitted in Sentences (6) and (7), *smoke detectors* installed in *buildings* required to be equipped with a fire alarm system shall be located near the entrance to *walkways* described in Articles 3.2.3.19. and 3.2.3.20. or vestibules provided in conformance with Article 3.2.6.3.

6) Smoke detectors installed at the entrance to the *walkways* in conformance with Article 3.1.8.14. shall be deemed to meet the requirements of Sentence (5).

7) Smoke detectors required by Sentence (5) may be replaced with *fire detectors* in Group F *occupancies* where the *smoke detectors* may be subjected to false alarms due to the activities within the *building*.

3.2.4.12. Prevention of Smoke Circulation

1) If a fire alarm system is installed, an air-handling system shall be designed to prevent the circulation of smoke upon a signal from a duct-type *smoke detector* if the air-handling system

a) serves more than one *storey*,
b) serves more than one *suite* in a *storey*, or
c) serves more than one *fire compartment* required by Sentence 3.3.3.5.(2).

3.2.4.13. Vacuum Cleaning System Shutdown

1) A central vacuum cleaning system in a *building* equipped with a fire alarm system shall be designed to shut down upon actuation of the fire alarm system.

3.2.4.14. Elevator Emergency Return

1) Deleted. [See Article 3.2.6.4. for high buildings.]
2) Deleted.
3) Deleted.

3.2.4.15. System Monitoring

1) An automatic sprinkler system shall be equipped with waterflow detecting devices and, if an annunciator is required by Article 3.2.4.8., shall be installed so that each device serves

a) not more than one *storey*, and
b) except as required by Sentence 3.2.4.8.(2), an area on each *storey* that is not more than the system area limits as specified in NFPA 13, "Installation of Sprinkler Systems."

2) Waterflow-detecting devices required by Sentence (1) shall be connected to the fire alarm system so that, upon its actuation, an *alert signal* or an *alarm signal* is initiated.
3) The actuation of each waterflow detecting device required by Sentence (1) shall be indicated separately on the fire alarm system annunciator.

3.2.4.16. Manual Stations

1) Except as permitted by Sentences (2) and (3), where a fire alarm system is installed, a manual station shall be installed in every *floor area* near

a) every principal entrance to the *building*, and
b) every required *exit*, and
c) every other egress facility that has been designed and identified as an *exit* and has all the features of a required *exit*.

(See Note A-3.2.4.16.(1).)
2) In a *building* that is *sprinklered* throughout, a manual station is not required at an exterior egress doorway from a *suite* that does not lead to an interior shared *means of egress* in a hotel or motel not more than 3 *storeys* in *building height*, provided each *suite* is served by an exterior *exit* facility leading directly to ground level.
3) In a *building* that is *sprinklered* throughout, a manual station is not required at an exterior egress doorway from a *dwelling unit* that does not lead to an interior shared *means of egress* in a *building* not more than 3 *storeys* in *building height* containing only *dwelling units*, provided each *dwelling unit* is served by an exterior *exit* facility leading directly to ground level.
4) In a *building* referred to in Sentences (2) or (3), manual stations shall be installed near doorways leading from shared interior corridors to the exterior.
5) Where a fire alarm system is installed, a manually operated fire alarm station shall be installed on the roof at each *exit* from a helicopter landing area.

3.2.4.17. Alert and Alarm Signals

1) In a 2-stage fire alarm system described in Sentence 3.2.4.4.(2), the same audible signal devices are permitted to be used to sound the *alert signals* and the *alarm signals*.
2) If audible signal devices with voice reproduction capabilities are intended for paging and similar voice message use, other than during a fire emergency, they shall be installed so that *alert signals* and *alarm signals* take priority over all other signals.
3) Audible signal devices forming part of a fire alarm or voice communication system shall not be used for playing music or background noise.

3.2.4.18. Audibility of Alarm Systems

(See Note A-3.2.4.18.)
1) Audible signal devices forming part of a fire alarm system shall be installed in a *building* so that

a) alarm signals are clearly audible throughout the *floor area*, and
b) alert signals are clearly audible in continuously staffed locations, and where there are no continuously staffed locations, throughout the *floor area*.

(See Note A-3.2.4.18.(1).)
2) The sound pattern of an *alarm signal* shall conform to the temporal pattern defined in Clause 4.2 of ISO 8201, "Acoustics – Audible emergency evacuation signal." (See Note A-3.2.4.18.(2).)
3) The sound patterns of *alert signals* shall be significantly different from the temporal patterns of *alarm signals*. (See Note A-3.2.4.18.(3).)
4) The fire *alarm signal* sound pressure level shall be not more than 110 dBA in any normally occupied area. (See Note A-3.2.4.18.(4).)
5) The sound pressure level in a sleeping room from a fire alarm audible signal device shall be not less than 75 dBA in a *building* of *residential* or *care occupancy* when any intervening doors between the device and the sleeping room are closed. (See Note A-3.2.4.18.(5).)

6) Except as required by Sentence (5), the sound pressure level from a fire alarm system's audible signal device within a *floor area* shall be not less than 10 dBA above the ambient noise level without being less than 65 dBA.
7) Except as permitted by Sentence (11), audible signal devices located within a *dwelling unit* shall include a means for them to be manually silenced for a period of not more than 10 min, after which time the devices shall restore themselves to normal operation. (See Note A-3.2.4.18.(7).)
8) Audible signal devices within a *dwelling unit* or a *suite* of *residential* or *care occupancy* shall be connected to the fire alarm system

a) in a manner such that a single open circuit or short circuit at one device will not impair the operation of other audible signal devices on that same circuit that serve the other *dwelling units* or *suites* of *residential* or *care occupancy*, or
b) on separate signal circuits that are not connected to the devices in any other *dwelling unit*, *public corridor* or *suite* of *residential* or *care occupancy*.

(See Note A-3.2.4.18.(8) and (9).)
9) Deleted.
10) Audible signal devices shall be installed in a *service space* referred to in Sentence 3.2.1.1.(8) and shall be connected to the fire alarm system.
11) Audible signal devices within *dwelling units* that are wired on separate signal circuits need not include a means for silencing as required by Sentence (7) provided the fire alarm system includes a provision for an automatic signal silence within *dwelling units*, where

a) the automatic signal silence cannot occur within the first 60 s of operation or within the zone of initiation,
b) a subsequent alarm elsewhere in the *building* will reactuate the silenced audible signal devices within *dwelling units*,
c) after a period of not more than 10 min, the silenced audible signal devices will be restored to continuous audible signal if the alarm is not acknowledged, and
d) the voice communication system referred to in Article 3.2.4.22. has a provision to override the automatic signal silence to allow the transmission of voice messages through silenced audible signal device circuits that serve the *dwelling units*.

(See Note A-3.2.4.18.(7).)
12) If a 2-stage fire alarm system has been installed with an automatic signal silence as described in Sentence (11), the system shall be designed so that any silenced audible signal devices serving *dwelling units* are reactuated whenever an *alarm signal* is required to be transmitted as part of the second stage. (See Note A-3.2.4.18.(7).)
13) A signal device forming part of a fire alarm system shall be provided that will sound *alert* or *alarm signals* that are clearly discernable to persons on the roof deck or balcony that are located

a) in the vicinity of an exterior door providing access to a private residential roof deck or balcony, or
b) on exterior public roof decks or balconies.

3.2.4.19. Visible Signal Devices and Visible Warning Systems

1) Visible signal devices shall be installed in addition to *alarm signals*

a) in *buildings* or portions thereof intended for use primarily by persons are deaf or hard of hearing,
b) in *assembly occupancies* in which music and other sounds associated with performances could exceed 100 dBA,
c) in any *floor area* in which the ambient noise level is more than 87 dBA, and
d) in any *floor area* in which the occupants
  i) use ear protection devices,
  ii) are located in an audiometric booth, or
  iii) are located in sound-insulating enclosures.

2) Visible signal devices required by Sentence (1) shall be installed so that the signal from at least one device is visible throughout the *floor area* or portion thereof in which they are installed. (See Note A-3.2.4.19.(2).)

3) A visible warning system shall be installed in the rooms and spaces required by Section 3.8. and shall conform to

- a) Sentence (4) where a fire alarm system is provided, and
- b) Sentence (5) where a fire alarm system is not provided.

4) The visible warning system required by Sentences (2) and (3) shall consist of strobe lights conforming to CAN/ULC-S526, "Visible Signal Devices for Fire Alarm Systems, Including Accessories" that are designed to operate as part of the fire alarm system, and

- a) have a luminous intensity of not less than
  - i) 75 candela, if the strobe light is located in a sleeping room or bed space, and
  - ii) 15 candela, if the strobe light is not located in a sleeping room or bed space,
- b) produce between 1 and 3 flashes per second, with the flashes synchronized when more than one strobe light is visible from a single location,
- c) have a clear or white translucent lens with the word "FIRE" clearly visible on the
  - i) lens, or
  - ii) attached nameplate,
- d) be installed in each
  - i) sleeping room or bed space,
  - ii) room closed off from the living area by a door including bathrooms, and
  - iii) living area or hallway serving the living area, and
- e) be located in conformance with the installation requirements for visible signal devices in CAN/ULC-S524, "Installation of Fire Alarm Systems."

5) Where a fire alarm system is not provided, the visible warning system required by Sentences (2) and (3) shall consist of strobe lights conforming to CAN/ULC-S526, "Visible Signal Devices for Fire Alarm Systems, Including Accessories" that shall

- a) be connected to, and activated by,
  - i) the *smoke alarms* required by Article 3.2.4.20. and Article 9.10.19.1., or
  - ii) the *smoke detectors* permitted by Article 3.2.4.20., 3.2.4.21. or 9.10.19.8.,
- b) have a luminous intensity of not less than
  - i) 75 candela, if the strobe light is located in a sleeping room or bed space, or
  - ii) 15 candela, if the strobe light is not located in a sleeping room or bed space,
- c) produce between 1 and 3 flashes per second, with the flashes synchronized when more than one strobe light is visible from a single location,
- d) have a clear or white translucent lens with the word "SMOKE" clearly visible on the
  - i) lens, or
  - ii) attached nameplate,
- e) be installed in each
  - i) sleeping room or bed space,
  - ii) room closed off from the living area by a door including bathrooms, and
  - iii) living area or hallway serving the living area, and
- f) be located not less than 2 100 mm above the floor on a wall or ceiling in a location that will maximize effectiveness.

6) The special outlet boxes and cover plates required by Sentences 3.8.2.12.(5) and 3.8.5.3.(4) shall be

- a) designed, located and wired specifically to allow strobe lights to operate in conformance with
  - i) Sentence (4) where a fire alarm system is provided, or
  - ii) Sentence (5) where a fire alarm system is not provided,
- b) permanently identified as "FIRE – Strobe Light Connection Only,"
- c) installed in each
  - i) sleeping room or bed space,

ii) room closed off from the living area by a door including bathrooms, and
iii) living area or hallway serving the living area, and

d) be located not less than 2 100 mm above the floor on a wall or ceiling in a location that will maximize effectiveness.

7) For the purposes of providing power to the strobe lights that may be connected to the outlets described in Sentence (6), it shall be assumed that the total special outlets for at least 20 percent of the *dwelling units* in the *building* are in use.

3.2.4.20. Smoke Alarms

1) Except as provided in Article 3.2.4.21., *smoke alarms* shall be installed in accordance with this Article.
2) Except as required by Sentence (5) and permitted by Sentence (8), *smoke alarms* conforming to CAN/ULC-S531, “Standard for Smoke Alarms,” shall be installed in each *dwelling unit* and, except for *care*, *treatment* or *detention occupancies* required to have a fire alarm system, in each sleeping room not within a *dwelling unit* or *suite* of *care occupancy*.
3) At least one *smoke alarm* shall be installed on each *storey* of a *dwelling unit* or *suite* of *care occupancy*.
4) On any *storey* of a *dwelling unit* containing sleeping rooms, a *smoke alarm* shall be installed

a) in each sleeping room, and
b) in a location between the sleeping rooms and the remainder of the *storey*, and if the sleeping rooms are served by a hallway, the *smoke alarm* shall be located in the hallway.

5) Where a *care occupancy* has individual *suites* for residents, a *smoke alarm* shall be installed

a) in each sleeping room, and
b) in a location between the sleeping rooms and the remainder of the *suite*, and if the sleeping rooms are served by a corridor within the *suite*, the *smoke alarm* shall be located in the corridor.

6) A *smoke alarm* shall be installed on or near the ceiling.
7) Except as permitted in Sentence (8), *smoke alarms* referred in Sentence (2) shall

a) be installed with permanent connections to an electrical circuit (See Note A-3.2.4.20.(7)(a).),
b) have no disconnect switch between the overcurrent device and the *smoke alarm*, and
c) in case the regular power supply to the *smoke alarm* is interrupted, be provided with a battery as an alternative power source that can continue to provide power to the *smoke alarm* for a period of no less than 7 days in the normal condition, followed by 4 minutes of alarm.

8) Suites of *residential occupancy* are permitted to be equipped with *smoke detectors* in lieu of *smoke alarms*, provided the *smoke detectors*

a) sound audible signals only within the *suite* they serve,
b)are installed in conformance with CAN/ULC-S524, “Installation of Fire Alarm Systems,” and
c) form part of the fire alarm system.

(See Note A-3.2.4.20.(8).)
9) If more than one *smoke alarm* is required in a *dwelling unit*, the *smoke alarms* shall be wired so that the actuation of one *smoke alarm* will cause all *smoke alarms* within the *dwelling unit* to sound.
10) A *smoke alarm* required by Sentence (2) shall be installed in conformance with CAN/ULC-S553, “Installation of Smoke Alarms.”
11) Except as permitted in Sentence (13), a manually operated silencing device shall be incorporated within the circuitry of a *smoke alarm* installed in a *dwelling unit* so that it will silence the signal emitted by the *smoke alarm* for a period of not more than 10 min, after which the *smoke alarm* will reset and again sound the alarm if the level of smoke in the vicinity is sufficient to reactuate the *smoke alarm*.
12) Suites of *residential occupancy* equipped with *smoke detectors* installed to CAN/ULC-S524, “Installation of Fire Alarm Systems,” as part of the fire alarm system in lieu of *smoke alarms* as permitted by Sentence (8), need not incorporate the manually operated device required in Sentence (12). (See Note A-3.2.4.20.(8).)
13) The sound patterns of *smoke alarms* shall

a) meet the temporal patterns of *alarm signals* (See Note A-3.2.4.18.(2).), or
b) be a combination temporal pattern and voice relay.

3.2.4.21. Residential Fire Warning Systems

1) Except where a fire alarm system is installed or required in a *building*, *smoke detectors* forming part of a residential fire warning system installed in conformance with CAN/ULC-S540, "Residential Fire and Life Safety Warning Systems: Installation, Inspection, Testing and Maintenance," are permitted to be installed in lieu of all *smoke alarms* required by Article 3.2.4.20., provided the system

a) is capable of sounding audible signals in accordance with Articles 9.10.19.2. and 9.10.19.5.,

b) is powered in accordance with Article 9.10.19.4., and

c) is provided with a silencing device in accordance with Article 9.10.19.6.

3.2.4.22. Voice Communication Systems

(See also Article 3.2.5.20)

1) A voice communication system required by Subsection 3.2.6. and Sentences (7) to (10) shall

a) consist of a two-way means of communication with the central alarm and control facility and to the mechanical control centre from each *floor area*, and

b) be capable of broadcasting prerecorded, synthesized, or live messages from the central alarm and control facility that are audible and intelligible in all parts of the *building*, except that this requirement does not apply to elevator cars (See Note A-3.2.4.22.(1)(b).).

2) The voice communication system referred to in Sentence (1) shall include a means to silence the *alarm signal* in a single stage fire alarm system while voice instructions are being transmitted, but only after the *alarm signal* has initially sounded for not less than 30 s.

3) The voice communication system referred to in Sentence (1) shall include a means to silence the *alert signal* and the *alarm signal* in a 2-stage fire alarm system while voice instructions are being transmitted, but only after the *alert signal* has initially sounded for not less than

a) 10 s in hospitals that have supervisory personnel on duty for twenty-four hours each day, or

b) 30 s for all other *occupancies*.

4) The voice communication system referred to in Clause (1)(b) shall be designed so that the *alert signal* or *alarm signal* in a 2-stage fire alarm system can be selectively transmitted to any zone or zones while maintaining an *alert signal* or selectively transmitting voice instructions to any other zone or zones in the *building*.

5) The 2-way communication system referred to in Clause (1)(a) shall be installed so that emergency telephones are located in each *floor area* near *exit* stair shafts.

6) Visible signal devices required by Sentence 3.2.4.19.(1) and visible warning systems required by Sentence 3.2.4.19.(3) shall continue to emit a visible signal while voice instructions are being transmitted.

7) Except for Group B, Division 1 and Group F, Division 1 *major occupancies*, where a fire alarm system is required under Subsection 3.2.4., a voice communication system shall be installed in *buildings* where a 2-stage fire alarm system is installed and whose *occupant load* exceeds 1 000.

8) A voice communication system required by Sentence (7) shall consist of loudspeakers that are

a) operated from the central alarm and control facility or, in the absence of such a facility, from a designated area, and

b) except in elevator cars, designed and located so that transmitted messages are audible and intelligible in all parts of the *building*.

(See Note A-3.2.4.22.(1)(b).)

9) Where the facility is not equipped with staff trained to provide instructions over the loudspeakers, a pre-recorded message shall be provided.

10) The voice communication system required by Sentence (7) shall meet the silencing and transmission requirements of Sentences (2) to (4).

11) Except where a radio antenna system conforming to Sentence 3.2.5.20.(1) is installed, emergency telephones shall be installed and located in each *floor area* near *exit* stair shafts for the 2-way communication system referred to in Clause (1)(a).

3.2.5. Provisions for Firefighting

(See Note A-3.)

3.2.5.1. Access to Above-Grade Storeys

1) Except for *storeys* below the *first storey*, direct access for firefighting shall be provided from the outdoors to every *storey* that is not *sprinklered* throughout and whose floor level is less than 25 m above *grade*, by at least one unobstructed window or access panel for each 15 m of wall in each wall required to face a *street* by Subsection 3.2.2.

2) An opening for access required by Sentence (1) shall

a) have a sill no higher than 900 mm above the inside floor, and

b) be not less than 1 100 mm high by not less than

i) 550 mm wide for a *building* not designed for the storage or use of *dangerous goods*, or

ii) 750 mm wide for a *building* designed for the storage or use of *dangerous goods*.

3) Access panels above the *first storey* shall be readily openable from both inside and outside, or the opening shall be glazed with plain glass.

4) Where locking devices to prevent access to *floor areas* are installed on *exit* doors

a) a master key shall be provided in an *acceptable* location accessible to firefighters, or

b) the exit doors shall be provided with a wired glass panel measuring no less than 0.0645 m^2 in area and located not more than 300 mm from the door opening hardware.

3.2.5.2. Access to Basements

1) Direct access from at least one *street* shall be provided from the outdoors in a *building* that is not *sprinklered* to each *basement* having a horizontal dimension more than 25 m.

2) The access required by Sentence (1) is permitted to be provided by

a) doors, windows or other means that provide an opening not less than 1 100 mm high and 550 mm wide, with a sill no higher than 900 mm above the inside floor, or

b) an interior stairway immediately accessible from the outdoors.

3.2.5.3. Roof Access

1) On a *building* more than 3 *storeys* in *building height* where the slope of the roof is less than 1 in 4, all main roof areas shall be provided with direct access from the *floor areas* immediately below, either by

a) a stairway, or

b) a hatch not less than 550 mm by 900 mm with a fixed ladder.

3.2.5.4. Access Routes

1) Every *building* shall be provided with fire department access route(s)

a) to the *building* face having a principal entrance, and

b) to each *building* face having access openings for firefighting as required by Articles 3.2.5.1. and 3.2.5.2.

(See Note A-3.2.5.4.(1).)

3.2.5.5. Location of Access Routes and Paths of Travel

(See Note A-3.2.5.5.)

1) Except as provided by Sentences (2) and (3), access routes required by Article 3.2.5.4. shall be located so that every access opening required by Articles 3.2.5.1. and 3.2.5.2. are located not less than 3 m and not more than 15 m from the closest portion of the access route, measured horizontally to the face of the *building*. (See Note A-3.2.5.5.(1).)

2) Access routes required by Article 3.2.5.4. shall be located so that the principal entrance is no less than 3 m and no more than 15 m from the closest portion of the access route, measured horizontally along the path of travel from the access route to the principal entrance. (See Note A-3.2.5.5.(2).)

3) Paths of travel for firefighters shall not be more than

a) 45 m from the access route to the entrance door of each *dwelling unit* for *sprinklered buildings* of *residential occupancy* with exiting directly to adjacent *grade*,
b) 55 m from the access route to the entrance door of each *dwelling unit* with exiting directly to adjacent *grade*, where the *dwelling unit* is separated from adjacent *floor areas* by a *fire separation* with at least 1 h *fire-resistance*, if
 i) exceeding Article 3.2.5.12 requirements, the building is sprinklered to NFPA 13R from NFPA 13D, or to NFPA 13 from NFPA 13R ,
 ii) [Deleted.]
 iii) a strobe light is installed outside the principal entrance of the *dwelling unit*, and is connected to an internal *smoke alarm* within the *dwelling unit*,
 iv) *sprinkler systems* are monitored by the fire alarm system and by an off-site monitoring service,
 v) [Deleted.]
 vi) lighting and emergency lighting is provided along the path of travel for firefighters with a minimum illumination level of 1 lx, and average illumination of not less than 10 lx, and
 vii) the fire alarm system has a graphic annunciator,
c) 65 m from the access route to the entrance door of each *dwelling unit* provided each *dwelling unit* has direct access to an exterior exit facility leading to adjacent ground level, where the *dwelling unit* may contain an *ancillary residential unit* or the *dwelling unit* has not more than one *dwelling unit* on top, if
 i) the requirements of Subclauses (b)(i) to (b)(vii) are met,
 ii) a 64 mm diameter fire department hose connection is located adjacent to the path of travel for firefighters located not more than 45 m measured from the hose connection to the principal entrance of each of the dwelling units,
 iii) the location of the fire department hose connections required by Subclause (c)(ii) is indicated on the fire alarm system graphic annunciator, and
 iv) the *building* is *sprinklered* to NFPA 13, and
d) 45 m from the access route to the entrance door, for non-residential portions of a *building*, which are cut off from and have no internal access to the remainder of the *building*. (See Note A-3.2.5.5.(3)(d).)

4) The access route from the hydrant location to the *building* location or from the hydrant location to the principal entrance of the *building* as described in Sentences (5) and (6), shall be no more than 90 m. (See Note A-3.2.5.5.(4).)

5) Where the access route runs continuously across the face of a *building*, the length of the access route shall be measured by measuring the shortest distance between a line drawn perpendicular to the access route and through the hydrant and a line drawn perpendicular to the access route and through the principal entrance of the *building*. (See Note A-3.2.5.5.(5).)

6) Where the access route terminates before the principal entrance of a *building*, the length of the access route shall be measured by measuring from a line drawn perpendicular to the access route and through the hydrant straight along the access route to its terminus and thereafter along the actual path of travel to the principal entrance. (See Note A-3.2.5.5.(6).)

3.2.5.6. Design of Access Routes and Paths of Travel

1) A portion of a roadway or yard provided as a required access route for fire department use shall
a) have a clear width not less than 6 m, unless it can be shown that lesser widths are satisfactory,
b) have a centre-line radius not less than 12 m,
c) have an overhead clearance not less than 5 m,
d) have a change of gradient not more than 1 in 12.5 over a minimum distance of 15 m,
e) be designed to support the expected loads imposed by firefighting equipment and be surfaced with concrete, asphalt or other material designed to permit accessibility under all climatic conditions,

f) have turnaround facilities for any dead-end portion of the access route more than 90 m long, and
g) be connected with a public thoroughfare.

(See Note A-3.2.5.6.(1).)

2) For *buildings* conforming to Article 3.2.2.50. or 3.2.2.58., no portion of the access route described in Sentence 3.2.2.10.(3) shall be more than 20 m below the uppermost floor level.

3) The unobstructed path of travel for firefighters from the curb to the main entrance or suite entrance door as required in Sentences 3.2.5.5.(1) to (3) and every access opening as required in Articles 3.2.5.1. and 3.2.5.2. shall be

a) no less than
   i) 1.2 m in width, or
   ii) 900 mm in width where serving not more than one *dwelling unit* or *ancillary residential unit*, and
b) surfaced with concrete, asphalt or similar material.

(See Note A-3.2.5.6.(3).)

3.2.5.7. Water Supply

1) Every *building* shall be provided with an adequate water supply for firefighting. (See Note A-3.2.5.7.(1).)

2) Buildings that are *sprinklered* throughout with a sprinkler system conforming to Article 3.2.5.12. or have a standpipe system conforming to Article 3.2.5.8. to 3.2.5.10. are deemed to comply with Sentence (1).

3.2.5.8. Standpipe Systems

1) Except as permitted by Sentence 3.2.5.9.(4), a standpipe system shall be installed in a *building* that is

a) more than 3 *storeys* in *building height*,
b) more than 14 m high measured between *grade* and the ceiling of the top *storey*, or
c) not more than 14 m high measured between *grade* and the ceiling of the top *storey* but has a *building area* exceeding the area shown in Table 3.2.5.8. for the applicable *building height* unless the *building* is *sprinklered* throughout.

Table 3.2.5.8.
Building Limits without Standpipe Systems
Forming Part of Sentence 3.2.5.8.(1)

Occupancy **Classification**	*Building Area*, **m^2**		
	1 *storey*	**2** *storeys*	**3** *storeys*
Group A	2 500	2 000	1 500
Group C	2 000	1 500	1 000
Group D	4 000	3 000	2 000
Group F, Division 2	1 500	1 500	1 000
Group F, Division 3	3 000	2 000	1 000

3.2.5.9. Standpipe System Design

1) Except as provided in Sentences (2) to (8), Articles 3.2.5.10. and 3.2.5.11., and Sentence 3.2.4.9.(2), the design, construction, installation and testing of a standpipe system shall conform to NFPA 14, “Installation of Standpipe and Hose Systems.”

2) A dry standpipe that is not connected to a water supply shall not be considered as fulfilling the requirements of this Article.

3) If more than one standpipe is provided, the total water supply need not be more than 30 L/s.
4) A standpipe need not be installed in a *storage garage* conforming to Article 3.2.2.90., provided the *building* is not more than 15 m high.
5) The residual water pressure at the design flow rate at the topmost hose connection of a standpipe system that is required to be installed in a *building* is permitted to be less than 690 kPa provided
a) the *building* is *sprinklered* throughout,
b) the water supply at the base of the sprinkler riser is capable of meeting, without a fire pump, the design flow rate and pressure demand of the sprinkler system, including the inside and outside hose allowance, and
c) fire protection equipment is available to deliver, by means of the fire department connection, the full demand flow rate at a residual water pressure of 690 kPa at the topmost hose connection of the standpipe system. (See Note A-3.2.5.9.(5)(c).)
6) A fire department connection shall be provided for every standpipe system.
7) If a standpipe system is required by Sentence 3.2.5.8.(1) and an *exit* stair shaft is not provided in the *building*, a standpipe system may be omitted if
a) a 64 mm diameter fire department hose connection is located adjacent to the path of travel for firefighters and is connected to a fire department connection in conformance with 3.2.5.15., and
b) the hose connection shall be available to reach all portions of the area with 30 m of hose plus 9 m of hose stream distance.
8) A standpipe system may be omitted from *dwelling units* where
a) the *building* is of *residential occupancy* throughout,
b) the path of travel may not exceed 15 m from the principal entrance of *suite* to the *fire department access route*,
c) egress from each *suite* complies with Sentence 3.3.4.4.(3), and
d) the travel distance from any point on the *floor area* to the primary entrance of each *suite* does not exceed 30 m.

3.2.5.10. Hose Connections

1) Hose connections shall be located in *exits*, in accordance with NFPA 14, “Installation of Standpipe and Hose Systems.”
2) Hose connections are not required within a *floor area*.
3) Hose connections shall be provided with sufficient clearance to permit the use of a standard fire department hose key.
4) Except as permitted by Sentence (5), 64 mm diam hose connections shall be installed in a standpipe system.
5) Hose connections for 64 mm diam hose are not required in a *building* that is not more than 25 m high, measured between *grade* and the ceiling level of the top *storey* and in which an automatic sprinkler system is not installed.

3.2.5.11. Hose Stations

1) Hose stations for 38 mm diam hose shall be installed for a standpipe system in a *building* that is not *sprinklered* throughout.
2) Hose stations for a 38 mm diam hose shall be installed for a standpipe system within every *floor area* that is not *sprinklered* throughout. (See Note A-3.2.5.11.(2).)
3) Hose stations shall be located in the *floor area* within 5 m of *exits* and at other locations to provide coverage of the entire *floor area*.
4) A hose station located on one side of a *horizontal exit* shall be considered to serve only the *floor area* on that side of the *horizontal exit*.
5) A hose cabinet shall be located so that its door, when fully opened, will not obstruct the required width of a *means of egress*.

6) Where a *building* or part thereof is used as a *distillery* and the *building* is *sprinklered* in conformance with Article 3.2.5.12., small hose (38 mm) stations are permitted to be supplied from interior sprinkler piping.
7) Where a hose station is provided in grain handling and storage facilities in which *combustible dusts* are produced in quantities or concentrations that create an explosion or fire hazard, fog and fine spray nozzles shall be used instead of nozzles that discharge a solid stream of water to prevent *combustible dusts* from being raised into suspension.

3.2.5.12. Automatic Sprinkler Systems

1) Except as permitted by Sentences (2), (3) and (4), an automatic sprinkler system shall be designed, constructed, installed and tested in conformance with NFPA 13, "Installation of Sprinkler Systems." (See Note A-3.2.5.12.(1).)
2) Instead of the requirements of Sentence (1), NFPA 13R, "Installation of Sprinkler Systems in Low-Rise Residential Occupancies," is permitted to be used for the design, construction and installation of an automatic sprinkler system installed
- a) in a *building* of Group C *major occupancy* containing no other *major occupancies* that
  - i) is not more than 4 *storeys* in *building height* and conforms to Articles 3.2.2.47., 3.2.2.48., 3.2.2.50., 3.2.2.51. or 3.2.2.54., or
  - ii) is not more than 3 *storeys* in *building height* and conforms to Article 9.10.1.3., or
- b) in a *building* of *care occupancy* with not more than 10 occupants that is not more than 3 *storeys* in *building height* and conforms to one of Articles 3.2.2.42. to 3.2.2.46.

(See Note A-3.2.5.12.(2).)
3) Instead of the requirements of Sentence (1), NFPA 13D, "Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes," is permitted to be used for the design, *construction*, installation and testing of an automatic *sprinkler system* installed
- a) in a residential *building* with not more than two principal *dwelling units*, where
  - i) each *dwelling unit* has its own sprinkler water supply, and
  - ii) a one tank-type water closet is supplied with water from the sprinkler head which is located farthest from the main water supply,
- b) in a *building* of *care occupancy*, provided
  - i) it contains not more than 2 *suites* of *care occupancy*,
  - ii) it has not more than 5 residents throughout, and
  - iii) a 30-minute water supply demand can be met,
- c) in a *building* of *residential occupancy* throughout that contains only *row housing* where
  - i)all vertical *suite* separations are constructed as a *fire separation* having no less than a 1 h *fire-resistance rating*,
  - ii)the *fire separation* described in Subclause (c)(ii) provides continuous protection from the top of the footing to the underside of the roof deck and any space between the top of the wall and the roof deck is tightly fitted with mineral wool or *noncombustible* material,
  - iii)each *dwelling unit* has its own sprinkler water supply, and
  - iv)one tank-type water closet is supplied with water from the sprinkler head which is located farthest from the main water supply, or
- d) in an *ancillary residential building* where
  - i) each bathroom, clothes closet, linen closet, and pantry must have sprinkler coverage, notwithstanding the exemptions set out in NFPA 13D,
  - ii) sprinklers are provided in each attached garage or carport, notwithstanding the exemptions set out in NFPA 13D,
  - iii) a one tank-type water closet is supplied with water from the sprinkler head which is located farthest from the main water supply,
  - iv) the path of travel for firefighters complies with Clause 3.2.5.5.(3)(a), and
  - v) each *dwelling unit* has direct access to an exterior *exit* facility complying with Sentence 3.3.4.4.(3);

4) If a *building* contains fewer than 9 sprinklers, the water supply for these sprinklers is permitted to be supplied from the domestic water system for the *building* provided the required flow for the sprinklers can be met by the domestic system.
5) If a water supply serves both an automatic sprinkler system and a system serving other equipment, control valves shall be provided so that either system can be shut off independently.
6) Notwithstanding the requirements of the standards referenced in Sentences (1) and (2) regarding the installation of automatic sprinkler systems, sprinklers shall not be omitted in any room or closet in the *storey* immediately below a roof assembly. (See Note A-3.2.5.12.(6).)
7) Fast response sprinklers shall be installed in *residential occupancies*, *care occupancies*, *treatment occupancies* and *detention occupancies*.
(See Note A-3.2.5.12.(7).)
8) Notwithstanding the requirements of the standards referenced in Sentences (1) and (2) regarding the installation of automatic sprinkler systems, in *buildings* conforming to Article 3.2.2.50. or 3.2.2.58., sprinklers shall be provided for balconies and decks exceeding 610 mm in depth measured perpendicular to the exterior wall. (See Note A-3.2.5.12.(8).)
9) Sprinklers in elevator machine rooms shall have a temperature rating not less than that required for an intermediate temperature classification and shall be protected against physical damage. (See Note A-3.2.5.12.(9).)
10) Except as provided in Subsection 3.2.8., closely spaced sprinklers and associated draft stops need not be installed around floor openings in conformance with NFPA 13, "Installation of Sprinkler Systems",
11) Notwithstanding Sentences (1) and (2) and except as permitted by Sentence (12), automatic sprinkler protection shall be provided for all unenclosed balconies, exterior decks, porches and patios of *buildings sprinklered* to NFPA 13R or NFPA 13 if

a) the framing or cladding is of *combustible construction*,
b) the depth of balcony, deck, porch, or patio is more than 1200 mm, and
c) the balcony, roof overhang or structure above is more than 300 mm overlapping the balcony, deck or patio below and is located less than 3 m above the finished floor of the balcony, deck or patio below.

12) Automatic sprinkler protection for an unenclosed exterior balcony of a residential *building* may be omitted if

a) the *building* is of *noncombustible construction*, and
b) the exterior wall assembly adjoining the balcony and the exterior ceiling assembly covering the balcony are constructed with *noncombustible* materials.

13) Notwithstanding the requirements of the standards referenced by Sentence (3) regarding the installation of automatic *sprinkler systems*, sprinklers shall be provided in any *storage garage* attached to a *building* of *residential occupancy* where a *fire separation* is not provided between the *storage garage* and adjacent *floor areas*.

3.2.5.13. Combustible Sprinkler Piping

1) Combustible sprinkler piping shall be used only for sprinkler systems in *residential occupancies* and other light-hazard *occupancies*. (See Note A-3.2.5.13.(1).)
2) Combustible sprinkler piping shall meet the requirements of ULC/ORD-C199P, "Combustible Piping for Sprinkler Systems."
3) Except as permitted by Sentence (5), *combustible* sprinkler piping shall be separated from the area served by the sprinkler system, and from any other *fire compartment*, by ceilings, walls, or soffits consisting of, as a minimum,

a) lath and plaster,
b) gypsum board not less than 9.5 mm thick,
c) plywood not less than 13 mm thick, or
d) a suspended membrane ceiling with
    i) steel suspension grids, and

ii) lay-in panels or tiles having a mass not less than 1.7 kg/m^2.

4) Except as permitted by Sentence (5), *combustible* sprinkler piping may be located above a ceiling provided that the distance between the edge of any ceiling opening that is not protected in conformance with Sentence (3) and the nearest sprinkler is not more than 300 mm.

5) Where *combustible* sprinkler piping has been tested in conformance with ULC/ORD-C199P, "Combustible Piping for Sprinkler Systems," and has been shown to meet the requirements therein without additional protection, conformance to Sentences (3) and (4) is not required.

3.2.5.14. Sprinklered Service Space

1) An automatic sprinkler system shall be installed in a *service space* referred to in Sentence 3.2.1.1.(8) if flooring for access within the *service space* is other than catwalks.

2) The sprinkler system required by Sentence (1) shall be equipped with waterflow detecting devices, with each device serving not more than one *storey*.

3) The waterflow detecting devices required by Sentence (2) shall be connected to the fire alarm system, to

a) initiate an *alert signal* in a 2-stage system or an *alarm signal* in a single stage system, and

b) indicate separately on the fire alarm system annunciator the actuation of each device.

3.2.5.15. Fire Department Connections

(Also See A-3.2.5.5.)

1) The fire department connection for a standpipe system shall be located horizontally within 5 m of the principal entrance of a *building*, have unobstructed access for a distance of not less than 1 m and be visible from the *street*.

2) The fire department connection for an automatic sprinkler system shall be located horizontally within 5 m of the principal entrance of a *building*, have unobstructed access for a distance of not less than 1 m and be visible from the *street*.

3.2.5.16. Portable Fire Extinguishers

1) Portable extinguishers shall be provided and installed in accordance with the Fire By-law.

2) In a Group B, Division 1 *major occupancy*, portable fire extinguishers are permitted to be located in secure areas, or in lockable cabinets provided

a) identical keys for all cabinets are located at all supervisory or security stations, or

b) electrical remote release devices are provided and are connected to an emergency power supply.

3.2.5.17. Protection from Freezing

1) Equipment forming part of a fire protection system shall be protected from freezing if

a) it could be adversely affected by freezing temperatures, and

b) it is located in an unheated area.

3.2.5.18. Fire Pumps

1) If a fire pump is installed, it shall be installed in accordance with the requirements of NFPA 20, "Installation of Stationary Pumps for Fire Protection." (See Note A-3.2.5.18.(1).)

3.2.5.19. Location of Building Safety Facilities for Firefighters

1) Fire fighting installations and *building* safety facilities including central control facility, firefighters' elevator and stairwells equipped with standpipes shall be centrally located in close proximity to the firefighters' entrance.

3.2.5.20. Radio Antenna Systems

(See Note A-3.2.5.20.).

1) Except as permitted by Sentence (2), an *acceptable* radio antenna system shall be installed in every *building* that

a) is more than 6 *storeys* in *building height*,
b) contains more than 1 *storey* in the basement, or
c) contains more than 1200 m² of *floor area* in the basement.

2) A radio antenna system shall not be required for

a) government *buildings* requiring security against transfer of signals inside and outside of *buildings*, and
b) where, in the opinion of the *Chief Building Official*, in consultation with the Fire Chief, radio signals compromise the intended use of the *building*.

3) A radio antenna system shall provide not less than 98% coverage at in each of the following critical locations in the *building*

a) *exit* stair shafts,
b) *exit* corridors,
c) *public corridors,*
d) corridors used by the public,
e) corridors serving classrooms or patients' sleeping rooms,
f) within 5 m of the fire alarm control unit,
g) within 5 m of the central alarm and control facility,
h) within-5 m of the fire alarm annunciator,
i) fire pump room,
j) emergency generator room,
k) electrical service and transformer room,
l) elevator machine room,
m) elevator lobbies,
n) elevator hoistways,
o) corridors in the basement and not within a *suite*, and
p) *storage garages* and associated vehicle ramps.

3.2.6. Additional Requirements for High Buildings

(See Note A-3.2.6.)

3.2.6.1. Application

1) Except as permitted by Sentence (2), this Subsection applies to a *building*

a) more than 18 m in height, measured between grade and the uppermost floor level of the top *storey*, or
b) with a *floor area* or part of a *floor area* located above the third *storey* designed or intended as a Group B, Division 2 or Group B, Division 3 *major occupancy*.

2) A *building* or that portion of a *building* separated in accordance with Division A, Article 1.3.3.4., need not comply with the requirements of this Subsection, provided

a) the *building* or that portion of a *building* does not exceed 6 storeys in *building height*,
b) the *building* or that portion of a *building* does not contain a *floor area* or part of a *floor area* located above the third *storey* designed or intended as a Group B, Division 2 or Group B, Division 3 *major occupancy*,
c) the principal entrance for fire fighters is located on the *storey* which requires vertical travel to the topmost floor level to be not more than 18 m,
d) except where vestibules designed to limit movement of smoke from a fire in a *floor area* below the lowest *exit storey* into upper *storeys* are provided, stairs and elevators shall not directly connect more than 6 consecutive *storeys* (See Note A-3.2.6.2.(4).), and
e) *exit* stair enclosures are provided with not less than a 2 h *fire separation*.
f) the *building* sprinklers are designed in accordance with NFPA 13 "Installation of Sprinkler Systems", except that the design area of the *floor areas* above the *basement* shall be twice the

design area otherwise permitted by NFPA 13 "Installation of Sprinkler Systems" after all reductions in design area have been applied.
(See Note A-3.2.6.1.(2).)

3.2.6.2. Limits to Smoke Movement

1) A *building* to which this Subsection applies shall be designed in accordance with Sentences (2) to (6) and Article 3.2.6.3. to limit the danger to occupants and firefighters from exposure to smoke in a *building* fire.
2) A *building* referred to in Sentence (1) shall be designed so that, during a period of 2 h after the start of a fire, each *exit* stair serving *storeys* below the lowest *exit level* will not contain more than 1% by volume of contaminated air from the fire floor, assuming an outdoor temperature equal to the January design temperature on a 2.5% basis determined in accordance with Subsection 1.1.3. (See Note A-3.2.6.2.(2).)
3) Each stairway that serves *storeys* above the lowest *exit level* shall have a vent to the outdoors, at or near the bottom of the stair shaft, that

a) has an openable area of 0.05 m^2 for every door between the stair shaft and a *floor area*, but not less than 1.8 m^2,
b) opens directly to the outdoors or into a vestibule that has a similar opening to the outdoors, and
c) has a door or *closure* that
  i) is openable manually, and
  ii) can remain in the open position during a fire emergency.

(See Note A-3.2.6.2.(3).)
4) Measures shall be taken to limit movement of smoke from a fire in a *floor area* below the lowest *exit storey* into upper *storeys*. (See Note A-3.2.6.2.(4).)
5) Except for exhaust fans in kitchens, washrooms and bathrooms in *dwelling units*, and except for fans used for smoke venting as required by Article 3.2.6.6., air moving fans in a system that serves more than 2 *storeys* shall be designed and installed so that in the event of a fire these fans can be stopped by means of a manually operated switch at the central alarm and control facility.
6) Except as provided in Article 3.2.4.12. or where there is a conflict with other smoke control measures in the *building*, air-handling systems used to provide make-up air to *public corridors* serving *suites* in a Group C *major occupancy* shall not shut down automatically upon activation of the fire alarm so as to maintain corridor pressurization.

3.2.6.3. Connected Buildings

1) If a *building* described in Article 3.2.6.1. is connected to any other *building*, measures shall be taken to limit movement of contaminated air from one *building* into another during a fire. (See Note A-3.2.6.3.(1).)

3.2.6.4. Emergency Operation of Elevators

1) Automatic and manual emergency recall shall be provided for all elevators serving *storeys* above the *first storey*.
2) Key-operated switches for emergency recall required by Sentence (1) shall be provided in a conspicuous location at

a) each elevator lobby on the recall level, and
b) the central alarm and control facility required by Article 3.2.6.7.

3) In-car emergency service switches shall be provided in all elevator cars.
4) Keys to operate the switches required by Sentences (2) and (3) shall be

a) provided in a suitably identified box conspicuously located on the outside of an elevator hoistway near the central alarm and control facility required by Article 3.2.6.7., and
b) kept at the central alarm and control facility.

5) The automatic emergency recall provided in accordance with Sentence (1) shall be activated by

a) *smoke detectors* installed in each *floor area* in front of the elevator(s), or
b) the *building* fire alarm system.

6) Where *smoke detectors* as provided in accordance with Sentence (5), are activated on the recall level, the automatic emergency recall signal shall automatically direct the elevator to an alternate floor level.
7) *Smoke detectors* provided in accordance with Sentence (5) shall be designed as part of the *building* fire alarm system.

3.2.6.5. Elevator for Use by Firefighters

1) At least one elevator shall be provided for use by firefighters in conformance with Sentences (2) to (6).
2) The elevator referred to in Sentence (1) shall have a useable platform area not less than 2.2 m^2 and shall be capable of carrying a load of 900 kg to the top floor that it serves from a landing on the *storey* containing the entrance for firefighter access referred to in Articles 3.2.5.4. and 3.2.5.5. within 1 min.
3) Each elevator for use by firefighters shall

a) be provided with a *closure* at each shaft opening so that the interlock mechanism remains mechanically engaged and electrical continuity is maintained in the interlock circuits and associated wiring for a period of not less than 1 h when the assembly is subjected to the standard fire exposure described in CAN/ULC-S104, "Fire Tests of Door Assemblies,"
b) be protected with a vestibule containing no *occupancy* and separated from the remainder of the *floor area* by a *fire separation* having a *fire-resistance rating* not less than 45 min, or
c) be protected with a corridor containing no *occupancy* and separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

4) Except as permitted by Sentence (5), an elevator referred to in Sentence (1) shall be capable of providing transportation from the *storey* containing the entrance for firefighter access referred to in Articles 3.2.5.4. and 3.2.5.5. to every floor that is above *grade* in the *building* and that is normally served by the elevator system.
5) If it is necessary to change elevators to reach any floor referred to in Sentence (4), the system shall be designed so that not more than one change of elevator is required when travelling to any floor in the *building* from the *storey* containing the entrance for firefighter access referred to in Articles 3.2.5.4. and 3.2.5.5.
6) Deleted.

3.2.6.6. Venting to Aid Firefighting

1) Means of venting each *floor area* to the outdoors shall be provided by windows, wall panels, smoke shafts, or the *building* exhaust system. (See Note A-3.2.6.6.(1).)
2) Fixed glass windows shall not be used for the venting required by Sentence (1) if the breaking of the windows could endanger pedestrians below.
3) Openable windows used for the venting required by Sentence (1) shall be permanently marked so that they are easily identifiable.
4) Elevator hoistways shall not be designed for the venting required by Sentence (1).

3.2.6.7. Central Alarm and Control Facility

1) A central alarm and control facility shall be provided on the *storey* containing the entrance for firefighter access referred to in Articles 3.2.5.4. and 3.2.5.5. in a location that

a) is readily accessible to firefighters entering the *building*, and
b) takes into account the effect of background noise likely to occur under fire emergency conditions, so that the facility can properly perform its required function under these conditions. (See Note A-3.2.6.7.(1).)

2) The central alarm and control facility required by Sentence (1) shall include

a) means to control the voice communication system required by Article 3.2.6.8., so that messages can be sent to
i) all loudspeakers simultaneously,
ii) individual *floor areas*, and
iii) exit stairwells,
b) means to indicate audibly and visually *alert signals* and *alarm signals* and a switch to

i) silence the audible portion of these signals, and
ii) indicate visually that the audible portion has been silenced,

c) means to indicate visually that elevators are on emergency recall,
d) an annunciator conforming to Article 3.2.4.8.,
e) means to transmit *alert signals* and *alarm signals* to the fire department in conformance with Article 3.2.4.7.,
f) means to release hold-open devices on doors to vestibules,
g) means to manually actuate *alarm signals* in the *building* selectively to any zone or zones,
h) means to silence the *alarm signals* referred to in Clause (g) in conformance with Sentences 3.2.4.22.(2) and 3.2.4.22.(3),
i) means, as appropriate to the measure for fire safety provided in the *building*, to

i) actuate auxiliary equipment identified in Articles 3.2.6.2., 3.2.6.3. and 3.2.6.6., or
ii) communicate with a continually staffed auxiliary equipment control centre,

j) means to communicate with telephones in elevator cars, separate from connections to firefighters' telephones, if elevator cars are required by ASME A17.1/CSA B44, "Safety Code for Elevators and Escalators," to be equipped with a telephone,
k) means to indicate visually, individual sprinkler system waterflow signals,
l) means to indicate audibly and visually, sprinkler and standpipe system supervisory signals and trouble signals,
m) a switch to silence the audible portion of a supervisory signal or a trouble signal, and
n) visual indication that the audible portion of a supervisory signal or a trouble signal has been silenced.

(See Note A-3.2.6.7.(2).)

3.2.6.8. Voice Communication System

1) A voice communication system or systems conforming to Article 3.2.4.22. shall be provided in all *buildings* conforming to Article 3.2.6.1.

a) **deleted,**
b) **deleted.**

3.2.6.9. Testing

1) The systems for control of smoke movement and mechanical venting required by Articles 3.2.6.2. and 3.2.6.6. shall be tested to ensure satisfactory operation. (See Note A-3.2.6.9.(1).)

3.2.7. Lighting and Emergency Power Systems

3.2.7.1. Minimum Lighting Requirements

1) An *exit*, a *public corridor*, or a corridor providing *access to exit* for the public or serving patients' sleeping rooms or classrooms shall be equipped to provide illumination to an average level not less than 50 lx at floor or tread level and at angles and intersections at changes of level where there are stairs or ramps.
2) The minimum value of the illumination required by Sentence (1) shall be not less than 10 lx.
3) Rooms and spaces used by the public shall be illuminated as described in Article 9.34.2.7.
4) Lighting outlets in a *building* of *residential occupancy* shall be provided in conformance with Subsection 9.34.2.

3.2.7.2. Recessed Lighting Fixtures

1) A recessed lighting fixture shall not be located in an insulated ceiling unless the fixture is designed for this type of installation.

3.2.7.3. Emergency Lighting

1) Emergency lighting shall be provided to an average level of illumination not less than 10 lx at floor or tread level in

a) *exits*,
b) principal routes providing *access to exit* in open *floor areas* and in *service rooms*,
c) corridors used by the public,
d) corridors serving sleeping rooms in a *treatment occupancy*,
e) corridors serving sleeping rooms in a *care occupancy*, except corridors serving sleeping rooms within individual *suites* of *care occupancy*,
f) corridors serving classrooms,
g) underground *walkways*,
h) *public corridors*,
i) *floor areas* or parts thereof where the public may congregate
  i) in Group A, Division 1 *occupancies*, or
  ii) in Group A, Division 2 and 3 *occupancies* having an *occupant load* of 60 or more,
j) *floor areas* or parts thereof where persons are cared for that are within daycare facilities, including *child care facilities*,
k) food preparation areas in commercial kitchens, and
l) public washrooms.

2) Emergency lighting to provide an average level of illumination of not less than 10 lx at floor or catwalk level shall be included in a *service space* referred to in Sentence 3.2.1.1.(8).
3) The minimum value of the illumination required by Sentences (1) and (2) shall be not less than 1 lx.
4) In addition to the requirements of Sentences (1) to (3), the installation of battery-operated emergency lighting in *buildings* or part thereof where *treatment* is provided shall conform to the appropriate requirements of CSA Z32, "Electrical Safety and Essential Electrical Systems in Health Care Facilities."

3.2.7.4. Emergency Power for Lighting

1) An emergency power supply shall be

a) provided to maintain the emergency lighting required by this Subsection from a power source such as batteries or generators that will continue to supply power in the event that the regular power supply to the *building* is interrupted, and
b) so designed and installed that upon failure of the regular power it will assume the electrical load automatically for a period of
  i) 2 h for a *building* within the scope of Subsection 3.2.6.,
  ii) 1 h for a *building* of Group B *major occupancy* classification that is not within the scope of Subsection 3.2.6.,
  iii) 1 h for a *building* constructed in accordance with Article 3.2.2.50. or 3.2.2.58., and
  iv) 30 min for a *building* of any other *occupancy*.

(See Note A-3.2.7.4.(1).)
2) If self-contained emergency lighting units are used, they shall conform to CSA C22.2 No. 141, "Emergency Lighting Equipment."

3.2.7.5. Emergency Power Supply Installation

1) Except as required by Articles 3.2.7.6. and 3.2.7.7., an emergency electrical power supply system shall be installed in conformance with CSA C282, "Emergency Electrical Power Supply for Buildings." (See Sentence 3.2.7.8.(1) for emergency electrical power supply for voice communication systems.)

3.2.7.6. Emergency Power for Treatment Occupancies

1) Except as required by Article 3.2.7.7., an emergency electrical power supply system for emergency equipment required by this Part for *treatment occupancies* shall be installed in conformance with CSA Z32, "Electrical Safety and Essential Electrical Systems in Health Care Facilities." (See Note A-3.2.7.6.(1).)

3.2.7.7. Fuel Supply Shut-off Valves

1) If a liquid or gas fuel-fired engine or turbine for an emergency electric power supply is dependent on a fuel supply from outside the *building*, the fuel supply shall be provided with a suitably-identified separate shut-off valve outside the *building*.

3.2.7.8. Emergency Power for Fire Alarm Systems

1) Fire alarm systems, including those incorporating a voice communication system, shall be provided with an emergency power supply conforming to Sentences (2), (3) and (4).

2) The emergency power supply required by Sentence (1) shall be supplied from

a) a generator,

b) batteries, or

c) a combination thereof.

3) The emergency power supply required by Sentence (1) shall be capable of providing

a) supervisory power for not less than 24 h, and

b) immediately following that period, emergency power under full load for not less than

i) 2 h for a *building* within the scope of Subsection 3.2.6.,

ii) 1 h for a *building* classified as a Group B *major occupancy* that is not within the scope of Subsection 3.2.6.,

iii) 1 h for a *building* constructed in accordance with Article 3.2.2.50. or 3.2.2.58.,

iv) 5 min for a *building* not required to be equipped with an annunciator, and

v) 30 min for any other *building*.

(See Note A-3.2.7.8.(3).)

4) The emergency power supply required by Sentence (1) shall be designed so that, in the event of a failure of the normal power source, there is an immediate automatic transfer to emergency power with no loss of information.

3.2.7.9. Emergency Power for Building Services

1) An emergency power supply capable of operating under a full load for not less than 2 h shall be provided by an emergency generator for

a) every elevator serving *storeys* above the *first storey* in a *building* that is more than 18 m high measured between *grade* and the floor level of the top *storey* and every elevator for firefighters in conformance with Sentence (2),

b) water supply for firefighting in conformance with Article 3.2.5.7., if the supply is dependent on electrical power supplied to the *building*,

c) fans and other electrical equipment that are installed to maintain the air quality specified in Articles 3.2.6.2. and 3.3.3.6.,

d) fans required for venting by Article 3.2.6.6., and

e) fans required by Clause 3.2.8.4.(1)(c) and Article 3.2.8.7. in *buildings* within the scope of Subsection 3.2.6.

(See Note A-3.2.7.9.(1).)

2) Except as permitted by Sentence (3), the emergency power supply for elevators required by Clause (1)(a) shall be capable of operating all elevators for firefighters plus one additional elevator simultaneously.

3) Sentence (2) does not apply if the time to recall all elevators under emergency power supply is not more than 5 min, each from its most remote *storey* to

a) the *storey* containing the entrance for firefighter access referred to in Articles 3.2.5.4. and 3.2.5.5., or

b) to a transfer lobby.

3.2.7.10. Protection of Electrical Conductors

1) Electrical and emergency conductors referred to in Clauses (a) to (c) shall be protected against exposure to fire, for a period of no less than 1 h, from the source of the emergency power supply to the branch circuits serving equipment, if

a) electrical conductors located within *buildings* identified in Article 3.2.6.1. are serving

i) fire alarms,

ii) emergency lighting, or

iii) emergency equipment within the scope of Articles 3.2.6.2. to 3.2.6.8.,

b) emergency conductors are serving fire pumps, and

c) electrical conductors are serving mechanical systems and auxillary equipment

i) that serve areas of refuge identified in Clause 3.3.3.6.(1)(b),

ii) that serve contained use areas identified in Clauses 3.3.3.7.(4)(a) and (b),or

iii) intended for fire and life safety purposes.

(See Note A-3.2.7.10.(1).)

2) Except as otherwise required by Sentence (3) and permitted by this Article, electrical conductors that are used in conjunction with systems identified in Sentence (1) shall

a) conform to CAN/ULC-S139, "Fire Test for Evaluation of Integrity of Electrical Power, Data and Optical Fibre Cables," including the hose stream application, to provide a circuit integrity rating of not less than 1 h (See Note A-3.2.7.10.(2)(a) and (3)(a).), or

b) be located in a *service space* that is separated from the remainder of the *building* by a *fire separation* that has a *fire-resistance rating* not less than 1 h.

3) Electrical conductors identified in Clause (1)(c) shall

a) conform to CAN/ULC-S139, "Fire Test for Evaluation of Integrity of Electrical Power, Data and Optical Fibre Cables," including the hose stream application, to provide a circuit integrity rating of not less than 2 h (See Note A-3.2.7.10.(2)(a) and (3)(a).), or

b) be located in a *service space* that is separated from the remainder of the *building* by a *fire separation* that has a *fire-resistance rating* not less than 2 h.

4) The *service spaces* referred to in Clauses (2)(b) and (3)(b) shall not contain any *combustible* materials other than the conductors being protected.

5) Except as stated in Sentences (7) and (9), the electrical conductors referred to in Sentence (1) are those that extend from the source of emergency power to

a) the equipment served, or

b) the distribution equipment supplying power to the equipment served, if both are in the same room. (See Note A-3.2.7.10.(5)(b).)

6) If a fire alarm transponder or annunciator in one *fire compartment* is connected to a central processing unit or another transponder or annunciator located in a different *fire compartment*, the electrical conductors connecting them shall be protected in accordance with Sentence (2).

7) Fire alarm system branch circuits within a *storey* that connect transponders and individual devices need not conform to Sentence (2). (See Note A-3.2.7.10.(7).)

8) Except as permitted in Sentence (9), if a distribution panel supplies power to emergency lighting, the power supply conductors leading up to the distribution panel shall be protected in accordance with Sentence (2).

9) Conductors leading from a distribution panel referred to in Sentence (8) to emergency lighting units in the same *storey* need not conform to Sentence (2).

10) Distribution panels serving emergency lighting units located on other *storeys* shall be installed in a *service room* separated from the *floor area* by a *fire separation* having a *fire-resistance rating* of at least 1 h.

11) Conductors leading from a distribution panel to emergency lighting units located on other *storeys* shall be protected in accordance with Sentence (2) between the distribution panel and the *floor area* where the emergency lighting units are located.

3.2.8. Mezzanines and Openings through Floor Assemblies

3.2.8.1. Application

1) Except as permitted by Article 3.2.8.2. and Sentence 3.3.4.2.(3), the portions of a *floor area* or a *mezzanine* that do not terminate at an exterior wall, a *firewall* or a vertical shaft shall

a) terminate at a vertical *fire separation* having a *fire-resistance rating* not less than that required for the floor assembly and extending from the floor assembly to the underside of the floor or roof assembly above, or

b) be protected in conformance with the requirements of Articles 3.2.8.3. to 3.2.8.8.

2) The penetration of a floor assembly by an *exit* or a *vertical service space* shall conform to the requirements of Sections 3.4., 3.5. and 3.6.

3) A *floor area* containing sleeping rooms in a *building* of Group B, Division 2 *major occupancy* shall not be constructed as part of an *interconnected floor space*.

3.2.8.2. Exceptions to Special Protection

1) A *mezzanine* need not terminate at a vertical *fire separation* nor be protected in conformance with the requirements of Articles 3.2.8.3. to 3.2.8.8. provided the *mezzanine*

a) serves a Group A, Division 1 *major occupancy*,

b) serves a Group A, Division 3 *major occupancy* in a *building* not more than 2 *storeys* in *building height*, or

c) serves a Group A, C, D, E or F *major occupancy* and

i) is 500 m^2 or less in area, and

ii) conforms to Sentence 3.2.1.1.(3) or (4).

2) Except for floors referred to in Sentence 3.1.10.3.(1) and Article 3.2.1.2., openings through a horizontal *fire separation* for vehicular ramps in a *storage garage* are not required to be protected with *closures* and need not conform to this Subsection.

3) If a *closure* in an opening in a *fire separation* would disrupt the nature of a manufacturing process, such as a continuous flow of material from *storey* to *storey*, the *closure* for the opening is permitted to be omitted provided precautions are taken to offset the resulting hazard. (See Note A-3.2.8.2.(3).)

4) An *interconnected floor space* in a Group B, Division 1 *occupancy* need not conform to the requirements of Articles 3.2.8.3. to 3.2.8.8. provided the *interconnected floor space* does not interconnect more than 2 adjacent *storeys*.

5) Except as permitted by Sentence (6), openings for escalators and inclined moving walks need not conform to the requirements in Articles 3.2.8.3. to 3.2.8.8. provided

a) the opening for each escalator or walk does not exceed 10 m^2,

b) the *building* is *sprinklered* throughout,

c) the *interconnected floor space* contains only Group A, Division 1, 2 or 3, Group D or Group E *major occupancies* (See Note A-3.2.8.2.(6)(c).), and

d) closely spaced sprinklers and associated draft stops shall be installed around the openings in conformance with NFPA 13, “Installation of Sprinkler Systems”.

6) An *interconnected floor space* need not conform to the requirements of Articles 3.2.8.3. to 3.2.8.8., provided

a) it consists of the *first storey* and the *storey* next above or below it, but not both,

b) it is *sprinklered* throughout or, where the *building area* is not more than one half of the area permitted by Subsection 3.2.2., the openings through the floor are used only for stairways, escalators or moving walks (See Note A-3.2.8.2.(6)(b).), and

c) it contains only Group A, Division 1, 2 or 3, Group D, Group E, or Group F, Division 2 or 3 *major occupancies*. (See Note A-3.2.8.2.(6)(c).)

3.2.8.3. Sprinklers

1) A *building* containing an *interconnected floor space* shall be *sprinklered* throughout.

2) Except for large floor openings as defined in NFPA 13, “Installation of Sprinkler Systems”, closely spaced sprinklers and associated draft stops shall be installed around floor openings in conformance with NFPA 13.

3.2.8.4. Vestibules

1) An *exit* opening into an *interconnected floor space* shall be protected at each opening into the *interconnected floor space* by a vestibule

a) with doorways that are not less than 1.8 m apart,

b) that is separated from the remainder of the *floor area* by a *fire separation* that is not required to have a *fire-resistance rating* (See Note A-3.1.8.1.(1)(b).), and

c) that is designed to limit the passage of smoke so that the *exit* stair shaft does not contain more than 1% by volume of contaminated air from the fire floor, assuming an outdoor temperature equal to the January design temperature on a 2.5% basis determined in accordance with Subsection 1.1.3. (See Note A-3.2.8.4.(1)(c).)

2) An *exit* opening into an *interconnected floor space* shall conform to Sentence 3.4.3.2.(6).

3) If an elevator hoistway opens into an *interconnected floor space* and into *storeys* above the *interconnected floor space*, either the elevator doors opening into the *interconnected floor space* or the elevator doors opening into the *storeys* above the *interconnected floor space* shall be protected by vestibules conforming to Sentence (1).

3.2.8.5. Protected Floor Space

1) A *protected floor space* used to satisfy the requirements of Clause 3.4.3.2.(6)(b) shall

a) be separated from the *interconnected floor space* by a *fire separation* having a *fire-resistance rating* not less than that required for the floor assembly of the *storey* in which it is located,

b) have all openings in the vertical *fire separation* between a *protected floor space* and the adjacent *interconnected floor space* protected by vestibules conforming to Sentence 3.2.8.4.(1), and

c) be designed so that it is not necessary to enter the *interconnected floor space* to reach an *exit*.

3.2.8.6. Draft Stops

1) A draft stop shall be provided at each floor level within an *interconnected floor space*, immediately adjacent to and surrounding the opening, and shall be not less than 500 mm deep measured from ceiling level down to the underside of the draft stop.

3.2.8.7. Mechanical Exhaust System

1) A mechanical exhaust system shall be provided to remove air from an *interconnected floor space* at a rate of 4 air changes per hour. (See Note A-3.2.8.7.(1).)

2) The mechanical exhaust system required by Sentence (1) shall be actuated by a switch located on the *storey* containing the entrance for firefighter access referred to in Articles 3.2.5.4. and 3.2.5.5. near the annunciator for the fire alarm system.

3.2.8.8. Combustible Content Limits

1) An *interconnected floor space* shall be designed so that the *combustible* contents, excluding interior finishes, in those parts of a *floor area* in which the ceiling is more than 8 m above the floor, are limited to not more than 16 g of *combustible* material for each cubic metre of volume of the *interconnected floor space*.

3.2.9. Integrated Fire Protection and Life Safety Systems

3.2.9.1. Testing

1) Where fire protection and life safety systems and systems with fire protection and life safety functions are integrated with each other, they shall be tested as a whole in accordance with CAN/ULC-S1001, “Integrated Systems Testing of Fire Protection and Life Safety Systems,” to verify that they have been properly integrated. (See Note A-3.2.9.1.(1).)

Section 3.3. Safety within Floor Areas

(See Note A-3.3.)

3.3.1. All Floor Areas

3.3.1.1. Separation of Suites

1) Except as permitted by Sentences (2) to (4), a *suite* shall be separated from adjoining *suites* by a *fire separation* having a *fire-resistance rating* not less than 1 h.
(See also Subsection 3.3.3. for *care*, *treatment* or *detention occupancies*, Article 3.3.4.2. for *residential occupancies*, and Article 3.1.8.7. for *fire dampers*.)

2) The *fire-resistance rating* of the *fire separation* required by Sentence (1) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or

b) the floor assembly below the *floor area*, if there is no floor assembly above.

3) *Occupancies* that are served by *public corridors* conforming to Clause 3.3.1.4.(4)(b) in a *building* that is *sprinklered* throughout, are not required to be separated from one another by *fire separations* provided the *occupancies* are

a) *suites* of *business and personal services occupancy*,

b) fast food vending operations that do not provide seating for customers,

c) *suites* of *mercantile occupancy*, or

d) any combination of these occupancies.

4) No *fire separation* is required between *suites* of *business and personal services occupancy*.

5) Except as permitted by Sentence (6), each *suite* other than a residential *suite*, located at ground level and having direct access to the street shall be separated from horizontally and vertically adjoining *suites* by a *fire separation* having a *fire-resistance rating* not less than 2 h.

6) The *fire separation* required by Sentence (5) need not be provided to a *storage garage* (See Article 3.3.5.6.).

3.3.1.2. Hazardous Substances, Equipment and Processes

1) Except as provided in Subsections 3.3.5. and 3.3.6., the storage, handling and use of hazardous substances shall be in conformance with the applicable requirements of

a) the Fire By-law, and

b) provincial regulations or other regulatory enactments.

(See Note A-3.3.1.2.(1).)

2) Systems for the ventilation of cooking equipment that is not within a *dwelling unit* and is used in processes producing grease-laden vapours shall be designed and installed in conformance with Articles 3.6.3.5., 6.3.1.7. and 6.9.1.3. (See Note A-3.3.1.2.(2).)

3) A fuel-fired *appliance* shall not be installed in a corridor serving as an *access to exit*.

3.3.1.3. Means of Egress

1) Access to exit within *floor areas* shall conform to Subsections 3.3.2. to 3.3.5., in addition to the requirements of this Subsection.

2) If a podium, terrace, platform or contained open space is provided, egress requirements shall conform to the appropriate requirements of Sentence 3.3.1.5.(1) for rooms and *suites*.

3) Means of egress shall be provided from every roof which is intended for *occupancy*, and from every podium, terrace, platform or contained open space.

4) At least two separate *means of egress* shall be provided from a roof, used or intended for an *occupant load* more than 60, to stairs designed in conformance with the requirements regarding *exit* stairs stated in Section 3.4.

5) A roof-top enclosure shall be provided with an *access to exit* that leads to an *exit*
a) at the roof level, or
b) on the *storey* immediately below the roof.

6) A roof-top enclosure which is more than 200 m^2 in area shall be provided with at least 2 *means of egress*.

7) Two points of egress shall be provided for a *service space* referred to in Sentence 3.2.1.1.(8) if
a) the area is more than 200 m^2, or
b) the travel distance measured from any point in the *service space* to a point of egress is more than 25 m.

8) Except as permitted by Sentences 3.3.4.4.(5) and (6), each *suite* in a *floor area* that contains more than one *suite* shall have
a) an exterior *exit* doorway, or
b) a doorway
i) into a *public corridor*, or
ii) to an exterior passageway.

9) Except as permitted by this Section and by Sentence 3.4.2.1.(2), at the point where a doorway referred to in Sentence (8) opens onto a *public corridor* or exterior passageway, it shall be possible to go in opposite directions to each of 2 separate *exits*.

3.3.1.4. Public Corridor Separations

1) Except as otherwise required by this Part or as permitted by Sentence (4), a *public corridor* shall be separated from the remainder of the *storey* by a *fire separation*.

2) Except as permitted by Sentence (3) and Clauses (4)(a) and (b), the *fire separation* between a *public corridor* and the remainder of the *storey* shall have a *fire-resistance rating* not less than 45 min.

3) If a *storey* is *sprinklered* throughout, no *fire-resistance rating* is required for a *fire separation* between a *public corridor* and the remainder of the *storey*, provided the corridor does not serve a *care*, *treatment* or *detention occupancy* or a *residential occupancy*. (See Note A-3.1.8.1.(1)(b).)

4) No *fire separation* is required in a *sprinklered floor area* between a *public corridor* and
a) except as required by Sentences 3.3.3.5.(8) and 3.3.4.2.(1), and notwithstanding Sentence 3.4.2.4.(2), the remainder of a *storey*, provided the travel distance from any part of the *floor area* to an *exit* is not more than 45 m,
b) a room or a *suite*, provided the *public corridor* complies with Sentence 3.3.1.9.(6) and Clause 3.4.2.5.(1)(d), or
c) a space containing plumbing fixtures required by Subsection 3.7.2., provided the space and the *public corridor* are separated from the remainder of the *storey* by a *fire separation* having a *fire-resistance rating* not less than that required between the *public corridor* and the remainder of the *storey*.

3.3.1.5. Egress Doorways

1) Except for *dwelling units*, a minimum of 2 egress doorways located so that one doorway could provide egress from the room or *suite* as required by Article 3.3.1.3. if the other doorway becomes inaccessible to the occupants due to a fire which originates in the room or *suite*, shall be provided for every room and every *suite*
a) that is used for a *high-hazard industrial occupancy* and whose area is more than 15 m^2,
b) intended for an *occupant load* more than 60,
c) in a *floor area* that is not *sprinklered* throughout, and
i) the area of a room or *suite* is more than the value in Table 3.3.1.5.-A, or
ii) the travel distance within the room or *suite* to the nearest egress doorway is more than the value in Table 3.3.1.5.-A, or
d) in a *floor area* that is *sprinklered* throughout and does not contain a *high-hazard industrial occupancy* and
i) the travel distance to an egress doorway is more than 25 m, or

ii) the area of the room or *suite* is more than the value in Table 3.3.1.5.-B.

2) Where 2 egress doorways are required by Sentence (1), they shall be placed at a distance from one another equal to or greater than one third of the maximum overall diagonal dimension of the area to be served, measured as the shortest distance that smoke would have to travel between the nearest required egress doors.

Table 3.3.1.5.-A
Egress in Floor Area not Sprinklered Throughout
Forming Part of Sentence 3.3.1.5.(1)

Occupancy of Room or *Suite*	Maximum Area of Room or *Suite*, m^2	Maximum Distance to Egress Doorway, m
Group A	150	15
Group C	100(1)	15(1)
Group D	200	25
Group E	150	15
Group F, Division 2	150	10
Group F, Division 3	200	15

Notes to Table 3.3.1.5.-A:
See Article 3.3.4.4. for *dwelling units*.

Table 3.3.1.5.-B
Egress in Floor Area Sprinklered Throughout
Forming Part of Sentence 3.3.1.5.(1)

Occupancy of Room or *Suite*	Maximum Area of Room or *Suite*, m^2
Group A	200
Group B, Division 1	100
Group B, Division 2	
sleeping rooms	100
other than sleeping rooms	200
Group B, Division 3	
sleeping rooms not in *suites*	100
individual *suites*	150
other than sleeping rooms	200
Group C	150(1)
Group D	300
Group E	200

Group F, Division 2	200
Group F, Division 3	300

Notes to Table 3.3.1.5.-B:
See Article 3.3.4.4. for *dwelling units*.

3.3.1.6. Travel Distance

1) If more than one egress doorway is required from a room or *suite* referred to in Article 3.3.1.5., the travel distance within the room or *suite* to the nearest egress doorway shall not exceed the maximum travel distances specified in Clauses 3.4.2.5.(1)(a), (b), (c) and (f) for *exits*.

3.3.1.7. Deleted.

3.3.1.8. Headroom Clearance

1) Except within the *floor area* of a *storage garage*, the minimum headroom clearance in every *access to exit* shall conform to the requirements of Article 3.4.3.4. for *exits*. (See also Sentence 3.3.5.4.(5).)

3.3.1.9. Corridors

1) The minimum width of a *public corridor* shall be 1 100 mm.
2) Except as required by Sentence 3.3.3.3.(3), the minimum unobstructed width of a corridor used by the public or a corridor serving classrooms or patients' sleeping rooms shall be 1 100 mm.
3) Except as permitted by Sentence (4), obstructions located within 1 980 mm of the floor shall not project more than 100 mm horizontally into an *exit* passageway, a *public corridor*, a corridor used by the public or a corridor serving classrooms or patients' sleeping rooms in a manner that would create a hazard for a person with a visual disability traveling adjacent to the walls.
4) The horizontal projection of an obstruction referred to in Sentence (3) is permitted to be more than 100 mm provided the clearance between the obstruction and the floor is less than 680 mm. (See Note A-3.3.1.9.(4).)
5) If a corridor contains an *occupancy*, the *occupancy* shall not reduce the unobstructed width of the corridor to less than its required width.
6) If a *public corridor* conforming to Clause 3.4.2.5.(1)(d) contains an *occupancy*,
- a) the *occupancy* shall be located so that for pedestrian travel there is an unobstructed width not less than 3 m at all times adjacent and parallel to all rooms and *suites* that front onto the *public corridor*, and
- b) the combined area of all *occupancies* in the *public corridor* shall be not more than 15% of the area of the *public corridor*.

7) Except for a dead-end corridor that is entirely within a *suite* or as permitted by Sentences 3.3.3.3.(1) and 3.3.4.4.(6), a dead-end corridor is permitted provided it is not more than 6 m long.

3.3.1.10. Aisles

1) Except as otherwise stated in this Section, aisles shall be provided in conformance with the Fire By-law.

3.3.1.11. Door Swing

1) Except as permitted by Sentence (5) and Article 3.3.1.12., a door that opens into a corridor or other facility providing *access to exit* from a *suite* or room not located within a *suite* shall swing on a vertical axis.
2) Except as permitted by Article 3.3.1.12., a door that opens into a corridor or other facility providing *access to exit* from a room or *suite* that is used or intended for an *occupant load* more than 60 or for a *high-hazard industrial occupancy* shall swing in the direction of travel to the *exit*.
3) Every door that divides a corridor that is not wholly contained within a *suite* shall swing on a vertical axis in the direction of travel to the *exit*.

4) If a pair of doors is installed in a corridor that provides *access to exit* in both directions, the doors shall swing in opposite directions, with the door on the right hand side swinging in the direction of travel to the *exit*.
5) Doors that serve storage *suites* not more than 28 m^2 in area in warehousing *buildings* need not conform to Sentence (1).

3.3.1.12. Sliding Doors

1) Except as permitted by Sentences (2) and 3.3.1.11.(5), a sliding door provided in the locations described in Article 3.3.1.11. shall
  a) be designed and installed to swing on the vertical axis in the direction of travel to the *exit* when pressure is applied, and
  b) be identified as a swinging door by means of a label or decal affixed to it.
2) In a Group B, Division 1 *occupancy*, or in an *impeded egress zone* in other *occupancies*, sliding doors used in an *access to exit* need not conform to Sentence (1) and Article 3.3.1.11.
3) Movable *partitions* used to separate a *public corridor* from an adjacent *business and personal services occupancy* or a *mercantile occupancy* need not conform to Sentence (1) and Sentences 3.3.1.11.(1) and (2), provided the *partitions* are not located in the only *means of egress*. (See Note A-3.3.1.12.(3).)

3.3.1.13. Doors and Door Hardware

1) Except as required by Article 3.3.3.4., a door that opens into or is located within a *public corridor* or other facility that provides *access to exit* from a *suite* shall
  a) provide a clear opening of not less than 800 mm if there is only one door leaf,
  b) in a doorway with multiple leaves, have the active leaf providing a clear opening of not less than 800 mm,
  c) not open onto a step, and
  d) have a threshold conforming to Sentence (11), except where it
    i) is used to confine the spillage of *flammable liquids* within a *service room* or within a room in an *industrial occupancy*, or
    ii) provides access to an exterior balcony, unless the balcony is required by Clause 11.3.7.1.(1)(c).
2) Except as provided in Sentences (6) and (7), a door in an *access to exit* shall be readily openable in travelling to an *exit* without requiring keys, special devices or specialized knowledge of the door-opening mechanism.
3) Except as permitted by Sentence (4), door release hardware shall comply with Clause 3.8.3.8.(1)(c) and the door shall be openable with not more than one releasing operation. (See also Sentence 3.8.3.6.(4).)
4) An egress door from an individual *dwelling unit* or from a *suite* of *residential occupancy* is permitted to be provided with additional devices that require a releasing operation additional to the main door release hardware, provided the devices are readily operable from the inside without the use of keys, special devices or specialized knowledge. (See Note A-3.3.1.13.(4).)
5) Except as provided in Sentence 3.4.6.17.(9), door release hardware shall be installed between 900 mm and 1100 mm above the finished floor.
6) An egress door in an *access to exit* serving a *contained use area* or an *impeded egress zone* is permitted to be equipped with locking devices, provided they can be released either locally or remotely in conformance with Sentence (8) or (9). (See Note A-3.3.1.13.(6).)
7) A door in an *access to exit* is permitted to be equipped with an electromagnetic lock conforming to Sentence 3.4.6.16.(4) or (5). (See Note A-3.3.1.13.(7).)
8) Local locking devices permitted by Sentence (6) shall be operable by a key from both sides of the door.
9) Controls for the remote release of door locking devices permitted by Sentence (6) shall be located in an area readily available to security personnel.
10) Locking devices permitted by Sentence (6) that are electrically operated shall be
  a) designed to operate on emergency power, and

b) capable of manual release by security personnel.

11) Except in locations described in Subclauses (1)(d)(i) and (ii), in doorways, where the threshold is not flush with the floor, the threshold shall be not more than 13 mm higher than the finished floor surface, and where it is higher than 6 mm, shall be beveled to a slope no steeper than 1 in 2.

12) Door assemblies providing *access* shall be designed in accordance with Subsection 3.8.3.

3.3.1.14. Ramps and Stairways

1) Except as permitted by Sentence (2), Article 3.3.1.16., Article 3.3.4.7. and Subsection 3.3.2., ramps and stairways that do not serve as *exits* shall conform to the requirements for *exit* ramps and stairways stated in Sentence 3.4.3.2.(8) and Articles 3.4.3.4., and 3.4.6.1. to 3.4.6.9.

2) Ramps and stairways that serve *service rooms*, *service spaces* or *industrial occupancies* need not comply with Sentence (1), provided

a) they are intended only for occasional use for servicing equipment and machinery, and

b) they do not serve as *exits*.

3.3.1.15. Exterior Passageways

1) An exterior passageway leading to a required *exit* shall conform to the requirements of Section 3.4. for exterior *exit* passageways.

3.3.1.16. Tapered Treads in a Curved Flight

1) Flights of stairs shall consist solely of

a) straight *flights*, or

b) curved *flights* complying with Sentence (2).

(See also Articles 3.3.1.14. and 3.4.6.9.)

2) Tapered treads in a curved *flight* that is not required as an *exit* shall have

a) a minimum *run* of 150 mm,

b) a *run* not less than 280 mm when measured at a point 300 mm from the centre line of the handrail at the narrow end of the tread, and

c) a riser conforming to Sentence 3.4.6.8.(2).

3) Tapered treads shall have a consistent angle and uniform *run* and rise dimensions in accordance with the construction tolerances stipulated in Article 3.4.6.8. when measured at a point 300 mm from the centre line of the handrail at the narrow end of the tread.

4) All *tapered treads* within a *flight* shall turn in the same direction.

3.3.1.17. Capacity of Access to Exits

(See Article 3.3.1.9. for minimum widths of corridors.)

1) The capacity of an *access to exit* shall be based on the *occupant load* of the portion of the *floor area* served.

2) In an *access to exit* the required width of ramps with a slope not more than 1 in 8, doorways, and corridors shall be based on not less than 6.1 mm per person.

3) In an *access to exit* the required width of a ramp with a slope more than 1 in 8 shall be based on not less than 9.2 mm per person.

4) In an *access to exit* from a *floor area* used or intended to be used for patients in a Group B, Division 2 *occupancy* or residents in a Group B, Division 3 *occupancy*, the required width of corridors, doorways, and ramps shall be based on not less than 18.4 mm per person.

5) The capacity of stairs in an *access to exit* shall conform to the requirements for stairs in Sentences 3.4.3.2.(1) to (3).

6) In a *building* that is not *sprinklered* throughout in accordance with Sentence 3.2.5.12.(1), an *access to exit* that is part of the principal entrance serving a dance hall or a licensed beverage establishment with an *occupant load* more than 250 shall provide at least one half of the required *exit* width.

3.3.1.18. Guards

1) Except as provided in Sentence (5) and Article 3.3.2.9., a *guard* not less than 1 070 mm high shall be provided

a) around any roof to which access is provided for purposes other than maintenance,

b) at openings into smoke shafts referred to in Subsection 3.2.6. that are less than 1 070 mm above the floor, and

c) at each raised floor, *mezzanine*, balcony, gallery, interior or exterior vehicular ramp, and at other locations where (See Note A-9.8.8.1.)

i) the difference in elevation is more than 600 mm between the walking surface and the adjacent surface, or

ii) the adjacent surface within 1.2 m of the walking surface has a slope of more than 1 in 2.

2) Except as provided in Sentence 3.3.2.9.(4) and Articles 3.3.4.7. and 3.3.5.10., openings through *guards* shall be of a size that prevents the passage of a spherical object whose diameter is more than 100 mm.

3) Deleted.

4) Except for *guards* conforming to Article 3.3.5.10., *guards* shall be designed so that no member, attachment or opening located between 140 mm and 900 mm above the level protected by the *guard* facilitates climbing. (See Note A-9.8.8.6.(1).)

5) Sentence (1) does not apply

a) to the front edges of *stages*,

b) to loading docks, or

c) where access is provided for maintenance purposes only.

6) Swimming pools greater than 450 mm deep shall be protected in conformance with Article 9.8.8.1.

3.3.1.19. Transparent Doors and Panels

1) Except as permitted by Sentence (5), a glass or transparent door shall be designed and constructed so that the existence and position of the door is readily apparent, by attaching visually contrasting hardware, bars or other permanent fixtures to it.

2) The visibility of fully glazed transparent doors, sidelights and panels shall be enhanced through the inclusion of mullions, markings or other elements that

a) are visually contrasting,

b) are at least 50 mm high,

c) extend the full width of the door, sidelight or panel, and

d) are located between 1 350 mm and 1 500 mm above the floor.

3) A glass door shall be constructed of

a) laminated or tempered safety glass conforming to CAN/CGSB-12.1-M, “Tempered or Laminated Safety Glass,” or

b) wired glass conforming to CAN/CGSB-12.11-M, “Wired Safety Glass.”

4) Except as permitted by Sentence (5), transparent panels used in an *access to exit* that, because of their physical configuration or design, could be mistaken as a *means of egress* shall be made inaccessible by barriers or railings.

5) Sliding glass *partitions* that separate a *public corridor* from an adjacent *occupancy* and that are open during normal working hours need not conform to Sentences (1) and (4), provided the *partitions* are suitably marked in conformance with Sentence (2) to indicate their existence and position.

6) Where vision glass is provided in doors or transparent sidelights, the lowest edge of the glass shall be no higher than 900 mm above floor level.

7) Glass in doors and in sidelights that could be mistaken for doors, within or at the entrances to *dwelling units* and in public areas, shall conform to the requirements of Article 9.6.1.4.

8) A window in a public area that extends to less than 1 000 mm above the floor and is located above the second *storey* in a *building* of *residential occupancy*, shall be protected by a barrier or railing to not less than

1 070 mm above the floor, or the window shall be non-openable and designed to withstand the lateral design loads for balcony *guards* required by Article 4.1.5.14.

9) An openable window which has a width of 380 mm or less, is located less than 1 070 mm above interior floor level, and which opens to a space more than 600 mm below the level of the interior floor, shall be protected by a *guard*, in conformance with Article 3.3.1.18.

10) An openable window which has a width greater than 380 mm, is located less than 1 070 mm above interior floor level, and which opens to a space more than 600 mm below the level of the interior floor, shall be protected by

a) an opening mechanism that limits the unobstructed opening to no more than 100 mm measured either vertically or horizontally, or

b) a guard in conformance with Article 3.3.1.18.

3.3.1.20. Exhaust Ventilation and Explosion Venting

1) Except as provided in Sentence (2), an exhaust ventilation system designed in conformance with the appropriate requirements of Part 6 shall be provided in a *building* or part of a *building* in which dust, fumes, gases, vapour or other impurities or contaminants have the potential to create a fire or explosion hazard. (See also Article 4.2.4.13.)

2) Where a *fire separation* required to have a *fire-resistance rating* is penetrated by a ventilation system required by Sentence (1) for power-ventilated enclosures in laboratories, the ducts shall be

a) continuously enclosed from the first penetrated *fire separation* to any subsequent *fire separations* or concealed spaces and all the way through to the outdoors so that the highest *fire-resistance rating* of all the penetrated *fire separations* is maintained, and

b) exempted from the requirement to be equipped with a *fire damper*, smoke damper and fire/smoke damper as stated in Article 3.1.8.7.

3) Explosion relief devices, vents or other protective measures conforming to Subsection 6.3.1. and Article 6.9.1.2. shall be provided for a space in which substances or conditions that have the potential to create an explosion hazard are present as a result of the principal use of a *building*.

3.3.1.21. Janitors' Rooms

1) Except as permitted by Sentences (2) and (3), a room or space within a *floor area* for the storage of janitorial supplies shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

2) The *fire-resistance rating* of the *fire separation* required by Sentence (1) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or

b) the floor assembly below the *floor area*, if there is no floor assembly above.

3) The *fire separation* required by Sentence (1) is not required to have a *fire-resistance rating* if the *floor area* in which the room or space is located is *sprinklered* throughout.

3.3.1.22. Common Laundry Rooms

1) Except as permitted by Sentences (2) and (3), in a *building* of *residential occupancy*, a laundry room in a *floor area* that is not within a *dwelling unit* shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

2) The *fire-resistance rating* of the *fire separation* required by Sentence (1) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or

b) the floor assembly below the *floor area*, if there is no floor assembly above.

3) The *fire separation* required by Sentence (1) is not required to have a *fire-resistance rating* if the *floor area* in which the laundry room is located is *sprinklered* throughout.

3.3.1.23. Obstructions

1) No obstruction shall be permitted in any *occupancy* that would restrict the width of a normal *means of egress from any part of a floor area* to less than 750 mm unless an alternative *means of egress* is provided adjacent to, accessible from, and plainly visible from the obstructed *means of egress*. (See Note A-3.3.1.23.(1).)

3.3.1.24. Signs in Service Spaces

1) Illuminated signs conforming to Sentences 3.4.5.1.(2) and (6) shall be provided to indicate the direction to egress points in a *service space* referred to in Sentence 3.2.1.1.(8).

3.3.1.25. Welding and Cutting

1) Except as provided in Sentence (2), welding and cutting operations shall be carried out in a room

- a) separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h, or
- b) protected by an automatic fire extinguishing system.

2) Sentence (1) shall not apply to *industrial occupancies* where the welding and cutting operations do not present a fire or explosion hazard to adjacent areas.

3.3.2. Assembly Occupancy

3.3.2.1. Scope

1) This Subsection applies to *assembly occupancies* and to outdoor places of assembly.

2) Except as required in Sentence (3), provisions 12.2.3.2, 12.2.3.3, 12.2.5.4, 12.2.5.5, 12.2.5.6, 12.2.11.1, 12.4.1 and 12.4.2 of Chapter 12 of NFPA 101, "Life Safety Code," are permitted to be used in lieu of Articles 3.3.2.4., 3.3.2.5., 3.3.2.9., 3.3.2.11. and 3.3.2.12. (See Note A-3.3.2.1.(2).)

3) The minimum clear width of aisle accessways between rows of seats shall be calculated according to provisions 12.2.5.5.2, 12.2.5.5.4.1 and 12.2.5.5.5.1 of Chapter 12 of NFPA 101, "Life Safety Code," except that in no case shall the width be less than 400 mm.

3.3.2.2. Fire Separations

1) Except as permitted by Sentence (2), the seating area of a Group A, Division 1 *occupancy* shall be separated from adjacent *occupancies* in the *floor area* by a *fire separation* having a *fire-resistance rating* not less than 1 h if the *occupant load* in the seating area exceeds 200.

2) The *fire-resistance rating* of the *fire separation* required by Sentence (1) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

- a) the floor assembly above the *floor area*, or
- b) the floor assembly below the *floor area*, if there is no floor assembly above.

3) If usable space exists under tiers of seats in arena-type *buildings*, a *fire separation* with a *fire-resistance rating* not less than 45 min shall be provided between the space and the seats or the space shall be *sprinklered*.

3.3.2.3. Non-fixed Seating

1) Non-fixed seating shall conform to the Fire By-law.

3.3.2.4. Fixed Seats

1) Except for the requirements of Article 3.3.2.8. for bench-type seats and except as required or permitted by Sentence (2) and Articles 3.3.2.11. and 3.3.2.12., fixed seats in places of assembly shall be

- a) attached or secured to the floor, platform or platform riser,
- b) provided with arms and back, and

c) arranged in rows having an unobstructed passage not less than 400 mm wide measured horizontally between plumb lines from the backs of the seats in one row and the edges of the furthest forward projection of the seats in the next row in the unoccupied position.

2) For fixed seats with backs and with folding tablet arms, the value of 400 mm required by Clause (1)(c) shall be measured when the tablet arms are in the use position, but is permitted to be measured in the stored position provided

a) there are not more than 7 seats between any seat and the nearest aisle,

b) the seats are located in a lecture hall or an auditorium used for instructional purposes, and

c) the tablet arm, when raised manually to a vertical position, falls by the force of gravity to the stored position.

(See Note A-3.3.2.4.(2).)

3) Except as permitted by Sentence (4), aisles shall be located so that there are not more than 7 seats with backs or 20 seats without backs between any seat and the nearest aisle.

4) The requirements of Sentence (3) do not apply if

a) egress doorways are provided to serve both ends of rows of seats,

b) each doorway referred to in Clause (a) serves not more than 3 rows of seats, and

c) each row contains not more than 100 seats.

3.3.2.5. Aisles

1) Except as required by Articles 3.3.2.11. and 3.3.2.12., aisles leading to exits shall be provided in conformance with Sentences (2) to (17) in places of assembly which contain fixed seats.

2) The minimum clear width of aisles shall be not less than 1 100 mm, except that the width is permitted to be reduced to not less than

a) 750 mm if serving not more than 60 seats, and

b) 900 mm if serving seats on one side only.

3) Except in the case of bleacher seats, the minimum clear width of aisles referred to in Sentence (2) shall be measured at the point farthest from an *exit*, cross aisle or foyer and shall be increased by 25 mm for each metre of distance toward the *exit*, cross aisle or foyer.

4) Aisles shall terminate in a cross aisle, foyer or *exit*, and the width of the cross aisle, foyer or *exit* shall be not less than the required width of the widest aisle plus 50% of the total required width of the remaining aisles that it serves.

5) Dead-end aisles shall be not more than 6 m long.

6) The length of travel to an *exit* door by any aisle shall be not more than 45 m.

7) Side aisles shall be not less than 1 100 mm wide if seating is provided in conformance with Sentence 3.3.2.4.(4).

8) An aisle that has a slope not more than 1 in 8 shall not be stepped.

9) An aisle that slopes more than 1 in 8 shall be stepped.

10) The passageway between rows of seats served by a stepped aisle shall be level at right angles to the line of travel.

11) The riser of a step in an aisle shall be

a) not less than 110 mm high, and

b) not more than 200 mm high.

12) Variations are permitted in riser height provided

a) the height of adjacent risers does not vary by more than 6 mm, and

b) the width of a tread or a platform in the direction of travel is not less than 430 mm.

13) Steps in an aisle shall

a) have a *run* not less than 230 mm exclusive of nosings,

b) have a tread width not less than 250 mm,

c) extend to the adjacent rows of seats in a manner that will not create a hazard from tripping, and

d) have a finish on the treads conforming to Sentence 3.4.6.1.(1).

14) The location of every riser in an aisle shall be made apparent from both directions of travel by strategically placed lighting or contrasting marking stripes.
15) A platform in an aisle shall be level, except that a slope not more than 1 in 50 is permitted for a platform that is not less than 430 mm wide in the direction of *exit* travel.
16) If a step is used at the entry to a row of seats from a stepped aisle, an unobstructed platform not less than 800 mm square shall be provided adjacent to the aisle.
17) The finish of the surface of a platform in or adjacent to a stepped aisle shall conform to Sentence 3.4.6.1.(1).

3.3.2.6. Corridors

1) Except as permitted by Sentences (2) to (4), a corridor used by the public in an *assembly occupancy* as an *access to exit* shall be separated from the remainder of the *floor area* by a *fire separation* having a *fire-resistance rating* not less than 1 h.
2) The *fire-resistance rating* of the *fire separation* required by Sentence (1) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or
b) the floor assembly below the *floor area*, if there is no floor assembly above.

3) The *fire-resistance rating* required by Sentence (1) is permitted to be waived if the *floor area* in which the corridor is located is *sprinklered* throughout.
4) The requirement for a *fire separation* stated in Sentence (1) is permitted to be waived if the distance from any point in the *floor area* to an *exit* measured along the path of travel to the *exit* does not exceed the travel distance permitted by Article 3.4.2.5.

3.3.2.7. Doors

1) A door equipped with a latching mechanism in an *access to exit* from a room or *suite* of *assembly occupancy* containing an *occupant load* more than 100 shall be equipped with a device that will release the latch and allow the door to swing wide open when a force not more than that specified in Sentence 3.8.3.6.(8) is applied to the device in the direction of travel to the *exit*.

3.3.2.8. Fixed Bench-Type Seats without Arms

1) If fixed bench-type seats without arms are provided, the seat width per person shall be assumed to be 450 mm.
2) The centre-to-centre spacing between rows of bench-type seats shall be not less than 760 mm if back rests are provided, and not less than 550 mm if back rests are not provided.
3) A clear space of not less than 300 mm shall be provided between the back of each seat and the front of the seat immediately behind it.

3.3.2.9. Guards

1) Except as required by Sentences (2) to (4) for bleacher seats, *guards* shall be installed in outdoor and indoor places of assembly with fixed seats so that

a) at the fascia of every box, balcony or gallery where the seats extend to the edge, the height of *guards* is not less than

i) 760 mm in front of the seats, and
ii) 920 mm if located at the end of aisles or at the foot of steps,

b) the height of *guards* along every cross aisle other than those adjacent to the fascia of every box, balcony or gallery is not less than 660 mm, except that *guards* need not be provided if the backs of the seats along the front side of the aisle are not less than 600 mm above the floor of the aisle, and
c) where the seating is arranged in successive tiers and the height of rise between platforms is more than 450 mm, the height of *guards* is not less than 660 mm along the entire row of seats at the edge of the platform.

2) The backs and ends of bleacher seats more than 1 200 mm above the ground or floor that are not adjacent to a wall shall be protected with a *guard*

a) not less than 1 070 mm high above an adjacent aisle surface or foot rest, and

b) not less than 920 mm high above the centre of an adjacent seat board.

3) If the front of a bleacher is more than 600 mm above the ground or floor, it shall be protected with a *guard* not less than 840 mm high above the front foot rest.

4) The size of any opening in a *guard* required by Sentences (2) and (3) shall not allow the passage of a sphere whose diameter is more than 300 mm.

3.3.2.10. Handrails in Aisles with Steps

(See Note A-3.3.2.10.)

1) Handrails shall be provided in aisles with steps in conformance with Table 3.3.2.10.

Table 3.3.2.10.
Types and Location of Handrails in Aisles with Steps
Forming Part of Sentence 3.3.2.10.(1)

Aisle Width	Aisle Serving Seating on One Side	Aisle Serving Seating on Both Sides
	Handrail Requirements	
Less than 1 100 mm	a continuous handrail located on the side of the aisle opposite the seats that conforms to Sentences 3.4.6.5.(5) to (8), (11), (13) and (14)	a handrail located on one side at the end of each row of seats that conforms to Sentences 3.4.6.5.(5) to (8), (11), (13) and (14)
1 100 mm or more	a centre-line handrail that conforms to Sentence (2) or a continuous handrail located on the side of the aisle opposite the seats that conforms to Sentences 3.4.6.5.(5) to (8), (11), (13) and (14), plus a handrail located at the end of each row of seats that conforms to Sentences 3.4.6.5.(5) to (8), (11), (13) and (14)	a centre line handrail that conforms to Sentence (2)

2) Handrails installed along aisle centre lines as required by Table 3.3.2.10. shall

a) comply with Sentences 3.4.6.5.(5) to (7) and (14),

b) have gaps not less than 560 mm and not more than 915 mm wide, measured horizontally, at intervals not exceeding five rows,

c) comply with Sentence 3.4.6.5.(11) at terminations and required gaps, and

d) have an intermediate rail located 305 mm below the principal handrail.

3.3.2.11. Outdoor Places of Assembly

1) A Group A, Division 4 *occupancy* and each tier or balcony that has a capacity of more than

a) 1 000 persons shall have not less than 3 separate *exits*, or

b) 4 000 persons shall have not less than 4 separate *exits*.

2) In a Group A, Division 4 *occupancy*, every seat shall be located so that the travel distance is not more than 45 m measured along the path of travel from the seat to

a) the ground,

b) an *exit*,

c) an opening to a passageway leading from the seating area, or

d) a portal, a vomitory or any other opening through the seating deck structure.

3) Exits from outdoor stadia or grandstands shall be located not more than 25 m apart.
4) The capacity of a *means of egress* for a Group A, Division 4 *occupancy* shall conform to the requirements of Sentence 3.4.3.2.(3).
5) Aisles in a Group A, Division 4 *occupancy* shall
a) be located so that there are not more than 20 seats between any seat and the nearest aisle, and
b) be not less than 1 200 mm wide, except that an aisle serving less than 60 persons is permitted to be 750 mm wide.

3.3.2.12. Bleachers

1) Steps provided in aisles of bleachers of the telescopic type shall
a) have risers not more than 250 mm high, and
b) have treads with a *run* not less than 280 mm.
2) If the vertical distance between seating platforms in bleachers is more than 280 mm, an intermediate step shall be provided the full width of the aisle and proportioned to provide 2 equal risers between platforms.
3) If the vertical distance between seating platforms in bleachers is more than 450 mm, 2 intermediate steps shall be provided the full width of the aisle so that there are 3 equal risers between platforms.
4) If the passageway between rows of seats is not a closed deck, footboards shall be provided so that
a) the total width of the footboards shall be not less than three quarters of the centre-to-centre spacing between rows of seats, and
b) the spacing between footboard members shall be not more than 25 mm.
5) Openings above footboards and below the seats in rows of bleacher seats shall be provided with intermediate construction so that there is no opening that would permit the passage of a sphere of more than 100 mm in diameter.

3.3.2.13. Libraries

1) Except as permitted by Sentence (2), a library book storage room that is not normally accessible to the public shall be separated from the remainder of the *building* by a *fire separation* with a *fire-resistance rating* not less than 2 h if it
a) is more than 250 m^2 in area, or
b) contains book stacks that
i) are more than 10 m high, or
ii) penetrate more than one floor assembly.
2) The *fire separation* required by Sentence (1) is not required if the book storage room is *sprinklered*.
3) Open book shelves are permitted above and below a *mezzanine* floor in a library *building* provided the height of the shelves is not more than 2.1 m but not more than 75% of the floor-to-ceiling height of the space above or below the *mezzanine* floor assembly.

3.3.2.14. Stages for Theatrical Performances

1) A *stage* for theatrical performances and ancillary spaces, including workshops, dressing rooms and storage areas, shall be *sprinklered*.
2) A *fire separation* with a *fire-resistance rating* not less than 1 h shall be provided between a *stage* for theatrical performances and ancillary spaces, including workshops, dressing rooms and storage areas.
3) Except as permitted by Sentence (6), a *stage* for theatrical performances and ancillary spaces, including workshops, dressing rooms and storage areas, shall be separated from the seating area by a *fire separation* having a *fire-resistance rating* not less than 1 h, except for a proscenium opening protected with
a) a sprinkler deluge system conforming to the requirements of NFPA 13, “Installation of Sprinkler Systems,”
b) an unframed fire curtain if the opening is not more than 20 m wide, or
c) a semi-rigid fire curtain if the opening is more than 20 m wide.
4) A fire curtain required by Sentence (3) shall be of a type acceptable to the *authority having jurisdiction* and designed to close

a) automatically upon the actuation of the sprinkler system,
b) automatically upon actuation of the fire alarm system, and
c) manually by remote control devices located at the curtain control panel and at each side of the *stage*.

5) At least 2 vents for the purpose of venting fire and smoke to the outside of a *building* shall be provided above a *stage* designed for theatrical performances and shall
a) have an aggregate area not less than one eighth of the area of the *stage* behind the proscenium opening, and
b) be arranged to open automatically upon actuation of the sprinkler system.

6) The *fire separation* referred to in Sentence (3) is not required between a *stage* and a seating area in a *building* that is *sprinklered* throughout, provided a sprinkler deluge system is installed at the boundary between the *stage* and the seating area.

3.3.2.15. Risers for Stairs

1) In a Group A, Division 2 *occupancy* used for the serving of food and beverages, an interior *flight* of stairs with fewer than 3 risers is permitted provided it
a) is not less than 900 mm wide,
b) is illuminated at all times that occupants are on the premises, and
c) has a handrail on each side.

3.3.2.16. Storage Rooms

1) Where storage rooms are required by Part 4 of Division B of the Fire By-law for the storage of *flammable liquids* or *combustible liquids* in *assembly occupancies*, such rooms shall not be located above or below the *first storey*.

3.3.2.17. Deleted

(See Article 3.2.1.8.)

3.3.3. Care, Treatment or Detention Occupancies

3.3.3.1. Application

1) This Subsection applies to *care*, *treatment* and *detention occupancies*. (See Note A-3.3.3.1.(1).)

3.3.3.2. Separations between Care, Treatment or Detention Occupancies and Repair Garages

1) The *fire separation* required by Sentence 3.3.5.5.(1) between a *care*, *treatment* or *detention occupancy* and a *repair garage* shall have no openings.

3.3.3.3. Corridors

1) Except as provided in Sentence (2), a corridor used by the public or serving patients' or residents' sleeping rooms shall have no dead-end portion.

2) Corridors are permitted to have dead-portions, where
a) the area served by the dead-end portion has a second and separate *means of egress*, or
b) the corridor serves a *suite* of *care occupancy* and the dead-end portion does not exceed 6 m.

3) Corridors shall be not less than
a) 2 400 mm wide in *buildings* of *treatment occupancy* where the corridors may be used to move patients or residents in beds,
b) 1 650 mm wide
i) in *buildings* of *care* or *treatment occupancy* where the corridors will not be used to move patients or residents in beds, and
ii) in *buildings* of *care occupancy* with more than 10 residents and where the corridors serve the residents, or

c) 1 100 mm wide in *buildings* of *care occupancy* with not more than 10 residents.

4) Paired doors in a corridor referred to in Clause (3)(a) shall

a) swing in opposite directions, the right-hand door swinging in the direction of travel, and

b) be not less than 1 100 mm wide.

3.3.3.4. Doorway Width

1) Except as provided in Sentence (2) and within individual *suites* of *care occupancy*, the minimum clear width of a doorway shall be 850 mm where it opens into or is located within a *public corridor* or other facility that provides *access to exit* for patients or residents in *floor areas* containing *care* or *treatment occupancies*.

2) The minimum clear width of doorways through which it is necessary to move patients in bed shall be 1 050 mm. (See Note A-3.3.3.4.(2).)

3.3.3.5. Compartments and Fire Separations

1) Floor areas containing patients' or residents' sleeping rooms in a *care* or *treatment occupancy* where overnight sleeping accommodation is provided for more than a total of 10 patients or residents shall conform to Sentences (2) to (13).

2) Except as permitted by Sentence (3), a *floor area* described in Sentence (1) shall be divided into not less than 2 *fire compartments*, each not more than 1 000 m^2 in area.

3) The *floor area* on either side of a *horizontal exit conforming to* Article 3.4.6.10. is permitted to be considered as a *fire compartment* in applying the requirements of this Article.

4) Except as permitted by Sentence (5), *fire separations* separating *fire compartments* required by Sentence (2) shall have a *fire-resistance rating* not less than 1 h.

5) The *fire-resistance rating* of a *fire separation* referred to in Sentence (4) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or

b) the floor assembly below the *floor area*, if there is no floor assembly above.

6) The travel distance from any point within each *fire compartment* referred to in Sentence (2) to a door to an adjoining *fire compartment* shall be not more than 45 m.

7) Each *fire compartment* referred to in Sentence (2) shall be capable of accommodating, in addition to its own occupants, the occupants of the largest adjacent *fire compartment* based on a clear floor space of 2.5 m^2 per patient in the adjacent *fire compartment*.

8) Except as provided in Sentences (9) to (13), walls between patients' or residents' sleeping rooms and the remainder of the *floor area* shall be constructed as *fire separations* but are not required to have a *fire-resistance rating* unless one is required by other provisions in this Part. (See Note A-3.1.8.1.(1)(b).)

9) The *fire separation* requirements of Sentence (8) do not apply to walls within a group of intercommunicating patients' or residents' sleeping rooms, provided the group of rooms does not

a) contain more than 5 patients or residents, or

b) include storage, bathing or toilet facilities serving persons not occupying the group of rooms.

(See Note A-3.3.3.5.(9).)

10) The *fire separation* requirements of Sentence (8) do not apply to walls within individual *suites* of *care occupancy*.

11) A door in a *fire separation* required by Sentence (8) is permitted to be equipped with a roller latch.

12) Except as permitted by Sentence (13), a *fire separation* required by Sentence (8) shall not have any grilles, louvres or other openings.

13) A door or wall separating a patient's or resident's sleeping room from an ensuite toilet room, shower room or similar ancillary space is permitted to incorporate grilles and louvres, provided

a) the adjacent rooms are not used to store flammable or *combustible* materials, and

b) the openings are located so that smoke cannot pass through these rooms to other parts of the *building*.

(See Note A-3.3.3.5.(13).)

14) Walls between individual *suites* of *care occupancy* and the remainder of the *floor area* in *buildings* of *care occupancy* shall be constructed as *fire separations* with a *fire-resistance rating* not less than that specified for *residential occupancies* in Sentences 3.3.4.2.(1) and (2).
15) Floor assemblies within individual *suites* of *care occupancy* need not be constructed as *fire separations*, provided the *suites* meet the conditions described in Clauses 3.3.4.2.(3)(a) and (b).
16) The *fire-resistance rating* of the *fire separation* required by Sentence 3.3.5.6.(1) is permitted to be waived if the *fire separation* is located between individual *suites* of *care occupancy* and an attached *storage garage* containing not more than 5 vehicles, provided the conditions described in Sentence 3.3.4.2.(4) are met.
17) *Fire dampers* in *fire separations* between *fire compartments* described in Sentence (2) shall be designed to close upon a signal from a *smoke detector* in either *fire compartment*. (See Note A-3.3.3.5.(17).)

3.3.3.6. Areas of Refuge

1) Compartments containing rooms such as operating rooms, recovery rooms, delivery rooms and intensive care units, from which it is impracticable to move patients in an emergency, shall be

a) separated from adjacent spaces by *fire separations* having a *fire-resistance rating* not less than 1 h, and

b) provided with a mechanical air supply so that during a period of 2 h after the start of a fire in another space, the compartments will not contain more than 1% by volume of contaminated air from the fire area.

3.3.3.7. Contained Use Areas

1) A *contained use area* shall conform to Sentences (2) to (5).
2) A *contained use area* shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.
3) Except as permitted by Sentence (4), a *building* that includes a *contained use area* shall be *sprinklered* throughout.
4) A *contained use area*, in a *building* for which Articles 3.2.2.20. to 3.2.2.90. do not require the installation of an automatic sprinkler system, is not required to be *sprinklered* as required by Sentence (3) provided

a) the *building* is designed so that during a period of 2 h after the start of a fire in the *contained use area* other *fire compartments* will not contain more than 1% by volume of contaminated air from the *contained use area*,

b) the *building* is designed so that during a period of 2 h after the start of a fire in another part of the *building* the *contained use area* will not contain more than 1% by volume of contaminated air from the other part of the *building*,

c) all doors are designed to be remotely released in conformance with Sentence 3.3.1.13.(6), and

d) the *contained use area* does not contain any rooms lined with *combustible* padding.

5) A corridor serving a *contained use area* shall have no dead-end portion unless the area served by the dead-end portion has a second and separate *means of egress*.

3.3.4. Residential Occupancy

3.3.4.1. Scope

1) This Subsection applies to *residential occupancies*.

3.3.4.2. Fire Separations

1) Except as permitted by Sentences (2), 3.2.2.9.(2), and *ancillary residential units* complying with Section 9.37, *suites* of *residential occupancy*, shall be separated from each other and the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

2) The *fire-resistance rating* of the *fire separation* required by Sentence (1) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or

b) the floor assembly below the *floor area*, if there is no floor assembly above.

3) Floor assemblies within a *dwelling unit* need not be constructed as *fire separations* provided

a) the distance between the lowest floor level and the uppermost floor level within the *dwelling unit* is not more than 6 m, and

b) the *dwelling unit* is separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than

i) 1 h if the *building* is not *sprinklered* throughout,

ii) 45 min if the *building* is *sprinklered* throughout and it is not more than 3 *storeys* in *building height*, or

iii) 1 h if the *building* is *sprinklered* throughout and it is more than 3 *storeys* in *building height*.

4) The *fire-resistance rating* of the *fire separation* required by Sentence 3.3.5.6.(1) is permitted to be waived if the *fire separation* is located between a *dwelling unit* and an attached *storage garage* containing not more than 5 vehicles, provided

a) the *dwelling unit* and the attached *storage garage* are *sprinklered*,

b) the *dwelling unit* and the attached *storage garage* are separated from the remainder of the *building* in conformance with Sentences (1), (2) and (3),

c) there are no air duct systems connecting the *storage garage* and the *dwelling unit*,

d) the construction between the *storage garage* and the *dwelling unit* provides an effective barrier to gas and exhaust fumes, and

e) every door between the *storage garage* and the *dwelling unit* is

i) tight fitting and weather-stripped to provide an effective barrier against the passage of gas and exhaust fumes,

ii) fitted with a self-closing device, and

iii) not located in a room intended for sleeping.

5) The *fire separation* required by Sentence 3.3.5.6.(1) is not required between a *dwelling unit* and an attached *storage garage*, serving that *dwelling unit* only, provided

a) the *dwelling unit* and its attached *storage garage* are separated from the remainder of the *building* in conformance with Sentences (1), (2) and (3),

b) there are no air duct systems connecting the *storage garage* and the *dwelling unit*,

c) the construction between the *storage garage* and the *dwelling unit* provides an effective barrier to gas and exhaust fumes, and

d) every door between the *storage garage* and the *dwelling unit* is

i) tight fitting and weather-stripped to provide an effective barrier against the passage of gas and exhaust fumes,

ii) fitted with a self-closing device, and

iii) not located in a room intended for sleeping.

3.3.4.3. Storage Rooms

1) Sprinklers shall be installed in a storage room provided for the use of tenants in a *residential occupancy* within a *floor area* but not contained within a *suite*.

2) Except as permitted by Sentence (3), a storage room referred to in Sentence (1) shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

3) The *fire-resistance rating* of the *fire separation* required by Sentence (2) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or

b) the floor assembly below the *floor area*, if there is no floor assembly above.

4) Except for the storage of *flammable liquids* and *combustible liquids* inside a *building* containing not more than one principal *dwelling unit* and garages or sheds attached to these *dwelling units*, where storage rooms are required by Part 4 of Division B of the Fire By-law for the storage of *flammable liquids* or *combustible liquids* in *residential occupancies*, such rooms shall not be located above or below the *first storey*.

3.3.4.4. Egress from Dwelling Units

1) Single storey dwelling units in an apartment building need not lead to a public corridor or exterior passageway on the same storey provided the dwelling units are served by private stairways leading directly to a public access to exit on the storey

a) immediately above, and

b) immediately below.

(See Note A-3.3.4.4.(1).)

2) Except as permitted by Sentences (3), (4), and (7), a *dwelling unit* containing more than one *storey* shall have an exit door or an egress door opening directly into a public access to exit from the uppermost *storey* and from the lowest storey of the dwelling unit so that each of these storeys is served by an *exit* or egress door located not more than 1.5 m above or below its floor level.

3) A single exit is permitted from a dwelling unit provided the exit is an exterior doorway not more than 1.5m above adjacent ground level and

a) it is not necessary to travel up or down more than one storey to reach the exit door,

b) in a *sprinklered building*, it is not necessary to travel up or down more than two *storeys* to reach the exit door, provided the travel distance to a single *exit* door does not exceed 25 m, or

c) the uppermost floor level opens to a balcony not more than 6 m above adjacent ground level.

4) An egress door from either the uppermost storey or the lowest storey of a dwelling unit, as required by Sentence (2), need not be provided if that storey is served by a stairway that

a) leads to a public access to exit,

b) has no direct access to any other storey in the dwelling unit, and

c) is separated from the other storeys in the dwelling unit by a fire separation having a fire-resistance rating not less than 45 min.

5) In a *building* of residential occupancy not more than 3 storeys in *building height*, a doorway from a dwelling unit is permitted to open directly into an exit stairway provided the dwelling unit has a second and separate means of egress.

6) If a dwelling unit has a second and separate means of egress, one means of egress from a dwelling unit is permitted to pass through

a) an interior corridor served by a single exit,

b) an exterior balcony served by a single exit stairway, or

c) an exterior passageway served by a single exit stairway.

7) A single *means of egress* is permitted from a *dwelling unit* in a sprinklered *building* if it is not necessary to travel more than 18 m from the most remote point within the *dwelling unit*, and (See Note A-3.3.4.4.(7).)

a) 1 *storey* up or down, or

b) two *storeys* above the *first storey* of the *building*.

3.3.4.5. Automatic Locking Prohibition

1) Except for hotels and motels, a door opening onto a *public corridor* which provides *access to exit* from a *suite* shall be designed not to lock automatically. (See Note A-3.3.4.5.(1).)

3.3.4.6. Sound Transmission

1) Occupants of *dwelling units* shall be protected from airborne noise in conformance with Section 5.8.

3.3.4.7. Stairs, Ramps, Landings, Handrails and Guards for Dwelling Units

1) Except as required in Article 3.3.4.8., stairs, ramps, landings, handrails and *guards* within a *dwelling unit* shall conform to the appropriate requirements in Section 9.8.
2) Exterior stairs, ramps, landings, handrails and *guards* serving a single *dwelling unit*, and loads on *guards* serving not more than two *dwelling units*, shall conform to the appropriate requirements in Section 9.8.

3.3.4.8. Protection of Openable Windows
1) Except as provided in Sentence (2), openable windows in *suites* of *residential occupancy* shall be protected by
a) a *guard* with a minimum height of 1 070 mm constructed in accordance with Article 3.3.1.18., or
b) a mechanism capable of controlling the free swinging or sliding of the openable part of the window so as to limit any clear unobstructed opening to not more than 100 mm measured either vertically or horizontally where the other dimension is greater than 380 mm.
2) Windows need not be protected in accordance with Sentence (1) where
a) the only opening having greater dimensions than those allowed by Clause (1)(b) is located higher than 1 070 mm above the finished floor, or
b) the bottom edge of the openable portion of the window is located less than 1 800 mm above the floor or ground on the other side of the window.

3.3.4.9. Resistance to Forced Entry
1) *Dwelling units* shall conform to Article 9.7.2.1. and Subsection 9.7.5.

3.3.5. Industrial Occupancy

3.3.5.1. Scope
1) This Subsection applies to *industrial occupancies*.

3.3.5.2. Fire Extinguishing Systems
1) In addition to other requirements in this By-law for the installation of automatic fire extinguishing systems, an appropriate fire extinguishing system shall be installed in every *industrial occupancy floor area* to provide protection if required by
a) provincial or territorial regulations or other regulatory enactments, or
b) the Fire By-law, in the absence of the regulations or bylaws referred to in Clause (a).

3.3.5.3. Basements
1) A *basement* shall not be used for the storage, manufacture or handling of volatile solids, liquids or gases that generate explosive air-vapour mixtures or for processes that involve explosive dusts.
2) Entrances and *exits* to a *basement* and to rooms containing *building* services shall be separate from the remainder of the *building* in a *building* in which
a) the storage, manufacture or handling of volatile materials can generate explosive air-vapour mixtures, or
b) processes occur that produce explosive dusts.
3) Basements and rooms referred to in Sentence (2) shall be separated from the remainder of the *building* with a vapour-tight separation.

3.3.5.4. Repair and Storage Garages
1) If access is provided from a *storage garage* to a stair tower or elevator serving *occupancies* above the level of the *storage garage*, the access shall be through a vestibule conforming to Sentence 3.3.5.7.(4).
2) Treads and landings in interior stairs that extend to the roof of a *storage garage* shall be designed to be free of accumulations of ice and snow.

3) A mechanical *storage garage* not more than 4 *storeys* in *building height*, in which no persons other than parking attendants are permitted above the *street* floor level, need not have a *fire separation* between the *exits* and the remainder of the *building*.
4) A garage shall be provided with natural or mechanical ventilation in conformance with the requirements of Subsection 6.3.1. and Article 6.9.1.2. to prevent excessive accumulation of carbon monoxide, exhaust fumes or flammable and toxic vapours.
5) The clear height in a *storage garage* shall be not less than 2 m.
6) Where garage floors or ramps are 600 mm or more above the adjacent ground or floor level, every opening through such floors and the perimeter of floors and ramps shall be provided with

a) a continuous curb not less than 140 mm high, a *guard* not less than 1 070 mm high, and a vehicle guardrail not less than 500 mm high conforming to Sentence (7), or
b) a full-height wall conforming to Sentence (7).

7) Vehicle guardrails and full-height walls required in Sentence (6) shall be designed and constructed to withstand the loading values stipulated in Sentence 4.1.5.15.(1).
8) Deleted.

3.3.5.5. Repair Garage Separation

1) A *repair garage* and any ancillary spaces serving it, including waiting rooms, reception rooms, tool and parts storage areas and supervisory office space, shall be separated from other *occupancies* by a *fire separation* having a *fire-resistance rating* not less than 2 h.

3.3.5.6. Storage Garage Separation

1) Except as permitted by Sentences 3.3.4.2.(4) and (5), a *storage garage* shall be separated from other *occupancies* by a *fire separation* with a *fire-resistance rating* not less than 1.5 h.

3.3.5.7. Vestibules

1) Except as provided in Sentence (2), if access is provided through a *fire separation* between a *storage garage* and a Group A, Division 1 or Group B *occupancy*, the access shall be through a vestibule conforming to Sentence (4).
2) If access is provided through a *fire separation* between a *storage garage* and a Group B, Division 3 *occupancy* with not more than 10 occupants, access need not be through a vestibule, provided the *fire separation* complies with Clauses 3.3.4.2.(5)(b) to (d).
3) In a *building* more than 3 *storeys* in *building height*, access through a *fire separation* between a *storage garage* and a Group A, Division 2, 3 or 4, or a Group C *occupancy*, shall be through a vestibule conforming to Sentence (4).
4) If access is provided through a vestibule, as required by Sentences (1), (3) and 3.3.5.4.(1), the vestibule shall

a) be not less than 1.8 m long,
b) be ventilated
  i) naturally to outside air by a vent that has an unobstructed area of not less than 0.1 m^2 for each door that opens into the vestibule but not less than 0.4 m^2, or
  ii) mechanically at a rate of 14 m^3/h for each square metre of vestibule floor surface area, and
c) have openings between the vestibule and an adjoining *occupancy* provided with self-closing doors with no hold-open devices.

3.3.5.8. Dispensing of Fuel

1) Facilities for the dispensing of fuel having a *flash point* below 37.8°C shall not be installed above any space intended for *occupancy*.
2) Facilities for the dispensing of fuel having a *flash point* below 37.8°C shall not be installed in any *building*, except that this requirement does not apply to a canopy which is open on not less than 75% of its perimeter.

3.3.5.9. Multiple-Tenant Self-Storage Warehouses

1) Except where a *building* is *sprinklered* throughout, each individual tenancy in a multiple tenant self storage warehouse classified as an *industrial occupancy* shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 45 min.

3.3.5.10. Guards

1) Except where they serve *storage garages*, *guards* in *industrial occupancies* are permitted to consist of

a) a top railing, and

b) one or more intermediate rails spaced such that openings through the *guard* are of a size that prevents the passage of a spherical object whose diameter is 535 mm.

3.3.6. Design of Hazardous Areas

3.3.6.1. Application

1) This Subsection applies to design and fire protection requirements for *buildings* or parts thereof used for the storage, handling, use and processing of *dangerous goods*, including *flammable liquids* and *combustible liquids*, in quantities in excess of those identified in Table 3.2.7.1. of Division B of the Fire By-law (See Note A-3.3.6.1.(1).)

3.3.6.2. Storage of Dangerous Goods

1) Solid and liquid *dangerous goods* classified as oxidizers or organic peroxides shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* of not less than 2 h.

2) Reactive materials shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* of not less than 2 h. (See Note A-3.3.6.2.(2).)

3) The design of *buildings* or parts thereof used for the storage of *dangerous goods* classified as explosives shall conform to the "Explosives Act" and its Regulations, published by Natural Resources Canada.

4) Where wiring or electrical equipment is located in areas in which flammable gases or vapours, *combustible dusts* or *combustible fibres* are present in quantities sufficient to create a hazard, such wiring and electrical equipment shall conform to the requirements for hazardous locations as required by the Electrical Safety Regulation.

3.3.6.3. Indoor Storage of Anhydrous Ammonia and Flammable, Toxic and Oxidizing Gases

1) Where required by the Fire By-law, cylinders of *dangerous goods* classified as flammable gases stored indoors shall be located in a room

a) that is separated from the remainder of the *building* by a gas-tight *fire separation* having a *fire-resistance rating* of at least 2 h,

b) that is located on an exterior wall of the *building*,

c) that can be entered from the exterior, and

d) whose *closures* leading to the interior of the *building* are

i) equipped with self-closing devices that keep the *closures* closed when not in use, and

ii) constructed so as to prevent the migration of gases from the room into other parts of the *building*.

2) Where required by the Fire By-law cylinders of anhydrous ammonia or *dangerous goods* classified as toxic or oxidizing gases stored indoors shall be located in a room

a) that is separated from the remainder of the *building* by a gas-tight *fire separation* having a *fire-resistance rating* of at least 1 h,

b) that is located on an exterior wall of the *building*,

c) that can be entered from the exterior, and

d) whose *closures* leading to the interior of the *building* are

i) equipped with self-closing devices that keep the *closures* closed when not in use, and

ii) constructed so as to prevent the migration of gases from the room into other parts of the *building*.

3.3.6.4. Storage and Dispensing Rooms for Flammable Liquids and Combustible Liquids

1) Fire separations for rooms where *flammable liquids* and *combustible liquids* are stored are required to be constructed with a *fire-resistance rating* in conformance with Subsection 4.2.9. of Division B of the Fire By-law.

2) Where Class IA or IB liquids specified in Subsection 4.1.2. of Division B of the Fire By-law are dispensed within a storage room, the room shall be designed to prevent critical structural and mechanical damage from an internal explosion in conformance with good engineering practice such as that described in NFPA 68, "Explosion Protection by Deflagration Venting." (See Note A-3.3.6.4.(2).)

3.3.6.5. Tire Storage

1) A tire storage area designed to contain more than 375 m^3 of rubber tires shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* of not less than 2 h. (See Note A-3.3.6.5.(1).)

3.3.6.6. Ammonium Nitrate Storage

1) Where Article 3.2.9.1. of Division B of the Fire By-law applies due to the quantity and nature of the stored product, and as stipulated in Sentences (2) to (6), *buildings* used for the storage of ammonium nitrate shall be classified as *medium-hazard industrial occupancies* (Group F, Division 2).

2) Buildings intended for the storage of ammonium nitrate shall be not more than one *storey* in *building* height.

3) Buildings intended for the storage of ammonium nitrate shall not

a) have *basements* or crawl spaces, or

b) contain open floor drains, tunnels, elevator pits or other pockets that might trap molten ammonium nitrate.

4) Buildings intended for the storage of ammonium nitrate shall have not less than 0.007 m^2 of vent area for each square metre of storage area, unless mechanical ventilation is provided.

5) All flooring in storage areas described in Sentence (1) shall be constructed of *noncombustible* materials.

6) Buildings intended for the storage of ammonium nitrate shall be designed to prevent the ammonium nitrate from coming into contact with *building* materials that

a) will cause the ammonium nitrate to become unstable,

b) may corrode or deteriorate by reason of contact with the ammonium nitrate, or

c) will become impregnated with the ammonium nitrate.

(See Note A-3.3.6.6.(6).)

3.3.6.7. Flooring Materials

1) Floors in areas where *dangerous goods* are stored shall be constructed of impermeable materials to prevent the absorption of chemicals.

3.3.6.8. Fire Separations in Process Plants

1) In *process plants*, areas where unstable liquids are handled or where small-scale unit chemical processes occur shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* of not less than 2 h.

3.3.6.9. Basements and Pits

1) Process plants where Class I and II *flammable liquids* and *combustible liquids* are handled shall not be constructed with *basements* or covered pits.

3.3.7. Building Security

3.3.7.1. Scope

1) This Subsection is intended to address issues of life safety through the security of *buildings*.

3.3.7.2. Skylights

1) All openable skylights shall be designed to prevent opening from the outside when in the closed and locked position.

2) All exterior skylight fasteners shall be tamperproof.

3.3.7.3. Doors

1) All entrance and exterior doors to *dwelling units*, doors between *dwelling units* and attached garages, and doors which provide direct or indirect access from *storage garages* to *dwelling units* shall conform to Subsections 9.6.1. and 9.7.3.

3.3.7.4. Sidelights to Doors

1) All sidelights to doors and all windows adjacent to doors located within 915 mm of the door locks shall conform to Sentence 9.6.1.4.(1).

3.3.7.5. Exterior Sliding Windows

1) In *buildings* of *residential occupancy*, all exterior windows with a sliding sash located within 5 m of finished grade, shall be provided with a positive, automatically locking mechanism and installed so that the sliding sash cannot be removed from its frame when in the locked position.

3.3.7.6. Security Gates for Storage Garages

1) Security gates installed at vehicle entrances or at secured areas in *storage garages* shall comply with the following provisions.

a) Except as required in Clause (1)(b), a security gate shall be designed and installed with clearance between the moving parts and adjacent surfaces which is sufficient to prevent injury or entrapment and is no greater than 100 mm.

b) If a horizontally sliding security gate opens by sliding into a pocket guard enclosure constructed against a wall,

i)the clearance between the pocket guard enclosure and the wall surface shall be no greater than 25 mm; and

ii)the clearance between the pocket guard enclosure and the gate frame shall be no greater than 25 mm on each side of the gate frame.

c) A security gate shall be designed and installed with

i)a load sensitive device designed to reverse the gate on contact with an obstruction,

ii)a five second audible or visual warning device indicating the opening or closing of the gate, and

iii)a maximum clearance between the gate frame and wall surface of no more than 25 mm.

3.3.7.7. Security for Storage Garage

1) The provisions of Sentences (2) to (7) shall apply to a *storage garage* with more than 19 parking spaces.

2) If access is provided from a *storage garage* to a stair tower or to an elevator through a vestibule, the vestibule shall be constructed

a) with *closures* glazed with clear wired glass in steel frames, which provide the greatest possible unobstructed view from the *storage garage* into the stair tower or vestibule,

b) as a *fire separation* with a *fire-resistance rating* of not less than 1 hr,

c) with full or half glazed *closures* with a *fire-protection rating* of not less than 45 min between the *storage garage* and the vestibule and between the vestibule and the stair tower, and

d) with a row of sprinkler heads running the full width of the glazing, installed on the garage side of the vestibule at a spacing of 1800 mm on centre parallel to the glass, located between 150 mm to 300 mm perpendicular to the glazing and vertically installed on the garage ceiling in conformance with NFPA requirements.

(See Note A-3.3.7.7.(2).)

3) A stair shaft serving a *storage garage* and which is connected to a *storey* containing an *occupancy* other than a *storage garage*, shall terminate at that *storey*.

4) Except for open-air *storage garages* and *buildings* of *residential occupancy*, a *storage garage* shall be provided with *exits* which only serve the *storage garage* and which exit directly outside the *building*.

5) Except as provided in Sentence 3.3.7.7.(6), an exterior stair shaft or elevator vestibule which serves as access to a *storage garage* shall be unenclosed.

6) An enclosed exterior stair shaft or elevator vestibule which serves as access to a *storage garage* shall conform to Clauses (2)(a) and (c) but need not conform to the *fire separation* and *fire-resistance rating* requirements.

7) Where the stair shaft or vestibule in Sentence (5) or (6) is required to have a *fire-resistance rating*, due to spatial separation requirements, the provisions of Clauses (2)(a), (b) and (c) shall apply.

8) Despite the provisions of Sentence 3.2.7.1.(2) and Table 9.34.2.7., *storage garages* shall meet the following average lighting levels measured at floor level

a) 550 lx in the first 15 m of entrance roadway,

b) 110 lx in traffic aisles, and

c) 220 lx in pedestrian access vestibules, stairwells and elevator lobbies.

3.3.7.8. Washrooms in Public Buildings

1) Public access to washrooms in a public *building* shall be located in areas which are open to the public and shall not be located in enclosed stairwells.

3.3.7.9. Mailbox Construction in Multi-Family Buildings

(See Note A-3.3.7.9.)

1) In a *multi-family building* or parts thereof, commonly accessible mailbox assembly serving at least 20 dwelling units shall

a) be constructed of heavy gauge metal,

b) designed to resist prying and tampering,

c) be well secured to framing members, blocking, or other solid construction,

d) have individual storage compartment access doors made of 16 gauge steel or 4.76 mm thick aluminum,

e) be hinged so that the hinge or hinge pin cannot be removed from the outside when the doors are closed, and

f) be provided with a 5 pin cylinder cam lock that when locked, the bolt will engage with the frame for each storage compartment.

3.3.8. Public Storage Facilities

3.3.8.1. Egress From Storage Lockers

1) Despite the provisions of this By-law, an egress door from a storage locker in a public storage facility is not required to swing on a vertical axis if

a) the storage locker is equipped with its own sprinkler head,

b) the *building* is fully *sprinklered* in conformance with NFPA 13,

c) the *building* is equipped with a fire alarm system in conformance with Subsection 3.2.4.,

d) each storage locker is separated from the remainder of the *floor area* by a solid wall assembly without openings,

e) the storage locker door is equipped with a failsafe locking mechanism,

f) the size of the storage locker does not exceed 50 m^2 and the travel distance to the egress door does not exceed 10 m,
g) the overhead door only serves a single storage locker, and
h) a continuous steel mesh is installed across the entire storage area and located no higher than 460 mm below the sprinkler head.

Section 3.4. Exits

3.4.1. General

3.4.1.1. Scope

1) Exit facilities complying with this Section shall be provided from every *floor area* that is intended for *occupancy*. (See Note A-3.4.1.1.(1).)

3.4.1.2. Separation of Exits

1) Except as permitted by Sentence (2), if more than one *exit* is required from a *floor area*, each *exit* shall be separate from every other *exit* leading from that *floor area*.
2) If more than 2 *exits* are provided from a *floor area*, *exits* are permitted to converge in conformance with Sentence 3.4.3.1.(2), provided the cumulative capacity of the converging *exits* does not contribute more than 50% of the total required *exit* width for the *floor area*.
3) Contiguous *exit* stairs (scissors stairs) are not permitted in a 5 or 6 *storey* wood frame *building*.

3.4.1.3. Access to Exits

1) *Access to exits* shall conform to Section 3.3.

3.4.1.4. Types of Exit

1) Subject to the requirements of this Section, an *exit* from any *floor area* shall be one of the following, used singly or in combination:
a) an exterior doorway,
b) an exterior passageway,
c) an exterior ramp,
d) an exterior stairway,
e) a fire escape (conforming to Subsection 3.4.7.),
f) a *horizontal exit*,
g) an interior passageway,
h) an interior ramp, or
i) an interior stairway.

3.4.1.5. Exterior Exit Passageways

1) Access to an exterior *exit* passageway from a *floor area* shall be through *exit* doors at the floor level.

3.4.1.6. Restricted Use of Horizontal Exits

1) Except as permitted by Sentence (2), *horizontal exits* shall not comprise more than one half of the required number of *exits* from any *floor area*.
2) In a hospital or nursing home with *treatment*, *horizontal exits* serving patients' sleeping rooms shall comprise not more than two thirds of the required number of *exits* from any *floor area*. (See Note A-3.4.1.6.(2).)

3.4.1.7. Slide Escapes

1) A slide escape shall not be erected on any *building* as a required *exit*, but is permitted to be provided as an additional egress facility if unusual hazards are foreseen.

3.4.1.8. Transparent Doors and Panels

1) Glass and transparent panels in an *exit* shall conform to the appropriate requirements of Article 3.3.1.19. for glass and transparent panels in an *access to exit*.

3.4.1.9. Mirrors near Exits

1) No mirror shall be placed in or adjacent to any *exit* in a manner that would confuse the direction of *exit*.

3.4.1.10. Combustible Glazing in Exits

1) *Combustible* glazing is not permitted in wall or ceiling assemblies or in *closures* used to construct an *exit* enclosure.

3.4.2. Number and Location of Exits from Floor Areas

3.4.2.1. Minimum Number of Exits

1) Except as permitted by Sentences (2) to (4), every *floor area* intended for *occupancy* shall be served by at least 2 *exits*.

2) A *floor area* in a *building* not more than 2 *storeys* in *building height*, is permitted to be served by one *exit* provided the total *occupant load* served by the *exit* is not more than 60, and

a) in a *floor area* that is not *sprinklered* throughout, the *floor area* and the travel distance are not more than the values in Table 3.4.2.1.-A, or

b) in a *floor area* that is *sprinklered* throughout

i) the travel distance is not more than 25 m, and

ii) the *floor area* is not more than the value in Table 3.4.2.1.-B.

Table 3.4.2.1.-A
Criteria for One Exit (Floor Area Not Sprinklered Throughout)
Forming Part of Sentence 3.4.2.1.(2)

Occupancy of *Floor Area*	Maximum *Floor Area*, m^2	Maximum Travel Distance, m
Group A	150	15
Group B	75	10
Group C	100	15
Group D	200	25
Group E	150	15
Group F, Division 2	150	10
Group F, Division 3	200	15

Table 3.4.2.1.-B
Criteria for One Exit (Floor Area Sprinklered Throughout)
Forming Part of Sentence 3.4.2.1.(2)

Occupancy **of** *Floor Area*	**Maximum** *Floor Area*, **m**^{2}
Group A	200
Group B	100
Group C	150
Group D	300
Group E	200
Group F, Division 2	200
Group F, Division 3	300

3) Except as permitted by Sentence (4), if Sentence (2) permits a single *exit* from a *floor area* classified as Group B or Group C *occupancy*, the *exit* shall be an exterior doorway not more than 1.5 m above adjacent ground level.
4) The requirements of Sentences (1) and (2) are permitted to be waived for *dwelling units* that have an *access to exit* conforming to Sentences 3.3.4.4.(1) to (4) and 3.3.4.4.(7).
5) Exits are not required directly from roof-top enclosures that are provided with *access to exits* in conformance with Sentences 3.3.1.3.(5) and (6).

3.4.2.2. Means of Egress from Mezzanines
1) Except as permitted by Sentences (2) and (3), the space above a *mezzanine* shall be served by *means of egress* leading to *exits* accessible at the *mezzanine* level on the same basis as *floor areas*.
2) The *means of egress* from a *mezzanine* need not conform to Sentence (1), provided
- a) the *mezzanine* is not required to terminate at a vertical *fire separation*, as permitted in Sentence 3.2.8.2.(1),
- b) the *occupant load* of the *mezzanine* is not more than 60,
- c) the area of the *mezzanine* does not exceed the area limits stated in Table 3.4.2.2., and
- d) the distance limits stated in Table 3.4.2.2. measured along the path of travel are not exceeded from any point on the *mezzanine* to
  - i) an egress door serving the space that the *mezzanine* overlooks, if the space is served by a single egress door, or
  - ii) the egress stairway leading to an *access to exit* in the space below if that space is required to be served by 2 or more egress doorways in conformance with Sentence 3.3.1.5.(1).

3) At least half of the required *means of egress* from a *mezzanine* shall comply with Sentence (1) if the *mezzanine* is not required to terminate at a *fire separation* as permitted by Sentence 3.2.8.2.(1).

Table 3.4.2.2.
Criteria for Egress from Mezzanine Space
Forming Part of Sentence 3.4.2.2.(2)

Occupancy **of Space**	**Maximum Area, m**^{2}	**Distance Limits, m**

Assembly occupancy	150	15
Residential occupancy	100	15
Business and personal services occupancy	200	25
Mercantile occupancy	150	15
Medium-hazard industrial occupancy	150	10
Low-hazard industrial occupancy	200	15

3.4.2.3. Distance between Exits

1) Except as provided in Sentence (2), the least distance between 2 *exits* from a *floor area* shall be

a) one half the maximum diagonal dimension of the *floor area*, but need not be more than 9 m for a *floor area* having a *public corridor*, or

b) one half the maximum diagonal dimension of the *floor area*, but not less than 9 m for all other *floor areas*.

(See Note A-3.4.2.3.(1).)

2) *Exits* need not comply with Sentence (1) where

a) the *floor area* is divided so that not less than one third of the *floor area* is on each side of a *fire separation*, and

b) it is necessary to pass through the *fire separation* to travel from one *exit* to another *exit*.

3) The minimum distance between *exits* referred to in Sentence (1) shall be the shortest distance that smoke would have to travel between the *exits*, assuming that the smoke will not penetrate an intervening *fire separation*.

4) The distance between 2 exterior discharges of *exit* stairs serving the same *floor area* shall be

a) not less than 9 m, or

b) not less than 6 m, where

i) the *building* is *sprinklered* throughout, and

ii) the 2 exterior discharges are located within 15 m of a *street*.

3.4.2.4. Travel Distance

1) Except as permitted by Sentence (2), for the purposes of this Subsection, travel distance means the distance from any point in the *floor area* to an *exit* measured along the path of travel to the *exit*.

2) The travel distance from a *suite* or a room not within a *suite* is permitted to be measured from an egress door of the *suite* or room to the nearest *exit*, provided

a) the *suite* or room is separated from the remainder of the *floor area* by a *fire separation*

i) having a *fire-resistance rating* not less than 45 min in a *floor area* that is not *sprinklered* throughout, or

ii) which is not required to have a *fire-resistance rating*, in a *floor area* that is *sprinklered* throughout, and

b) the egress door opens onto

i) an exterior passageway,

ii) a corridor used by the public that is separated from the remainder of the *floor area* in conformance with the requirements in Article 3.3.1.4. for the separation of *public corridors*, or

iii) a *public corridor* that is separated from the remainder of the *floor area* in conformance with Article 3.3.1.4. (See Note A-3.1.8.1.(1)(b).)

3) Travel distance to an exit shall be not more than 50 m from any point in a *service space* referred to in Sentence 3.2.1.1.(8).

3.4.2.5. Location of Exits

1) Except as permitted by Sentences (2) and 3.3.2.5.(6), if more than one *exit* is required from a *floor area*, the *exits* shall be located so that the travel distance to at least one *exit* shall be not more than

a) 25 m in a *high-hazard industrial occupancy*,

b) 40 m in a *business and personal services occupancy*,

c) 45 m in a *floor area* that contains an *occupancy* other than a *high-hazard industrial occupancy*, provided it is *sprinklered* throughout,

d) 105 m in any *floor area*, served by a *public corridor,* in which rooms and *suites* are not separated from the remainder of the *floor area* by a *fire separation*, provided

i) the *public corridor* is not less than 9 m wide,

ii) the ceiling height in the *public corridor* is not less than 4 m above all floor surfaces,

iii) the *building* is *sprinklered* throughout, and

iv) not more than one half of the required egress doorways from a room or *suite* open into the *public corridor* if the room or *suite* is required to have more than one egress doorway,

e) 60 m in any *storage garage* that conforms to the requirements of Article 3.2.2.90., and

f) 30 m in any *floor area* other than those referred to in Clauses (a) to (e).

2) Except for a *high-hazard industrial occupancy*, Sentence (1) need not apply if *exits* are placed along the perimeter of the *floor area* and are not more than 60 m apart, measured along the perimeter, provided each main aisle in the *floor area* leads directly to an *exit*.

3) *Exits* shall be located and arranged so that they are clearly visible or their locations are clearly indicated and they are accessible at all times.

3.4.2.6. Principal Entrances

1) For the purposes of this Section, at least one door at every principal entrance to a *building* providing access from the exterior at ground level shall be designed in accordance with the requirements for *exits*.

2) In a *building* that is not *sprinklered* throughout in accordance with Sentence 3.2.5.12.(1), the principal entrance serving a dance hall or a licensed beverage establishment with an *occupant load* more than 250 shall provide at least one half of the required *exit* width.

3.4.3. Width and Height of Exits

3.4.3.1. Exit Width Based on Occupant Load

1) For the purpose of determining the aggregate width of *exits*, the *occupant load* of every room or *floor area* shall be determined in conformance with Subsection 3.1.17.

2) Except as permitted by Sentence 3.4.3.2.(4), the required *exit* width shall be cumulative if 2 or more *exits* converge.

3.4.3.2. Exit Width

1) Except as permitted by Sentence (3), the minimum aggregate required width of *exits* serving *floor areas* intended for *assembly occupancies*, *residential occupancies*, *business and personal services occupancies*, *mercantile occupancies*, and *industrial occupancies* shall be determined by multiplying the *occupant load* of the area served by

a) 6.1 mm per person for ramps with a slope of not more than 1 in 8, doorways, corridors and passageways,

b) 8 mm per person for a stair consisting of steps whose rise is not more than 180 mm and whose *run* is not less than 280 mm, or

c) 9.2 mm per person for

i) ramps with a slope of more than 1 in 8, or

ii) stairs, other than stairs conforming to Clause (b).

2) The minimum aggregate width of *exits* serving *floor areas* intended for a *care*, *treatment* or *detention occupancy* shall be determined by multiplying the *occupant load* of the area served by 18.4 mm per person.

3) The minimum aggregate width of *means of egress* serving a Group A, Division 4 *occupancy* shall be determined by multiplying the *occupant load* of the area served by

- a) 1.8 mm per person for
  - i) aisles,
  - ii) stairs other than *exit* stairs, and
  - iii) ramps and passageways in vomitories and *exits*, and
- b) 2.4 mm per person for *exit* stairs.

4) Except as required by Sentences 3.4.3.2.(5) and (6), the required *exit* width need not be cumulative in an *exit* serving 2 or more *floor areas* located one above the other.

5) The required *exit* width for an *exit* stair in an assembly hall or *theatre* serving more than one balcony level shall conform to Sentence (6).

6) The required *exit* width for *exit* stairs that serve *interconnected floor space* designed in accordance with Articles 3.2.8.3. to 3.2.8.8. shall be cumulative, unless

- a) the stairs provide not less than 0.3 m^2 of area of treads and landings for each occupant of the *interconnected floor space* (See Note A-3.4.3.2.(6).), or
- *b) protected floor spaces* conforming to Article 3.2.8.5. are provided at each floor level and the *protected floor space* on a floor level has not less than 0.5 m^2 of space for each occupant of that floor level of the *interconnected floor space*.

(See Note A-3.4.3.2.(6)(a).)

7) If more than one *exit* is required, every *exit* shall be considered as contributing not more than one half of the required *exit* width.

8) The minimum widths of *exits* shall conform to Tables 3.4.3.2.-Aand 3.4.3.2.-B.

Table 3.4.3.2.-A
Minimum Widths of Exit Corridors, Passageways, Ramps, Stairs and Doorways in Group A, Group B, Division 1, and Groups C, D, E and F Occupancies
Forming Part of Sentence 3.4.3.2.(8)

Occupancy **Classification**	***Exit* Corridors and Passageways , mm**	**Ramps, mm**	**Stairs, mm**	**Doorways, mm**
Group A, Group B, Division 1, Group C, Group D, Group E, Group F	1 100	1 100	900[(1)] 1 100[(2)]	800

Notes to Table 3.4.3.2.-A:
[(1)] Serving not more than 2 *storeys* above the lowest *exit level* or not more than 1 *storey* below the lowest *exit level*.
[(2)] Serving more than 2 *storeys* above the lowest *exit level* or more than 1 *storey* below the lowest *exit level*.

Table 3.4.3.2.-B
Minimum Widths of Exit Corridors, Passageways, Ramps, Stairs and Doorways in Group B, Division 2 and Division 3 Occupancies
Forming Part of Sentence 3.4.3.2.(8)

Occupancy **Classification**	***Exit* Corridors**	**Ramps, mm**		**Stairs, mm**		**Doorways, mm**	
		Not serving	**Serving**	**Not serving**	**Serving**	**Not serving**	**Serving**

	and Passageways, mm	patients' or residents' sleeping rooms(1)	patients' or residents' sleeping rooms(1)	patients' or residents' sleeping rooms(1)	patients' or residents' sleeping rooms(1)	patients' or residents' sleeping rooms(1)	patients' or residents' sleeping rooms(1)
Group B, Division 2	1 100	1 100	1 650	900(2) 1 100(3)	1 650	850	1 050
Group B, Division 3							
with more than 10 residents	1 100	1 100	1 100	900(2) 1 100(3)	1 100(2) 1 650(3)	850	850
with not more than 10 residents	1 100	1 100	1 100	900(2) 1 100(3)	900(2) 1 100(3)	850	850

Notes to Table 3.4.3.2.-B:

(1) (1) Minimum widths of ramps, stairs and doorways do not apply within individual *suites* of *care occupancy*.

(2) (2) Serving not more than 2 *storeys* above the lowest *exit level* or not more than 1 *storey* below the lowest *exit level*.

(3) Serving more than 2 *storeys* above the lowest *exit level* or more than 1 *storey* below the lowest *exit level*.

3.4.3.3. Exit Width Reduction

1) Except as permitted by Sentences (2) and (4), no fixture, turnstile or construction shall project into or be fixed within the required width of an *exit*.

2) Swinging doors in their swing shall not reduce the required width of *exit* stairs or landings to less than 750 mm or reduce the width of an *exit* passageway to less than the minimum required width.

3) Doors shall be installed so that, when open, they do not diminish nor obstruct the required width of the *exit*.

4) Handrails and construction below handrails, including handrail supports and stair stringers, shall not project more than 100 mm into the required width of a *means of egress*.

3.4.3.4. Headroom Clearance

(See Note A-3.4.3.4.)

1) Except as permitted by Sentences (4) and (5), every *exit* shall have a clear height over the clear width of the *exit* of not less than 2 050 mm.

2) The clear height of stairways shall be measured vertically over the clear width of the stairway, from the straight line tangent to the tread and landing nosings to the lowest element above. (See Note A-9.8.7.4.)

3) The clear height of landings shall be measured within the clear width of the landing vertically to the lowest element above.

4) Except as permitted by Sentence (5), the headroom clearance for doorways shall be not less than 2 030 mm.

5) No door closer or other device shall be installed so as to reduce the headroom clearance of a doorway to less than 1 980 mm.

3.4.4. Fire Separation of Exits

3.4.4.1. Fire-Resistance Rating of Exit Separations

1) Except as permitted by Sentences (2), 3.3.5.4.(3), 3.4.4.2.(2) and 3.4.4.3.(1), every *exit* shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than that required by Subsection 3.2.2., but not less than 45 min, for

a) the floor assembly above the *storey*, or

b) the floor assembly below the *storey*, if there is no floor assembly above.

2) The *fire-resistance rating* of the *fire separation* referred to in Sentence (1) need not be more than 2 h.

3) If an *exit* stair in an assembly hall or *theatre* serves more than one balcony level, the *exit* stair shall be separated from the remainder of the *building* in conformance with Sentence (1).

3.4.4.2. Exits through Lobbies

1) Except as permitted by Sentence (2), no *exit* from a *floor area* above or below the *first storey* shall lead through a lobby.

2) Not more than one *exit* from a *floor area* is permitted to lead through a lobby, provided

a) the lobby floor is not more than 4.5 m above *grade*,

b) the path of travel through the lobby to the outdoors is not more than 15 m,

c) the adjacent rooms or premises having direct access to the lobby do not contain a *care*, *residential* or *industrial occupancy*,

d) the lobby is not located within an *interconnected floor space* other than as described in Sentence 3.2.8.2.(6),

e) the lobby conforms to the requirements for *exits*, except that

i) rooms other than *service rooms* and storage rooms are permitted to open onto the lobby,

ii) the *fire separation* between the lobby and a room used for the sole purpose of control and supervision of the *building* need not have a *fire-resistance rating*,

iii) the *fire separation* between the lobby and adjacent *occupancies* that are permitted to open onto the lobby need not have a *fire-resistance rating* provided the lobby and adjacent *occupancies* are *sprinklered*, and

iv) passenger elevators are permitted to open onto the lobby, provided the elevator doors are designed to remain closed except while loading and unloading passengers, and

(See Note A-3.4.4.2.(2)(e).)

f) a *fire separation*, constructed in accordance with Sentence 3.4.4.1.(1), is maintained between the lobby and any *exit* permitted by this Sentence to lead through the lobby.

3.4.4.3. Exterior Passageway Exceptions

1) The requirements of Sentences 3.4.4.1.(1) and 3.2.3.13.(1) and (3) do not apply to an exterior *exit* passageway provided

a) not less than 50% of the exterior side is open to the outdoors, and

b) an *exit* stair is provided at each end of the passageway.

3.4.4.4. Integrity of Exits

1) A *fire separation* that separates an *exit* from the remainder of the *building* shall have no openings except for

a) standpipe and sprinkler piping,

b) electrical wires and cables, totally enclosed *noncombustible* raceways and *noncombustible* piping that serve only the *exit*,

c) openings required by the provisions of Subsection 3.2.6.,

d) exit doorways,

e) wired glass and glass block permitted by Article 3.1.8.16., and

f) wires, cables, totally enclosed noncombustible raceways, and distributed antenna for a radio antenna system conforming to Sentence 3.2.5.20.(1).

2) Exits within scissors stairs and other contiguous *exit* stairways shall be separated from each other by a smoke-tight *fire separation* having a *fire-resistance rating* not less than that required for the floor assembly through which they pass.
3) Fire separations separating contiguous stairs described in Sentence (2) shall not be pierced by doorways, ductwork, piping or any other openings that affect the continuity of the separation.
4) A fuel-fired *appliance* shall not be installed in an *exit*.
5) An *exit* shall not be used as a *plenum* for a heating, ventilating or air-conditioning system.
6) An *exit* shall be designed for no purpose other than for exiting, except that an *exit* is permitted also to be designed to serve as an access to a *floor area*.
7) A *service room* shall not open directly into an *exit*.
8) Storage rooms, washrooms, toilet rooms, laundry rooms and similar ancillary rooms shall not open directly into an *exit*.
9) Service spaces referred to in Sentence 3.2.1.1.(8) shall not open directly into an *exit*.

3.4.5. Exit Signs

3.4.5.1. Exit Signs

1) Every *exit* door shall have an *exit* sign placed over or adjacent to it if the *exit* serves
- a) a *building* more than 2 *storeys* in *building height*,
- b) a *building* having an *occupant load* of more than 150, or
- c) a room or *floor area* that has a fire escape as part of a required *means of egress*.

2) Every *exit* sign shall
- a) be visible on approach to the *exit*,
- b) consist of a green and white or lightly tinted graphical symbol meeting the colour specifications referred to in ISO 3864-1, "Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs and safety markings," and
- c) conform to ISO 7010, "Graphical symbols – Safety colours and safety signs – Registered safety signs," for one or more of the following symbols (See Note A-3.4.5.1.(2)(c).):
  - i) E001 emergency exit (left hand),
  - ii) E002 emergency exit (right hand),
  - iii) E005 Direction, arrow (90° increments), safe condition, and
  - iv) E006 Direction, 45° arrow (90° increments), safe condition.

3) Internally illuminated *exit* signs shall be continuously illuminated and
- a) where illumination of the sign is powered by an electrical circuit, conform to CSA C22.2 No. 141, "Emergency Lighting Equipment," or
- b) where illumination of the sign is not powered by an electrical circuit, conform to CAN/ULC-S572, "Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems."

4) Externally illuminated exit signs shall be continuously illuminated and conform to CAN/ULC-S572, "Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems." (See Note A-3.4.5.1.(4).)
5) The circuitry serving lighting for externally and internally illuminated *exit* signs shall
- a) serve no equipment other than emergency equipment, and
- b) be connected to an emergency power supply as described in Article 3.2.7.4.

6) Where no *exit* is visible from a *public corridor*, from a corridor used by the public in a Group A or B *major occupancy*, or from principal routes serving an open *floor area* having an *occupant load* of more than 150, an *exit* sign conforming to Clauses (2)(b) and (c) with an arrow or pointer indicating the direction of egress shall be provided.
7) Except for egress doorways described in Sentence 3.3.2.4.(4), an *exit* sign conforming to Sentences (2) to (5) shall be placed over or adjacent to every egress doorway from rooms with an *occupant load* of more than 60 in Group A, Division 1 *occupancies*, dance halls, licensed beverage establishments, and other similar *occupancies* that, when occupied, have lighting levels below that which would provide easy identification of the egress doorway.

3.4.5.2. Signs for Stairs and Ramps at Exit Level

1) In a *building* more than 2 *storeys* in *building height*, any part of an *exit* ramp or stairway that continues up or down past the lowest *exit level* shall have a posted sign clearly indicating that it does not lead to an *exit*.

3.4.6. Types of Exit Facilities

(See Note A-3.4.6.)

3.4.6.1. Slip Resistance of Ramps and Stairs

1) The surfaces of ramps, and landings and treads
- a) shall have a finish that is slip resistant, and
- b) if accessible to the public, shall have either a colour contrast or a distinctive pattern, readily visible from both directions of travel, to demarcate the leading edge of the tread and the leading edge of the landing, as well as the beginning and end of a ramp.

2) Treads and landings of exterior *exit* stairs more than 10 m high shall be designed to be free of ice and snow accumulations.

3.4.6.2. Minimum Number of Risers

1) Except as permitted by Sentence 3.3.2.15.(1), every *flight* of interior stairs shall have not less than 3 risers.

3.4.6.3. Maximum Vertical Rise of Stair Flights and Required Landings

1) No *flight* of stairs shall have a vertical rise of more than 3.7 m between floors or landings, except that a *flight* of stairs serving as an *exit* in a Group B, Division 2 *occupancy* shall have a vertical rise not more than 2.4 m between floors or landings.

2) Except as provided in Sentence (3), a landing shall be provided
- a) at the top and bottom of each *flight* of interior and exterior stairs,
- b) at the top and bottom of every section of ramp,
- c) where a doorway opens onto a stair or ramp,
- d) where a ramp opens onto a stair, and
- e) where a stair opens onto a ramp.

3) A landing may be omitted at the bottom of an exterior stair or ramp, provided there is no gate, door or fixed obstruction within the lesser of
- a) the width of the stair or ramp, or
- b) 1 100 mm.

4) Landings required at the top of a *flight* of stairs shall be provided with tactile walking surface indicators conforming to Subsection 3.8.3. unless the stairs are
- a) stairs within *dwelling units* or serving not more than two *dwelling units*,
- *b)exit* stairs not normally used for access purposes, or
- c) fire escape stairs.

3.4.6.4. Dimensions of Landings

(See Note A-3.4.6.4.)

1) Except as provided in Sentence (2), a landing shall be at least as wide and as long as the width of the stairway in which it occurs.

2) In a straight stairway and in a stairway that turns less than 90°, the length of the landing need not be more than the lesser of
- a) the required width of stair, or
- b) 1 100 mm.

3) The length of a landing shall be measured perpendicular to the nosing of adjacent steps, at a distance equal to half the length required in Sentence (2), from the narrow edge of the landing.

4) Where a doorway or stairway empties onto a ramp through a side wall, there shall be a level area extending across the full width of the ramp, and for a distance of 300 mm on either side of the wall opening, except one side if it abuts on an end wall.
5) Where a doorway or stairway empties onto a ramp through an end wall, there shall be a level area extending across the full width of the ramp and along its length for not less than 900 mm.

3.4.6.5. Handrails

1) One handrail shall be provided on stairs that are less than 1 100 mm in width.
2) One handrail shall be provided on each side of
- a) stairs that are 1 100 mm or more in width,
- b) curved *flights* of any width, and
- c) ramps.

3) In addition to Sentence (2), intermediate handrails shall be provided so that
- a) a handrail is reachable within 750 mm of all portions of the required *exit* width,
- b) at least one portion of the stair or ramp between two handrails is the minimum width required for stairways or ramps (See Sentences 3.4.3.2.(8) and 3.4.3.3.(4).), and
- c) all other portions of the stair or ramp between two handrails have a clear width of 510 mm or more.

4) Where a stair or ramp is wider than its required *exit* width, handrails shall be located along the most direct path of travel. (See Note A-3.4.6.5.(4).)
5) Handrails shall be continuously graspable along their entire length, be free of any sharp or abrasive elements, and have
- a) a circular cross-section with an outside diameter not less than 30 mm and not more than 43 mm, or
- b) a non-circular cross-section with a perimeter not less than 100 mm and not more than 125 mm and whose largest cross-sectional dimension is not more than 45 mm.

6) The height of handrails on stairs, on aisles with steps and on ramps shall be measured vertically from the top of the handrail to
- a) a straight line drawn tangent to the tread nosings of the stair or aisle step served by the handrail (See Note A-9.8.7.4.), or
- b) the surface of the ramp, floor or landing served by the handrail.

7) Except as provided in Sentence (8) and Clause 3.8.3.5.(1)(e), the height of handrails on stairs, on aisles with steps and on ramps shall be
- a) not less than 865 mm, and
- b) not more than 1 070 mm.

8) Handrails installed in addition to required handrails need not comply with Sentence (7).
9) Required handrails shall be continuously graspable throughout the length of
- a) a ramp, and
- b) a *flight* of stairs, from the bottom riser to the top riser.

(See Note A-9.8.7.2.)
10) Except where interrupted by doorways, at least one handrail shall be continuous throughout the length of a stairway or ramp, including at landings. (See Note A-3.4.6.5.(10).)
11) Handrails shall be terminated in a manner that will not obstruct pedestrian travel or create a hazard. (See Note A-3.4.6.5.(10).)
12) At least one handrail at the side of a stairway or ramp shall extend horizontally not less than 300 mm beyond the top and bottom of the stairway or ramp. (See Note A-3.4.6.5.(10).)
13) The clearance between a handrail and any surface behind it shall be not less than
- a) 50 mm, or
- b) 60 mm if the surface behind the handrail is rough or abrasive.

14) Handrails and their supports shall be designed and constructed to withstand the loading values specified in Sentence 4.1.5.14.(7).

15) A ramp shall have handrails on both sides.

3.4.6.6. Guards

1) Every *exit* shall have a wall or a well-secured *guard* on each side, where

a) there is a difference in elevation of more than 600 mm between the walking surface and the adjacent surface, or

b) the adjacent surface within 1.2 m of the walking surface has a slope of more than 1 in 2.

(See Note A-9.8.8.1.)

2) Except as required by Sentence (4), the height of *guards* for *exit* stairs and *exit* ramps as well as their landings shall be not less than 1 070 mm.

3) The height of *guards* shall be measured vertically to the top of the *guard* from

a) a line drawn through the outside edges of the stair nosings, or

b) the surface of the ramp or landing.

4) The height of *guards* for exterior stairs and landings more than 10 m above adjacent ground level shall be not less than 1 500 mm measured vertically to the top of the *guard* from the surface of the landing or from a line drawn through the outside edges of the stair nosings.

5) Except as provided in Sentence 3.3.1.18.(3) and Articles 3.3.4.7. and 3.3.5.10., *guards* in *exits* shall not have any openings that permit the passage of a spherical object whose diameter is more than 100 mm.

6) In a stairway, a window for which the distance measured vertically between the bottom of the window and a line drawn through the outside edges of the stair nosings is less than 900 mm, or a window that extends to less than 1 070 mm above the landing, shall

a) be protected by a *guard* that is

i) located approximately 900 mm above a line drawn through the outside edges of the stair nosings, or

ii) not less than 1 070 mm high measured to the top of the *guard* from the surface of the landing, or

b) be fixed in position and designed to resist the lateral design loads specified for *guards* and walls in Articles 4.1.5.14. and 4.1.5.16.

7) Except for *guards* conforming to Article 3.3.5.10., *guards* that protect a level located more than one *storey* or 4.2 m above the adjacent level shall be designed so that no member, attachment or opening located between 140 mm and 900 mm above the level being protected by the *guard* facilitates climbing. (See Note A-9.8.8.6.(1).)

3.4.6.7. Ramp Slope

(See also Article 3.8.3.5.)

1) Except as required for aisles by Article 3.3.2.5., the maximum slope of a ramp shall be

a) 1 in 10 in any *assembly*, *care*, *treatment*, *detention* or *residential occupancy*,

b) 1 in 6 in an *industrial occupancy*,

c) 1 in 8 in all other *occupancies*, and

d) 1 in 10 for an exterior ramp.

3.4.6.8. Treads and Risers

(See Note A-9.8.4.)

1) Except as permitted for *dwelling units* and by Sentence 3.4.7.5.(1) for fire escapes, steps for stairs shall have a *run* of not less than 280 mm between successive steps.

2) Steps for stairs referred to in Sentence (1) shall have a rise between successive treads not less than 125 mm and not more than 180 mm.

3) Except as provided in Article 3.3.4.7. and except for fire escape stairs, stairs that are principally used for maintenance and service, and stairs that serve *industrial occupancies* other than *storage garages*, steps for stairs shall have no open risers.

4) Except in fire escape stairs and where an exterior stair adjoins a *walkway* as permitted in Sentence 3.4.6.3.(3), risers, measured as the vertical nosing-to-nosing distance, shall be of uniform height in any one *flight*, with a maximum tolerance of

a) 5 mm between adjacent treads or landings, and
b) 10 mm between the tallest and shortest risers in a *flight*.

5) Except in fire escape stairs, treads shall have a uniform *run* with a maximum tolerance of

a) 5 mm between adjacent treads, and
b) 10 mm between the deepest and shallowest treads in a *flight*.

6) Treads and risers shall not differ significantly in *run* and rise in successive *flights* in any stair system.
7) The slope of treads or landings shall not exceed 1 in 50.
8) The top of the nosing of stair treads shall

a) except as permitted in Sentence (10), have either a radius or a bevel between 6 mm and 10 mm in horizontal dimension,
b) have no abrupt angles on the underside, and
c) not project more than 38 mm.

9) The front edge of stair treads in *exits* and public *access to exits* shall be at right angles to the direction of *exit* travel.
10) If resilient material is used to cover the nosing of a stair tread, the minimum rounded or beveled edge required by Sentence (8) is permitted to be reduced to 3 mm.
11) Stairs shall be provided with tactile warning strips conforming to Article 3.8.3.9. unless the stairs are

a) stairs within or serving *dwelling units*,
b) *exit* stairs not normally used for access purposes, or
c) fire escape stairs.

3.4.6.9. Curved Flights in Exits

1) Exit stair *flights* shall consist solely of

a) straight *flights*, or
b) curved *flights* complying with Sentence (2).

2) A curved *flight* used as an *exit* shall have

a) a handrail on each side,
b) a minimum *run* of 240 mm,
c) a *run* that conforms to Article 3.4.6.8. when measured at a point 300 mm from the centre line of the handrail at the narrow end of the tread, and
d) an inside radius that is not less than twice the stair width.

3)Tapered treads shall have a consistent angle and uniform *run* and rise dimensions in accordance with the construction tolerances stipulated in Article 3.4.6.8. when measured at a point 300 mm from the centre line of the handrail at the narrow end of the tread.
4) All *tapered treads* within a *flight* shall turn in the same direction.

3.4.6.10. Horizontal Exits

1) The *floor area* on each side of a *horizontal exit* shall be sufficient to accommodate the occupants of both *floor areas*, allowing not less than 0.5 m^2 of clear floor space per person, except that 1.5 m^2 shall be provided for each person in a wheelchair and 2.5 m^2 for each bedridden patient.
2) If vestibules, enclosed balconies or bridges are used as parts of a *horizontal exit*, their clear width shall be not less than that of the *exit* doorways opening into them, except that handrails are not permitted to project into this clear width more than 100 mm.
3) In a *horizontal exit* where there is a difference in level between the connected *floor areas*, slopes not more than those specified for ramps in Article 3.4.6.7. are permitted to be used.
4) No stairs or steps shall be used in a *horizontal exit*.
5) If 2 doors are provided in a *horizontal exit* that comprises a part of the required number of *exits* from the *floor areas* on both sides of the *exit*

a) the doors shall be mounted adjacent to each other with the door on the right side in the direction of travel through the *horizontal exit* swinging in the direction of travel through the *horizontal exit*, and

b) signs shall be provided on each side of the *horizontal exit* to indicate the door that swings in the direction of travel from that side.

(See Note A-3.4.6.10.(5).)

6) If a *horizontal exit* utilizes bridges between *buildings* or outside balconies, the bridges or balconies shall conform to Article 3.2.3.19.

3.4.6.11. Doors

1) The distance between a stair riser and the leading edge of a door during its swing shall be not less than 300 mm.

2) Except as provided in Sentence (3) and where doorways are used to confine the spillage of *flammable liquids* within a *service room* or within a room in an *industrial occupancy*, a threshold for a doorway in an *exit* shall be not more than 13 mm higher than the surrounding finished floor surface.

3) Except for doors providing *access* to ground level as required by Clause 11.3.7.1.(1)(d) and (e), an *exit* door is permitted to open onto not more than one step which shall be not more than 150 mm high where there is a risk of blockage by ice or snow.

4) Exit doors shall be clearly identifiable. (See Note A-3.4.6.11.(4).)

5) No door leaf in an *exit* doorway with more than one leaf shall be less than 610 mm wide.

6) Where an *exit* door leading directly to the outside is subject to being obstructed by parked vehicles or storage because of its location, a visible sign or a physical barrier prohibiting such obstructions shall be installed on the exterior side of the door.

3.4.6.12. Direction of Door Swing

1) Except for doors serving a single *dwelling unit* and except as permitted by Sentence (2), (3) and Article 3.4.6.14., every *exit* door shall

a) open in the direction of *exit* travel, and

b) swing on its vertical axis.

2) Exit doors need not conform to Sentence (1), where

a) they serve *storage garages* serving not more than one *dwelling unit*,

b) they serve accessory *buildings* serving not more than one *dwelling unit*,

c) **reserved**, or

d) **reserved**.

3) Despite the provisions of Sentence (1), principal entrance doors opening to an *acceptable* open space at ground level are not required to swing in the direction of *exit* travel if

a) the *suite* is located at ground level,

b) the *suite* does not serve a Group F, Division 1 *occupancy*, and

c) the *occupant load* is not more than 60 persons.

3.4.6.13. Self-closing Devices

1) An *exit* door that is normally required to be kept closed

a) shall be provided with a self-closing mechanism, and

b) shall never be secured in an open position except as permitted by Sentence 3.1.8.14.(1).

3.4.6.14. Sliding Doors

1) Except as permitted by Sentences (2) and 3.4.6.12.(2), an *exit* door leading directly to outdoors at ground level is permitted to be a sliding door provided it conforms to Sentence 3.3.1.12.(1).

2) An *exit* door serving a Group B, Division 1 *occupancy*, or an *impeded egress zone* in other *occupancies*, is permitted to be a sliding door that does not conform to Sentence 3.3.1.12.(1) provided it is designed to be released in conformance with Article 3.3.1.13.

3.4.6.15. Revolving Doors

1) Except as permitted by Sentence (3), a revolving door, if used, shall
  a) be collapsible,
  b) have hinged doors providing equivalent exiting capacity located adjacent to it,
  c) be used as an *exit* from the ground floor level only,
  d) not be used at the foot of any stairway, and
  e) have all glass in door leaves and enclosure panels conforming to
    i) CAN/CGSB-12.1-M, "Tempered or Laminated Safety Glass," or
    ii) CAN/CGSB-12.11-M, "Wired Safety Glass."

2) Except as permitted by Sentence (3), a revolving door shall not be considered to have an exiting capacity for more than 45 persons.

3) An electrically powered revolving door is not required to conform to Sentences (1) and (2) provided
  a) the door leaves will collapse and stop automatic rotation of the door system and not obstruct the doorway if a force not more than that specified in Sentence 3.4.6.16.(2) is applied at the centre of a door leaf,
  b) the door leaves are capable of being opened from inside the *building* without requiring keys, special devices, or specialized knowledge of the door opening mechanism,
  c) the allowable exiting capacity is based on the clear width of passage through the door enclosure when the doors are fully collapsed,
  d) a permanent sign, whose centre line is between 1 000 mm and 1 500 mm above the floor, is placed on each face of each door leaf indicating the method for collapsing the door leaf in an emergency, and
  e) glass used for door leaves and enclosure panels is safety glass conforming to
    i) CAN/CGSB-12.1-M, "Tempered or Laminated Safety Glass," or
    ii) CAN/CGSB-12.11-M, "Wired Safety Glass."

3.4.6.16. Door Release Hardware

1) Except for devices on doors serving a *contained use area* or an *impeded egress zone* designed to be remotely released in conformance with Article 3.3.1.13., and except as permitted by Sentences (4) and (5) and Article 3.4.6.17., locking, latching and other fastening devices on a principal entrance door to a *building* as well as those on every *exit* door shall include release hardware complying with Clause 3.8.3.8.(1)(c) to permit the door to be readily opened from the inside with not more than one releasing operation and without requiring keys, special devices or specialized knowledge of the door-opening mechanism. (See Note A-3.4.6.16.(1).)

2) If a door is equipped with a latching mechanism, a device that will release the latch and allow the door to swing wide open when a force of not more than 90 N is applied to the device in the direction of travel to the *exit* shall be installed on
  a) every *exit* door from a *floor area* containing an *assembly occupancy* having an *occupant load* more than 100,
  b) every door leading to an *exit* lobby from an *exit* stair shaft, and every exterior door leading from an *exit* stair shaft in a *building* having an *occupant load* more than 100, and
  c) every *exit* door from a *floor area* containing a *high-hazard industrial occupancy*.

3) Except as required by Sentence 3.8.3.6.(8), every *exit* door shall be designed and installed so that, when the latch is released, the door will open under a force of not more than 90 N, applied at the knob or other latch releasing device.

4) Except as permitted in Sentence (7), electromagnetic locks that do not incorporate latches, pins or other similar devices to keep the door in the closed position are permitted to be installed on doors, other than those leading directly from a *high-hazard industrial occupancy,* provided
  a) the *building* is equipped with a fire alarm system,

b) the locking device releases upon actuation of the *alarm signal* from the *building's* fire alarm system,
c) the locking device releases immediately upon loss of power controlling the electromagnetic locking mechanism and its associated auxiliary controls,
d) except for locking devices installed in conformance with Sentence (5), the locking device releases immediately upon actuation of a manually operated switch readily accessible only to authorized personnel,
e) except as provided in Clause (k), a force of not more than 90 N applied to the door opening hardware initiates an irreversible process that will release the locking device within 15 s and not re-lock until the door has been opened,
f) upon release, the locking device must be reset manually by the actuation of the switch referred to in Clause (d),
g) a legible sign is permanently mounted on the door to indicate that the locking device will release within 15 s of applying pressure to the door-opening hardware,
h) the total time delay for all electromagnetic locks in any path of egress to release is not more than 15 s (See note A-3.4.6.16.(4)(h).),
i) where a bypass switch is installed to allow testing of the fire alarm system, actuation of the switch
i) can prevent the release of the locking device by the fire alarm system, as stated in Clause (b), during the test, and
ii) causes an audible and visual signal to be indicated at the fire alarm annunciator panel required by Article 3.2.4.9. and at the monitoring station specified in Sentence 3.2.4.8.(4),
j) emergency lighting is provided at each door, and
k) where they are installed on doors providing emergency crossover access to *floor areas* from *exit* stairs directly into a public corridor in accordance with Sentence 3.4.6.18.(2),
i) the locking device releases immediately upon the operation of a manual station for the fire alarm system located on the wall on the *exit* stair side not more than 600 mm from the door, and
ii) a legible sign with the words “re-entry door unlocked by fire alarm” written in letters at least 25 mm high with a stroke of at least 5 mm is permanently mounted on the door on the *exit* stair side.

(See Notes A-3.4.6.16.(4). and A-3.3.1.13.(7).)

5) Electromagnetic locks that do not incorporate latches, pins or other similar devices to keep the door in the closed position are permitted to be installed on doors in Group B, Division 2 and Division 3 *occupancies*, provided
a) the *building* is
i) equipped with a fire alarm system, and
ii) sprinklered,
b) the electromagnetic lock releases upon
i) actuation of the *alarm signal* from the *building's* fire alarm system,
ii) loss of its power supply and of power to its auxiliary controls,
iii) actuation of a manually operated switch that is readily accessible at a constantly attended location within the locked space, and
iv) actuation of the manual station installed within 0.5 m of each door and equipped with an auxiliary contact, which directly releases the electromagnetic lock,
c) upon release, the electromagnetic lock requires manual resetting by actuation of the switch referred to in Subclause (b)(iii),
d) a legible sign with the words “EMERGENCY EXIT UNLOCKED BY FIRE ALARM” written in letters at least 25 mm high with a stroke at least 5 mm wide is permanently mounted on the door,
e) the operation of any by-pass switch, where provided for testing of the fire alarm system, sets off an audible signal and a visual signal at the fire alarm annunciator panel and at the monitoring station referred to in Sentence 3.2.4.7.(4), and

f) emergency lighting is provided at the doors.

(See Note A-3.4.6.16.(5).)

6) Except as provided in Sentence 3.4.6.17.(9), door release hardware for the operation of the doors referred to in this Section shall be installed at a height between 900 mm and 1 100 mm above the finished floor.

(See also Subclause 3.8.3.6.(6)(a)(v).)

7) As an alternative to the requirements of Clauses (e), (f) and (g) in Sentence 3.4.6.16.(4), acceptable door release hardware for an electromagnetic lock shall be located in close proximity to the exit door and shall be equipped with

a) a push button together with a motion sensor or a pressure sensitive pad that will immediately release the locking device,

b) a push button that is

i) directly connected to the electrical circuit that provides power to the locking device, without any intervening mechanism,

ii) embossed with the word "EXIT" on the activation surface in text with dimensions of no less than 25 mm,

iii) internally illuminated by a permanent LED type light source, and

iv) labeled "DOOR RELEASE" in plain and legible characters,

c) an electromagnetic lock that

i) will reset automatically, except as provided in (c)(ii),

ii) has an automatic reset feature that is not activated for at least 15 seconds, and

iii) can only be reset by manual means after the activation of the fire alarm system.

(See Note A-3.4.6.16.(7).)

3.4.6.17. Security for Banks and Mercantile Floor Areas

1) If a *building* is *sprinklered* throughout, the requirements of Sentence 3.4.6.16.(1) are permitted to be waived for *exit* and egress doors complying with Sentences (2) to (9) that serve a *floor area* or part of a *floor area* used exclusively for

a) a bank, or

b) the sale of retail merchandise.

(See Note A-3.4.6.17.(1).)

2) Exit and egress doors referred to in Sentence (1) shall be designed to prevent locking at any time that the part of the *floor area* that they serve is open to the public.

3) A sign with the words "This door shall not be locked at any time that the public is present" in letters not less than 50 mm high shall be permanently affixed to both sides of doors referred to in Sentence (1).

4) Exit and egress facilities complying with Sentences (5) to (9) shall be incorporated for egress by persons other than the public from a *floor area* or a part of a *floor area* referred to in Sentence (1) during times when the public is neither present nor being admitted to the area that they serve.

5) In *exit* and egress facilities referred to in Sentence (4), at least one door at each *exit* and egress location shall

a) be operable in conformance with Sentence 3.4.6.16.(1), or

b) be equipped with locks conforming to Sentence 3.4.6.16.(4) that release immediately

i) if an *alert signal* or *alarm signal* is initiated in the fire alarm system, or

ii) the sprinkler system is actuated.

6) A door referred to in Sentence (5) shall be permanently and distinctly marked to indicate that it is an emergency *exit*.

7) Exit and egress facilities required for evacuation of persons other than the public from a *floor area* or a part of a *floor area* referred to in Sentence (1) shall have an aggregate width based on the maximum number of persons other than the public and determined in accordance with Articles 3.4.3.1. to 3.4.3.3.

8) Travel distance to an *exit* referred to in Sentence (7) shall not exceed the travel distance determined in accordance with Subsection 3.4.2.

9) Exit and egress doors serving a *floor area* or part of a *floor area* referred to in Sentence (1) are permitted to be equipped with locks that require keys, special devices or specialized knowledge of the door opening mechanism provided

a) the doors do not lead into *exit* stairs,
b) the doors do not lead from *exit* stairs to the exterior of the *building*,
c) the doors do not serve any other *occupancy*,
d) the area served contains at least one telephone
i) that is accessible and in operation at all times,
ii) that is not coin or card operated, and
iii) marked to indicate that it is for emergency use,
e) the area served is illuminated by normal power or by emergency power when the doors are locked,
f) there are provisions that enable an announcement to be made throughout the area served before the locks are fastened, and
g) the locks are designed for use during times that the *building* is not occupied.

3.4.6.18. Emergency Crossover Access to Floor Areas

1) Except as permitted in Sentence (2), doors providing access to *floor areas* from *exit* stairs shall not have locking devices to prevent entry into any *floor area* from which the travel distance up or down to an unlocked door is more than 2 *storeys*.
2) Doors referred to in Sentence (1) are permitted to be equipped with electromagnetic locks, provided they open directly into a public corridor and comply with Sentences 3.4.6.16.(4) and (5).
3) Doors referred to in Sentence (1) shall be identified by a sign on the stairway side to indicate that they are openable from that side.
4) Locked doors intended to prevent entry into a *floor area* from an *exit* stair shall

a) be identified by a sign on the stairway side to indicate the location of the nearest unlocked door in each direction of travel, and
b) be openable with a master key that fits all locking devices and is kept in a designated location accessible to firefighters or be provided with a wired glass panel not less than 0.0645 m^2 in area and located not more than 300 mm from the door opening hardware.

5) Where access to *floor areas* through unlocked doors is required by Sentence (1), it shall be possible for a person entering the *floor area* to have access through unlocked doors within the *floor area* to at least one other *exit*.

3.4.6.19. Floor Numbering

1) Arabic numerals indicating the assigned floor number shall

a) be mounted permanently on the stair side of the wall at the latch side of doors to *exit* stair shafts,
b) be not less than 60 mm high, raised approximately 0.7 mm above the surface,
c) be located 1 500 mm from the finished floor and not more than 300 mm from the door, and
d) be contrasting in colour with the surface to which they are applied. (See Note A-3.4.6.19.(1)(d).)

3.4.7. Fire Escapes

3.4.7.1. Scope

1) Except as permitted by Sentence (2), fire escapes shall not be erected on a *building*.
2) If it is impracticable to provide one or more of the *exit* facilities listed in Article 3.4.1.4., fire escapes conforming to Articles 3.4.7.2. to 3.4.7.7. are permitted to serve *floor areas* in an existing *building* provided the *floor areas* served are not more than

a) 2 *storeys* above ground level in *care*, *treatment* or *detention occupancies*, and
b) 5 *storeys* above ground level in other *occupancies*.

3.4.7.2. Fire Escape Construction

1) Fire escapes shall be of metal or concrete, of the stair type extending to ground level, constructed throughout in a strong substantial manner and securely fixed to the *building*, except that wooden fire escapes are permitted to be used on *buildings* of *combustible construction* if all posts and brackets are not less than 89 mm in their least dimension and all other woodwork is not less than 38 mm in its least dimension.

3.4.7.3. Access to Fire Escapes

1) Access to fire escapes shall be from corridors through doors at floor level, except that access from a *dwelling unit* is permitted to be through a casement window having an unobstructed opening not less than 1 100 mm high by 550 mm wide with a sill height of not more than 900 mm above the inside floor.
2) The clear area of a fire escape balcony onto which a door opens, shall be not less than 1 m^2.

3.4.7.4. Protection of Fire Escapes

1) If a fire escape serves any *storey* above the second, openings located in a zone described in Sentence (2), including access doorways in the exterior walls of the *building* to which the fire escape is attached, shall be protected by *closures* conforming to Subsection 3.1.8.
2) The zone referred to in Sentence (1) extends from any balcony, platform or stairway of a fire escape to a distance

- a) 3 m horizontally,
- b) 10 m below, or
- c) 1.8 m above.

3.4.7.5. Stairs

1) Stairs shall be inclined at an angle of not more than 45° with the horizontal, and their steps shall have risers not more than 210 mm high and treads not less than 220 mm wide exclusive of nosing.
2) Stairway headroom shall be not less than 1 950 mm plus the height of one riser measured vertically above the nosing of any tread or platform.
3) The width of a fire escape shall conform to Articles 3.4.3.1. to 3.4.3.3., except that the width is permitted to be reduced to 550 mm provided the fire escape serves

- a) not more than 3 *storeys*, and
- b) not more than 15 persons.

4) If a *flight* of stairs leading to the ground at the foot of a fire escape is not fixed in position, it shall be held in the raised position without a latch or locking device, and shall be fitted with a counterbalancing device that will permit it to be easily and quickly brought into position for use.

3.4.7.6. Guards and Railings

1) The open sides of every platform, balcony and stairway forming part of a fire escape shall be protected by *guards* not less than 920 mm high measured vertically above the nosing of any tread or platform.
2) The top rail of a *guard* is permitted to serve as a handrail if it is free from obstructions which could break a handhold.
3) A wall handrail shall be installed if the fire escape is more than 550 mm wide.
4) Unless it can be shown that the size of openings that exceed this limit does not present a hazard, there shall be no opening that permits the passage of a sphere whose diameter is more than 100 mm through a *guard* for a fire escape.
5) Unless it can be shown that the location and size of an opening do not present a hazard, a *guard* for a fire escape shall be designed so that no member, attachment or opening located between 140 mm and 900 mm above a platform or the nosing of any tread will facilitate climbing.

3.4.7.7. Landings

1) Platforms for a fire escape shall be provided in conformance with the requirements for stair landings in Articles 3.4.6.3. and 3.4.6.4.

Section 3.5. Vertical Transportation

3.5.1. General

3.5.1.1. Scope

1) This Section applies to vertical transportation facilities installed in a *building*, including elevators, escalators and dumbwaiters.
2) Elevators in a *building* within the scope of Subsection 3.2.6. shall conform to Articles 3.2.6.4., 3.2.6.5. and 3.2.6.6.

3.5.2. Standards

3.5.2.1. Elevators, Escalators and Dumbwaiters

1) The design, construction, installation and *alteration* of every elevator, escalator and dumbwaiter shall conform to the Elevating Devices Safety Regulation.
(See Note A-3.5.2.1.(1).)
2) Before being placed in service, every elevator, escalator or dumbwaiter installation, including safety and control devices, shall be inspected and tested in accordance with the Elevating Devices Safety Regulation.
3) Passenger elevators shall conform to Appendix E of ASME A17.1/CSA B44, "Safety Code for Elevators and Escalators."

3.5.3. Fire Separations

3.5.3.1. Fire Separations for Elevator Hoistways

1) Except as permitted by Sentence (2), a *vertical service space* used as an elevator hoistway shall be separated from all other portions of each adjacent *storey* by a *fire separation* having a *fire-resistance rating* conforming to Table 3.5.3.1. for the *fire-resistance rating* required by Subsection 3.2.2. for

a) the floor assembly above the *storey*, or
b) the floor assembly below the *storey*, if there is no floor assembly above.

Table 3.5.3.1.
Fire Separation for Vertical Transportation Space
Forming Part of Articles 3.5.3.1.and 3.5.3.2.

Fire-Resistance Rating of *Fire Separation* Required for Floor Assembly	Minimum *Fire-Resistance Rating* of *Vertical Service Space* for Elevator Hoistway	Minimum *Fire-Resistance Rating* of *Vertical Service Space* for Dumbwaiters
less than 45 min	45 min	–
45 min	45 min	45 min
1 h	1 h	45 min
1.5 h	1.5 h	1 h
2 h or more	2 h	1 h

2) Passenger elevators, other than those provided for firefighters in accordance with Article 3.2.6.5., are permitted to be located within *interconnected floor space* without being enclosed in a hoistway separated from the remainder of the *building*, provided the elevator machinery is located in a room separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than that required for hoistways by Sentence (1).

3.5.3.2. Vertical Service Spaces for Dumbwaiters

1) A *vertical service space* containing a dumbwaiter shall be separated from all other portions of each adjacent *storey* by a *fire separation* having a *fire-resistance rating* conforming to Table 3.5.3.1. for the *fire-resistance rating* required by Subsection 3.2.2. for

a) the floor assembly above the *storey* or

b) the floor assembly below the *storey*, if there is no floor assembly above.

3.5.3.3. Fire Separations for Elevator Machine Rooms

1) Except as permitted by Sentence (2), a room containing elevator machinery shall be separated from all other parts of the *building* by a *fire separation* having a *fire-resistance rating* not less than that required for the *vertical service space* containing the elevator hoistway.

2) A room containing elevator machinery need not be separated from the elevator hoistway that it serves provided the room and the hoistway are separated from all other parts of the *building* by a *fire separation* having a *fire-resistance rating* not less than that required for the *vertical service space* containing the elevator hoistway.

3.5.4. Dimensions and Signs

3.5.4.1. Elevator Car Dimensions

1) Except as permitted in Sentence (3), if one or more elevators are provided in a *building*, each *storey* with access to an elevator shall be served by at least one elevator which has inside dimensions that will accommodate and provide adequate access for a patient stretcher 2 010 mm long and 610 mm wide in the prone position. (See Note A-3.5.4.1.(1).)

2) An elevator satisfying the requirements of Sentence (1) shall be clearly identified on the main entrance level of the *building*.

3) The requirement in Sentence (1) to accommodate and provide adequate access for a patient stretcher

a) is waived for a limited-use / limited-application elevator designed and installed in accordance with ASME A17.1/CSA-B44, "Safety Code for Elevators and Escalators" and

b) does not apply to a lift designed and installed in accordance with CAN/CSA-B355 "Lifts for Persons with Physical Disabilities".

3.5.4.2. Floor Numbering

1) Arabic numerals indicating the assigned floor number shall be mounted permanently on both jambs of passenger elevator hoistway entrances in conformance with Appendix E of ASME A17.1/CSA B44, "Safety Code for Elevators and Escalators."

Section 3.6. Service Facilities

3.6.1. General

3.6.1.1. Scope

1) The provisions of this Section apply to *horizontal service spaces*, *vertical service spaces*, *attic or roof spaces*, ducts, crawl spaces, shaft spaces, *service rooms*, and mechanical penthouses, and facilities contained therein.

3.6.1.2. Electrical Wiring and Equipment

1) The installation of electrical wiring and electrical equipment shall conform to the requirements of the Electrical Safety Regulation.

3.6.1.3. Lightning Protection Systems

1) A lightning protection system, when provided, shall conform to the requirements of CAN/CSA-B72-M, "Installation Code for Lightning Protection Systems."

3.6.1.4. Storage Use Prohibition

1) Service spaces shall not be designed to facilitate subsequent use as storage space.

3.6.1.5. Appliances Installed outside a Building

1) A fuel-fired *appliance* installed on the roof of a *building* or in another location outside the *building* shall be installed not less than

a) 1.2 m from a property line, measured horizontally, and

b) 3 m from an adjacent wall of the same *building* if that wall contains any opening within 3 *storeys* above and 5 m horizontally from the *appliance*, unless every opening within these limits is protected by

i) a *closure* having a *fire-protection rating* not less than 45 min determined in accordance with Article 3.1.8.4., or

ii) a wired glass assembly permitted for use in a vertical *fire separation* and described in D-2.3.15. in Appendix D.

3.6.2. Service Rooms

3.6.2.1. Fire Separations around Service Rooms

1) Except as permitted by Sentences (2), (8), (9) and (10), fuel-fired *appliances* shall be installed in *service rooms* separated from the remainder of the *building* by *fire separations* having a *fire-resistance rating* not less than 1 h.

2) Except as required by Sentence (3), a fuel-fired *appliance* that serves only one room or *suite* is not required to be installed in a *service room* separated from the remainder of the *building*.

3) A solid-fuel-burning *appliance* shall not be located in a *repair garage*, a *storage garage*, or any other location where it could be exposed to flammable vapours or gases, unless

a) it is enclosed in a *service room* that is separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h,

b) it is supplied with combustion air directly from outside the *building*, and

c) the heat that it generates is supplied indirectly to the space served by means of ducts or piping.

4) A *service room* containing an incinerator shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 2 h.

5) Equipment that uses a liquid having a *flash point* below 93.3°C shall be installed in a *service room* separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

6) Electrical equipment that is required to be located in a service room according to the Electrical Safety Regulation shall be installed in a service room separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

7) Except as permitted by Sentence (8), in a *storey* that is not *sprinklered* throughout, a *service room* that contains service equipment other than that addressed by Sentences (1) to (6) shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

8) Where a *service room* contains a limited quantity of service equipment, and the service equipment neither constitutes a fire hazard nor is essential to the operation of fire safety systems in the *building*, the requirements for a *fire separation* shall not apply.
9) A *fire separation* is not required between a fireplace and the space it serves.
10) A *fire separation* is not required between a roof-top *appliance* and the *building* it serves.

3.6.2.2. Service Rooms under Exits

1) A *service room* containing service equipment subject to possible explosion, such as *boilers* operating in excess of 100 kPa (gauge) and some types of refrigerating machinery and transformers, shall not be located directly under a required *exit*.

3.6.2.3. Service Equipment

1) A *service room* containing space heating, space cooling and service water heating *appliances* is permitted to contain other service equipment such as electrical service equipment.

3.6.2.4. Incinerator Rooms

1) A *service room* containing an incinerator shall not contain other fuel-fired *appliances*.

3.6.2.5. Combustible Refuse Storage

1) Except as required by Sentence 3.6.3.3.(9), a room for the storage of *combustible* refuse shall be
- a) separated from the remainder of the *building* by a *fire separation* with a *fire-resistance rating* not less than 1 h, and
- b) *sprinklered*.

(See Note A-3.6.2.5.(1).)

3.6.2.6. Door Swing for Service Rooms

1) A swing-type door from a *service room* containing a *boiler* or incinerator shall swing outward from the room, except that the door shall swing inward if the door opens onto a corridor or any room used for an *assembly occupancy*. (See also Sentence 3.4.4.4.(7).)

3.6.2.7. Electrical Equipment Vaults

1) An electrical equipment vault the Electrical Safety Regulation shall conform to Sentences (2) to (8).
2) An electrical equipment vault referred to in Sentence (1) shall be separated from the remainder of the *building* by a *fire separation* of *solid masonry* or concrete construction having a *fire-resistance rating* not less than
- a) 3 h if the vault is not protected by an automatic fire extinguishing system, or
- b) 2 h if the vault is protected by an automatic fire extinguishing system.

3) If a *building* is *sprinklered* throughout, an electrical equipment vault referred to in Sentence (1) need not be *sprinklered* provided
- a) the vault is designed for no purpose other than to contain the electrical equipment, and
- b) the vault contains a *smoke detector* which will actuate the *building* fire alarm system in the event of a fire in the vault.

4) Only pipes or ducts necessary for fire protection or the proper operation of the electrical installation shall penetrate the *fire separation* referred to in Sentence (2).
5) Explosion-relief devices and vents or other protective measures conforming to Sentence 3.3.1.20.(3) shall be provided for an electrical equipment vault referred to in Sentence (1) that contains dielectric-liquid-filled electrical equipment. (See Note A-3.6.2.7.(5).)
6) An electrical equipment vault referred to in Sentence (1) shall be provided with a ventilation system designed in conformance with Part 6 to prevent the ambient temperature in the vault from exceeding 40°C.
7) The ventilation system required by Sentence (6) shall be separate from the system for the remainder of the *building* and shall be designed so that it is automatically shut off in the event of a fire in the vault.

8) The floor of an electrical equipment vault referred to in Sentence (1) shall be liquid tight and surrounded by liquid tight walls and sills of sufficient height to confine within the vault all of the liquid from the largest item of electrical equipment, but to a height of not less than 100 mm.
9) Electrical equipment vaults shall be secured against unauthorized entry.

3.6.2.8. Emergency Power Installations
1) Where a generator intended to supply emergency power for lighting, fire safety and life safety systems is located in a *building*, except where such *building* is used solely for the purpose of housing the generator and its ancillary equipment, it shall be located in a room that
a) is separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 2 h, and
b) contains only the generating set and equipment related to the emergency power supply system.

3.6.3. Vertical Service Spaces and Service Facilities

3.6.3.1. Fire Separations for Vertical Service Spaces
1) Except as provided in Articles 3.6.3.3. and 3.6.3.5. and Section 3.5., a *vertical service space* shall be separated from all other portions of each adjacent *storey* by a *fire separation* having a *fire-resistance rating* conforming to Table 3.6.3.1. for the *fire-resistance rating* required by Subsection 3.2.2. for
a) the floor assembly above the *storey*, or
b) the floor assembly below the *storey*, if there is no floor assembly above.
(See Note A-3.6.3.1.(1).)

Table 3.6.3.1.
Fire Separations for Vertical Service Spaces
Forming Part of Sentence 3.6.3.1.(1)

Fire-Resistance Rating **of** *Fire Separation* **Required for Floor Assembly**	**Minimum** *Fire-Resistance Rating* **of** *Vertical Service Space*
less than 45 min	–
45 min	45 min
1 h	45 min
1.5 h	1 h
2 h or more	1 h

2) A *vertical service space* that does not extend through the roof of a *building* shall be enclosed at the top with construction having a *fire-resistance rating* not less than that required for the *vertical service space* walls.
3) A *vertical service space* that does not extend to the bottom of a *building* shall be enclosed at the lowest level with construction having a *fire-resistance rating* not less than that required for the *vertical service space* walls.
4) A vent from a *vertical service space* not extending to the roof shall be enclosed within the *building* with construction having a *fire-resistance rating* not less than that required for the *vertical service space* walls.
5) Only openings that are necessary for the use of the *vertical service space* shall be permitted through a *vertical service space* enclosure.

3.6.3.2. Foamed Plastic Protection

1) Foamed plastic insulation in a *vertical service space* shall be protected in conformance with Article 3.1.5.14.

3.6.3.3. Linen and Refuse Chutes

1) A linen chute or refuse chute shall
a) be impervious to moisture,
b) have a smooth internal surface,
c) be corrosion-resistant,
d) be constructed of *noncombustible* material, and
e) be located in a shaft in which there are no services other than *noncombustible* drain, waste and vent piping or *noncombustible* water piping.

2) A shaft containing a linen chute or refuse chute shall have a *fire-resistance rating* conforming to Sentence 3.6.3.1.(1), but not less than
a) 1 h if the chute outlet for the discharge room is protected by an automatic, self-latching *closure* held open by a fusible link, or
b) 2 h if no *closure* is provided at the chute outlet into the discharge room.

3) An interior linen chute or refuse chute shall extend not less than 1 m above the roof and shall be vented above the roof with a vent which
a) has an unobstructed area not less than the cross-sectional area of the chute, and
b) is equipped with a cover that will open automatically, or that can be opened manually, in the event of a fire in the chute.

4) Intake openings for a linen chute or a refuse chute shall
a) have an area not more than 60% of the cross-sectional area of the chute, and
b) be fitted with *closures* designed to close automatically and latch after use.

5) Intake openings for a linen chute or a refuse chute shall be located in rooms or compartments that
a) have no dimension less than 750 mm,
b) are separated from the remainder of the *building* by a *fire separation* with a *fire-resistance rating* not less than 45 min,
c) are designed for no other purpose, and
d) do not open directly into an *exit*.

6) Sprinklers shall be installed at the top of each linen chute or refuse chute, at alternate floor levels and in the room or bin into which the chute discharges.

7) The room into which a linen chute discharges shall be separated from the remainder of the *building* by a *fire separation* with a *fire-resistance rating* not less than 1 h.

8) A refuse chute shall be equipped at the top with spray equipment for washing-down purposes.

9) A refuse chute shall discharge only into a room or bin separated from the remainder of the *building* by a *fire separation* with a *fire-resistance rating* not less than 2 h.

10) The room or bin into which a refuse chute discharges shall be of sufficient size to contain the refuse between normal intervals of emptying, be impervious to moisture and be equipped with a water connection and floor drain for washing-down purposes.

11) A room into which a refuse chute discharges shall contain no service equipment that is not related to refuse handling and disposal.

3.6.3.4. Exhaust Duct Negative Pressure

1) If a *vertical service space* contains an *exhaust duct* that serves more than one *fire compartment*,
a) the duct shall have a fan located at or near the exhaust outlet to ensure that the duct is under negative pressure, and
b) the individual *fire compartments* shall not have individual fans that exhaust directly into the duct in the *vertical service space*.

3.6.3.5. Grease Duct Enclosures

(See Note A-3.6.3.5.)
1) Except as provided in Sentence (2), *fire separations* enclosing grease ducts for commercial cooking operations shall conform to NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations."
2) The *fire-resistance rating* of field-applied and factory-built grease duct enclosure assemblies shall be determined in conformance with CAN/ULC-S144, "Fire Resistance Test – Grease Duct Assemblies."

3.6.4. Horizontal Service Spaces and Service Facilities

3.6.4.1. Scope

1) This Subsection applies to *horizontal service spaces* and service facilities, including ceiling spaces, duct spaces, crawl spaces and *attic or roof spaces*.

3.6.4.2. Fire Separations for Horizontal Service Spaces

1) Except as provided in Article 3.6.3.5., a *horizontal service space* that penetrates a required vertical *fire separation* shall be separated from the remainder of the *building* it serves in conformance with Sentence (2).
2) If a *horizontal service space* or other concealed space is located above a required vertical *fire separation* other than a vertical shaft, this space need not be divided at the *fire separation* as required by Article 3.1.8.3. provided the construction between this space and the space below is a *fire separation* with a *fire-resistance rating* equivalent to that required for the vertical *fire separation*, except that the *fire-resistance rating* is permitted to be not less than 30 min if the vertical *fire separation* is not required to have a *fire-resistance rating* more than 45 min. (See Note A-3.6.4.2.(2).)

3.6.4.3. Plenum Requirements

1) A concealed space used as a *plenum* within a floor assembly or within a roof assembly need not conform to Sentence 3.1.5.18.(1) and Article 3.6.5.1., provided
- a) all materials within the concealed space have a *flame-spread rating* not more than 25 and a smoke developed classification not more than 50, except for
  - i) tubing for pneumatic controls,
  - ii) optical fibre cables and electrical wires and cables with *combustible* insulation, jackets or sheathes that are used for the transmission of voice, sound or data and conform to Sentences 3.1.4.3.(2) and 3.1.5.21.(2) (FT6 Rating), and
  - iii) totally enclosed non-metallic raceways with an FT6 rating, when tested in accordance with Clause 3.1.5.23.(1)(a), in *buildings* required to be of *noncombustible construction.*, and
  - iv) **Deleted,**
- b) the supports for the ceiling membrane are of *noncombustible* material having a melting point not below 760°C.

2) If a concealed space referred to in Sentence (1) is used as a return-air *plenum* and incorporates a ceiling membrane that forms part of the required *fire-resistance rating* of the assembly, every opening through the membrane shall be protected by a *fire stop flap* that
- a) stops the flow of air into the concealed space in the event of a fire,
- b) is supported in a manner that will maintain the integrity of the ceiling membrane for the duration of time required to provide the required *fire-resistance rating*,
- c) conforms to CAN/ULC-S112.2, "Fire Test of Ceiling Firestop Flap Assemblies," and
- d) activates at a temperature approximately 30°C above the normal maximum temperature that occurs in the return-air *plenum*, whether the air duct system is operating or shut down.

3) Notwithstanding Sentence (1), all optical fibre cables and electrical wires and cables installed in a concealed space used as a plenum shall:
- a) have a flame spread of no more than 1.5 m, a smoke density of not more than 0.5 at peak optical density and a smoke density not more than 0.15 at average optical density when tested in

conformance with the Horizontal Flame and Smoke Test referenced in Clause 4.11.6. of CAN/CSA C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables" (FT6 Rating),

b) be located in totally enclosed noncombustible raceways (See Note A-3.1.4.3.(1)(b)(i).), or

c) be located in totally enclosed nonmetallic raceway conforming to Article 3.1.5.23.

4) Notwithstanding Clause (3)(a), minor components of wiring systems such as communication conductors no more than 9 m in length, including the drop down to floor level, that exhibit a vertical char of no more than 1.5 m when tested in conformance with the Vertical Flame Test - Cables in Cable trough in Clause 4.11.4. of the CAN/CSA C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables" (FT4 Rating), may be installed in a concealed space used as a plenum.

3.6.4.4. Attic or Roof Space Access

1) An *attic or roof space* more than 600 mm high shall be provided with access from the floor immediately below by a hatchway not less than 550 mm by 900 mm or by a stairway.

3.6.4.5. Horizontal Service Space Access

1) A *horizontal service space*, consisting of ceiling and duct spaces, which is more than 1 200 mm high and 600 mm wide shall have inspection doors not less than 300 mm in both horizontal and vertical dimensions placed so that the entire interior of the duct or space can be viewed.

3.6.4.6. Crawl Space Access

1) A crawl space shall have at least one access opening not less than 550 mm by 900 mm.

3.6.5. Air Duct and Plenum Systems

3.6.5.1. Duct Materials

1) Except as permitted by Sentences (2) to (5) and Article 3.6.4.3., all ducts, duct connectors, associated fittings and *plenums* used in air duct systems shall be constructed of steel, aluminum alloy, copper, clay, asbestos-cement or other *noncombustible* material.

2) Except as permitted by Sentence (3), ducts, associated fittings and *plenums* are permitted to contain *combustible* material provided they

a) conform to the appropriate requirements for Class 1 duct materials in CAN/ULC-S110, "Test for Air Ducts,"

b) conform to Article 3.1.5.18. in a *building* required to be of *noncombustible construction*,

c) conform to Subsection 3.1.9.,

d) are used only in horizontal runs in a *building* required to be of *noncombustible construction*,

e) are not used in vertical runs serving more than 2 *storeys* in a *building* permitted to be of *combustible construction*, and

f) are not used in air duct systems in which the air temperature could be more than 120°C.

3) Combustible ducts which are part of a duct system conveying only ventilation air and are contained entirely within a *dwelling unit* need not comply with the requirements of Sentences (1) and (2).

4) Duct sealants shall have a *flame-spread rating* not more than 25 and a smoke developed classification not more than 50.

5) Duct connectors that contain *combustible* materials and that are used between ducts and air outlet units shall

a) conform to the appropriate requirements for Class 1 air duct materials in CAN/ULC-S110, "Test for Air Ducts,"

b) be not more than 4 m long,

c) be used only in horizontal runs, and

d) not penetrate a required *fire separation*.

3.6.5.2. Vibration Isolation Connectors

1) Except as permitted by Sentence (2), vibration isolation connectors in air duct systems shall be *noncombustible*.
2) Combustible fabric vibration isolation connectors are permitted provided they

a) are not more than 250 mm long,
b) comply with the flame-resistance requirements of CAN/ULC-S109, "Flame Tests of Flame-Resistant Fabrics and Films," and
c) are not used in a location where they are exposed to heated air or radiation from heat sources that could cause the exposed surface temperature to be more than 120°C.

3.6.5.3. Tape

1) Tape used to seal joints in air ducts, *plenums* and other parts of air duct systems shall meet the flame-resistance requirements for fabric in CAN/ULC-S109, "Flame Tests of Flame-Resistant Fabrics and Films."

3.6.5.4. Coverings, Linings, Adhesives and Insulation

1) Coverings, linings and associated adhesives and insulation for air ducts, *plenums* and other parts of air duct systems that would have an exposed surface temperature more than 120°C when exposed to heated air or radiation from heat sources shall be of *noncombustible* material.
2) Except as permitted by Sentence (3), *combustible* coverings and linings, including associated adhesives and insulation, shall have

a) a *flame-spread rating* not more than 25 on any exposed surface or any surface that would be exposed by cutting through the material in any direction, and
b) a smoke developed classification not more than 50.

3) The outer covering of ducts, *plenums* and other parts of air duct systems used within an assembly of *combustible construction* is permitted to have

a) an exposed surface *flame-spread rating* not more than 75, and
b) a smoke developed classification not more than 50.

4) Combustible coverings and linings referred to in Sentences (2) and (3) shall not flame, glow, smoulder or smoke when tested in accordance with the method of test in ASTM C 411, "Hot-Surface Performance of High-Temperature Thermal Insulation," at the maximum temperature to which the coverings and linings are to be exposed in service.
5) Except as permitted by Sentence (6), foamed plastic insulation shall not be used as part of an air duct system or for insulating an air duct.
6) Foamed plastic insulation is permitted to be installed in a ceiling space that is used as a return air *plenum* provided the foamed plastic insulation is protected from exposure to the *plenum* in accordance with Article 3.1.5.14.
7) Combustible coverings and linings of ducts, including associated adhesives and insulation, shall be interrupted where the duct penetrates a *fire separation* and at the immediate area of operation of heat sources in a duct system, including electric resistance heaters or fuel-burning heaters or *furnaces*.

3.6.5.5. Insulation and Coverings

1) Insulation and coverings on pipes in which the temperature of the fluid exceeds 120°C shall

a) be made of *noncombustible* material, or
b) not flame, glow, smoulder or smoke when tested in accordance with ASTM C 411, "Hot-Surface Performance of High-Temperature Thermal Insulation," at the maximum temperature to which the insulation or covering is to be exposed in service.

2) Except as permitted by Sentence (5), where *combustible* insulation is used on piping in a *horizontal service space* or a *vertical service space*, the insulation and coverings on that piping shall have a *flame-spread rating*, on any exposed surface and on any surface that would be exposed by cutting through the material in any direction,

a) not more than 25 in a *building* required to be of *noncombustible construction*, or
b) not more than 75 in a *building* permitted to be of *combustible construction*.

3) Except as permitted by Sentence (5), insulation and coverings on piping located in rooms and spaces other than the *service spaces* described in Sentence (2) shall have a *flame-spread rating* not more than that required for the interior finish of the ceiling of the room or space.
4) Except as permitted by Sentence (5), *combustible* insulation and covering used on piping in a *building* within the scope of Subsection 3.2.6. shall have a smoke developed classification not more than 100.
5) No *flame-spread rating* or smoke developed classification limits are required for *combustible* insulation and coverings used on piping located within a

a) concealed space in a wall,
b) floor slab, or
c) noncombustible enclosure.

3.6.5.6. Clearance of Ducts and Plenums

1) The clearance of *furnace plenums* from *combustible* material shall conform to the requirements of the appropriate standards referenced in Sentence 6.2.1.5.(1).
2) If the *plenum* clearance required in accordance with Sentence (1) is not more than 75 mm, the clearance between a *supply duct* and *combustible* material shall be not less than

a) the required *plenum* clearance within a horizontal distance of 450 mm from the *plenum*, and
b) 12 mm at a horizontal distance of 450 mm or more from the *plenum*, except that this clearance is permitted to be reduced to zero beyond a bend or offset in the duct sufficiently large to shield the remainder of the *supply duct* from direct radiation from the *furnace* heat exchanger.

(See Note A-3.6.5.6.(2).)
3) If the *plenum* clearance required in accordance with Sentence (1) is more than 75 mm but not more than 150 mm, a) the clearance between a *supply duct* and *combustible* material shall be not less than

a) the required *plenum* clearance within a horizontal distance of 1 800 mm from the *plenum*, and
b) 12 mm at a horizontal distance of 1 800 mm or more from the *plenum*, except that this distance is permitted to be reduced to zero beyond a bend or offset in the duct sufficiently large to shield the remainder of the *supply duct* from direct radiation from the *furnace* heat exchanger.

(See Note A-3.6.5.6.(3).)
4) If the *plenum* clearance required in accordance with Sentence (1) is more than 150 mm, the clearance between a *supply duct* and *combustible* material shall be not less than

a) the required *plenum* clearance within a horizontal distance of 1 000 mm from the *plenum*,
b) 150 mm within a horizontal distance between 1 000 mm and 1 800 mm from the *plenum*, and
c) 25 mm at a horizontal distance of 1 800 mm or more from the *plenum*, except that this distance is permitted to be reduced to 8 mm beyond a bend or offset in the duct sufficiently large to shield the remainder of the *supply duct* from direct radiation from the *furnace* heat exchanger.

(See Note A-3.6.5.6.(4).)
5) If a register is installed in a floor directly over a pipeless *furnace*, a double-walled register box with not less than 100 mm between walls, or a register box with the warm-air passage completely surrounded by the cold-air passage, shall be permitted instead of the clearances listed in Sentences (2), (3) and (4).

3.6.5.7. Supply, Return, Intake and Exhaust-Air Openings

1) Combustible grilles, diffusers and other devices for supply, return, and exhaust-air openings in rooms shall conform to the *flame-spread rating* and smoke developed classification requirements for the interior finish of the surface on which they are installed.

3.6.5.8. Return-Air System

1) Except as required by Sentences (2) and (3), *return ducts* shall be constructed of material having a *flame-spread rating* not more than 150.
2) If any part of a *return duct* will be exposed to radiation from the *furnace* heat exchanger or other radiating part within the *furnace*, that part of a *return duct* directly above or within 600 mm of the outside *furnace* casing shall be *noncombustible*.

3) Return ducts serving solid-fuel-burning *furnaces* shall be constructed of *noncombustible* material.

4) Combustible return ducts shall be lined with *noncombustible* material

a) below floor registers,

b) at the bottom of vertical ducts, and

c) under *furnaces* having a bottom return.

3.6.5.9. Location of Exhaust Vents in a Building Containing not more than Two Principal Dwelling Units

1) In exhaust vents serving heating and air conditioning equipment and similar appliances, other than direct vented fireplaces, shall be directed

a) vertically through the roof of a *building*, with the discharge located at least 1.5 m away from any property line, or

b) horizontally through an exterior wall which faces a *street*, with the discharge located at least 3 m away from any property line.

Section 3.7. Health Requirements

3.7.1. Height of Rooms

greg

3.7.1.1. Room and Space Height

1) The height of every room and space shall be sufficient so that the ceiling or ceiling fixtures do not obstruct movement or activities below.

2) The unobstructed height in *dwelling units* shall conform to Subsection 9.5.3.

3.7.2. Plumbing Facilities

3.7.2.1. Plumbing and Drainage Systems

1) Except as permitted in Sentence (2), if the installation of a *sanitary drainage system* is not possible because of the absence of a water supply, sanitary privies, chemical closets or other means for the disposal of human waste shall be provided.

2) Waterless urinals are permitted to be used in *buildings* provided with a water supply.

3.7.2.2. Water Closets

1) Except as permitted by Sentence (4), water closets shall be provided for each sex assuming that the *occupant load* is equally divided between males and females, unless the proportion of each sex expected in the *building* can be determined with reasonable accuracy. (See Note A-3.7.2.2.(1).)

2) Deleted.

3) Deleted.

4) Both sexes are permitted to be served by a single water closet if the *occupant load* in an *occupancy* referred to in Sentence (6), (10), (12), (13), (14) or (16) is not more than 25.

5) Urinals are permitted to be substituted for two thirds of the number of water closets required by this Article for males, except that if only 2 water closets are required for males, one urinal is permitted to be substituted for one of the water closets.

6) Except as permitted by Sentences (4), (7), (8), (17) and (18), the number of water closets required for *assembly occupancies* shall conform to Table 3.7.2.2.-A.

Table 3.7.2.2.-A
Water Closets for an Assembly Occupancy
Forming Part of Sentence 3.7.2.2.(6)

Number of Persons of Each Sex	Minimum Number of Water Closets	
	Male	Female
1 - 25	1	1
26 - 50	1	2
51 - 75	2	3
76 - 100	2	4
101 - 125	3	5
126 - 150	3	6
151 - 175	4	7
176 - 200	4	8
201 - 250	5	9
251 - 300	5	10
301 - 350	6	11
351 - 400	6	12
Over 400	7, plus 1 for each additional increment of 200 males in excess of 400	13, plus 1 for each additional increment of 100 females in excess of 400

7) The number of water closets required for primary schools and *child care facilities* shall be at least one for each 30 males and one for each 25 females.
8) The number of water closets required for places of worship and undertaking premises shall be at least one for each 150 persons of each sex.
9) The number of water closets required for a *treatment* or *detention occupancy* shall be determined on the basis of the special needs of the *occupancy*.
10) Except as permitted by Sentences (4) and (7), the number of water closets required for a *care* or *residential occupancy* shall be at least one for each 10 persons of each sex.
11) At least one water closet shall be provided for each *dwelling unit*.
12) Except as permitted by Sentences (4) and (17), the number of water closets required for a *business and personal services occupancy* shall conform to Table 3.7.2.2.-B.

Table 3.7.2.2.-B
Water Closets for a Business and Personal Services Occupancy
Forming Part of Sentences 3.7.2.2.(12) and (16)

Number of Persons of Each Sex	Minimum Number of Water Closets for Each Sex
1 - 25	1
26 - 50	2
Over 50	3, plus 1 for each additional increment of 50 persons of each sex in excess of 50

13) Except as permitted by Sentences (4), (16) and (17), the number of water closets required for a *mercantile occupancy* shall be at least one for each 300 males and one for each 150 females.
14) Except as permitted by Sentences (4) and (17), the number of water closets required for an *industrial occupancy* shall conform to Table 3.7.2.2.-C.

Table 3.7.2.2.-C
Water Closets for an Industrial Occupancy
Forming Part of Sentence 3.7.2.2.(14)

Number of Persons of Each Sex	Minimum Number of Water Closets for Each Sex
1 - 10	1
11 - 25	2
26 - 50	3
51 - 75	4
76 - 100	5
Over 100	6, plus 1 for each additional increment of 30 persons of each sex in excess of 100

15) In a *building* whose *floor area* is more than 600 m^2 and that includes one or more individual tenant spaces for a *business and personal services occupancy* or *mercantile occupancy*, water closets shall be located so that they are accessible to the public when the *building* is occupied.
16) The number of water closets required in a *suite* of *mercantile occupancy* whose area is not more than 500 m^2 is permitted to be determined in accordance with Table 3.7.2.2.-B based solely on the total number of staff.
17) Two unisex toilet rooms may serve an *assembly occupancy*, a *business and personal services occupancy*, a *mercantile occupancy*, or an *industrial occupancy* provided
a) the *suite* area of the *occupancy* is not more than 200 m^2,
b) the total *occupant load* of the *occupancy* is no more than 60 persons,
c) each toilet room is fitted out with one water closet and one lavatory, and
d) at least one of the toilet rooms complies with the requirements of Sentence 3.7.2.10.(9)
18) Three unisex toilet rooms are permitted to serve 61 to 100 persons in an *assembly occupancy* provided
a) each toilet room is fitted out with one water closet and one lavatory, and

b) at least one of the unisex toilet rooms complies with the requirements of Sentence 3.7.2.10.(9).

3.7.2.3. Lavatories

1) Except as permitted by Sentence (2), at least one lavatory shall be provided in a room containing one or 2 water closets or urinals, and at least one additional lavatory shall be provided for each additional 2 water closets or urinals.
2) Wash fountains in circular form are permitted to be provided in lieu of lavatories required by Sentence (1) provided each 500 mm of circumference is considered to be the equivalent of one lavatory.
3) Any shelf or projection above a lavatory shall be located so that it will not be a hazard.
4) Lavatories required by Sentence (1) shall be equipped with faucets that
a) operate automatically, or
b) have a manual control that
i) complies with Clause 3.8.3.8.(1)(c),
ii) does not require the application of continuous force to maintain water flow, and
iii) where metered, provides at least 10 s of water flow.

3.7.2.4. Mobile Home Facilities

1) If mobile homes do not have individual sanitary facilities connected to a central water supply and drainage system, a service *building* shall be provided for public use.
2) The service *building* required by Sentence (1) shall contain
a) at least one water closet for each sex if the service *building* facilities serve not more than 10 mobile homes, and
b) an additional water closet for each sex for each additional 10 mobile homes.
3) If a service *building* is required by Sentence (1), it shall contain lavatories as required by Sentence 3.7.2.3.(1) and at least
a) one laundry tray or similar facility, and
b) one bathtub or shower for each sex.

3.7.2.5. Safety Glass

1) Glass, other than safety glass, shall not be used for a shower or bathtub enclosure.

3.7.2.6. Surface Protection

1) Wall and floor surfaces below the uppermost surfaces of a urinal shall be protected from deterioration by impervious and durable material for a distance from the urinal to a point not less than 900 mm from the projected outline of the urinal on to the wall or floor.
2) Floor surfaces around a water closet shall be protected from deterioration by an impervious and durable material for a distance not less than 900 mm from the projected outline of the water closet on the floor.

3.7.2.7. Floor Drain

1) A floor drain shall be installed in a washroom containing a urinal equipped with an automatic flushing device.

3.7.2.8. Grab Bars Installation

1) Grab bars shall
a) be slip-resistant and free of any sharp or abrasive elements,
b) be mounted on surfaces that are free of any sharp or abrasive elements,
c) be able to resist a load of not less than 1.3 kN applied vertically or horizontally,
d) be 30 mm to 40 mm in diameter, and
e) where mounted on a wall, have a clearance of 35 mm to 45 mm from the wall.

3.7.2.9. Bathtubs and Showers

1) Where a bathtub is installed in a hotel or a motel, it shall
a) have a clear floor space at least 750 mm wide along its length, except that a water closet and a lavatory are permitted to project into this space provided they do not restrict access to the bathtub,
b) have faucets and other controls that conform to Clause 3.8.3.8.(1)(c),
c) have a slip-resistant bottom surface,
d) have grab bars that
i) conform to Sentence 3.7.2.8.(1),
ii) are not less than 1 200 mm long located vertically at the end of the bathtub that is adjacent to the clear floor space, with the lower end between 180 mm and 280 mm above the bathtub rim, and
iii) are not less than 1 200 mm long located horizontally along the length of the bathtub at 180 mm to 280 mm above the bathtub rim, and
e) be capable of being accessed along its full length with no tracks mounted on the bathtub rim.

2) A shower door that swings on a vertical axis shall be capable of opening outwards from a shower stall forming part of a site constructed fixture.

3.7.2.10. Accessible Washrooms

1) Where washrooms, baths or showers are required to be *accessible*, they shall conform to Subsection 3.8.3.
(See Note A-3.8.)

3.7.2.11. Gender Neutral Washroom Requirements
(See Note A-3.7.2.11.)

1) Individual toilet stalls in *gender neutral washroom facilities* shall
a) have partition walls and doors that are full height with a clear opening height of no less than 150 mm and no more than 300 mm, measured from the finished floor to the underside of the partition wall or door, and
b) have a locking devices equipped with display mechanisms to indicates on the outside of the stall door if the stall is occupied.

2) The main entrance door serving the *gender neutral washroom facility* shall
a) have no door, or
b) have a door with an open transom or louvered grill.

3.7.3. Medical Gas Piping Systems

3.7.3.1. Medical Gas Piping

1) If a non-flammable medical gas piping system is installed, it shall be installed in conformance with
a) CSA Z7396.1, “Medical Gas Pipeline Systems – Part 1: Pipelines for Medical Gases, Medical Vacuum, Medical Support Gases, and Anaesthetic Gas Scavenging Systems,”and
b) Part 3 of Division B of the Fire By-law.

Section 3.8. Accessibility

Section 3.8. Accessibility
(See Note A-3.8.)

3.8.1. Scope

3.8.1.1. Scope

1) This Section is concerned with the design and construction of *buildings* and *occupancies* to make them *accessible*.
2) *Buildings* and facilities required to be *accessible* in accordance with Subsection 3.8.2. shall be designed in accordance with Subsection 3.8.3.
3) Access to *existing buildings* shall be provided to the extent required in Division B, Part 11.
4) *Adaptable dwelling units* shall be designed and constructed in accordance with Subsection 3.8.5.

3.8.2. Application

3.8.2.1. General

(See Note A-3.8.2.1.)
1) Except as provided in Clause 3.8.2.3.(2)(j), the requirements of this Section apply to all *buildings* and all areas of *buildings* where work functions can reasonably be expected to be performed by *persons with disabilities* except

a) *dwelling units*, row houses, boarding houses, lodging houses and construction camps, except as required by
  i) Article 3.8.2.12., or
  ii) Subsection 3.8.5.,

b) apartment and condominiums *buildings* except that an *accessible* path of travel conforming to Subsection 3.8.3. from *accessible* entrances as described in Article 3.8.2.2. throughout common areas and, if provided, to parking areas and passenger loading zones as described in Article 3.8.2.5. is required unless the *building* is not equipped with a passenger-elevating device, in which case an *accessible* path of travel as described in Article 3.8.2.3.
  i) need only be provided on the levels with *accessible* entrances, and
  ii) need not be provided where the difference in floor elevation between the entrance level or levels and every *dwelling unit* exceeds 600 mm,

c) *high-hazard industrial occupancies*,

d) *buildings* that are not intended to be occupied on a daily or full-time basis, including but not limited to automatic telephone exchanges, pump houses and substations,

e) public toilet *buildings* in locations such as highway rest areas, campgrounds, picnic grounds, parks and recreational vehicle parks where an *accessible* path of travel conforming to Subsection 3.8.3. is provided from a roadway or *street* to at least one other *accessible* public toilet *building*,

f) the *storey* next above or below the *accessible storey* in a *building* of not more than two *storeys* in *building height* provided the *storey* next above or below the *accessible storey*
  i) is less than 600 m² in *floor area*,
  ii) contains only facilities that are also contained on the *accessible storey*,
  iii) does not contain a *assembly major occupancy* with an area more than 100 m², and
  iv) is not served by a passenger-elevating device connecting the *storey* next above or below the *accessible storey* (See Note A-3.8.2.1.(1)(f) and (g).), and

g) the *storey* next above or below the *accessible storey* in a *building* with not more than one *storey* above the *first storey*, provided the *storey* next above or below the *accessible storey*
  i) is less than 600 m² in *floor area*,
  ii) contains only facilities that are also contained on the *accessible storey*,
  iii) does not contain an *assembly major occupancy* with an area more than 100 m², and
  iv) is not served by a passenger-elevating device connecting the *storey* next above or below the *accessible storeys*. (See Note A-3.8.2.1.(1)(f) and (g).)

2) *Buildings* and parts of *buildings* required by Sentence (1) and this Subsection to be *accessible* shall comply with Subsection 3.8.3. including, without limitation, exterior paths and stairs within property lines from roadways, *streets*, parking areas, exterior passenger-loading zones, and ancillary areas to all *accessible* entrances of these *buildings*.

3) The requirements of this Section take precedence over other requirements contained in this Part and in Part 9.
4) Where an *accessible* path of travel connects to a path of travel on the adjacent side of a *firewall* through a doorway, the requirements of this Section shall apply to the *floor areas* on both sides of the *firewall* as if they were in the same *building*.
5) *Access* shall be provided to *alterations*, additions and changes in *occupancy* to the extent required in Subsection 3.8.4.
6) Notwithstanding the exceptions of Sentence (1), the Enhanced Accessibility requirements of Sentence 3.8.3.1.(2) shall apply to all apartments and condominiums which contains three or more principal *dwelling units* served by an elevator and a *public corridor*.

3.8.2.2. Entrances
(See Note A-3.8.2.2.)
1) In addition to the *accessible* entrances required by Sentence (2), the principal entrance and not less than 50% of all pedestrian entrances of a *building* referred to in Sentence 3.8.2.1.(1) shall be *accessible* and shall lead from
a) the outdoors at sidewalk, roadway or *street* level, or
b) an *accessible* path of travel that complies with Subsection 3.8.3. and leads from a sidewalk, roadway or *street*.
2) A *suite* of *assembly occupancy*, *business and personal services occupancy* or *mercantile occupancy* that is located in the *first storey* of a *building*, or in a *storey* to which an *accessible* path of travel is provided, and that is completely separated from the remainder of the *building* so that there is no access to the remainder of the *building*, shall have at least one *accessible* entrance.
3) An *accessible* entrance required by Sentence (1) or (2) shall be designed in accordance with Subsection 3.8.3.
4) At an *accessible* entrance that includes more than one doorway, only one of the doorways is required to be designed in accordance with Subsection 3.8.3.
5) If a *walkway* or pedestrian bridge connects two *accessible storeys* in different *buildings*, the path of travel from one *storey* to the other *storey* by means of the *walkway* or bridge shall be *accessible*.
6) Where provided, an intercom system shall be installed at the principal entrance to an apartment or condominium building conforming to Sentence (1).

3.8.2.3. Areas Requiring Access
(See Note A-3.8.2.3.)
1) Except as permitted by Sentence (2), *access* from the *accessible* entrances required by Sentences 3.8.2.2.(1) and (2) shall be provided throughout the entrance *storey* or *storeys* and within all other normally occupied *floor areas* as required by Sentence 3.8.2.1.(1).
2) Except as required by Sentence (3), *access*is not required
a) to *service rooms*,
b) to elevator machine rooms,
c) to janitor's rooms,
d) to *service spaces*,
e) to crawl spaces,
f) to *attic or roof spaces*,
g) **reserved**,
h) **reserved**,
i) within portions of a *floor area* with fixed seats in an *assembly occupancy* where those portions are not part of the *accessible* path of travel to spaces designated for wheelchair use,
j) within floor levels of a *suite* of *residential occupancy* that are not at the same level as the entry level to the *suite*,

k) **reserved**, or
l) within those parts of a *floor area* that are not at the same level as the entry level, provided facilities and uses provided on any raised or sunken level are also *accessible* on the entry level.

3) In an *assembly occupancy*, the number of spaces designated for wheelchair use within rooms or areas with fixed seats shall conform to Table 3.8.2.3. (See also Article 3.8.3.21. for additional requirements.)

Table 3.8.2.3.
Designated Wheelchair Spaces
Forming Part of Sentence 3.8.2.3.(3)

Number of Fixed Seats in Seating Area	Number of Spaces Required for Wheelchairs
50 and under	2
51-150	4
151-300	5
301 - 500	6
501 - 5 000	6, plus one additional space for each increment of up to 150 in excess of 501 fixed seats
5 001 and over	36, plus one additional space for each increment of up to 200 in excess of 5 001 fixed seats

3.8.2.4. Path of Travel to Storeys Served by Escalators and Moving Walks

1) In a *building* in which an escalator or inclined moving walk provides access to any floor level above or below the entrance floor level, an interior *accessible* path of travel shall also be provided to hose floor levels. (See Note A-3.8.2.4.(1).)

2) The route from the escalator or inclined moving walk to the *accessible* path of travel that leads from floor to floor as required by Sentence (1) shall be clearly indicated by appropriate signs. (See also Article 3.8.2.10.)

3.8.2.5. Path of Travel to Parking Areas and Passenger-Loading Zones

(See Note A-3.8.2.5.)

1) An *accessible* path of travel shall be provided between parking stalls for *persons with disabilities* and an *accessible* entrance referred to in Article 3.8.2.2. (See Note A-3.8.2.5.(1).)

2) Where a passenger-elevating device serves one or more indoor parking levels, an *accessible* path of travel shall be provided between each parking level containing stalls for *persons with disabilities* and all other parts of the *building* required to be *accessible* in accordance with Subsection 3.8.3.

3) Passenger-loading zones shall comply with Subsection 3.8.3. and be provided with an *accessible* path of travel to an *accessible* entrance referred to in Article 3.8.2.2.

3.8.2.6. Controls and Outlets

1) Except as provided in Sentence 3.5.2.1.(3), controls for the operation of *building* services or safety devices, including electrical switches, thermostats, faucets, door and window hardware and intercom switches, that are intended to be operated by the occupant and are located in an *accessible floor area* shall comply with Subsection 3.8.3. (See Note A-3.8.2.6.(1).)

2) Electrical outlets that are intended for occupant use and are located in an *accessible floor area* shall be located in conformance with Subsection 3.8.3. (See Note A-3.8.2.6.(2).)

3.8.2.7. Power Door Operators

1) Except as provided in Sentences (2) and (3), every door that provides an *accessible* path of travel through an entrance referred to in Article 3.8.2.2., including the interior doors of a vestibule where provided, shall be equipped with a power door operator that complies with Subsection 3.8.3. and allows persons to activate the opening of the door in the intended direction of travel, where the entrance serves

a) a hotel,

b) a *building* of *treatment major occupancy*, or

c) a *building* of *assembly*, *care*, *business and personal service* or *mercantile major occupancy* more than 500 m^2 in *building area*.

2) The requirements of Sentence (1) do not apply to an individual *suite* having an area less than 500 m^2 in a *building* having only *suites* of *assembly*, *care*, *business and personal services* or *mercantile occupancy* if the *suite* is completely separated from the remainder of the *building* so that there is no access to the remainder of the *building*.

3) Only the active leaf in a multiple leaf door in an *accessible* path of travel need conform to the requirements of this Article.

3.8.2.8. Plumbing Facilities

1) Except as permitted by Sentences (2) and (12), and as required by Sentence (3), a washroom in a *storey* to which *access* is required in accordance with Article 3.8.2.3., shall be *accessible* to the extent required by this Article and in accordance with Subsection 3.8.3. (See Note A-3.8.2.8.(1) to (3).)

2) A washroom need not conform to the requirements of Sentence (1) provided

a) it is located within a *suite* of *residential occupancy* or a *suite* of *care occupancy*,

b) other *accessible* washrooms are provided on the same *floor area* within 45 m along an *accessible* path of travel,

c) **reserved**, or

d) it is located in a *business and personal services* or *mercantile occupancy*, with multiple *suites*, where at least one *accessible* washroom complying with Subsection 3.8.3. is either

i) available to all *suites*, or

ii) provided in each *suite* not having *access* to a washroom described in Subclause (i).

(See Note A-3.8.2.8.(1) to (3).)

3) In *buildings* and *occupancies* in which water closets are required in accordance with Subsection 3.7.2., at least one universal washroom complying with Subsection 3.8.3. shall be provided in the entrance *storey*, unless

a) an *accessible* path of travel is provided to a universal washroom complying with Subsection 3.8.3. elsewhere in the *building*, or

b) the water closets required by Subsection 3.7.2. are for *dwelling units* only.

(See Note A-3.8.2.8.(1) to (3).)

4) Reserved.

5) At least one water-closet stall or enclosure in a washroom required by Sentence (1)to be *accessible* shall comply with Subsection 3.8.3.

6) Where urinals are provided in an *accessible* washroom, at least one urinal shall comply with Subsection 3.8.3.

7) An *accessible* washroom shall be provided with at least one lavatory that complies with Subsection 3.8.3.

8) Where mirrors are provided in an *accessible* washroom, at least one mirror shall comply with Subsection 3.8.3.

9) Except as permitted in Sentence (12), in each location where drinking fountains are provided, at least one shall comply with Subsection 3.8.3. (See Note A-3.8.2.8.(9).)

10) Except within a *suite* of *residential occupancy*, where showers are provided in a *building*, at least one shower stall in each group of showers shall comply with Subsection 3.8.3.

11) Where a bathtub is installed in a *suite* required to be *accessible*, it shall comply with Subsection 3.8.3.

12) In *occupancies* or parts of *occupancies* designed to be *accessible* and used predominantly by children, in patient areas in *treatment occupancies*, and in resident areas in *care occupancies*, it is permissible to design and locate plumbing fixtures and grab bars differently than described in Subsection 3.8.3. to accommodate the special needs of children, patients, residents and *care* providers.

3.8.2.9. Assistive Listening Devices

(See Note A-3.8.2.9.)

1) In a *building* of *assembly occupancy*, all classrooms, auditoria, meeting rooms and *theatres* with an area of more than 100 m^2 shall be equipped with an assistive listening system complying with Subsection 3.8.3.

2) Courtrooms shall be equipped with an assistive listening system complying with Subsection 3.8.3.

3.8.2.10. Signs and Indicators

1) Unless the degree of *access* provided is such as to make these signs unnecessary, signs complying with Subsection 3.8.3. shall be installed in an *accessible floor area* to indicate the location of

- a) *accessible* entrances,
- b) alternate *access* routes,
- c) *accessible* spaces in seating areas,
- d) *accessible* refreshment facilities,
- e) *accessible* checkout lanes,
- f) *accessible* public telephones,
- g) *accessible* washrooms,
- h) *accessible* showers,
- i) *accessible* passenger-elevating devices,
- j) *accessible* parking stalls,
- k) *accessible* passenger-loading zones, and
- l) facilities for persons that are deaf or hard of hearing.

2) Where a washroom is not designed to accommodate persons with physical disabilities in a *storey* to which an *accessible* path of travel is required, signs shall be provided to indicate the location of *accessible* washrooms.

3) Except as provided in Sentence (4) and Sentence 3.4.6.3.(4), tactile walking surface indicators complying with Subsection 3.8.3. shall be provided

- a) at landings at the top of *flights* of stairs,
- b) at an entry to a vehicular route or area where no curbs or any other element separate the vehicular route or area from a pedestrian route, and
- c) along any edge of a platform that is not protected by a *guard*, and
  - i) higher than 250 mm above the adjacent surface, or
  - ii) above an adjacent slope having a gradient of more than 1 in 3.

4) Sentence (3) does not apply to *stages* or loading docks.

3.8.2.11. Counters and Counters for Telephones

1) Every counter at which the public is served and intended as a work surface for extended business transactions shall comply with Subsection 3.8.3. (See Note A-3.8.2.11.(1).) (See also Note A-3.8.2.3.)

2) Built-in shelves and counters provided for public telephones shall comply with Subsection 3.8.3.

3.8.2.12. Sleeping Rooms and Bed Spaces

1) Sentences (2) and (3) apply to sleeping rooms and bed spaces provided in

- a) residential clubs,
- b) residential schools and colleges,
- c) dormitories, and
- d) hotels and motels.

2) When sleeping rooms or bed spaces are provided, at least one for every 40 or part thereof shall conform to Subsection 3.8.3.

3) Where sleeping rooms or bed spaces are provided

a) for residential clubs, schools, colleges and dormitories, at least one room or space, in addition to rooms or spaces described in Sentence (2), shall be equipped with a visible warning system conforming to Article 3.2.4.19., and

b) for hotels and motels, at least one room or space for every 20 or part thereof, in addition to the rooms or spaces described in Sentence (1), shall be equipped with a visible warning system conforming to Article 3.2.4.19.

4) Sleeping rooms and bed spaces provided in *care occupancies* where the *building* is not equipped with a 2-stage fire alarm system shall be equipped with a visible warning system conforming to Article 3.2.4.19. (See also Clause 3.2.4.3.(1)(c).)

5) Each *dwelling unit* in an apartment or condominium *building* designed primarily for senior citizens shall be provided with special outlet boxes and cover plates as described in Sentence 3.2.4.19.(6). (See also Sentence 3.2.4.19.(7).)

3.8.3. Design

3.8.3.1. Design Standards

1) *Buildings* or parts thereof and facilities that are required to be *accessible* shall be designed in accordance with

a) this Subsection, or

b) the provisions of CSA B651, “Accessible Design for the Built Environment,” listed in Table 3.8.3.1., in their entirety.

(See Note A-3.8.3.1.(1).)

2) Notwithstanding the requirements of Sentence (1), *buildings* required to comply with the requirements of Article 3.8.2.1.(6) shall be equipped with the following (See Note A-3.8.3.1.(2))

a) interior and exterior stairs and ramps that are *accessible* to the public, with a colour contrast or distinctive pattern, visible from both directions of travel, demarcating the leading edge of treads,

b) door opening hardware within *dwelling units* and common amenity areas which may be operated

i) without tight grasping or twisting of the wrist, and

ii) by application, of a force of not more than 38 N for exterior doors or 22 N for interior doors, at the handle, push plate or latch-releasing device, except where the *Chief Building Official* determines that a greater force is necessary to ensure proper *building* function,

c) kitchen sinks and washbasins within *dwelling units* and common amenity spaces with faucets activated by levers or by devices that do not require tight grasping or twisting of the wrist,

d) wall assemblies reinforced adjacent to the toilet and bathtub to accommodate the future installation of grab bars,

e) an accessible path of travel from the main entrance and from any parking area or parking facility serving the *building* to the entry doors of *dwelling units* and to common amenity areas,

f) a clearance of not less 450 mm beside the latching jamb of dwelling unit entry doors

i) notwithstanding Clause 3.8.3.5.(1)(c),

ii) Despite the provisions of Clause (4)(f), if the *dwelling unit* contains pre-wired outlet boxes for a residential style automatic door opener and related controls, and the *Chief Building Official* determines that provision of the required clearance is impractical, the *Chief Building Official* may waive the clearance requirement.

g) accessible gender neutral washrooms in public or common amenity areas of the *building*,

h) entry doors with level thresholds leading into each *dwelling unit*, except for ramps or other devices conforming to Article 3.8.3.10.,

i) a washroom at the main entry level of each *dwelling unit*, containing a washbasin and toilet, with a minimum clear doorway opening of 800 mm and a minimum floor space, clear of the door swing, of 750 mm by 1 200 mm in front of each of the washbasin and toilet,

j) all doors in the accessible path of travel equipped with a self-closer with a closing period of no less than 3 seconds, measured from a door open position of 70 degrees to a point 75 mm from the door closed position,
k) power-operated doors at the main *building* entrance and the entrance from the parking area, and
l) signage in public areas, amenity spaces and exits in multi-unit residential *buildings* in conformance with Sentence 3.8.3.12.(3) of Division B.

Table 3.8.3.1.
Accessible Design Provisions
Forming Part of Sentence 3.8.3.1.(1)

Accessible **Application (By-law References)**	**Applicable** *CSA B651* **Provisions**
Interior accessible routes (3.8.3.2.)	4.3 and 5.1
Exterior accessible routes (3.8.3.3.)	8.2.1 to 8.2.5 and 8.2.7
Passenger pickup areas (3.8.3.4.)	9.3
Ramps (3.8.3.5.)	5.3 and 5.5
Doors and doorways (3.8.3.6.)	5.2
Passenger-elevating devices (3.8.3.7.)	5.6.2
Operating controls (3.8.3.8.)	4.2
Signage and indicators (3.8.3.9.)	4.3.5., 4.5 and 9.4
Drinking fountains (3.8.3.10.)	6.1
Washroom facilities (3.8.3.11. to 3.8.3.15.)	6.2 and 6.3
Bathing facilities (3.8.3.16. and 3.8.3.17.)	6.5
Communication (3.8.3.18. and 3.8.3.20.)	6.6
Counters (3.8.3.19. and 3.8.3.20.)	6.7.1
Spaces in seating areas (3.8.3.21.)	6.7.2

3.8.3.2. Accessible Path of Travel

1) Except as required elsewhere in this Part or as permitted by Article 3.8.3.6. pertaining to doorways, an *accessible* path of travel shall have

a) except for handrails, that are permitted to project not more than 100 mm from either or both sides into the clear area, an unobstructed width of not less than 1 500 mm except that the unobstructed width may be reduced to not less than

i) 1 100 mm between any two structures or fixtures in public aisles in merchandising establishments and exhibition facilities,
ii) 920 mm for permanent food service lines, and
iii) 810 mm through turnstiles, controlled checkout lanes or other restricted passageways constructed to control the flow or pedestrian traffic, and

b) an unobstructed height of not less than 1 980 mm for the full width of the route.

2) Interior and exterior walking surfaces that are within an *accessible* path of travel shall

a) have no opening that will permit the passage of a sphere more than 13 mm in diameter,

b) have any elongated openings oriented approximately perpendicular to the direction of travel,
c) be stable, firm and slip-resistant,
d) have a cross slope no steeper than 1 in 50,
e) be beveled at a maximum slope of 1 in 2 at changes in level between 6 mm and 13 mm,
f) be provided with sloped floors or ramps at changes in level more than 13 mm, and
g) be designed as a ramp complying with Article 3.8.3.5. where the floor or walk has a slope steeper than 1 in 20.

(See Note A-3.8.3.2.(2).)

3) An *accessible* path of travel is permitted to include ramps, passenger elevators or other platform-equipped passenger-elevating devices to overcome a difference in level. (See Note A-3.8.3.2.(3).)

4) The width of an *accessible* path of travel that is more than 30 m long shall be increased to not less than 800 mm for a length of 800 mm at intervals not exceeding 30 m.

5) An *accessible* path of travel shall be equipped to provide illumination in accordance with Sentences 3.2.7.1.(1) and (2). (See also Sentence 3.2.7.1.(3) and Article 9.34.2.7.)

6) An exterior mechanical lift and its controls provided in accordance with Sentence (3), shall be provided
a) where existing exterior site constraints make use of a ramp or elevator infeasible, and
b) sufficiently protected from inclement weather by
i) weather and moisture resistant construction, and
ii) sufficient cover or enclosure so as to ensure its continued safe operation.

(See Note A-3.8.3.2.(6)(a).)

3.8.3.3. Exterior Walks

1) Exterior walks that form part of an *accessible* path of travel shall
a) have a slip-resistant, continuous and even surface,
b) be not less than 500 mm wide, and
c) have a level area conforming to Clause 3.8.3.5.(1)(c) adjacent to an entrance doorway.

2) Exterior walks that form part of an *accessible* path of travel may contain curb ramps that shall
a) have a running slope
i) between 1 in 8 to 1 in 10 where the vertical rise is less than 75 mm, and
ii) between 1 in 10 to 1 in 12 where the vertical rise is 75 mm to 200 mm,
b) have a width of not less than 1 500 mm exclusive of flared sides,
c) have a surface including flared sides that shall
i) be slip-resistant,
ii) have tactile walking surface indicators conforming to Article 3.8.3.9., and
iii) have a smooth transition from the curb ramp to the adjacent surfaces, and
d) have flared sides with a slope of not more than 1 in 12 where pedestrians are likely to walk across them.

3) Curb ramps described in Sentence (2) do not require handrails or *guards*.

3.8.3.4. Passenger-Loading Zones and Parking Requirements

1) If a passenger-loading zone is provided, it shall have
a) an access aisle not less than 1 500 mm wide and 6 000 mm long adjacent and parallel to the vehicle pull-up space,
b) a curb ramp constructed in accordance with Sentence 3.8.3.3.(2), where there are curbs between the access aisle and the vehicle pull-up space and the difference in elevation between levels is not more than 200 mm, and
c) a clear height of not less than 2 750 mm at the pull-up space and along the vehicle access and egress routes.

2) Parking stalls for *persons with disabilities* shall comply with the Parking By-law (See Note A-3.8.3.4.(2).), and shall
a) have a firm, slip-resistant and level surface,

b) be located adjacent to an *accessible* entrance conforming to Article 3.8.3.5., and
c) be marked with signage or symbols identifying such stalls as exclusively for the use of *persons with disabilities*.

3) Where parking stalls are provided for *persons with disabilities*, entry and *exit* controls, security controls, ticketing equipment, and pay stations serving such parking stalls shall be designed and installed so that all user functions are located no more than 1 200 mm above the finished paved area, and are *accessible*.

4) This Article does not apply to *existing buildings* except for spaces created by
a) an *addition*,
b) the reconstruction of an existing space, and
c) the conversion of an existing space into an *ancillary residential unit*.

3.8.3.5. Ramps

1) Except as provided in Sentence 3.8.3.3.(2), a ramp located in an *accessible* path of travel shall
a) have a clear width not less than
i) 1 500 mm,
ii) 915 mm if the ramp serves a passageway that is 6 m or less in width, or
iii) 915 mm if a second ramp with a clear width not less than 915 mm also serves a passageway that is greater than 6 m in width,
(See Note A-3.4.3.4.),
b) have a slope not more than 1 in 12 (See Note A-3.8.3.5.(1)(b).),
c) have a level area not less than 1 500 by 1 500 mm at the top and bottom and at intermediate levels of a ramp leading to a door, so that on the latch side the level area extends not less than
i) 600 mm beyond the edge of the door opening where the door opens towards the ramp, or
ii) 300 mm beyond the edge of the door opening where the door opens away from the ramp,
(See Note A-3.8.3.5.(1)(c).),
d) have a level area not less than1 500 mm long and at least the same width as the ramp
i) at intervals not more than 9 m along its length, and
ii) where there is an abrupt change in the direction of the ramp, and
e) except as provided in Sentences (2) and (3), be equipped with a handrail on each side of the ramp conforming to Article 3.4.6.5., except that they shall be not less than 865 mm and not more than 965 mm high, and
f) be equipped with *guards* conforming to Article 3.4.6.6.

2) Handrails installed in addition to required handrails need not comply with the height requirements stated in Clause (1)(e).

3) The requirement for handrails in Clause (1)(e) need not apply to a ramp serving as an aisle for fixed seating.

4) The surfaces of ramps and landings shall
a) be hard or resilient where the ramp is steeper than 1 in 15 (See Note A-3.8.3.5.(4)(a).),
b) have a cross slope no steeper than 1 in 50, and
c) where exposed to water, be designed to drain.

5) Ramps and landings not at *grade* or adjacent to a wall shall have edge protection consisting of
a) a curb not less than 75 mm high, or
b) a raised barrier or rail located not more than 100 mm from the ramp or landing surface.

6) Reserved.

3.8.3.6. Doorways and Doors

1) Except where stated otherwise, this Article applies to swinging and sliding doors.

2) Every doorway that is located in an *accessible* path of travel shall have a clear width not less than 850 mm

a) for swinging doors, when measured from the face of the active leaf, in the open position of 90° to the doorway, to the outside edge of the stop on the door frame, and
b) for sliding doors, when measured from the edge of the door, in the open position, to the outside edge of the stop on the door frame.

(See Note A-3.8.3.6.(2).)

3) Doorways in an *accessible* path of travel to at least one bathroom within an *accessible suite* of *residential occupancy* shall have a clear width not less than 810 mm when measured in accordance with Clauses (2)(a) and (b). (See Article 3.8.2.12. and Note A-3.8.3.6.(3).)

4) Door-operating devices shall be graspable and operable
a) in accordance with Clause 3.8.3.8.(1)(c), and
b) at a height between 900 mm and 1 100 mm above the floor.

(See also Sentence 3.3.1.13.(4) regarding door release operation.)
(See Note A-3.8.3.6.(4).)

5) A threshold for a doorway referred to in Sentences (2) and (3) shall conform to Sentence 3.3.1.13.(11).

6) Power operated doors required by Sentence 3.8.2.7.(1) shall
a) have operators that activate automatically or through the use of controls that
i) function for passage in both directions when located in an *accessible* path of travel,
ii) are marked with the International Symbol of Access,
iii) are located clear of the door swing and not less than 600 mm and no more than 1 500 mm from that door swing,
iv) comply with Subclause 3.8.3.8.(1)(b),
v) are operable from a height between 150 mm and 300 mm as well as between 900 mm and 1 100 mm above the floor, and
vi) are operable by touching or approaching any part of their surface with a fist, arm or foot, and
b) unless equipped with safety sensors, have operators that
i) fully open the door in not less than 3 s, and
ii) require a force not more than 65 N to stop movement of the door, and
c) have a clear and level space extending the height of the doorway and not less than 1 100 mm long by the width of the door assembly on both sides of the assembly plus the arc of the door swing on any side into which the door swings.

(See Note A-3.8.3.6.(6) and (7).)

7) A cane-detectable *guard* shall be installed on the hinged side of power-assisted doors that swing open into the path of travel. (See Note A-3.8.3.6.(6) and (7).)

8) Except as provided in Sentence (9) and except for a door with a power door operator complying with Sentence (6), when unlatched, a door in an *accessible* path of travel shall open when the force applied to the handle, push plate or latch-releasing device is not more than
a) 38 N in the case of an exterior swinging door,
b) 22 N in the case of an interior swinging door, or
c) 22 N in the case of a sliding door.

9) Sentence (8) does not apply to a door at the entrance to a *dwelling unit*, or where greater forces are required in order to close and latch the door against the prevailing difference in air pressure on opposite sides of the door. (See Note A-3.8.3.6.(9).)

10) Except for a door at the entrance to a *dwelling unit*, a closer for a door in an *accessible* path of travel shall have a closing period of not less than 3 s measured from when the door is in an open position of 70° to the doorway, to when the door reaches a point 75 mm from the closed position, measured from the leading edge of the latch side of the door. (See Note A-3.8.3.6.(10).)

11) Unless equipped with a power door operator complying with Sentence (6), a door in an *accessible* path of travel shall have a clear and level space extending the height of the doorway and not less than
a) 1 500 mm deep by the width of the door assembly plus not less than 600 mm beside the latching jamb of the door on any side of the assembly into which a swinging door swings,

b) 1 200 mm deep by the width of the door assembly plus not less than 300 mm beside the latching jamb of the door on any side of the assembly into which a swinging door does not swing,
c) 1 200 mm deep by a width not less than 900 mm, including not less than 50 mm on the latching jamb side where the approach is perpendicular to a sliding door, and
d) 1 050 mm deep by a width not less than 1 390 mm, including not less than 540 mm on the latching jamb side where the approach is parallel to a sliding door.

(See Note A-3.8.3.6.(11).)

12) Doors in an *accessible* path of travel which are installed in series shall be separated by a distance of not less than 1 500 mm plus the width of any door that swings into the space in the path of travel from one door to another. (See also Clauses 3.2.8.4.(1)(a) and 3.3.5.7.(4)(a).)

13) Only the active leaf in a multiple-leaf door in an *accessible* path of travel need conform to the requirements of this Article.

14) Except as provided in Clause 3.8.3.5.(1)(c), the floor surface on each side of a door in an *accessible* path of travel shall be level within a rectangular area
a) as wide as the door plus the clearance required on the latch side by Sentence (11), and
b) whose dimension perpendicular to the closed door is not less than the width of the *accessible* path of travel but need not exceed 1 500 mm.

3.8.3.7. Passenger-Elevating Devices

1) A passenger-elevating device in an *accessible* path of travel shall conform to
a) Appendix E of ASME A17.1/CSA B44, “Safety Code for Elevators and Escalators,” (See also Sentence 3.5.2.1.(3).), or
b) CSA B355, “Lifts for Persons with Physical Disabilities.”

(See also Sentence 3.5.4.1.(3).)

3.8.3.8. Controls and Outlets

1) Controls described in this Section shall
a) be mounted 455 mm to 1 200 mm above the floor,
b) be adjacent to and centred on either the length or the width of a clear floor space of 1 350 mm by 800 mm, and
c) be operable
i) with one hand in a closed fist position, without requiring tight grasping, pinching with fingers, or twisting of the wrist, and
ii) unless otherwise stated, with a force not more than 22 N.

2) Electrical outlets described in this Section shall be located in conformance with Clause (1)(a).
(See Note A-3.8.2.6.(2).)

3.8.3.9. Signs and Indicators

1) Signs required by Article 3.8.2.10. shall incorporate the International Symbol of Access or the International Symbol of Access for Hearing Loss and appropriate graphical or textual information that clearly indicates the type of facilities available. (See Note A-3.8.3.9.(1).)

2) Signs required by Sentence (1) shall
a) be located so as to be easily read and understood,
b) be located so as to be seen by a person using a wheelchair,
c) be located so as to avoid shadow areas and surface glare, and
d) have characters and symbols in colours that contrast highly with their backgrounds.

3) Where provided, tactile walking surface indicators shall
a) be slip-resistant,
b) be durable,
c) be not more than 3 mm above or below the surrounding surface,
d) be detectable when walked upon, as being different from the surrounding surface,

e) be in a contrasting colour to the surrounding surface, and
f) when provided at stairs,
i) be located one tread width back from the top riser, and
ii) measure 600 mm to 650 mm by the full width of the stair, and
g) when provided on ramps or platforms,
i) be located 150 mm to 200 mm back from the lower end of the ramp or edge of platform, and
ii) measure 600 mm to 650 mm by the full width of the ramp or platform, but not including flared sides of the ramp.
(See Note A-3.8.3.9.(5).)

3.8.3.10. Drinking Fountains

1) Drinking fountains required by Sentence 3.8.2.8.(9) shall
a) be located along an *accessible* path of travel,
b) have a minimum clear floor space of 800 mm by 1 350 mm in front of it,
c) where it has frontal access, provide a knee clearance in accordance with Clause 3.8.3.15.(1)(d),
d) have a spout that
i) is located near the front of the unit, at a height between 750 mm and 915 mm above the floor, and
ii) directs water flow in a trajectory that is nearly parallel to the front of the unit, at a height not less than 100 mm, and
e) be equipped with controls that
i) activate automatically, or
ii) are located either on the front or on both sides of it and comply with Clause 3.8.3.8.(1)(c).

3.8.3.11. Water-Closet Stalls

1) Water-closet stalls and enclosures required by Sentence 3.8.2.8.(5) shall
a) be not less than 1 500 mm wide by 1 500 mm deep,
b) have a clear floor space of not less than 1 500 mm by 1 500 mm in front of the accessible stall,
c) be equipped with a door that
i) can be latched from the inside with a mechanism conforming to Clause 3.8.3.8.(1)(c),
ii) is aligned with either the transfer space adjacent to the water closet or with a clear floor space not less than 1 500 mm by 1 500 mm within the stall,
iii) provides a clear opening not less than 850 mm wide when measured in accordance with Clauses 3.8.3.6.(2)(a) and (b),
iv) is self-closing so that, when at rest, the door is ajar by not more than 50 mm beyond the jamb,
v) swings outward, unless there is clear floor space within the stall of at least 800 mm by 1 350 mm plus the arc of the door swing (See Note A-3.8.3.11.(1)(c)(v).),
vi) where the door swings outward, is provided with a horizontal, D-shaped, visually contrasting door pull not less than 140 mm long located on the inside such that its midpoint is 200 mm to 300 mm from the hinged side of the door and 900 mm to 1 100 mm above the floor (See Note A-3.8.3.11.(1)(c)(vi).), and
vii) is provided with a horizontal, D-shaped, visually contrasting door pull not less than 140 mm long located on the outside such that its midpoint is 120 mm to 220 mm from the latch side and 900 mm to 1 100 mm above the floor,
d) have a water closet located so that the distance between the centre line of the fixture and the wall on one side is 460 mm to 480 mm,
e) be equipped with an L-shaped grab bar that
i) is mounted on the side wall closest to the water closet,

ii) has horizontal and vertical components not less than 760 mm long mounted with the horizontal component 750 mm to 850 mm above the floor and the vertical component 150 mm in front of the water closet (See Note A-3.8.3.11.(1)(e)(ii).), and
iii) complies with Article 3.7.2.8.,

f) be equipped with either one grab bar at least 600 mm long and centred over the water closet, or two grab bars at least 300 mm long and located either side of the flush valve, that
i) conform to Article 3.7.2.8.,
ii) are mounted on the rear wall, and
iii) are mounted at the same height as the grab bar on the side wall or 100 mm above the top of the attached water tank, if applicable,

g) be equipped with a coat hook mounted not more than 1 200 mm above the floor on a side wall and projecting not more than 50 mm from the wall, and

h) be equipped with a toilet paper dispenser mounted on the side wall closest to the water closet such that
i) the bottom of the dispenser is 600 mm to 800 mm above the floor, and
ii) the closest edge of the dispenser is not more than 300 mm from the front of the water closet.

3.8.3.12. Universal Washrooms

(See Note A-3.8.3.12.)

1) A universal washroom shall

a) be served by an *accessible* path of travel,

b) have a door complying with Article 3.8.3.6. that
i) has a latch-operating mechanism located 900 mm to 1 100 mm above the floor that complies with Clause 3.8.3.8.(1)(c) and is capable of being locked from the inside, and released from the outside in case of emergency, and
ii) if it is an outward swinging door that is not self-closing, is provided with a horizontal, D-shaped, visually contrasting door pull not less than 140 mm long located on the inside such that its midpoint is ii) 200 mm to 300 mm from the hinged side of the door and 900 mm to 1 100 mm above the floor (See Note A-3.8.3.11.(1)(c)(vi).),

c) have one lavatory and one mirror conforming to Article 3.8.3.15.,

d) have one water closet conforming to Article 3.8.3.13. and Clause 3.8.3.11.(1)(d), with a clear floor space at least 900 mm wide that is parallel and adjacent to the open side of the water closet,

e) have grab bars conforming to Clauses 3.8.3.11.(1)(e) and (f),

f) have a coat hook conforming to Clause 3.8.3.11.(1)(g),

g) have a toilet paper dispenser conforming to Clause 3.8.3.11.(1)(h),

h) unless counter space of not less than 200 mm by 400 mm is provided, have a shelf located not more than 1 200 mm above the floor with a useable surface of not less than 200 mm by 400 mm, and

i) have a clear floor space of not less than
i) 3.7 m² with no dimension less than 1 700 mm when the door swings out, and
ii) 4.0 m² with no dimension less than 1 800 mm when the door swings in.

3.8.3.13. Water Closets

1) A water closet for a person with physical disabilities shall

a) be equipped with a seat that is not the spring-up type located 430 mm to 480 mm above the floor,

b) flush automatically or be equipped with a flushing control that
i) is located 500 mm to 900 mm above the floor,
ii) is located not more than 350 mm from the transfer side, and
iii) complies with Clause 3.8.3.8.(1)(c),

c) be equipped with a seat lid or other back support, and
d) where it has a tank, have a securely attached tank top.

(See Note A-3.8.3.13.(1).)

3.8.3.14. Urinals

1) Urinals described in Sentence 3.8.2.8.(6) shall

a) be wall-mounted or floor mounted, with the opening of the basin located not more than 430 mm above the floor,
b) be adjacent to an *accessible* route,
c) have a clear width of approach of 800 mm centred on the urinal and unobstructed by privacy screens,
d) have no step in front of it,
e) have a flush control that
   i) is automatic, or
   ii) complies with Clause 3.8.3.8.(1)(c) and is located 900 mm to 1 100 mm above the floor, and
f) have a vertically mounted grab bar installed on each side that
complies with Article 3.7.2.8.,
g) is not less than 600 mm long, with its centre line 1 000 mm above the floor, and
h) is located not more than 380 mm from the centre line of the urinal.

3.8.3.15. Lavatories and Mirrors

1) Lavatories required by Sentence 3.8.2.8.(7) shall

a) be equipped with faucets complying with Sentence 3.7.2.3.(4),
b) be located to provide a clear floor space in front of the lavatory of not less than 920 mm wide by 1 350 mm deep centered on the lavatory,
c) have a rim height not more than 865 mm above the floor,
d) have a clearance beneath the lavatory not less than
   i) 760 mm wide,
   ii) 735 mm high at the front edge,
   iii) 685 mm high at a point 250 mm back from the front edge, and
   iv) 250 mm high to a point 500 mm back from the front edge, (See Note A-3.8.3.15.(1)(d).)
e) have insulated water supply and drain pipes where these pipes are exposed (See Note A-3.8.3.15.(1)(e).),
f) have a soap dispenser that
   i) is automatic, or
   ii) complies with Clause 3.8.3.8.(1)(c) and is located not more than 1 100 mm above the floor, within 500 mm from the front of the lavatory (See Note A-3.8.3.15.(1)(f).), and
g) have a towel dispenser or other hand-drying equipment located close to the lavatory, with operating controls not more than 1 200 mm above the floor in an area that is accessible to persons using wheelchairs.

2) Mirrors required by Sentence 3.8.2.8.(8) shall be

a) mounted with their bottom edge not more than 1 000 mm above the floor, or
b) fixed in an inclined position so as to be usable by a person using a wheelchair.

3.8.3.16. Showers

1) Showers required by Sentence 3.8.2.8.(10) shall

a) have an entrance not less than 1 500 mm wide and be not less than 900 mm deep,
b) have a clear floor space at the entrance to the shower that is not less than 900 mm deep and the same width as the shower, except that fixtures are permitted to project into that space provided they do not restrict access to the shower (See Note A-3.8.3.16.(1)(b).),

c) have no doors or curtains that obstruct the controls or the clear floor space at the entrance to the shower,
d) have a slip-resistant floor surface,
e) have a threshold not more than 13 mm higher than the finished floor, and where it is higher than 6 mm, beveled to a slope no steeper than 1 in 2,
f) have 2 grab bars that
i) conform to Sentence 3.7.2.8.(1),
ii) one of which is not less than 1 000 mm long and located vertically on the side wall 50 mm to 80 mm from the adjacent clear floor space, with its lower end 600 mm to 650 mm above the floor, and,
iii) one of which is L-shaped and located on the wall opposite the entrance to the shower, with a horizontal member not less than 1 000 mm long mounted 750 mm to 870 mm above the floor and a vertical member not less than 750 mm long mounted 400 mm to 500 mm from the side wall on which the other vertical grab bar is mounted,
(See Note A-3.8.3.16.(1)(f).),
g) have a hinged seat that is not spring-loaded or a fixed seat with a smooth, slip-resistant surface and no rough edges, the seat being
i) not less than 450 mm wide and 400 mm deep,
ii) mounted on the same side wall as the vertical grab bar, at 460 mm to 480 mm above the floor,
iii) designed to carry a minimum load of 1.3 kN,
iv) impervious to water, and
v) designed to be easily cleaned,
h) have a pressure-equalizing or thermostatic-mixing valve and other controls that
i) comply with Clause 3.8.3.8.(1)(c), and
ii) are mounted on the wall opposite the entrance to the shower at not more than 1 200 mm above the floor and within reach of the seat,
i) have a hand-held shower head with not less than 1 800 mm of flexible hose located so that it
i) can be reached from a seated position,
ii) can be used in a fixed position at a height of 1 200 mm and 2 030 mm, and
iii) does not obstruct the use of the grab bars, and
j) have recessed soap holders that can be reached from the seated position.

3.8.3.17. Bathtubs

1) Bathtubs required by Sentence 3.8.2.8.(11) shall
a) be located in a room with a clear floor space not less than 1 500 mm in diameter,
b) be not less than 1 500 mm long,
c) have a clear floor space at the entrance to the bathtub not less than 900 mm wide and the same length as the bathtub, except that fixtures are permitted to project into that space provided they do not restrict access to the bathtub,
d) be capable of being accessed along its full length with no tracks mounted on its rim,
e) have a pressure-equalizing or thermostatic-mixing valve and other controls that
i) conform to Clause 3.8.3.8.(1)(c), and
ii) are located on the centre line or between the centre line of the bathtub and the exterior edge of the bathtub rim, at a maximum height of 450 mm above the rim and within reach of the seat,
f) have three grab bars
i) that conform to Sentence 3.7.2.8.(1),
ii) that are not less than 1 200 mm long,

iii) two of which are located vertically at each end of the bathtub, set 80 mm to 120 mm in from the outside edge of the bathtub, with their lower end 180 mm to 280 mm above the bathtub rim, and
iv) one of which is located horizontally along the length of the bathtub at 180 mm to 280 mm above the bathtub rim,
g) have a slip-resistant bottom surface,
h) be equipped with a hand-held shower head that complies with Clause 3.8.3.16.(1)(i),
i) have a removable seat with a smooth, slip-resistant surface and no rough edges that is
i) wide enough to give stability to the user (See Subclause 3.8.3.16.(1)(g)(i).), and
ii) complies with Subclauses 3.8.3.16.(1)(g)(iii) to (v), and
j) have recessed soap holders that can be reached from the seated position.
(See Note A-3.8.3.17.)

3.8.3.18. Assistive Listening Devices

(See Note A-3.8.3.18.)

1) Except as provided in Sentence (2), assistive listening systems required by Article 3.8.2.9. shall encompass the entire seating area.

2) If an assistive listening system referred to in Article 3.8.2.9. is an induction loop system, only half the seating area in the room need be encompassed.

3.8.3.19. Counters

1) Counters required by Sentence 3.8.2.11.(1) shall have
a) at least one *accessible* section not less than 760 mm long, adjacent to a clear floor space of not less than 800 mm by 1 350 mm, centred over a knee space conforming to Clause (c),
b) a surface not more than 865 mm above the floor, and
c) except as provided in Sentence (2) and where the counter is intended to be used as a work surface, a knee space underneath it that is
i) not less than 760 mm wide,
ii) not less than 685 mm high, and
iii) not less than 485 mm deep.

2) A counter that is used in a cafeteria, or one that performs a similar function where movement takes place parallel to the counter, need not be provided with a knee space underneath it.

3.8.3.20. Shelves or Counters for Telephones

(See Note A-3.8.3.20.)

1) Shelves or counters required by Sentence 3.8.2.11.(2) shall
a) be level,
b) be not less than 350 mm deep,
c) have, for each telephone provided, a clear space not less than 250 mm wide having no obstruction within 250 mm above the surface,
d) have a section with a surface not more than 865 mm above the floor serving at least one telephone, and
e) have a clear floor space of not less than 800 mm by 1 350 mm centred on and within 300 mm in front of the telephone.

2) Where a wall-hung telephone is provided above the shelf or counter section described in Clause (1)(d), it shall be located so that the receiver and coin slot are not more than 1 200 mm above the floor.

3.8.3.21. Spaces in Seating Area

1) Spaces designated for wheelchair use referred to in Sentence 3.8.2.3.(3) shall be
a) clear and level, or level with removable seats,

b) not less than 900 mm wide and 1 525 mm long to permit a wheelchair to enter from a side approach and 1 350 mm long where the wheelchair enters from the front or rear of the space,
c) arranged so that at least 2 designated spaces are side by side,
d) located adjoining an *accessible* path of travel without infringing on egress from any row of seating or any aisle requirements, and
e) situated, as part of the designated seating plan,
i) to provide a choice of viewing location,
ii) to provide a clear view of the event taking place, and
iii) in motion picture *theatres*, to not be in the front third of the seating area.

3.8.3.22. Sleeping Rooms and Bed Spaces
(See Note A-3.8.3.22.)
1) Sleeping rooms and bed spaces required to be *accessible* in Sentence 3.8.2.12.(1) shall have
a) a turning area of not less than 1 500 mm in diameter on one side of a bed,
b) a clearance of not less than 900 mm to allow for functional use of the room or space by persons using wheelchairs,
c) when a balcony is provided, an *accessible* balcony,
d) at least one closet that provides
i) a clear opening not less than 900 mm wide,
ii) clothes hanger rods capable of being lowered to a height of 1 200 mm,
iii) at least one shelf capable of being lowered to a height of 1 200 mm,
e) *accessible* light switches, thermostats and other controls that are specifically provided for use by the occupant located between 900 mm and 1 200 mm above the finished floor and operable in accordance with Clause 3.8.3.8.(1)(c),
f) *accessible* electrical outlets located in conformance with Clause 3.8.3.8.(1)(a), and
g) a bathroom, where provided as part of the sleeping room or bed space, or *access* to a bathroom, where not provided as part of the sleeping room or bed space
i) conforming to Clauses 3.8.3.11.(1)(a) and (d) with a water closet conforming to Article 3.8.3.13.,
ii) provided with grab bars conforming to Clauses 3.8.3.11.(1)(e) and (f),
iii) provided with a lavatory and mirror conforming to Article 3.8.3.15., and
iv) provided with a bathtub conforming to Article 3.8.3.17. or a shower conforming to Article 3.8.3.16.

3.8.4. Alterations and Additions to Existing Buildings

3.8.4.1. Application
1) All *existing buildings* shall be upgraded in accordance with Part 11.
2) Deleted.

3.8.4.2. Deleted.

3.8.4.3. Deleted.

3.8.4.4. Deleted.

3.8.4.5. Deleted.

3.8.4.6. Deleted.

3.8.4.7. Deleted.

3.8.4.8. Deleted.

3.8.5. Adaptable Dwelling Units

3.8.5.1. Application

1) Except as permitted by Sentences (2) and (3), this Subsection applies to
- a) the design and construction of *dwelling units* in *residential occupancy buildings*, and
- b) the interior paths of travel and common facilities intended for use by the residents.

2) This Subsection need not apply to
- a) hotels, motels, *single room accommodation* and similar commercial occupancies,
- b) boarding houses, lodging houses, dormitories and similar facilities, or
- c) *dwelling units* subsidiary to non-residential uses.

3) This Subsection does not apply to *existing buildings*, except for *additions* or spaces created by
- a) the reconstruction of an existing space, or
- b) the conversion of an existing space into a new *dwelling unit*.

4) *Dwelling units* required by Article 3.8.5.1. to comply with this Subsection shall be considered *adaptable dwelling units*.

3.8.5.2. Construction Requirements

1) The construction of *adaptable dwelling units* and the *building* in which they are located shall conform to the requirements in this Subsection and to *access* requirements for *residential occupancy buildings* elsewhere in this By-law.

3.8.5.3. Entrance Doors to Dwelling Units

1) *Adaptable dwelling units* shall have at least one entrance door no less than 865 mm wide, equipped with
- a) two peepholes, one located at 1067 mm above the floor and the other located at 1524 mm above the floor, or a glass sidelight or intercom security type system (See Note A-3.8.5.3.(1).),
- b) a beveled threshold not more than 13 mm above the floor level, except for entrance doors serving balconies and basements, and
- c) door opening hardware that does not require a tight grasp or twisting action of the wrist, and can be opened with a force of not more than 38 N.

3.8.5.4. Interior Doors, Corridors, and Stairs in Dwelling Units

1) Doorways in *adaptable dwelling units* shall have
- a) a clear width of least 800 mm,
- b) door opening hardware that does not require a tight grasp or twisting action of the wrist and can be opened with a force of not more than 22 N, and
- c) beveled thresholds no more than 13 mm above the floor.

2) Corridors in *adaptable dwelling units* shall have a clear width of at least 900 mm.

3) Except for interior stairs within *laneway houses*, at least one staircase within a *adaptable dwelling unit* shall have a minimum width of 915 mm.

3.8.5.5. Adaptable Dwelling Unit Bathrooms

(See Note A-3.8.5.5.)

1) One bathroom in an *adaptable dwelling unit* of more than 40 m² shall
- a) have a minimum clear floor space of 750 mm by 1200 mm in front of a washbasin, toilet, bathtub or shower,
- b) be configured to accommodate the future installation of a low barrier shower and shall be constructed with
  - i) double floor joists under a bathtub on timber construction,

ii) a second shower drain under a bathtub on timber construction with concrete topping,
iii) a second shower drain under a bathtub on a concrete slab, or
iv) measures to the satisfaction of the *Chief Building Official* where it can be demonstrated that the future installation of a low barrier shower can be installed without substantial changes to the *building* structure or layout, and

c) be located on an *accessible* floor level or the largest floor level where there is no accessible floor.

2) Walls adjacent to the water closet and bathtub or shower shall accommodate the future installation of grab bars conforming to

a) Clauses 3.8.3.11.(1)(e) and (f) for water closets, and
b) Clause 3.8.3.16.(1)(f) for showers or 3.8.3.17.(1)(f) for bathtubs.

(See Note A-3.8.5.5.(2).)

3) All bath and shower controls in *adaptable dwelling units* shall be easily accessible from an open floor space or offset.

4) All washbasins in *adaptable dwelling units* shall be equipped with lever-type faucets or hardware that does not require a tight grasp or twisting action of the wrist.

3.8.5.6. Adaptable Dwelling Unit Kitchens

1) The kitchen in an *adaptable dwelling unit* shall be designed so that the *cooktop* and sink are adjacent or can have a continuous counter between them.

2) Kitchen sinks in *adaptable dwelling units*, shall use lever-type faucets or hardware that does not require a tight grasp or twisting action of the wrist.

3) All waste pipes running from under-sink “P” traps to drain stacks shall be installed no higher than 305 mm above the finished floor.

3.8.5.7. Controls, Switches and Outlets

1) Controls and switches in an *adaptable dwelling unit* intended for regular occupant use, including electrical, telephone, cable and data outlets shall be mounted 455 mm to 1 200 mm above the floor, except where

i) in the opinion of the *Chief Building Official*, a different height is necessary to accommodate appliances or equipment, or
ii) otherwise required for safety or other regulatory enactments.

2) Controls for the operation of *building* services or safety devices, electrical switches, thermostats and intercoms in a *adaptable dwelling unit* shall be located no more than 1 200 mm above the finished floor, except where, in the opinion of the *Chief Building Official*, a different height is necessary for safety reasons.

3) At least one electrical receptacle shall be provided in the vicinity of the stair required by Sentence 3.8.5.4.(3).

3.8.5.8. Living Room Window Requirements

1) In an *adaptable dwelling unit*, at least one window in a living room shall have a window sill no higher than 800 mm above the finished floor.

Section 3.9. Reserved.

Section 3.10. Objectives and Functional Statements

3.10.1. Objectives and Functional Statements

3.10.1.1. Attributions to Acceptable Solutions

1) For the purpose of compliance with this By-law as required in Clause 1.2.1.1.(1)(b) of Division A, the objectives and functional statements attributed to the acceptable solutions in this Part shall be the objectives and functional statements listed in Table 3.10.1.1. (See Note A-1.1.2.1.(1).)

Table 3.10.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 3
Forming Part of Sentence 3.10.1.1.(1)

Functional Statements and Objectives(1)	
3.1.3.1. Separation of Major Occupancies	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
(3)	[F02,F03,F06-OS1.2] [F10,F05-OS1.5]
	[F02,F03,F06-OP1.2]
3.1.3.2. Prohibition of Occupancy Combinations	
(1)	[F02,F03-OS1.2] [F10-OS1.5]
(2)	[F02,F03-OS1.2]
(3)	[F02,F03-OS1.2]
(4)	[F02,F03-OS1.2]
3.1.3.3. Artist Live/Work – Class A Artist Studio	
(1)	[F03, F20-OS1.2, OS2.2, OP1.2]
3.1.3.4. Artist Live/Work – Class B Artist Studio	
(1)	[F02, F03, F11, F12, F20, F73, F81-OS1.2, OS2.2, OA1, OP1.2, OP2.2]
3.1.3.5. Training School	
(1)	[F02-OS3.7]
3.1.3.6. Industrial Flex Space	
(1)	[F02, F03, F11-OS1.2, OS3.7]
3.1.4.1. Combustible Materials Permitted	
(2)	[F02-OS1.2]
	[F02-OP1.2]
3.1.4.2. Protection of Foamed Plastics	
(1)	[F01-OS1.1] [F02-OS1.2]
	[F01-OP1.1] [F02-OP1.2]
(2)	[F01-OS1.1] [F02-OS1.2]
	[F01-OP1.1] [F02-OP1.2]

3.1.4.3. Wires and Cables	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F02-OS1.2]
	[F02-OP1.2]
(3)	**Deleted.**
	Deleted.
3.1.4.5. Fire-Retardant-Treated Wood	
(1)	[F02-OS1.2]
	[F02-OP1.2]
3.1.4.8. Exterior Cladding	
(1)	[F03,F02-OP3.1]
3.1.5.1. Noncombustible Materials	
(1)	[F02-OS1.2]
	[F02-OP1.2]
3.1.5.5. Combustible Cladding on Exterior Walls	
(2)	[F03,F02-OP3.1]
3.1.5.21. Wires and Cables	
(2)	[F02-OS1.2]
	[F02-OP1.2]
(3)	**Deleted.**
	Deleted.
3.1.5.23. Non-metallic Raceways	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F02-OS1.2]
	[F02-OP1.2]
3.1.6.2. Restrictions	
(1)	[F10,F12,F36-OS3.7]
	[F20-OS2.2]
(2)	[F10,F36-OS3.7] Applies to portion of By-law text: "An *air-supported structure* shall not be used for Groups B, C, … *major occupancies* or for classrooms."
	[F01,F02,F36-OS1.5] Applies to portion of By-law text: "An *air-supported structure* shall not be used for … Group F, Division 1 *major occupancies*

	…"
(3)	[F10-OS3.7]
3.1.6.3. Clearance to Other Structures	
(2)	(a) [F03-OS1.2]
	(b) [F10-OS3.7]
	(a) [F03-OP3.1]
3.1.6.4. Clearance to Flammable Material	
(1)	[F01-OS1.1] [F03-OS1.2]
	[F01-OP1.1] [F03-OP1.2]
3.1.6.5. Flame Resistance	
(1)	[F02-OS1.2]
3.1.6.6. Emergency Air Supply	
(1)	[F20-OS3.7]
3.1.6.7. Electrical Systems	
(1)	[F34-OP1.1]
	[F34-OS3.3]
	[F34-OS1.1]
(2)	[F81-OP1.1]
	[F81-OS1.1]
3.1.7.1. Determination of Ratings	
(1)	[F03-OS1.2] [F04-OS1.3]
	[F03-OP1.2] [F04-OP1.3]
3.1.7.5. Rating of Supporting Construction	
(1)	[F04-OS1.3]
	[F04-OP1.3]
(3)	[F04-OS1.3]
	[F04-OP1.3]
3.1.8.1. General Requirements	
(1)	(a) [F03-OS1.2]
	(a) [F03-OP1.2]
(2)	[F03-OS1.2] Applies to the requirement that openings in *fire separations* be protected with *closures*, shafts or other means.
	[F03-OP1.2] Applies to the requirement that openings in *fire separations* be protected with *closures*, shafts or other means.
3.1.8.2. Combustible Construction Support	

(1)	[F04-OS1.2]
	[F04-OP1.2]
3.1.8.3. Continuity of Fire Separations	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	(a) [F03-OS1.2]
	(a) [F03-OP1.2]
	(b) [F03-OS1.2]
	(b) [F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
3.1.8.4. Determination of Ratings and Classifications	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
3.1.8.5. Installation of Closures	
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F81-OS1.2]
	[F81-OP1.2]
(5)	[F81-OP1.2]
	[F81-OS1.2]
(6)	[F03-OS1.2]
	[F03-OP1.2]

(7)	[F03-OS1.2]
	[F03-OP1.2]
3.1.8.6. Maximum Openings	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
3.1.8.7. Location of Fire Dampers and Smoke Dampers	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
3.1.8.10. Installation of Fire Dampers	
(1)	[F04-OS1.2]
	[F04-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
(5)	[F82-OS1.2] Applies to portion of By-law text: "A tightly fitted access door shall be installed for each *fire damper* to provide access for the inspection of the damper …"
	[F82-OP1.2] Applies to portion of By-law text: "A tightly fitted access door shall be installed for each *fire damper* to provide access for the inspection of the damper …"
	[F82-OH1.2] Applies to portion of By-law text: "A tightly fitted access door shall be installed for each *fire damper* to provide access for … the resetting of the release device."
3.1.8.11. Installation of Smoke Dampers	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]

(4)	[F03-OS1.2]
	[F03-OP1.2]
(5)	[F82-OS1.2] Applies to portion of By-law text: "A tightly fitted access door shall be installed for each smoke damper to provide access for the inspection of the damper …"
	[F82-OH1.2] Applies to portion of By-law text: "A tightly fitted access door shall be installed for each smoke damper to provide access for the inspection of the damper …"
	[F82-OP1.2] Applies to portion of By-law text: "A tightly fitted access door shall be installed for each *fire damper* to provide access for the … resetting of the release device."
3.1.8.12. Twenty-Minute Closures	
(3)	[F03-OS1.2]
	[F03-OP1.2]
3.1.8.13. Self-closing Devices	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.1.8.14. Hold-Open Devices	
(1)	[F03-OS1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
(5)	[F03-OS1.2]
	[F03-OP1.2]
(6)	[F03-OS1.2]
	[F03-OP1.2]
3.1.8.15. Door Latches	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.1.8.16. Wired Glass and Glass Block	
(3)	[F04-OS1.2] Applies to portion of By-law text: "Glass blocks permitted by Sentence (1) shall be … reinforced with steel reinforcement in each horizontal joint."
	[F04-OP1.2] Applies to portion of By-law text: "Glass blocks permitted by Sentence (1) shall be … reinforced with steel reinforcement in each horizontal joint."
3.1.8.17. Temperature Rise Limit for Doors	

(1)	[F03,F31-OS1.2] [F05-OS1.5]
	[F03-OP1.2]
3.1.8.18. Area Limits for Wired Glass and Glass Block	
(1)	[F05-OS1.5] [F31-OS1.2]
	[F30-OS3.1]
(2)	[F05-OS1.5] [F31-OS1.2]
3.1.9.1. Fire Stops	
(1)	[F03-OS1.2] [F04-OS1.3]
	[F03-OP1.2] [F04-OP1.3]
(2)	[F03-OS1.2]
	[F03-OP3.1]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
3.1.9.2. Combustibility of Service Penetrations	
(1)	[F03-OS1.2] [F02,F04-OS1.3] Applies to portion of By-law text: “Except as permitted by Articles 3.1.9.3. and 3.1.9.5., pipes, ducts, electrical outlet boxes, totally enclosed raceways or other similar service equipment that penetrate an assembly required to have a *fire-resistance rating* shall be *noncombustible* …”
	[F03-OP1.2] [F02,F04-OP1.3] Applies to portion of By-law text: “Except as permitted by Articles 3.1.9.3. and 3.1.9.5., pipes, ducts, electrical outlet boxes, totally enclosed raceways or other similar service equipment that penetrate an assembly required to have a *fire-resistance rating* shall be *noncombustible* …”
3.1.9.4. Penetration by Outlet Boxes	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
3.1.9.5. Combustible Piping Penetrations	
(3)	[F03-OS1.2] [F02,F04-OS1.3]
	[F03-OP1.2] [F02,F04-OP1.3]
3.1.9.6. Openings through a Membrane Ceiling	
(1)	[F04-OS1.3]
	[F04-OP1.3]
3.1.10.1. Prevention of Firewall Collapse	
(1)	[F04-OP1.2]

	[F04-OS1.2]
	[F04-OP3.1]
(2)	[F03,F04-OP1.2]
	[F03,F04-OS1.2]
	[F03,F04-OP3.1]
(4)	[F04-OS1.2]
	[F04-OP1.2]
	[F04-OP3.1]
3.1.10.2. Rating of Firewalls	
(1)	[F03-OS1.2] Applies to portion of By-law text: "A *firewall* that separates a *building* or *buildings* with *floor areas* containing a Group E or a Group F, Division 1 or 2 *major occupancy* shall be constructed as a *fire separation* of *noncombustible construction* having a *fire-resistance rating* not less than 4 h …"
	[F03-OP1.2] Applies to portion of By-law text: "A *firewall* that separates a *building* or *buildings* with *floor areas* containing a Group E or a Group F, Division 1 or 2 *major occupancy* shall be constructed as a *fire separation* of *noncombustible construction* having a *fire-resistance rating* not less than 4 h …"
	[F03-OP3.1] Applies to portion of By-law text: "A *firewall* that separates a *building* or *buildings* with *floor areas* containing a Group E or a Group F, Division 1 or 2 *major occupancy* shall be constructed as a *fire separation* of *noncombustible construction* having a *fire-resistance rating* not less than 4 h …"
(2)	[F03-OS1.2]
	[F03-OP1.2]
	[F03-OP3.1]
(3)	[F80,F04-OP1.2]
	[F80,F04-OS1.2]
	[F80,F04-OP1.3]
(4)	[F80,F04-OP1.2]
	[F80,F04-OS1.2]
	[F80,F04-OP3.1]
3.1.10.3. Continuity of Firewalls	
(1)	[F03-OS1.2] Applies to portion of By-law text: "A *firewall* shall extend from the ground continuously through, or adjacent to, all *storeys* of a *building* or *buildings* so separated …"
	[F03-OP1.2] Applies to portion of By-law text: "A *firewall* shall extend from the ground continuously through, or adjacent to, all *storeys* of a *building* or *buildings* so separated …"
	[F03-OP3.1] Applies to portion of By-law text: "A *firewall* shall extend from the ground continuously through, or adjacent to, all *storeys* of a *building* or *buildings* so separated …"
3.1.10.4. Parapets	
(1)	[F03-OP1.2]
	[F03-OS1.2]

	[F03-OP3.1]
3.1.10.5. Maximum Openings	
(1)	[F03-OP1.2] Applies to portion of By-law text: "… the aggregate width of openings shall be not more than 25% of the entire length of the *firewall*."
	[F03-OS1.2] Applies to portion of By-law text: "… the aggregate width of openings shall be not more than 25% of the entire length of the *firewall*."
	[F03-OP3.1] Applies to portion of By-law text: "… the aggregate width of openings shall be not more than 25% of the entire length of the *firewall*."
3.1.10.7. Combustible Projections	
(1)	[F03-OP1.2] Applies to portion of By-law text: "*Combustible* material shall not extend across the end of a *firewall* …"
	[F03-OS1.2] Applies to portion of By-law text: "*Combustible* material shall not extend across the end of a *firewall* …"
	[F03-OP3.1] Applies to portion of By-law text: "*Combustible* material shall not extend across the end of a *firewall* …"
(2)	[F03-OS1.2]
	[F03-OP1.2]
	[F03-OP3.1]
3.1.11.1. Separation of Concealed Spaces	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.1.11.2. Fire Blocks in Wall Assemblies	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.1.11.3. Fire Blocks between Nailing and Supporting Elements	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
3.1.11.4. Fire Blocks between Vertical and Horizontal Spaces	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.1.11.5. Fire Blocks in Horizontal Concealed Spaces	
(1)	[F03,F04-OS1.2]
	[F03,F04-OP1.2]
(2)	[F03,F04-OS1.2]
	[F03,F04-OP1.2]
(3)	[F02,F03-OP1.2] [F04-OP1.3]
3.1.11.6. Fire Blocks in Crawl Spaces	

(1)	[F03,F04-OS1.2]
	[F03,F04-OP1.2]
3.1.11.7. Fire Block Materials	
(1)	[F04-OS1.2]
	[F04-OP1.2]
(5)	[F04-OP1.2]
	[F04-OS1.2]
(6)	[F03-OP1.2]
	[F03-OS1.2]
3.1.12.1. Determination of Ratings	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F02-OS1.2]
	[F02-OP1.2]
3.1.13.2. Flame-Spread Rating	
(1)	[F02-OS1.2]
	[F02-OP1.2]
3.1.13.5. Skylights	
(1)	[F02-OS1.5]
3.1.13.6. Corridors	
(1)	[F02-OS1.2,OS1.5]
	[F02-OP1.2]
(5)	[F02-OS1.2,OS1.5]
	[F02-OP1.2]
(6)	[F02-OS1.2]
	[F02-OP1.2]
3.1.13.7. High Buildings	
(1)	[F02-OS1.2]
	[F02-OP1.2]
3.1.13.9. Underground Walkways	
(1)	[F02-OS1.2]
	[F02-OP3.1]
3.1.13.10. Exterior Exit Passageway	

(1)	[F02-OS1.5]
3.1.13.11. Elevator Cars	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F02-OS1.2]
	[F02-OP1.2]
3.1.14.1. Fire-Retardant-Treated Wood Roof Systems	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F02-OS1.3,OS1.2]
	[F02-OP1.3]
3.1.14.2. Metal Roof Deck Assemblies	
(1)	[F02-OS1.2]
	[F02-OP1.2]
3.1.14.3. Overhead Skylight Glazing	
(1)	[F20, F21, F23, F30-OS2.1, OS2.2, OS2.4, OS3.1]
3.1.14.4. Green Roof Assembly	
(1)	[F02, F03, F61-OS1.1, OP1.1, OP2.3]
3.1.15.1. Roof Covering Classification	
(1)	[F02-OS1.2]
	[F02-OP1.2]
	[F02-OP3.1]
3.1.15.2. Roof Coverings	
(1)	[F02-OS1.2]
	[F02-OP1.2]
	[F02-OP3.1]
(3)	[F02-OS1.2]
	[F02-OP1.2]
	[F02-OP3.1]
3.1.16.1. Fabric Canopies and Marquees	
(1)	[F02-OS1.2,OS1.5]
	[F02-OP1.2]
3.1.17.1. Occupant Load Determination	

(1)	[F10-OS3.7]
	[F72-OH2.1] [F71-OH2.3]
(2)	[F10-OS3.7]
	[F72-OH2.1] [F71-OH2.3]
(4)	[F10-OS3.7]
	[F72-OH2.1] [F71-OH2.3]
3.2.1.2. Storage Garage Considered as a Separate Building	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
3.2.1.4. Floor Assembly over Basement	
(1)	[F03-OS1.2] [F04-OS1.3]
	[F03-OP1.2] [F04-OP1.3]
(2)	[F04-OS1.2,OS1.3]
	[F04-OP1.2,OP1.3]
3.2.1.5. Fire Containment in Basements	
(1)	[F02-OS1.2,OS1.3]
	[F02-OP1.2,OP1.3]
3.2.1.7. Containment in Group C Combustible Buildings Greater than 2 Storeys	
(1)	[F02, F03, F10-OS1.2, OS1.5]
(3)	[F05, F10-OS1.2, OS1.5]
(4)	[F02, F03-OS1.2]
	[F05, F10-OS1.2, OS1.5]
(5)	[F03-OS1.2, OP1.2]
3.2.2.2. Special and Unusual Structures	
(1)	[F02,F03,F04-OS1.2,OS1.3]
	[F02,F03,F04-OP1.2,OP1.3]
3.2.2.6. Multiple Major Occupancies	
(1)	[F02,F03,F04-OS1.2,OS1.3]
	[F02,F03,F04-OP1.2,OP1.3]

3.2.2.7. Superimposed Major Occupancies	
(3)	[F04-OS1.3]
	[F04-OP1.3]
(4)	[F04-OS1.3]
	[F04-OP1.3]
3.2.2.10. Streets	
(1)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
3.2.2.15. Storeys below Ground	
(2)	(a) [F02,F04-OS1.2,OS1.3]
	(a) [F02,F04-OP1.2,OP1.3]
	(b),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.18. Automatic Sprinkler System Required	
(2)	[F02,F04-OS1.2,OS1.3]
	[F02,F04-OP1.2,OP1.3]
(3)	[F02-OS1.2, OP1.2]
(4)	[F02-OS1.2, OP1.2]
3.2.2.20. Group A, Division 1, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.21. Group A, Division 1, One Storey, Limited Area, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination …"
	[F02-OP1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination …"

	[F03-OS1.2] [F04-OS1.2,OS1.3] Applies to portion of By-law text: "… (a) floor assemblies shall be *fire separations* … (i) with a *fire-resistance rating* not less than 45 min …" and to Clause (b).
	[F03-OP1.2] [F04-OP1.2,OP1.3] Applies to portion of Code text: "… (a) floor assemblies shall be *fire separations*… (i) with a *fire-resistance rating* not less than 45 min …" and to Clause (b).
3.2.2.22. Group A, Division 1, One Storey, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	[F03-OS1.2] [F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min, …" and to Clause (d).
	[F03-OP1.2] [F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min, …" and to Clause (d).
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.23. Group A, Division 2, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.24. Group A, Division 2, up to 6 Storeys, Any Area, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.25. Group A, Division 2, up to 2 Storeys	
(2)	[F04-OS1.3] Applies to portion of By-law text: "… c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, …" and to *Clause (d)*.
	[F04-OP1.3] Applies to portion of By-law text: "… c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less

	than 45 min, …" and to *Clause (d)*.
	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
3.2.2.26. Group A, Division 2, up to 2 Storeys, Increased Area, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.27. Group A, Division 2, up to 2 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
3.2.2.28. Group A, Division 2, One Storey	
(2)	[F03-OP1.2]
	[F03-OS1.2]
3.2.2.29. Group A, Division 3, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.30. Group A, Division 3, up to 2 Storeys	
(2)	[F02-OS1.2] Applies to portion of By-law text: "Except as permitted by Clauses (c) and (d), the *building* referred to in Sentence (1) shall be of

	noncombustible construction …"
	[F02-OP1.2] Applies to portion of By-law text: "Except as permitted by Clauses (c) and (d), the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
	[F04-OS1.3] Applies to portion of By-law text: "… c) roof assemblies shall … (i) have a *fire-resistance rating* not less than 45 min, …" and to Clause (d).
	[F04-OP1.3] Applies to portion of By-law text: "… c) roof assemblies shall (i) … have a *fire-resistance rating* not less than 45 min, …" and to Clause (d).
(3)	[F02-OS1.2] [F04-OS1.3]
	[F02-OP1.2] [F04-OP1.3]
3.2.2.31. Group A, Division 3, up to 2 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "Except as permitted by Clause (c) … the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "Except as permitted by Clause (c) … the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.32. Group A, Division 3, One Storey, Increased Area	
(2)	(a),(c) [F04-OS1.3]
	(a),(c) [F04-OP1.3]
	[F04-OS1.3] Applies to portion of By-law text: "… b) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, …" and to Clause (c).
	[F04-OP1.3] Applies to portion of By-law text: "… b) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, …" and to Clause (c).
(3)	[F02-OS1.2] [F04-OS1.3]
	[F02-OP1.2] [F04-OP1.3]
3.2.2.33. Group A, Division 3, One Storey, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"

3.2.2.35. Group A, Division 4	
(1)	[F02-OS1.2] Applies to portion of By-law text: "… a *building* classified as Group A, Division 4 shall be of *noncombustible construction*."
	[F02-OP1.2] Applies to portion of By-law text: "… a *building* classified as Group A, Division 4 shall be of *noncombustible construction*."
(4)	[F02,F04-OS1.2,OS1.3]
	[F02,F04-OP1.2,OP1.3]
3.2.2.36. Group B, Division 1, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.37. Group B, Division 1, up to 3 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.38. Group B, Division 2, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.39. Group B, Division 2, up to 3 Storeys, Sprinklered	

(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.40. Group B, Division 2, up to 2 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.41. Group B, Division 2, One Storey, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
3.2.2.42. Group B, Division 3, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.43. Group B, Division 3, up to 3 Storeys (Noncombustible), Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]

	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.44. Group B, Division 3, up to 3 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	[F03-OS1.2] [F04-OS1.2,OS1.3] Applies to portion of By-law text: "...a) ... floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h, ..." and to Clause (c).
	[F03-OP1.2] [F04-OP1.2,OP1.3] Applies to portion of By-law text: "...a) ... floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h, ..." and to Clause (c).
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.45. Group B, Division 3, up to 2 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.46. Group B, Division 3, One Storey, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
3.2.2.47. Group C, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.48. Group C, up to 6 Storeys, Sprinklered, Noncombustible Construction	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"

(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.49. Group C, up to 3 Storeys, Noncombustible Construction	
(2)	[F02-OS1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F03-OS1.2] [F04-OS1.2,OS1.3] Applies to portion of By-law text: "a) ... floor assemblies shall be *fire separation* with a *fire-resistance rating* not less than 1 h, …" and to Clause (d).
	[F03-OP1.2] [F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h, …" and to Clause (d).
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.50. Group C, up to 6 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3]
	(a) [F02,F04-OP1.2,OP1.3]
(2)	[F03-OS1.2] [F04-OS1.2,OS1.3] Applies to portion of By-law text: "a) ... floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h, …" and to Clause (e).
	[F03-OP1.2] [F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h, …" and to Clause (e).
	(b),(d),(e) [F04-OS1.3]
	(b),(d),(e) [F04-OP1.3]
	[F02-OS1.2] Applies to portion of By-law text: "...c)... the roof assembly shall be constructed of *noncombustible construction* or *fire-retardant-treated wood* conforming to Article 3.1.4.5., ...
	[F02-OP1.2] Applies to portion of By-law text: "...c)... the roof assembly shall be constructed of *noncombustible construction* or *fire-retardant-treated wood* conforming to Article 3.1.4.5., ...
3.2.2.51. Group C, up to 4 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	[F03-OS1.2] [F04-OS1.2,OS1.3] Applies to portion of By-law text: "...a) ... floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h, ..." and to Clause (c).
	[F03-OP1.2] [F04-OP1.2,OP1.3] Applies to portion of By-law text: "...a) ... floor assemblies shall be *fire separations* with a *fire-resistance rating*

	not less than 1 h, ...” and to Clause (c).
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.52. Group C, up to 3 Storeys, Increased Area	
(2)	[F03-OS1.2] [F04-OS1.2,OS1.3] Applies to portion of By-law text: “... a) ... floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h, ...” and to Clause (d).
	[F03-OP1.2] [F04-OP1.2,OP1.3] Applies to portion of By-law text: “... a) ... floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h, ...” and to Clause (d).
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.53. Group C, up to 3 Storeys	
(2)	[F03-OS1.2] [F04-OS1.2,OS1.3] Applies to portion of By-law text: “... a) ... floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min, ...” and to Clause c).
	[F03-OP1.2] [F04-OP1.2,OP1.3] Applies to portion of By-law text: “...a) ... floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min, …” and to Clause (d)
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.54. Group C, up to 3 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: “… a) … the *building* is *sprinklered* throughout …”
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: “… a) … the *building* is *sprinklered* throughout …”
(2)	[F03-OS1.2] [F04-OS1.2,OS1.3] Applies to portion of By-law text: “ ... a) ... floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min, …” and to Clause (c).
	[F03-OP1.2] [F04-OP1.2,OP1.3] Applies to portion of By-law text: “… a) … floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min, …” and to Clause (c).
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.55. Group D, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: “… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …”
	[F02-OP1.2] Applies to portion of By-law text: “… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …”
	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: “… a) … the *building* shall be *sprinklered* throughout …”
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: “… a) … the *building* shall be *sprinklered* throughout …”
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]

	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.56. Group D, up to 6 Storeys	
(2)	[F02-OS1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
	[F04-OS1.3] Applies to portion of By-law text: "… c) roof assemblies shall have a *fire-resistance rating* not less than 1 h …" and to Clause (d).
	[F04-OP1.3] Applies to portion of By-law text: "… c) roof assemblies shall have a *fire-resistance rating* not less than 1 h, …" and to Clause (d).
3.2.2.57. Group D, up to 6 Storeys, Sprinklered, Noncombustible Construction	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.58. Group D, up to 6 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3]
	(a) [F02,F04-OP1.2,OP1.3]
(2)	(a),(e) [F03-OS1.2] [F04-OS1.3,OS1.2]
	(a),(e) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(d),(e) [F04-OS1.3]
	(b),(d),(e) [F04-OP1.3]
	[F02-OS1.2] Applies to portion of By-law text: "...c)... the roof assembly shall be constructed of *noncombustible construction* or *fire-retardant-treated wood* conforming to Article 3.1.4.5., ...
	[F02-OP1.2] Applies to portion of By-law text: "...c)... the roof assembly shall be constructed of *noncombustible construction* or *fire-retardant-treated wood* conforming to Article 3.1.4.5., ...
3.2.2.59. Group D, up to 4 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"

(2)	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.60. Group D, up to 3 Storeys	
(2)	[F04-OS1.3] Applies to portion of By-law text: "… c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, …" and to Clause (d).
	[F04-OP1.3] Applies to portion of By-law text: "… c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, …" and to Clause (d).
	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
3.2.2.61. Group D, up to 3 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.62. Group D, up to 2 Storeys	
(2)	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.63. Group D, up to 2 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.

	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.64. Group E, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.65. Group E, up to 4 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.66. Group E, up to 3 Storeys	
(2)	(a),(e) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(e) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.67. Group E, up to 3 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	(a),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.68. Group E, up to 2 Storeys	

(2)	[F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(b) [F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.69. Group E, up to 2 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	[F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(b) [F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.70. Group F, Division 1, up to 4 Storeys, Sprinklered	
(2)	(c),(d) [F04-OP1.3]
	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
3.2.2.71. Group F, Division 1, up to 3 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination …"
	[F02-OP1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination …"
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.72. Group F, Division 1, up to 2 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	[F03-OS1.2] Applies to portion of By-law text: "… a) [*noncombustible*] floor assemblies shall be *fire separations* …"
	[F03-OP1.2] Applies to portion of By-law text: "… a) [*noncombustible*] floor assemblies shall be *fire separations* …"
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.74. Group F, Division 2, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"

	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.75. Group F, Division 2, up to 4 Storeys, Increased Area, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of Code text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of Code text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.76. Group F, Division 2, up to 3 Storeys	
(2)	(a),(e) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(e) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
	[F04-OS1.3] Applies to portion of By-law text: "… c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min …" and to Clause (d).
	[F04-OP1.3] Applies to portion of By-law text: "… c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, …" and to Clause (d).
3.2.2.77. Group F, Division 2, up to 4 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	(a),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.78. Group F, Division 2, up to 2 Storeys	
(2)	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.

	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.79. Group F, Division 2, up to 2 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.80. Group F, Division 3, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.81. Group F, Division 3, up to 6 Storeys	
(2)	[F02-OS1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) shall be of *noncombustible construction*…"
	[F02-OP1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.82. Group F, Division 3, up to 6 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"

	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.83. Group F, Division 3, up to 4 Storeys	
(2)	[F04-OS1.3] Applies to portion of By-law text: "… c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min …" and to Clause (d).
	[F04-OP1.3] Applies to portion of By-law text: "… c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, …" and to Clause (d).
	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
3.2.2.84. Group F, Division 3, up to 4 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.85. Group F, Division 3, up to 2 Storeys	
(2)	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.86. Group F, Division 3, up to 2 Storeys, Sprinklered	
(1)	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… a) … the *building* is *sprinklered* throughout …"
(2)	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.

	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.87. Group F, Division 3, One Storey	
(1)	[F02-OS1.2] Applies to portion of By-law text: “A *building* classified as Group F, Division 3 is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination …”
	[F02-OP1.2] Applies to portion of By-law text: “A *building* classified as Group F, Division 3 is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination …”
3.2.2.88. Group F, Division 3, One Storey, Sprinklered	
(1)	[F02-OS1.2] Applies to portion of By-law text: “A *building* classified as Group F, Division 3 is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination …”
	[F02-OP1.2] Applies to portion of By-law text: “A *building* classified as Group F, Division 3 is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination …”
	[F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: “… a) … the *building* is *sprinklered* throughout …”
	[F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: “… a) … the *building* is *sprinklered* throughout …”
3.2.2.89. Group F, Division 3, One Storey, Any Area, Low Fire Load Occupancy	
(2)	[F02-OS1.2]
	[F02-OP1.2]
3.2.2.90. Group F, Division 3, Storage Garages up to 22 m High	
(1)	[F02-OS1.2] Applies to portion of By-law text: “A *building* used as a *storage garage* with all *storeys* constructed as *open-air storeys* and having no other *occupancy* above it is permitted to have its floor, wall, ceiling and roof assemblies constructed without a *fire-resistance rating* provided it is: a) of *noncombustible construction*…”
	[F02-OP1.2] Applies to portion of By-law text: “A *building* used as a *storage garage* with all *storeys* constructed as *open-air storeys* and having no other *occupancy* above it is permitted to have its floor, wall, ceiling and roof assemblies constructed without a *fire-resistance rating* provided it is: a) of *noncombustible construction*…”
3.2.3.1. Limiting Distance and Area of Unprotected Openings	
(1)	[F03-OP3.1]
(5)	[F03-OP3.1]
(6)	[F03-OP3.1]
(8)	[F03-OP3.1]
(9)	[F03-OP3.1]
(10)	[F03-OP3.1]
3.2.3.2. Area of Exposing Building Face	
(2)	[F03-OP3.1]
(3)	[F03-OP3.1]
3.2.3.4. Party Wall	
(1)	[F03-OP3.1]

3.2.3.5. Wall with Limiting Distance Less Than 1.2 m	
(1)	[F03-OP3.1]
(2)	[F03-OP3.1]
3.2.3.6. Combustible Projections	
(1)	[F03-OP3.1]
(2)	[F03-OP3.1]
(3)	[F03-OP3.1]
(5)	[F03-OP3.1]
3.2.3.7. Construction of Exposing Building Face	
(1)	[F03,F02-OP3.1]
(2)	[F03,F02-OP3.1]
(3)	[F02,F03-OP3.1]
(4)	[F03,F02-OP3.1]
3.2.3.8. Protection of Exterior Building Face	
(1)	[F03,F02-OP3.1]
3.2.3.9. Protection of Structural Members	
(1)	[F04-OS1.3]
	[F04-OP1.3]
3.2.3.10. Unlimited Unprotected Openings	
(1)	[F03-OP3.1]
(2)	[F03-OP3.1]
3.2.3.11. Low Fire Load, One Storey Building	
(1)	(b) [F03-OP3.1]
	(a) [F04-OP3.1]
3.2.3.12. Area Increase for Unprotected Openings	
(1)	[F03-OP3.1]
3.2.3.13. Protection of Exit Facilities	
(4)	[F06-OS1.2] [F05-OS1.5]
	[F06-OP1.2]
(5)	[F10-OS1.5, OS3.7]
3.2.3.14. Wall Exposed to Another Wall	
(1)	[F03-OS1.2]
	[F03-OP1.2]

	[F03-OP3.1]
(2)	[F03-OS1.2]
	[F03-OP1.2]
	[F03-OP3.1]
3.2.3.15. Wall Exposed to Adjoining Roof	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.2.3.16. Protection of Soffits	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F02-OS1.2]
	[F02-OP1.2]
3.2.3.17. Canopy Protection for Vertically Separated Openings	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F02-OS1.2]
	[F02-OP1.2]
3.2.3.18. Covered Vehicular Passageway	
(1)	[F03-OP3.1]
(2)	[F02-OP3.1]
3.2.3.19. Walkway between Buildings	
(1)	[F03-OP3.1]
(2)	[F02-OP3.1]
(3)	[F02,F12-OP3.1]
3.2.3.20. Underground Walkway	
(1)	[F01,F02-OP3.1]
(2)	[F03-OP3.1]

(3)	[F02-OP3.1] Applies to portion of By-law text: "An underground *walkway* shall be of *noncombustible construction* …"
	[F80-OP2.3] Applies to portion of By-law text: "An underground *walkway* shall be … suitable for an underground location."
(4)	(a) [F05-OS1.5] [F06-OS1.2]
	(b) [F10-OS1.5] [F12-OS1.2]
3.2.3.22. Installation of Service Lines Under Buildings	
(1)	[F01-OS1.1]
	[F01-OP1.1]
3.2.4.1. Determination of Requirement for a Fire Alarm System	
(1)	[F11-OS1.5] [F13-OS1.5,OS1.2]
	[F13-OP1.2]
(4)	[F11-OS1.5]
3.2.4.2. Continuity of Fire Alarm System	
(1)	[F11-OS1.5]
(2)	[F11-OS1.5]
(3)	[F11-OS1.5]
(4)	[F10-OS1.5] [F03-OS1.2]
(5)	[F11,F13-OS1.2]
(6)	[F11-OS1.5]
3.2.4.3. Types of Fire Alarm Systems	
(1)	(a) [F11-OS1.5]
	(b) [F11-OS1.4] [F13-OS1.5]
	(c),(d) [F11-OS1.5]
3.2.4.4. Description of Fire Alarm Systems	
(1)	[F11-OS1.5]
(2)	(a) [F11-OS1.4] [F13-OS1.5]
	(b),(c) [F11-OS1.5]
(3)	[F13-OS1.5]
(4)	[F13-OS1.5]
3.2.4.5. Installation and Verification of Fire Alarm Systems	
(1)	[F11,F81-OS1.5] [F13,F12,F81-OS1.5,OS1.2]
	[F12,F11-OS3.7] Applies to voice communication systems.
(2)	[F82-OS1.5]
3.2.4.6. Silencing of Alarm Signals	

(1)	[F11-OS1.5]
(2)	[F81,F34-OS1.5]
(3)	[F12-OS3.5]
3.2.4.7. Signals to Fire Department	
(1)	[F13-OS1.5,OS1.2]
	[F13-OP1.2]
(2)	[F13-OS1.5,OS1.2]
	[F13-OP1.2]
(3)	[F13-OS1.5,OS1.2]
	[F13-OP1.2]
(4)	[F81,F13-OS1.5,OS1.2]
	[F81,F13-OP1.2]
(5)	[F13-OS1.5,OS1.2]
	[F13-OP1.2]
(6)	[F13-OP1.2]
	[F13-OS1.2]
3.2.4.8. Annunciator and Zone Indication	
(1)	[F12-OS1.5,OS1.2]
(2)	[F12-OS1.5,OS1.2]
(4)	[F12-OS1.2,OS1.5]
(7)	[F12-OS1.5,OS1.2]
(8)	[F12-OS1.5,OS3.7]
(9)	[F12-OS1.5,OS3.7]
(11)	[F12-OS1.2. OS1.5]
3.2.4.9. Electrical Supervision	
(1)	[F82-OS1.5,OS1.2]
(2)	[F82-OS1.2]
	[F82-OP1.2]
(3)	(a),(d),(e),(f),(g) [F82-OS1.2]
	(a),(d),(e),(f),(g) [F82-OP1.2]
	(b),(c) [F82-OS1.5]
(4)	[F81-OP1.2]
	[F82-OS1.2]

(5)	[F82-OS1.2]
	[F82-OP1.2]
(6)	[F82-OS1.2]
	[F82-OP1.2]
(7)	[F82-OS1.2]
	[F82-OP1.2]
3.2.4.10. Fire Detectors	
(1)	[F11-OS1.5]
(2)	[F11-OS1.5]
(3)	[F02-OS1.2] [F11-OS1.5]
(4)	[F11-OS1.5]
3.2.4.11. Smoke Detectors	
(1)	[F11-OS1.5]
(3)	[F12-OS1.5]
(4)	[F10-OS1.5]
(5)	[F11-OS1.5]
(7)	[F11-OS1.4,OS1.5]
3.2.4.12. Prevention of Smoke Circulation	
(1)	[F03-OS1.2]
3.2.4.13. Vacuum Cleaning System Shutdown	
(1)	[F03-OS1.2]
3.2.4.14. Elevator Emergency Return	
(1)	**Deleted.**
(2)	**Deleted.**
(3)	**Deleted.**
3.2.4.15. System Monitoring	
(1)	[F11-OS1.5] [F12-OS1.5,OS1.2]
	[F12-OP1.2]
(2)	[F11-OS1.5] [F13-OS1.5,OS1.2]
	[F13-OP1.2]
(3)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
3.2.4.16. Manual Stations	

(1)	[F11-OS1.5]
(2)	[F02-OS1.2] [F12-OS1.2,OS1.5] [F10-OS1.5]
(3)	[F02-OS1.2] [F12-OS1.2,OS1.5] [F10-OS1.5]
(4)	[F11-OS1.5]
(5)	[F11-OS1.5]
3.2.4.17. Alert and Alarm Signals	
(2)	[F11-OS1.5]
(3)	[F11-OS1.5]
3.2.4.18. Audibility of Alarm Systems	
(1)	[F11-OS1.5]
(2)	[F11-OS1.5]
(3)	[F11-OS1.5]
(4)	[F33-OS3.5]
(5)	[F11-OS1.5]
(6)	[F11-OS1.5]
(7)	[F11,F81-OS1.5]
(8)	[F11,F81-OS1.5]
(9)	**Deleted.**
(10)	[F11-OS1.5]
(12)	[F11-OS1.5]
3.2.4.19. Visible Signal Devices and Visible Warning Systems	
(1)	[F11-OS1.5]
(2)	[F11-OS1.5]
(4)	[F11, F81-OS1.5]
(5)	[F11, F81-OS1.5]
3.2.4.20. Smoke Alarms	
(2)	[F81,F11-OS1.5]
(3)	[F11-OS1.5]
(4)	[F11-OS1.5]
(5)	[F11-OS1.5]
(6)	[F11-OS1.5]
(7)	[F11,F81-OS1.5]

(8)	[F11,F81-OS1.5]
(10)	[F11-OS1.5]
(11)	[F81,F11-OS1.5]
(12)	[F11,F81-OS1.5]
(14)	[F11-OS1.5]
3.2.4.21. Residential Fire Warning Systems	
(1)	[F81,F11-OS1.5]
3.2.4.22. Voice Communication Systems	
(1)	[F12,F11-OS3.7]
(2)	[F11-OS1.5]
(3)	[F11-OS1.5] [F13-OS1.4,OS1.5]
(4)	[F11-OS1.5]
(5)	[F12-OS3.7]
(6)	[F11-OS1.5]
(7)	[F11-OS1.5]
(8)	[F11-OS1.5]
(9)	[F11-OS1.5]
3.2.5.1. Access to Above-Grade Storeys	
(1)	[F12-OS1.5,OS1.2]
	[F12-OP1.2]
(2)	[F12-OS1.5,OS1.2]
	[F12-OP1.2]
(3)	[F12-OS1.5,OS1.2]
	[F12-OP1.2]
(4)	[F12-OS1.2, OS1.5, OS3.7]
3.2.5.2. Access to Basements	
(1)	[F12-OS1.5,OS1.2]
	[F12-OP1.2]
(2)	[F12-OS1.5,OS1.2]
	[F12-OP1.2]
3.2.5.3. Roof Access	
(1)	[F12-OS1.2]
	[F12-OP1.2]

3.2.5.4. Access Routes	
(1)	[F12-OS1.5,OS1.2]
	[F12-OP1.2]
3.2.5.5. Location of Access Routes and Path of Travel	
(1)	[F12-OS1.5,OS1.2] [F06-OS1.1]
	[F12-OP1.2]
(2)	[F12-OS1.2]
	[F12-OP1.2]
(3)	[F12-OS1.2]
	[F12-OP1.2]
(4)	[F12-OS1.2]
	[F12-OP1.2]
(5)	[F12-OP1.2]
	[F12-OS1.2]
(6)	[F12-OP1.2]
	[F12-OS1.2]
3.2.5.6. Design of Access Routes and Paths of Travel	
(1)	[F12-OS1.2]
	[F12-OP1.2]
(2)	[F02,F12-OS1.2]
	[F02,F12,F03-OP1.2]
	[F02,F12,F03-OP3.1]
(3)	[F12-OS1.5, OS3.1, OS3.7]
3.2.5.7. Water Supply	
(1)	[F02-OS1.2]
	[F02-OP1.2]
	[F02-OP3.1]
3.2.5.8. Standpipe Systems	
(1)	[F02-OS1.2]
	[F02-OP1.2]
3.2.5.9. Standpipe System Design	
(1)	[F02-OS1.2]
	[F02-OP1.2]

(2)	[F12-OS1.2]
	[F12-OP1.2]
(5)	[F02-OS1.2]
	[F02-OP1.2]
(6)	[F12-OS1.2]
	[F12-OP1.2]
(7)	[F12-OS1.2, OP1.2]
3.2.5.10. Hose Connections	
(1)	[F03-OS1.2] [F05,F06-OS1.5,OS1.2]
	[F03,F06-OP1.2]
(3)	[F12-OS1.2]
	[F12-OP1.2]
(4)	[F02-OS1.2]
	[F02-OP1.2]
3.2.5.11. Hose Stations	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F02-OS1.2]
	[F02-OP1.2]
(3)	[F02,F12-OS1.2]
	[F02,F12-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
(5)	[F10-OS1.5]
(6)	[F02-OS1.2]
	[F02-OP1.2]
(7)	[F01-OS1.1]
3.2.5.12. Automatic Sprinkler Systems	
(1)	[F02,F81,F82-OS1.2]
	[F02,F81,F82-OP1.2]
(2)	[F02,F81-OS1.2]
	[F02,F81-OP1.2]
(3)	[F02,F81-OS1.2]

	[F02,F81-OP1.2]
(4)	[F02-OS1.2]
	[F02-OP1.2]
(5)	[F81-OS1.2]
	[F81-OP1.2]
(6)	[F02-OS1.2]
	[F02-OP1.2]
(7)	[F03-OS1.2]
	[F03-OP1.2]
	[F03-OP3.1]
(8)	[F81-OS3.3,OS3.6]
(11)	[F03-OS1.2]
(12)	[F03-OS1.2]
3.2.5.13. Combustible Sprinkler Piping	
(2)	[F02,F81-OS1.2]
	[F02,F81-OP1.2]
(3)	[F06-OS1.2]
	[F06-OP1.2]
(4)	[F06-OS1.2]
	[F06-OP1.2]
3.2.5.14. Sprinklered Service Space	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F12-OS1.2]
	[F12-OP1.2]
(3)	[F11-OS1.5] [F12-OS1.5,OS1.2]
	[F12-OP1.2]
3.2.5.15. Fire Department Connections	
(1)	[F12-OS1.2]
	[F12-OP1.2]
(2)	[F12-OS1.2]
	[F12-OP1.2]
3.2.5.16. Portable Fire Extinguishers	

(1)	[F02,F12,F81-OS1.2]
	[F02,F12,F81-OP1.2]
(2)	[F12-OS1.2]
	[F12-OP1.2]
3.2.5.17. Protection from Freezing	
(1)	[F81-OS1.2]
	[F81-OP1.2]
3.2.5.18. Fire Pumps	
(1)	[F02,F81-OS1.2] [F81-OS1.4]
	[F02,F81-OP1.2] [F81-OP1.4]
3.2.5.19. Location of Building Safety Facilities for Firefighters	
(1)	[F12-OS1.2, OP1.2]
3.2.5.20. Radio Antenna Systems	
(1)	[F12, F13 – OS1.2,OS1.5] [F12,F13 – OS3.7]
	[F12, F13- OP1.2]
3.2.6.2. Limits to Smoke Movement	
(1)	[F02-OS1.2,OS1.5]
	[F02-OP1.2]
(2)	[F06-OS1.2,OS1.5] [F05-OS1.5]
	[F06-OP1.2]
(3)	[F06-OS1.5,OS1.2] [F05-OS1.5]
	[F06-OP1.2]
(4)	[F03-OS1.2,OS1.5]
	[F03-OP1.2]
(5)	[F03-OS1.2,OS1.5]
	[F03-OP1.2]
(6)	[F03,F12-OS1.2,OS1.5]
	[F03,F12-OP1.2]
3.2.6.3. Connected Buildings	
(1)	[F03-OS1.2,OS1.5]
	[F03-OP1.2]
	[F03-OP3.1]
3.2.6.4. Emergency Operation of Elevators	

(1)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(2)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(3)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(4)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(5)	[F12-OS3.4]
(6)	[F12-OS3.4]
(7)	[F12-OS3.4]
3.2.6.5. Elevator for Use by Firefighters	
(1)	[F12,F06-OS1.2,OS1.5]
	[F12,F06-OP1.2]
(2)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(3)	[F06-OS1.2,OS1.5]
	[F06-OP1.2]
(4)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(5)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(6)	**Deleted.**
	Deleted.
3.2.6.6. Venting to Aid Firefighting	
(1)	[F06-OS1.2,OS1.5]
	[F06-OP1.2]
(2)	[F30-OS3.1]
(3)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(4)	[F03-OS1.2] [F12-OS1.2,OS1.5]
3.2.6.7. Central Alarm and Control Facility	
(1)	[F12-OS1.2,OS1.5]

	[F12-OP1.2]
(2)	[F12-OS1.2,OS1.5] [F11-OS1.5]
	[F12-OP1.2]
3.2.6.8. Voice Communication System	
(1)	[F12,F11-OS3.7]
3.2.6.9. Testing	
(1)	[F82-OS1.2,OS1.5]
	[F82-OP1.2]
3.2.7.1. Minimum Lighting Requirements	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
3.2.7.2. Recessed Lighting Fixtures	
(1)	[F01-OS1.1,OS1.2]
	[F01-OP1.1,OP1.2]
3.2.7.3. Emergency Lighting	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7]
(4)	[F30-OS3.1] [F10-OS3.7]
3.2.7.4. Emergency Power for Lighting	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30,F81-OS3.1] [F10,F81-OS3.7]
3.2.7.5. Emergency Power Supply Installation	
(1)	[F81,F06,F11,F02,F03,F10,F12-OS1.2,OS1.5]
	[F81,F06,F02,F03-OP1.2]
	[F81,F06,F02-OP3.1]
	[F81,F30-OS3.1] [F81,F11,F10,F12-OS3.7]
3.2.7.6. Emergency Power for Treatment Occupancies	
(1)	[F81,F06,F11,F02,F03,F10,F12-OS1.2,OS1.5]
	[F81,F06,F02,F03-OP1.2]
	[F81,F06,F02-OP3.1]
	[F81,F30-OS3.1] [F81,F11,F10,F12-OS3.7]
3.2.7.7. Fuel Supply Shut-off Valves	

(1)	[F12-OS1.1,OS1.2] Applies to the requirement for a suitably identified shut-off valve outside the *building*.
	[F12-OP1.2] Applies to the requirement for a suitably identified shut-off valve outside the *building*.
	[F12-OH5] Applies to the requirement for a suitably identified shut-off valve outside the *building*.
	[F81-OS1.2,OS1.5] Applies to the requirement for a suitably identified separate shut-off valve.
	[F81-OS3.1,OS3.7] Applies to the requirement for a suitably identified separate shut-off valve.
3.2.7.8. Emergency Power for Fire Alarm Systems	
(1)	[F11-OS1.5] [F13-OS1.5,OS1.2]
	[F13-OP1.2] Applies to the requirement for fire alarm systems, including those with a voice communication system, to be provided with an emergency power supply.
(2)	[F11-OS1.5] [F13-OS1.2,OS1.5]
	[F13-OP1.2]
(3)	[F11-OS1.5] [F13-OS1.5,OS1.2]
	[F13-OP1.2]
(4)	[F13-OP1.2]
	[F11-OS1.5] [F13-OS1.2,OS1.5]
3.2.7.9. Emergency Power for Building Services	
(1)	[F12,F02,F03-OS1.5,OS1.2]
	[F12,F02,F03-OP1.2]
	(b) [F02-OP3.1]
	(a) [F36-OS3.6] [F12,F10-OS3.7]
(2)	[F12-OS1.5,OS1.2]
	[F12-OP1.2]
	[F36-OS3.6] [F12-OS3.7]
3.2.7.10. Protection of Electrical Conductors	
(2)	[F06-OS1.2,OS1.5]
	[F06-OP1.2]
(3)	[F06-OS1.2,OS1.5]
	[F06-OP1.2]
(4)	[F06-OS1.2,OS1.5]
	[F06-OP1.2]
(6)	[F06-OS1.2,OS1.5]
	[F06-OP1.2]
(8)	[F06-OS1.2,OS1.5]

	[F06-OP1.2]
(10)	[F06-OS1.4]
	[F06-OP1.2]
	[F10-OS3.7]
3.2.8.1. Application	
(1)	[F03,F06-OS1.2] [F05-OS1.5]
	[F03,F06-OP1.2]
3.2.8.2. Exceptions to Special Protection	
(3)	[F03-OS1.2]
	[F03-OP1.2]
(5)	[F02,F03-OS1.2]
	[F02,F03-OP1.2]
3.2.8.3. Sprinklers	
(1)	[F02-OS1.2]
	[F02-OP1.2]
3.2.8.4. Vestibules	
(1)	[F06-OS1.2] [F05-OS1.5]
	[F06,F03-OP1.2]
3.2.8.5. Protected Floor Space	
(1)	[F05-OS1.2] [F06-OS1.5]
3.2.8.6. Draft Stops	
(1)	[F02-OS1.2] [F11-OS1.5] [F13-OS1.5,OS1.2]
	[F02,F13-OP1.2]
3.2.8.7. Mechanical Exhaust System	
(1)	[F03-OS1.5,OS1.2]
	[F03-OP1.2]
(2)	[F12-OS1.5,OS1.2]
	[F12-OP1.2]
3.2.8.8. Combustible Content Limits	
(1)	[F02-OS1.2]
	[F02-OP1.2]
3.2.9.1. Testing	
(1)	[F02,F81,F82-OS1.2,OS1.5]

	[F02,F81,F82-OP1.2]
3.3.1.1. Separation of Suites	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F02-OS1.2]
	[F02-OP1.2]
(5)	[F03-OS1.2, OP1.2]
3.3.1.2. Hazardous Substances, Equipment and Processes	
(1)	[F01,F02,F03-OS1.1,OS1.2]
	[F01,F02,F03-OP1.1,OP1.2]
	[F43-OS3.4]
(3)	[F43-OS3.7]
	[F05-OS1.5]
3.3.1.3. Means of Egress	
(3)	[F10-OS3.7]
(4)	[F10,F12,F05,F06-OS3.7]
(5)	[F10,F12-OS3.7]
(6)	[F10,F12,F05,F06-OS3.7]
(7)	[F10,F12,F05,F06-OS3.7]
(8)	[F05-OS1.5]
(9)	[F10,F12,F05,F06-OS3.7]
3.3.1.4. Public Corridor Separations	
(1)	[F03,F05-OS1.5] [F06-OS1.5,OS1.2]
	[F03,F06-OP1.2]
(2)	[F03,F05-OS1.5] [F06-OS1.5,OS1.2]
	[F03,F06-OP1.2]
(3)	[F03,F05-OS1.5] [F06-OS1.2,OS1.5]
	[F03,F06-OP1.2]
(4)	(a),(b) [F03,F05,F10-OS1.5] [F06,F12-OS1.2,OS1.5] (c) [F03,F05-OS1.5] [F03,F06-OS1.5,OS1.2]
	(a),(b) [F03,F06,F12-OP1.2] (c) [F03,F06-OP1.2]
3.3.1.5. Egress Doorways	
(1)	[F10,F05-OS1.5]

(2)	[F05,F10-OS1.5]
3.3.1.6. Travel Distance	
(1)	[F10-OS1.5]
3.3.1.9. Corridors	
(1)	[F10,F12-OS3.7]
(2)	[F10,F12-OS3.7]
(3)	[F30,F73-OS3.1]
(5)	[F10,F12-OS3.7]
(6)	(a) [F10,F12-OS3.7]
	(b) [F05-OS1.5] [F06-OS1.5,OS1.2]
3.3.1.11. Door Swing	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10-OS3.7]
(4)	[F10-OS3.7]
3.3.1.12. Sliding Doors	
(1)	(b) [F10-OS3.7]
3.3.1.13. Doors and Door Hardware	
(1)	(a),(b) [F10,F12-OS3.7]
	(c) [F10-OS3.7] [F30-OS3.1]
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F10-OS3.7]
(4)	[F10-OS3.7]
(5)	[F10-OS3.7]
	[F73-OA1]
(8)	[F12-OS3.7]
(9)	[F12-OS3.7]
(10)	[F12-OS3.7]
3.3.1.16. Tapered Treads in a Curved Flight	
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7]
(4)	[F30-OS3.1] [F10-OS3.7]
3.3.1.17. Capacity of Access to Exits	

(2)	[F10-OS3.7]
(3)	[F10-OS3.7]
(4)	[F10-OS3.7]
(6)	[F10-OS3.7]
3.3.1.18. Guards	
(1)	[F30-OS3.1]
(2)	[F30-OS3.1]
(3)	[F30-OS3.1]
(4)	[F30-OS3.1]
(6)	[F30-OS3.1]
3.3.1.19. Transparent Doors and Panels	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F20-OS3.1]
(4)	[F30-OS3.1] [F10-OS3.7]
(6)	[F30-OS3.1] [F10-OS3.7]
(8)	[F30-OS3.1]
(9)	[F30-OS3.1]
(10)	[F30-OS3.1]
3.3.1.20. Exhaust Ventilation and Explosion Venting	
(1)	[F01-OS1.1]
(2)	(a) [F02-OS1.2]
	(a) [F02-OP1.2]
(3)	[F02-OS1.3] Applies to the requirement for explosion-relief devices and vents.
	[F02-OP1.3] Applies to the requirement for explosion-relief devices and vents.
3.3.1.21. Janitors' Rooms	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F02-OS1.2]
	[F02-OP1.2]
3.3.1.22. Common Laundry Rooms	
(1)	[F03-OS1.2]
	[F03-OP1.2]

(3)	[F02-OS1.2]
	[F02-OP1.2]
3.3.1.23. Obstructions	
(1)	[F10-OS3.7]
3.3.1.24. Signs in Service Spaces	
(1)	[F10-OS3.7]
3.3.1.25. Welding and Cutting	
(1)	[F03,F02-OS1.2]
	[F03,F02-OP1.2]
3.3.2.1. Scope	
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7]
3.3.2.2. Fire Separations	
(1)	[F03-OS1.2]
(3)	[F03-OS1.2] Applies where space under tiers of seats is not *sprinklered*.
	[F03-OS1.2] Applies where space under tiers of seats is *sprinklered*.
3.3.2.4. Fixed Seats	
(1)	[F30-OS3.1] [F10-OS3.7]
(3)	[F10-OS3.7]
3.3.2.5. Aisles	
(2)	[F10-OS3.7]
(4)	[F10-OS3.7]
(5)	[F10-OS3.7]
(6)	[F10-OS3.7]
(7)	[F10-OS3.7]
(8)	[F10-OS3.7] [F30-OS3.1]
(9)	[F10-OS3.7] [F30-OS3.1]
(10)	[F10-OS3.7] [F30-OS3.1]
(11)	[F10-OS3.7] [F30-OS3.1]
(12)	[F10-OS3.7] [F30-OS3.1]
(13)	[F10-OS3.7] [F30-OS3.1]
(14)	[F10-OS3.7] [F30-OS3.1]
(15)	[F10-OS3.7] [F30-OS3.1]

(16)	[F10-OS3.7] [F30-OS3.1]
3.3.2.6. Corridors	
(1)	[F03,F05-OS1.5] [F06-OS1.5,OS1.2]
	[F03,F06-OP1.2]
(3)	[F03,F05-OS1.5] [F06-OS1.5,OS1.2]
	[F03,F06-OP1.2]
(4)	[F10-OS3.7]
3.3.2.7. Doors	
(1)	[F10-OS3.7]
3.3.2.8. Fixed Bench-Type Seats without Arms	
(1)	[F10-OS3.7]
	[F10-OS3.7]
3.3.2.10. Handrails in Aisles with Steps	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
3.3.2.11. Outdoor Places of Assembly	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10-OS3.7]
(5)	[F10-OS3.7]
3.3.2.12. Bleachers	
(1)	[F10-OS3.7] [F30-OS3.1]
(2)	[F10-OS3.7] [F30-OS3.1]
(4)	[F10-OS3.7] [F30-OS3.1]
(5)	[F30-OS3.1]
3.3.2.13. Libraries	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F02-OS1.2]
	[F02-OP1.2]
3.3.2.14. Stages for Theatrical Performances	
(1)	[F02-OS1.2]
	[F02-OP1.2]

(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
(5)	[F02-OS1.2] [F06-OS1.2,OS1.5]
	[F02,F06-OP1.2]
(6)	[F03-OS1.2,OS1.5]
	[F03-OP1.2]
3.3.2.15. Risers for Stairs	
(1)	[F30-OS3.1]
3.3.2.16. Storage Rooms	
(1)	[F12-OS1.2]
	[F12-OP1.2]
3.3.2.17. Deleted.	
3.3.3.2. Separations between Care, Treatment or Detention Occupancies and Repair Garages	
(1)	[F44-OS3.4]
	[F03-OS1.2]
3.3.3.3. Corridors	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10,F12-OS3.7]
(4)	(a) [F10-OS3.7]
	(b) [F10,F12-OS3.7]
3.3.3.4. Doorway Width	
(1)	[F10,F12-OS3.7]
(2)	[F10,F12-OS3.7]
3.3.3.5. Compartments and Fire Separations	
(2)	[F05-OS1.5] [F06-OS1.5,OS1.2]
	[F06-OP1.2]
(4)	[F05-OS1.2] [F06-OS1.2,OS1.5]
	[F03,F06-OP1.2]

(6)	[F10-OS1.5]
(7)	[F10-OS1.5]
(8)	[F03,F05-OS1.2] [F06-OS1.5]
(12)	[F03,F05-OS1.2] [F06-OS1.5]
(16)	[F02,F03-OS1.2] [F44-OS1.1]
	[F02,F03-OP1.2]
(17)	[F03-OS1.2]
3.3.3.6. Areas of Refuge	
(1)	[F03-OS1.2]
3.3.3.7. Contained Use Areas	
(2)	[F03-OS1.2] [F06-OS1.5,OS1.2]
	[F03,F06-OP1.2]
(3)	[F02-OS1.2] [F06-OS1.5,OS1.2]
	[F02,F06-OP1.2]
(4)	[F02-OS1.2] [F06-OS1.5,OS1.2]
	[F02,F06-OP1.2]
(5)	[F10-OS3.7]
3.3.4.2. Fire Separations	
(1)	[F03-OS1.2] [F05-OS1.5] [F06-OS1.5,OS1.2]
	[F03,F06-OP1.2]
(4)	[F02,F03-OS1.2] [F44-OS1.1]
	(a),(b) [F02,F03-OP1.2]
(5)	[F03-OS1.2] [F01-OS1.1]
	(a) [F03-OP1.2]
	[F44-OS3.4]
3.3.4.3. Storage Rooms	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F12-OS1.2]
	[F12-OP1.2]
3.3.4.4. Egress from Dwelling Units	

(2)	[F10,F05-OS3.7]
(3)	[F10-OS3.7]
(4)	[F05-OS1.2,OS1.5]
(5)	[F10,F05-OS3.7]
(6)	[F10,F05-OS3.7]
(7)	[F10-OS3.7]
3.3.4.5. Automatic Locking Prohibition	
(1)	[F10-OS3.7]
3.3.4.8. Protection of Openable Windows	
(1)	[F30-OS3.1]
3.3.5.2. Fire Extinguishing Systems	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.3.5.3. Basements	
(1)	[F12-OS1.2,OS1.5] [F01-OS1.1]
	[F12-OP1.2]
(2)	[F06-OS1.5,OS1.2] Applies to the separation of entrances to *basements* and to rooms containing *building* services from the remainder of the *building*.
	[F06-OP1.2] Applies to the separation of entrances from the remainder of the *building*.
	[F05-OS1.5] [F06-OS1.2,OS1.5] Applies to the separation of *exits* from the remainder of the *building*.
	[F06-OP1.2] Applies to the separation of *exits* from the remainder of the *building*.
(3)	[F44-OS1.1]
3.3.5.4. Repair and Storage Garages	
(2)	[F30-OS3.1] [F10,F12-OS3.7]
(5)	[F30-OS3.1]
(6)	[F30-OS3.1]
3.3.5.5. Repair Garage Separation	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.3.5.6. Storage Garage Separation	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.3.5.7. Vestibules	

(4)	[F44-OS3.4]
	[F44-OS1.1]
3.3.5.8. Dispensing of Fuel	
(1)	[F01-OS1.1]
(2)	[F01-OS1.1]
3.3.5.9. Multiple-Tenant Self-Storage Warehouses	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.3.6.2. Storage of Dangerous Goods	
(1)	[F03-OP1.2]
	[F03-OS1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F01,F02,F03,F81-OS1.1,OS1.2]
(4)	[F01-OS1.1]
	[F01-OP1.1]
3.3.6.3. Indoor Storage of Anhydrous Ammonia and Flammable, Toxic and Oxidizing Gases	
(1)	(a) [F03-OS1.2] [F44-OS1.1]
	(a) [F03-OP1.2]
	(a) [F44-OS1.2,OS1.5,OS1.1] Applies to gas-tight *fire separations*.
	(b) [F12-OS1.2] [F01-OS1.1] [F02-OS1.3]
	(b) [F02-OP1.3]
	(c) [F12-OS1.1]
	(d) [F44-OS1.1]
(2)	(a) [F03-OP1.2]
	(a) [F03-OS1.2] [F44-OS1.1]
	(a) [F44-OS1.2,OS1.5,OS1.1] Applies to gas-tight *fire separations*.
	(b) [F12-OS1.2] [F01-OS1.1]
	(c) [F12-OS1.1]
	(d) [F44-OS1.1]
3.3.6.4. Storage and Dispensing Rooms for Flammable Liquids and Combustible Liquids	
(1)	[F03-OS1.2]
	[F03-OP1.2]

(2)	[F02-OS1.3]
	[F02-OP1.3]
3.3.6.5. Tire Storage	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.3.6.6. Ammonium Nitrate Storage	
(2)	[F01-OS1.1] [F02,F12-OS1.2]
	[F01-OP1.1] [F02,F12-OP1.2]
(3)	[F03-OS1.2] [F01-OS1.1]
	[F03-OP1.2] [F01-OP1.1]
(4)	[F12,F02-OS1.1]
	[F12,F02-OP1.2]
(5)	[F44-OH5]
	[F01-OS1.1] [F02-OS1.2]
	[F43-OS3.4]
(6)	[F01,F81-OS1.1]
3.3.6.7. Flooring Materials	
(1)	[F43-OS3.4]
	[F44-OH5]
	[F01-OS1.1]
3.3.6.8. Fire Separations in Process Plants	
(1)	[F03-OP1.2]
	[F03-OS1.2]
3.3.6.9. Basements and Pits	
(1)	[F01-OS1.1]
	[F01-OP1.1]
3.3.7.2. Skylights	
(1)	[F34-OS4.1]
(2)	[F34-OS4.1]
3.3.7.5. Exterior Sliding Windows	
(1)	[F34-OS4.1]
3.3.7.6. Security Gates for Storage Garages	
(1)	[F36-OS3.6]

3.3.7.7. Security for Storage Garages	
(1)	[F34, F35-OS4.1]
(2)	[F34, F35-OS4.1] [F30-OS4.2]
(3)	[F34, F35-OS4.1] [F30-OS4.2]
(4)	[F34, F35-OS4.1] [F30-OS4.2]
(5)	[F34, F35-OS4.1] [F30-OS4.2]
(6)	[F34, F35-OS4.1] [F30-OS4.2]
(7)	[F34, F35-OS4.1]
(8)	[F30-OS4.2] [F35-OS4.2]
3.3.7.9. Mailbox Construction in Multi-Family Buildings	
(1)	[F34-OS4.3]
3.3.8.1. Public Storage Facilities	
(1)	[F10-OS3.7]
3.4.1.2. Separation of Exits	
(1)	[F10,F12,F05,F06-OS3.7]
	[F12,F06-OP1.2]
	[F12,F06-OS1.5,OS1.2]
(2)	[F10-OS3.7]
(3)	[F10, F12, F05, F06-OS3.7]
	[F12, F06-OP1.2]
	[F12, F06-OS1.5, OS1.2]
3.4.1.5. Exterior Exit Passageways	
(1)	[F10-OS3.7]
3.4.1.6. Restricted Use of Horizontal Exits	
(1)	[F10-OS3.7]
(2)	[F10,F05-OS3.7]
3.4.1.7. Slide Escapes	
(1)	[F10-OS3.7]
3.4.1.9. Mirrors near Exits	
(1)	[F10-OS3.7] [F30-OS3.1]
3.4.1.10. Combustible Glazing in Exits	
(1)	[F05-OS1.2] [F06-OS1.2,OS1.5]
	[F03,F06-OP1.2]

3.4.2.1. Minimum Number of Exits	
(1)	[F10,F12,F05,F06-OS3.7]
	[F12,F06-OS1.2]
	[F12,F06-OP1.2]
(3)	[F10-OS3.7]
3.4.2.2. Means of Egress from Mezzanines	
(1)	[F05-OS1.5]
3.4.2.3. Distance between Exits	
(1)	[F10,F05-OS1.5]
(4)	[F10-OS3.7]
3.4.2.4. Travel Distance	
(3)	[F10-OS3.7]
3.4.2.5. Location of Exits	
(1)	[F10-OS3.7]
(3)	[F10-OS3.7]
3.4.2.6. Principal Entrances	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
3.4.3.1. Exit Width Based on Occupant Load	
(2)	[F10-OS3.7]
3.4.3.2. Exit Width	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10-OS3.7]
(6)	[F10-OS3.7]
(7)	[F10-OS3.7]
(8)	[F12,F10-OS3.7] [F30-OS3.1]
	[F12-OP1.2]
	[F12-OS1.2]
3.4.3.3. Exit Width Reduction	
(1)	[F10,F12-OS3.7] [F30-OS3.1]
	[F12-OP1.2]
	[F12-OS1.2]

(2)	[F10,F12-OS3.7]
	[F12-OP1.2]
	[F12-OS1.2]
(3)	[F10,F12-OS3.7]
	[F12-OP1.2]
	[F12-OS1.2]
(4)	[F10,F12-OS3.7]
	[F12-OP1.2]
	[F12-OS1.2]
3.4.3.4. Headroom Clearance	
(1)	[F30-OS3.1] [F10,F12-OS3.7]
	[F12-OP1.2]
	[F12-OS1.2]
(4)	[F30-OS3.1] [F10,F12-OS3.7]
	[F12-OP1.2]
	[F12-OS1.2]
(5)	[F30-OS3.1] [F10,F12-OS3.7]
	[F12-OP1.2]
	[F12-OS1.2]
3.4.4.1. Fire-Resistance Rating of Exit Separations	
(1)	[F05-OS1.5] [F06-OS1.5,OS1.2] [F03-OS1.2]
	[F06,F03-OP1.2]
3.4.4.2. Exits through Lobbies	
(1)	[F05,F06-OS1.5]
(2)	[F12,F10,F05,F06-OS1.5]
3.4.4.3. Exterior Passageway Exceptions	
(1)	[F05,F06,F10-OS1.5]
3.4.4.4. Integrity of Exits	
(1)	[F05-OS1.5] [F06-OS1.5,OS1.2] [F03-OS1.2]
	[F06,F03-OP1.2]
(2)	[F05-OS1.5] [F06-OS1.5,OS1.2]
	[F06-OP1.2]
(3)	[F05-OS1.5] [F06-OS1.5,OS1.2]

	[F06-OP1.2]
(4)	[F05-OS1.5] [F06-OS1.5,OS1.2]
	[F06-OP1.2]
	[F43-OS3.7]
(5)	[F05-OS1.5] [F06-OS1.5,OS1.2] [F03-OS1.2]
	[F03,F06-OP1.2]
(6)	[F10,F12-OS3.7] [F30-OS3.1] [F31-OS3.2] [F32-OS3.3] [F43-OS3.4]
	[F10,F05-OS1.5] [F12-OS1.5,OS1.2]
	[F12-OP1.2]
(7)	[F05-OS1.5] [F06-OS1.5,OS1.2]
	[F06-OP1.2]
	[F43-OS3.7]
(8)	[F05-OS1.5] [F06-OS1.5,OS1.2]
	[F06-OP1.2]
(9)	[F05-OS1.5] [F06-OS1.5,OS1.2]
	[F06-OP1.2]
3.4.5.1. Exit Signs	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10,F81-OS3.7]
(4)	[F10,F81-OS3.7]
(5)	[F10-OS3.7]
(6)	[F10-OS3.7]
(7)	[F10-OS3.7]
3.4.5.2. Signs for Stairs and Ramps at Exit Level	
(1)	[F10-OS3.7]
3.4.6.1. Slip Resistance of Ramps and Stairs	
(1)	(a) [F10-OS3.7] [F30-OS3.1]
	(b) [F10-OS3.7] [F30-OS3.1]
(2)	[F10,F12-OS3.7] [F30-OS3.1]
	[F12-OP1.2]
	[F12-OS1.2,OS1.5]
3.4.6.2. Minimum Number of Risers	

(1)	[F30-OS3.1]
3.4.6.3. Maximum Vertical Rise of Stair Flights and Required Landings	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7] [F30-OS3.1]
(3)	[F10,F12-OS3.7] [F30-OS3.1]
(4)	[F30-OS3.1]
3.4.6.4. Dimensions of Landings	
(1)	[F10,F12-OS3.7] [F30-OS3.1]
	[F12-OP1.2]
	[F12-OS1.2,OS1.5]
(2)	[F10,F12-OS3.7] [F30-OS3.1]
	[F12-OP1.2]
	[F12-OS1.2,OS1.5]
(4)	[F10,F12-OS3.7] [F30-OS3.1]
(5)	[F10,F12-OS3.7] [F30-OS3.1]
3.4.6.5. Handrails	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F10-OS3.7] [F30-OS3.1]
(4)	[F30-OS3.1] [F10-OS3.7]
(5)	[F30-OS3.1] [F10-OS3.7]
(7)	[F30-OS3.1] [F10-OS3.7]
(9)	[F30-OS3.1] [F10-OS3.7]
(10)	[F30-OS3.1] [F10-OS3.7]
	[F73-OA1]
(11)	[F30-OS3.1] [F10-OS3.7]
(12)	[F30-OS3.1] [F10-OS3.7]
	[F73-OA1]
(13)	[F30-OS3.1] [F10-OS3.7]
(15)	[F30-OS3.1] [F10-OS3.7]
3.4.6.6. Guards	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]

(4)	[F30-OS3.1] [F10-OS3.7]
(5)	[F30-OS3.1]
(6)	[F30-OS3.1]
(7)	[F30-OS3.1]
3.4.6.7. Ramp Slope	
(1)	[F10-OS3.7] [F30-OS3.1]
3.4.6.8. Treads and Risers	
(1)	[F10-OS3.7] [F30-OS3.1]
(2)	[F10-OS3.7] [F30-OS3.1]
(3)	[F10-OS3.7] [F30-OS3.1]
	[F73-OA1]
(4)	[F10-OS3.7] [F30-OS3.1]
(5)	[F30-OS3.1] [F10-OS3.7]
(6)	[F30-OS3.1] [F10-OS3.7]
(7)	[F30-OS3.1] [F10-OS3.7]
(8)	[F30-OS3.1]
(9)	[F10-OS3.7] [F30-OS3.1]
(10)	[F30-OS3.1]
(11)	[F30-OS3.1, OA1]
3.4.6.9. Curved Flights in Exits	
(1)	[F10-OS3.7] [F30-OS3.1]
(2)	[F10-OS3.7] [F30-OS3.1]
(3)	[F30-OS3.1] [F10-OS3.7]
(4)	[F30-OS3.1] [F10-OS3.7]
3.4.6.10. Horizontal Exits	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(4)	[F10,F73-OS3.7]
(5)	[F10-OS3.7]
3.4.6.11. Doors	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7] Applies to portion of By-law text: “No *exit* door shall open directly onto a step …”

	[F81,F10-OS3.7] Applies where there is a danger of blockage from ice or snow.
(4)	[F10-OS3.7]
(5)	[F10,F12-OS3.7]
(6)	[F10-OS3.7]
3.4.6.12. Direction of Door Swing	
(1)	[F10-OS3.7]
3.4.6.13. Self-closing Devices	
(1)	[F05-OS1.5] [F06-OS1.5,OS1.2]
	[F06,F03-OP1.2]
3.4.6.14. Sliding Doors	
(2)	[F12-OS3.7]
3.4.6.15. Revolving Doors	
(1)	(a) [F30-OS3.1] [F10-OS3.7]
	(b) [F10,F12-OS3.7]
	(c) [F10-OS3.7]
	(d) [F30-OS3.1] [F10-OS3.7]
	(e) [F20-OS3.1]
(2)	[F10-OS3.7]
(3)	(a),(b),(d),(e) [F10,F81-OS3.7] [F20,F30-OS3.1]
3.4.6.16. Door Release Hardware	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10-OS3.7]
(4)	[F10,F81-OS3.7]
(5)	[F10,F81-OS3.7]
(6)	[F10-OS3.7]
	[F73-OA1]
(7)	[F10-OS3.7]
	[F73-OA1]
3.4.6.17. Security for Banks and Mercantile Floor Areas	
(1)	[F02-OS1.2] Applies to *sprinklered buildings*.
	[F10,F81-OS3.7] Applies to *exit* and egress doors that comply with the stated Sentences.
(2)	[F10-OS3.7]

(3)	[F81-OS3.7]
(5)	[F10-OS1.5]
(6)	[F10-OS3.7]
(9)	[F10,F81-OS3.7]
3.4.6.18. Emergency Crossover Access to Floor Areas	
(1)	[F10-OS3.7]
(3)	[F10-OS3.7]
(4)	[F10,F12-OS3.7]
	[F12-OP1.2]
	[F12-OS1.2,OS1.5]
(5)	[F10-OS3.7]
3.4.6.19. Floor Numbering	
(1)	[F10,F12,F73-OS3.7]
	[F73-OA1]
	[F12-OP1.2]
	[F12-OS1.2]
3.4.7.1. Scope	
(1)	[F10,F12-OS3.7]
(2)	[F10-OS3.7] [F30-OS3.1]
	[F10-OS1.5] [F12-OS1.2]
3.4.7.2. Fire Escape Construction	
(1)	[F05-OS1.5] [F06-OS1.2] Applies to the combustibility of materials used in the construction of fire escapes.
	[F10,F12-OS3.7] [F20-OS3.1] Applies to the type and construction of fire escapes.
	[F20-OS2.1] Applies to the type and construction of fire escapes.
3.4.7.3. Access to Fire Escapes	
(1)	[F10-OS3.7] Applies to portion of By-law text: “Access to fire escapes shall be from corridors through doors at floor level …”
(2)	[F30-OS3.1] [F10-OS3.7]
3.4.7.4. Protection of Fire Escapes	
(1)	[F05,F06-OS1.5]
3.4.7.5. Stairs	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10-OS3.7] Applies to the reduction in width permitted under certain conditions.

(4)	[F10-OS3.7] [F30-OS3.1]
3.4.7.6. Guards and Railings	
(1)	[F10-OS3.7] [F30-OS3.1]
(2)	[F10-OS3.7] [F30-OS3.1]
(3)	[F10-OS3.7] [F30-OS3.1]
(4)	[F30-OS3.1]
(5)	[F30-OS3.1]
3.5.2.1. Elevators, Escalators and Dumbwaiters	
(1)	[F30,F81-OS3.1] [F32,F81-OS3.3] [F36,F81-OS3.6]
(2)	[F82-OS3.1,OS3.3,OS3.6]
(3)	[F73-OA1]
3.5.3.1. Fire Separations for Elevator Hoistways	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.5.3.2. Vertical Service Spaces for Dumbwaiters	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.5.3.3. Fire Separations for Elevator Machine Rooms	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
3.5.4.1. Elevator Car Dimensions	
(1)	[F12-OS3.7]
(2)	[F12-OS3.7]
3.5.4.2. Floor Numbering	
(1)	[F73-OA1]
3.6.1.2. Electrical Wiring and Equipment	
(1)	[F01-OS1.1] [F02,F03-OS1.2] [F81-OS1.4]
	[F01-OP1.1] [F02,F03-OP1.2] [F81-OP1.4]
	[F32-OS3.3]
3.6.1.3. Lightning Protection Systems	
(1)	[F01,F81-OS1.1]

	[F01,F81-OP1.1]
3.6.1.4. Storage Use Prohibition	
(1)	[F01-OS1.1] [F02-OS1.2]
3.6.1.5. Appliances Installed outside a Building	
(1)	[F03-OS1.2]
	(b) [F03-OP1.2]
	(a) [F03-OP3.1]
3.6.2.1. Fire Separations around Service Rooms	
(1)	[F03-OS1.2,OS1.4]
	[F03-OP1.2,OP1.4]
(3)	[F01-OS1.1] [F03-OS1.2]
	[F01-OP1.1] [F03-OP1.2]
(4)	[F03-OS1.2,OS1.4]
	[F03-OP1.2,OP1.4]
(5)	[F03-OS1.2,OS1.4]
	[F03-OP1.2,OP1.4]
(6)	[F03-OS1.2,OS1.4]
	[F03-OP1.2,OP1.4]
(7)	[F03-OS1.2,OS1.4]
	[F03-OP1.2,OP1.4]
3.6.2.2. Service Rooms under Exits	
(1)	[F06,F05-OS3.7]
	[F02-OS1.2]
3.6.2.4. Incinerator Rooms	
(1)	[F02-OS1.2]
3.6.2.5. Combustible Refuse Storage	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.6.2.6. Door Swing for Service Rooms	
(1)	[F10-OS1.5] Applies to portion of By-law text: “A swing-type door from a *service room* containing a *boiler* or incinerator shall swing outward from the room …”
	[F30-OS3.1] Applies to portion of By-law text: “A swing-type door from a *service room* containing a *boiler* or incinerator shall swing … inward if the door opens onto a corridor or any room used for an *assembly occupancy*.”
3.6.2.7. Electrical Equipment Vaults	

(2)	[F03-OS1.2,OS1.4]
	[F03-OP1.2,OP1.4]
(3)	[F02-OS1.2] [F11-OS1.5] [F03-OS1.4]
	[F02-OP1.2] [F03-OP1.4]
(4)	[F03-OS1.2,OS1.4]
	[F03-OP1.2,OP1.4]
(6)	[F81-OS1.1]
(7)	[F03-OS1.2]
(8)	[F44-OS1.1] [F03-OS1.2]
(9)	[F34-OS1.1]
	[F34-OS3.3]
	[F34-OP1.1]
3.6.2.8. Emergency Power Installations	
(1)	[F03-OS1.2,OS1.4] [F06-OS1.2,OS1.5]
	[F03-OP1.2,OP1.4] [F06-OP1.2]
3.6.3.1. Fire Separations for Vertical Service Spaces	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
(5)	[F03-OS1.2]
	[F03-OP1.2]
3.6.3.2. Foamed Plastic Protection	
(1)	[F02-OS1.2]
3.6.3.3. Linen and Refuse Chutes	
(1)	(d),(e) [F02-OS1.2]
	(a),(b),(c) [F41-OH2.4,OH2.5]
(2)	[F03-OS1.2]
	[F03-OP1.2]

(3)	[F03-OS1.2]
(4)	(b) [F03-OS1.2]
	(a) [F41-OH2.4,OH2.5]
(5)	(a) [F81,F03-OS1.2]
	(a) [F81,F41-OH2.4,OH2.5]
	(a) [F81,F03-OP1.2]
	(b) [F03-OS1.2]
	(b) [F03-OP1.2]
	(c) [F01,F02-OS1.2]
	(c) [F01,F02-OP1.2]
	(d) [F05-OS1.5] [F06-OS1.5,OS1.2]
	(d) [F06-OP1.2]
(6)	[F02-OS1.2]
	[F02-OP1.2]
(7)	[F03-OS1.2]
	[F03-OP1.2]
(8)	[F02-OS1.2]
	[F41-OH2.4,OH2.5]
(9)	[F03-OS1.2]
	[F03-OP1.2]
(10)	[F81,F03-OS1.2] Applies to portion of By-law text: “The room or bin into which a refuse chute discharges shall be of sufficient size to contain the refuse between normal intervals of emptying …”
	[F81,F41-OH2.4,OH2.5] Applies to portion of By-law text: “The room or bin into which a refuse chute discharges shall be of sufficient size to contain the refuse between normal intervals of emptying …”
	[F41-OH2.4,OH2.5] Applies to portion of By-law text: “The room or bin into which a refuse chute discharges shall be … impervious to moisture and be equipped with a water connection and floor drain for washing-down purposes.”
(11)	[F01,F02-OS1.2]
3.6.3.4. Exhaust Duct Negative Pressure	
(1)	[F03-OS1.2]
3.6.3.5. Grease Duct Enclosures	
(1)	[F02,F03-OS1.2]
	[F02,F03-OP1.2]
(2)	[F02,F03-OS1.2]
	[F02,F03-OP1.2]

3.6.4.2. Fire Separations for Horizontal Service Spaces	
(2)	[F03-OS1.2]
	[F03-OP1.2]
3.6.4.3. Plenum Requirements	
(1)	[F02-OS1.2]
(2)	[F03-OS1.2,OS1.3]
	[F03-OP1.2,OP1.3]
(3)	[F02, F03-OS1.2, OS3.4]
3.6.4.4. Attic or Roof Space Access	
(1)	[F01,F02,F12-OS1.2]
	[F01,F02,F12-OP1.2]
3.6.4.5. Horizontal Service Space Access	
(1)	[F01,F02,F12-OS1.2]
	[F01,F02,F12-OP1.2]
3.6.4.6. Crawl Space Access	
(1)	[F01,F02,F12-OS1.2]
	[F01,F02,F12-OP1.2]
3.6.5.1. Duct Materials	
(1)	[F01,F02-OS1.2]
(2)	[F02-OS1.2]
(4)	[F02-OS1.2]
(5)	[F02-OS1.2]
3.6.5.2. Vibration Isolation Connectors	
(1)	[F01,F02-OS1.2]
(2)	[F02-OS1.2]
3.6.5.3. Tape	
(1)	[F02-OS1.2]
3.6.5.4. Coverings, Linings, Adhesives and Insulation	
(1)	[F02-OS1.2]
(2)	[F02-OS1.2]
(3)	[F02-OS1.2]
(4)	[F02-OS1.2]
(5)	[F02-OS1.2]

(6)	[F02-OS1.2]
(7)	[F01,F02-OS1.2]
3.6.5.5. Insulation and Coverings	
(1)	[F01,F02-OS1.2]
(2)	[F02-OS1.2]
(3)	[F02-OS1.2]
(4)	[F02-OS1.2]
3.6.5.6. Clearance of Ducts and Plenums	
(2)	[F01-OS1.2]
(3)	[F01-OS1.2]
(4)	[F01-OS1.2]
(5)	[F01-OS1.2]
3.6.5.7. Supply, Return, Intake and Exhaust-Air Openings	
(1)	[F02-OS1.2]
3.6.5.8. Return-Air System	
(1)	[F02-OS1.2]
(2)	[F01,F02-OS1.2]
(3)	[F01,F02-OS1.2]
(4)	[F01,F02-OS1.2]
3.6.5.9. Location of Exhaust Vents in a Building Containing not more than Two Principal Dwelling Units	
(1)	[F50-OH5]
	[F56-OH3.1]
3.7.1.1. Room and Space Height	
(1)	[F30-OS3.1]
3.7.2.1. Plumbing and Drainage Systems	
(1)	[F72-OH2.1]
(2)	[F72-OH2.1]
3.7.2.2. Water Closets	
(1)	[F72-OH2.1] Applies to portion of By-law text: "... water closets shall be provided ..."
(6)	[F72-OH2.1]
(7)	[F72-OH2.1]
(8)	[F72-OH2.1]
(9)	[F72-OH2.1]

(10)	[F72-OH2.1]
(11)	[F72-OH2.1]
(12)	[F72-OH2.1]
(13)	[F72-OH2.1]
(14)	[F72-OH2.1]
(15)	[F72-OH2.1]
(16)	[F72-OH2.1]
(17)	[F72-OH2.1]
(18)	[F72-OH2.1]
3.7.2.3. Lavatories	
(1)	[F71-OH2.3]
(3)	[F30-OS3.1]
(4)	[F71-OH2.3]
3.7.2.4. Mobile Home Facilities	
(1)	[F72-OH2.1] [F71-OH2.3]
(2)	[F72-OH2.1]
(3)	[F71-OH2.3] Applies to the minimum number of laundry trays or similar facilities, and of bathtubs or showers for each sex.
3.7.2.5. Safety Glass	
(1)	[F20-OS3.1]
3.7.2.6. Surface Protection	
(1)	[F72-OH2.1] [F40-OH2.4]
(2)	[F72-OH2.1] [F40-OH2.4]
3.7.2.7. Floor Drain	
(1)	[F40-OH2.4]
	[F30-OS3.1]
3.7.2.8. Grab Bars	
(1)	[F20-OS3.1]
3.7.2.9. Bathtubs	
(1)	[F74-OA2]
	(b) [F31-OS3.2]
	(d) [F30-OS3.1]
(2)	[F31-OS3.7]
	[F36-OS3.6.]

3.7.2.11. Gender Neutral Washroom Requirements	
(1)	F30, F34, F35-OS4.2]
(2)	[F30, F34-OS3.1]
3.7.3.1. Medical Gas Piping	
(1)	[F43,F81,F82-OS3.4]
	[F01,F02-OS1.1]
	[F01,F02-OP1.1]
3.8.2.2. Entrances	
(1)	[F73-OA1]
(2)	[F73-OA1]
(5)	[F73-OA1]
(6)	[F74-OA2]
3.8.2.3. Areas Requiring Access	
(1)	[F73-OA1]
(3)	[F74-OA2]
3.8.2.4. Path of Travel to Storeys Served by Escalators and Moving Walks	
(1)	[F73-OA1]
(2)	[F73-OA1]
3.8.2.5. Path of Travel to Parking Areas and Passenger-Loading Zones	
(1)	[F73-OA1]
(2)	[F73-OA1]
(3)	[F73-OA1]
3.8.2.6. Controls and Outlets	
(1)	[F74-OA2]
(2)	[F74-OA2]
3.8.2.7. Power Door Operators	
(1)	[F73-OA1]
3.8.2.8. Plumbing Facilities	
(1)	[F74-OA2]
	[F72-OH2.1] [F71-OH2.3]
(3)	[F72-OH2.1]
	[F73-OA1]
	[F74-OA2]

(5)	[F74-OA2]
(6)	[F74-OA2]
(7)	[F74-OA2]
(8)	[F74-OA2]
(9)	[F74-OA2]
(10)	[F74-OA2]
(11)	[F74-OA2]
3.8.2.9. Assistive Listening Devices	
(1)	[F74-OA2]
(2)	[F74-OA2]
3.8.2.10. Signs and Indicators	
(1)	[F74-OA2]
(2)	[F74-OA2]
(3)	[F30-OS3.1]
	[F73-OA1]
3.8.2.11. Counters and Counters for Telephones	
(1)	[F74-OA2]
(2)	[F74-OA2]
3.8.2.12. Sleeping Rooms and Bed Spaces	
(2)	[F73-OA1] [F74-OA2]
(3)	[F11-OS1.5]
(4)	[F11-OS1.5]
3.8.3.1. Design Standards	
(2)	[F73, F74-OA1]
3.8.3.2. Accessible Path of Travel	
(1)	[F73-OA1]
(2)	[F30-OS3.1]
	[F73-OA1]
	Reserved
	Reserved
	Reserved
	(c),(d) [F30-OS3.1]
(4)	[F73-OA1]

(5)	[F30-OS3.1]
	[F73-OA1] [F74-OA2]
3.8.3.3. Exterior Walks	
(1)	(a) [F73-OA1]
	(a) [F30-OS3.1]
	(b) [F73-OA1]
(2)	[F30-OS3.1]
	[F73-OA1]
3.8.3.4. Passenger-Loading Zones	
(1)	(a) [F74-OA2], [F30-OS3.1]
	(b) [F73-OA1]
	(c) [F74-OA2]
(2)	[F73, F74-OA1, OA2]
(3)	[F73, F74-OA1, OA2]
3.8.3.5. Ramps	
(1)	(a),(b),(c),(d),(e) [F73-OA1]
	(b),(c),(d),(e),(f) [F30-OS3.1]
	Reserved
	Reserved
	Reserved
	Reserved
(4)	(a) [F73-OA1]
	(b) and (c) [F30-OS3.1]
(5)	[F30-OS3.1]
3.8.3.6. Doorways and Doors	
(2)	[F73-OA1]
(3)	[F74-OA2]
(4)	[F74-OA2]
	[F10-OS3.7]
(5)	[F73-OA1] [F74-OA2]
	[F10,F30-OS3.1, OS3.7]
(6)	[F73-OA1]
(7)	[F30,F73-OS3.1]

(8)	[F73-OA1]
(10)	[F30-OS3.1]
	[F73-OA1]
(11)	[F73-OA1]
(12)	[F30-OS3.1]
	[F73-OA1]
(14)	[F73-OA1]
3.8.3.7. Passenger-Elevating Devices	
(1)	[F30-OS3.1] [F10-OS3.7]
3.8.3.8. Controls and Outlets	
(1)	[F74-OA2]
	[F10-OS3.7]
(2)	[F74-OA2]
3.8.3.9. Signs and Indicators	
(1)	[F74-OA2]
	[F73-OA1]
(2)	[F10-OS3.7]
	[F73-OA1] [F74-OA2]
(3)	[F30-OS3.1]
	[F73-OA1]
3.8.3.10. Drinking Fountains	
(1)	[F74-OA2]
3.8.3.11. Water-Closet Stalls	
(1)	[F74-OA2]
	[F72-OH2.1]
	(c)(i) [F74-OA2]
	(e) and (f) [F30,F20-OS3.1]
	(g) [F30-OS3.1] Applies to portion of By-law text: "… be equipped with a coat hook … projecting not more than 50 mm from the wall …"
3.8.3.12. Universal Washrooms	
(1)	[F74-OA2]
	(b) [F10-OS3.7]
	(f) [F30-OS3.1] Applies to the requirement for a coat hook.
	(h) [F74-OA2] Applies to the requirement for a shelf.

	[F72-OH2.1] [F71-OH2.3]
	(b) [F74-OA2] Applies to portion of By-law text: "… b) … a door capable of being locked from the inside …"
3.8.3.13. Water Closets	
(1)	[F74-OA2]
	[F72-OH2.1]
3.8.3.14. Urinals	
(1)	[F74-OA2]
	(f) [F30-OS3.1]
3.8.3.15. Lavatories and Mirrors	
(1)	[F74-OA2]
	[F71-OH2.3]
	(e) [F31-OS3.2]
(2)	[F74-OA2]
3.8.3.16. Showers	
(1)	[F74-OA2]
	(d),(e),(f),(g),(h),(i),(j) [F30-OS3.1]
	(g) [F20-OS3.1]
	(g) [F80-OH2.3]
	(g) [F71-OH2.3] Applies to portion of By-law text: "… v) … designed to be easily cleaned …"
	(h), (i) [F31-OS3.2]
3.8.3.17. Bathtubs	
(1)	[F74-OA2]
	(e),(h) [F31-OS3.2]
	(f),(g),(h),(i),(j) [F30-OS3.1]
3.8.3.18. Assistive Listening Devices	
(1)	[F74-OA2]
	[F11-OS3.7]
3.8.3.19. Counters	
(1)	[F74-OA2]
3.8.3.20. Shelves or Counters for Telephones	
(1)	[F74-OA2]
(2)	[F74-OA2]
3.8.3.21. Spaces in Seating Area	

(1)	[F74-OA2] Applies to entire Sentence except for portion of By-law text: "… without infringing on egress from any row of seating or any aisle requirements …"
	[F30-OS3.1] Applies to portion of By-law text: "… level, or level with removable seats …"
	(d) [F10-OS3.7]
3.8.3.22. Sleeping Rooms and Bed Spaces	
(1)	[F73-OA1] [F74-OA2]
3.8.4.2. Deleted.	
3.8.4.3. Deleted.	
3.8.4.4. Deleted.	
3.8.4.5. Deleted.	
3.8.4.6. Deleted.	
3.8.4.7. Deleted.	
3.8.4.8. Deleted.	
3.8.5.3. Entrance Doors to Dwelling Units	
(1)	[F75-OA1] [F75 -OA2]
3.8.5.4. Interior Doors, Corridors, and Stairs in Dwelling Units	
(1)	[F75-OA1] [F75-OA2]
(2)	[F75-OA1] [F75-OA2]
3.8.5.5. Adaptable Dwelling Unit Bathrooms	
(1)	[F75-OA1] [F75-OA2]
(2)	[F75-OA2]
(3)	[F75-OA2]
(4)	[F75-OA2]
3.8.5.6. Adaptable Dwelling Unit Kitchens	
(1)	[F75-OA2]
(2)	[F75-OA2]
(3)	[F75-OA2]
3.8.5.7. Controls, Switches and Outlets	
(1)	[F75-OA2]
(2)	[F75-OA2]
3.8.5.8. Living Room Window Requirements	
(1)	[F75-OA2]
3.9.2.2. Deleted.	

3.9.3.1.	**Deleted.**
3.9.3.2.	**Deleted.**

Notes to Table 3.10.1.1.:

(1) See Parts 2 and 3 of Division A.

Notes to Part 3
Fire Protection, Occupant Safety and Accessibility

A-3 Application of Part 3. In applying the requirements of this Part, it is intended that they be applied with discretion to buildings of unusual configuration that do not clearly conform to the specific requirements, or to buildings in which processes are carried out which make compliance with particular requirements in this Part impracticable. The definition of "building" as it applies to this By-law is general and encompasses most structures, including those which would not normally be considered as buildings in the layman's sense. This occurs more often in industrial uses, particularly those involving manufacturing facilities and equipment that require specialized design that may make it impracticable to follow the specific requirements of this Part. Steel mills, aluminum plants, refining, power generation and liquid storage facilities are examples. A water tank or an oil refinery, for example, has no floor area, so it is obvious that requirements for exits from floor areas would not apply. Requirements for structural fire protection in large steel mills and pulp and paper mills, particularly in certain portions, may not be practicable to achieve in terms of the construction normally used and the operations for which the space is to be used. In other portions of the same building, however, it may be quite reasonable to require that the provisions of this Part be applied (e.g., the office portions). Similarly, areas of industrial occupancy which may be occupied only periodically by service staff, such as equipment penthouses, normally would not need to have the same type of exit facility as floor areas occupied on a continuing basis. It is expected that judgment will be exercised in evaluating the application of a requirement in those cases when extenuating circumstances require special consideration, provided the occupants' safety is not endangered.

The provisions in this Part for fire protection features installed in buildings are intended to provide a minimum acceptable level of public safety. It is intended that all fire protection features of a building, whether required or not, will be designed in conformance with good fire protection engineering practice and will meet the appropriate installation requirements in relevant standards. Good design is necessary to ensure that the level of public safety established by the By-law requirements will not be reduced by a voluntary installation.

Firefighting Assumptions
The requirements of this Part are based on the assumption that firefighting capabilities are available in the event of a fire emergency. These firefighting capabilities may take the form of a paid or volunteer public fire department or in some cases a private fire brigade. If these firefighting capabilities are not available, additional fire safety measures may be required.

Firefighting capability can vary from municipality to municipality. Generally, larger municipalities have greater firefighting capability than smaller ones. Similarly, older, well established municipalities may have better firefighting facilities than newly formed or rapidly growing ones. The level of municipal fire protection considered to be adequate will normally depend on both the size of the municipality (i.e., the number of buildings to be protected) and the size of buildings within that municipality. Since larger buildings tend to be located in larger municipalities, they are generally, but not always, favoured with a higher level of municipal protection.

Although it is reasonable to consider that some level of municipal firefighting capability was assumed in developing the fire safety provisions in Part 3, this was not done on a consistent or defined basis. The requirements in the By-law, while developed in the light of commonly prevailing municipal fire protection levels, do not attempt to relate the size of building to the level of municipal protection. The responsibility for controlling the maximum size of building to be permitted in a municipality in relation to local firefighting capability rests with the municipality. If a proposed building is too large, either in terms of floor area or building height, to receive reasonable protection from the municipal fire department, fire protection requirements in addition to those prescribed in this By-law, may be necessary to compensate for this deficiency. Automatic sprinkler protection may be one option to be considered.

Alternatively, the municipality may, in light of its firefighting capability, elect to introduce zoning restrictions to ensure that the maximum building size is related to available municipal fire protection facilities. This is, by necessity, a somewhat arbitrary decision and should be made in consultation with Vancouver Fire and Rescue Services, who should have an appreciation of their capability to fight fires.

The requirements of Subsection 3.2.3. are intended to prevent fire spread from thermal radiation assuming there is adequate firefighting available. It has been found that periods of from 10 to 30 minutes usually elapse between the outbreak of fire in a building that is not protected with an automatic sprinkler system and the attainment of high radiation levels. During this period, the specified spatial separations should prove adequate to inhibit ignition of an exposed building face or the interior of an adjacent building by radiation. Subsequently, however, reduction of the fire intensity by firefighting and the protective wetting of the exposed building face will often be necessary as supplementary measures to inhibit fire spread.

In the case of a building that is sprinklered throughout, the automatic sprinkler system should control the fire to an extent that radiation to neighbouring buildings should be minimal. Although there will be some radiation effect on a sprinklered building from a fire in a neighbouring building, the internal sprinkler system should control any fires that might be ignited in the building and thereby minimize the possibility of the fire spreading into the exposed building. NFPA 80A, "Protection of Buildings from Exterior Fire Exposures," provides additional information on the possibility of fire spread at building exteriors.

The water supply requirements for fire protection installations depend on the requirements of any automatic sprinkler
installations and also on the number of fire streams that may be needed at any fire, having regard to the length of time the streams will have to be used. Both these factors are largely influenced by the conditions at the building to be equipped, and the quantity and pressure of water needed for the protection of both the interior and exterior of the building must be ascertained before the water supply is decided upon. Acceptable water supplies may be a public waterworks system that has adequate pressure and discharge capacity, automatic fire pumps, pressure tanks, manually controlled fire pumps in combination with pressure tanks, gravity tanks, and manually controlled fire pumps operated by remote control devices at each hose station.

A-3.1.2. Use Classification. The purpose of classification is to determine which requirements apply. This By-law requires classification in accordance with every major occupancy for which the building is used or intended to be used. Where necessary, an application clause has been inserted in this Part to explain how to choose between the alternative requirements which multiple occupancy classification may present.

A-3.1.2.1.(1) Major Occupancy Classification. The following are examples of the major occupancy classifications described in Table 3.1.2.1.:

Group A, Division 1

Motion picture theatres
Opera houses
Television studios admitting a viewing audience
Theatres, including experimental theatres

Group A, Division 2

Art galleries
Auditoria
Bowling alleys
Churches and similar places of worship

Clubs, nonresidential
Community halls
Courtrooms
Dance halls
Daycare Facilities for Children
Exhibition halls (other than classified in Group E)
Gymnasia
Lecture halls
Libraries
Licensed beverage establishments
Museums
Passenger stations and depots
Recreational piers
Restaurants
Schools and colleges, nonresidential
Undertaking premises

Group A, Division 3

Arenas
Indoor swimming pools, with or without spectator seating
Rinks

Group A, Division 4

Amusement park structures (not elsewhere classified)
Bleachers
Grandstands
Reviewing stands
Stadia

Group B, Division 1

Jails
Penitentiaries
Police stations with detention quarters
Prisons
Psychiatric hospitals with detention quarters
Reformatories with detention quarters

Group B, Division 2

Care facilities with treatment
Convalescent /recovery/rehabilitation centres with treatment
Hospices with treatment
Hospitals
Infirmaries
Nursing homes with treatment
Psychiatric hospitals without detention quarters
Respite centres with treatment

Group B, Division 3

Assisted/supportive living facilities
Care facilities without treatment
Children's custodial homes
Convalescent/recovery/rehabilitation centres without treatment
Group homes
Hospices without treatment
Nursing homes without treatment

Reformatories without detention quarters
Respite centres without treatment

Group C

Apartments
Boarding houses
Clubs, residential
Colleges, residential
Convents
Dormitories
Hotels
Houses
Lodging houses
Monasteries
Motels
Schools, residential

Group D

Banks
Barber and hairdressing shops
Beauty parlours
Dental offices
Dry cleaning establishments, self-service, not using flammable or explosive solvents or cleaners
Laundries, self-service
Medical offices
Offices
Police stations without detention quarters
Radio stations
Small tool and appliance rental and service establishments

Group E

Department stores
Exhibition halls
Markets
Shops
Stores
Supermarkets

Group F, Division 1

Bulk plants for flammable liquids
Bulk storage warehouses for hazardous substances
Cereal mills
Chemical manufacturing or processing plants
Distilleries
Dry cleaning plants
Feed mills
Flour mills
Grain elevators
Lacquer factories
Mattress factories
Paint, varnish and pyroxylin product factories
Rubber processing plants
Spray painting operations
Waste paper processing plants

Group F, Division 2

Aircraft hangars
Box factories
Candy plants
Cold storage plants
Dry cleaning establishments not using flammable or explosive solvents or cleaners
Electrical substations
Factories
Freight depots
Helicopter landing areas on roofs
Laboratories
Laundries, except self-service
Mattress factories
Planing mills
Printing plants
Repair garages
Salesrooms
Service stations
Storage rooms
Television studios not admitting a viewing audience
Warehouses
Wholesale rooms
Woodworking factories
Workshops

Group F, Division 3

Creameries
Factories
Laboratories
Light-aircraft hangars (storage only)
Power plants
Salesrooms
Sample display rooms
Storage garages, including open air parking garages
Storage rooms
Warehouses
Workshops

A-3.1.2.3.(1) Arena Regulation. The use of an arena is regulated in the Fire By-law.

A-3.1.2.6. Group A, Division 2, Low Occupant Load. A suite of Group A, Division 2 assembly is permitted to be classified as a Group D business and personal services occupancy provided the requirements of Article 3.1.2.6. are complied with. This re-classification permits the suite to be located in a building to which Part 9 of the By-law is applicable.

A-3.1.2.8. Child Care Facilities. A child care facility is regulated under the provincial enactments, and includes facilities more simply identified as “daycare” facilities which are typically occupied for a period of less than 24 hours each day (i.e., is not a residential facility). The term “daycare” is not meant to exclude facilities that provide short term care during the night for a period of less than 24 hours each day.

A-3.1.4.1.(1) Combustible Construction and Materials Permitted. The permission to use combustible construction or combustible materials stated in Articles 3.1.4.1., 3.1.5.5., 3.1.5.14. and 3.1.5.15. does not waive the requirements regarding construction type and cladding stated in Article 3.2.3.7.

A-3.1.4.2. Protection of Penetrations. Where foamed plastics are required to be protected from adjacent spaces within a building, the protection should be continuous so as to cover the foamed plastics so they are not exposed to the interior of the building. However, minor penetrations of the protective covering by small electrical and mechanical components, such as electrical outlets and fixtures, sprinkler piping, and mechanical vents, are acceptable because the penetrant and associated fittings and seals will prevent the small amount of foamed plastic surrounding the penetration from being exposed to the interior of the building.

Foamed plastics that are penetrated by larger components or assemblies, such as windows, are unlikely to be exposed to the interior of the building as they are protected by associated framing and finishes and/or the installation of a closure.

Small amounts of foamed plastics, such as air sealants used between major components of exterior wall construction, are not required to be protected. (See Sentence 3.1.5.2.(1).)

Penetrations of a fire separation or of a membrane forming part of an assembly required to have a fire-resistance rating are nevertheless required to be provided with a fire stop in accordance with Subsection 3.1.9.

A-3.1.4.2.(1) Concealed Space. The term “concealed space” includes any space that is not visibly apparent and that is provided with an opening to allow access for repair and periodic inspections.

A-3.1.4.2.(1)(c) Thermal Barrier in Combustible Construction. Any thermal barrier that is accepted under the requirements of Sentence 3.1.5.15.(2) for noncombustible construction is also acceptable for combustible construction.

A-3.1.4.2.(2) and 3.1.5.7.(3) Walk-in Coolers and Freezers. Sentences 3.1.4.2.(2) and 3.1.5.7.(3) are intended to apply to walk-in coolers and freezers that are constructed as stand-alone structures within a building.

A-3.1.4.3.(1)(b)(i) Raceway Definition. The term raceway is defined in CSA C22.1, “Canadian Electrical Code, Part I,” and includes both rigid and flexible conduit.

A-3.1.4.3.(1) Wire and Cable Equivalence. Electrical wires and cables that conform to the requirements of Sentence 3.1.5.21.(1) are deemed to satisfy the requirements of Sentence 3.1.4.3.(1).

3.1.4.3.(2) FT6 Rating. Wires and cables are required by Sentences 3.1.4.3.(2) and 3.1.5.23.(2), and Article 3.6.4.3. to be FT6 rated are required to not only meet the requirements of the By-law, but are also required to be tested and listed to meet the appropriate requirements of the Canadian Electrical Code as referenced by the Electrical By-law.

A-3.1.4.8.(1) Exterior Cladding. The requirements in Sentence 3.1.4.8.(1) are intended to limit the potential for fire spread on the exterior cladding of buildings of combustible construction through the use of noncombustible finishes on the exterior of the wall assembly or the use of a cladding/wall assembly that has been assessed with regard to its ability to resist flame propagation up the outside of a building. These cladding and wall assembly combinations can be used as infill or panel-type walls between structural elements, or attached directly to a loadbearing structural system. Note that these requirements apply independently of the provisions contained in Subsection 3.2.3. regarding spatial separation and exposure protection.

A-3.1.5.4.(1) Skylight Spacing. The minimum spacing dimensions for skylight assemblies are based on the distance that flame must travel along a flat ceiling surface. If ceilings have projecting beams or other features that would increase the distance the flame would have to travel along the surface, the distances specified may be measured accordingly.

A-3.1.5.5. Combustible Cladding on Exterior Walls. The requirements of Article 3.1.5.5. are not intended to limit the permissions for minor combustible components permitted by Article 3.1.5.2. For the purposes of this Article, a cladding system is considered as those materials outboard of the sheathing membrane.

A-3.1.5.5.(1)(b) Combustible Cladding on Exterior Walls. The performance of the wall assembly is assessed with regard to its ability to resist flame propagation up the outside of a building.

A-3.1.5.5.(1)(b)(i) Flame-Spread Distance. The maximum flame-spread distance referred to in Subclause 3.1.5.5.(1)(b)(i) means the distance between the top of the opening and the highest observable instance of flaming along the wall assembly; thus, intermittent flaming to a height of 5 m above the opening is acceptable.

A-3.1.5.5.(1)(b)(ii) Heat Flux Measurement. The heat flux to the assembly referred to in Subclause 3.1.5.5.(1)(b)(ii) is the maximum one-minute averaged heat flux measured by transducers located 3.5 m above the top of the opening. The intent of this criterion is to limit the spread of fire on the wall assembly to a height of 3.5 m above the opening.

Fire tests have shown that flame does not spread on the exterior surface of a wall assembly where the heat flux is less than 35 kW/m^2 above the opening.

A-3.1.5.6. Combustible Components in Exterior Walls. The requirements of Article 3.1.5.6. are not intended to limit the permissions for minor combustible components permitted by Article 3.1.5.2. The requirements of this article do not waive others specifically intended for the protection of combustible insulation in buildings of noncombustible construction.

A-3.1.5.14.(5)(d) Foamed Plastic Insulation Protection. The standard fire exposure temperature in CAN/ULC-S101, "Fire Endurance Tests of Building Construction and Materials," is the same as in CAN/ULC-S124, "Test for the Evaluation of Protective Coverings for Foamed Plastic." A thermal barrier that, when tested in conformance with CAN/ULC-S101, does not exceed an average temperature rise of 140°C on its unexposed face after a period of 10 min satisfies this requirement.

A-3.1.5.21.(1) Wire and Cable Flammability. In regulating the flammability characteristics of electrical wires and cables installed in a building, it is intended that the requirements of this Sentence and of other similar Sentences in the Code apply to wires and cables that are essentially a part of the distribution systems for power or communications. These distribution systems will normally include branch circuits that terminate at an outlet box in the space to be served and at that location cable terminators or plugs for individual items of equipment will be plugged in.

A-3.1.6. Tents and Air-Supported Structures. The requirements in this Subsection are intended to be limited to certain types of structure. For instance, the word "tent" as used in the By-law is intended to refer to a temporary shelter which is used at an open air event such as a fair or an exhibition. A tent will normally be constructed of a fabric held up by poles and attached to the ground by ties. The requirements for tents, however, are not intended to be applied to fabric structures located on buildings.

The term "air-supported structure," as used in the By-law, refers to an envelope which is held up by air pressure alone and which is erected on the ground or above a basement. The structure will usually require ballast or a positive ground anchorage system around the entire perimeter to secure it to the ground or basement. To reinforce this intent, the By-law prohibits the location of an air-supported structure above the first storey of any building.

The requirements of Subsection 3.1.6. are not intended to apply to air-supported roof assemblies on buildings, such as domed stadia, or to other types of air-supported structures, such as those over swimming pools situated on the roofs of buildings, which would not be anchored at or near ground level. These assemblies or structures are normally designed and evaluated on the basis of alternative solutions as permitted by Article 1.2.1.1. of Division A.

A-3.1.8.1.(1)(b) Barrier to Control Smoke Spread. Although a fire separation is not always required to have a fire-resistance rating, the fire separation should act as a barrier to the spread of smoke and fire until some response is initiated. When choosing products for fire stopping, the physical characteristics of the material used at the joints as well as the nature of the assembly and its potential movement should be taken into consideration.
If the fire-resistance rating of a fire separation is waived on the basis of the presence of an automatic sprinkler system, it is intended that the fire separation will be constructed so that it will remain in place and act as a barrier against the spread of smoke for a period of time until the sprinklers have actuated and controlled the fire.

A-3.1.8.1.(2) Installation of Closures. Although there is no explicit performance statement in the Building By-law that means of egress should be free of smoke, it is the intent that during the period when occupants are using a means of egress to evacuate from a floor area, the smoke contamination should not reach levels that would inhibit movement to the exit. This is particularly critical for persons with disabilities, who may not move at the same rate as other persons and who could be more susceptible to the effects of smoke contamination. NFPA 80, "Fire Doors and Other Opening Protectives," requires that a fire door protecting a means of egress be designed to minimize the possibility of smoke passing through the opening.

Although self-closing devices are not required for all doors in a fire separation (See Article 3.1.8.13.), it is assumed that in a fire situation every door in a fire separation is closed. Article 3.3.3.5. prohibits grilles and similar openings for certain doors in hospitals and nursing homes with treatment.

Although fire dampers that release on the fusion of a fusible link will help to control the spread of fire, a substantial quantity of smoke could have passed through the opening before that event. They are frequently located below the upper levels of a room and so the release of the fusible link of the fire damper that protects an opening will be delayed until the temperature at the level of the opening becomes high enough to fuse the link.
Similar concern has to be considered for other closure devices that are permitted to remain open on fusible links, and their location should be restricted in accordance with NFPA 80 and the Building By-law, except where their installation in another location will not allow the products of combustion to spread into means of egress.

A-3.1.8.3.(4) Fire Separation Continuity. The continuity of a fire separation where it abuts against another fire separation, a floor, a ceiling or an exterior wall assembly is maintained by filling all openings at the juncture of the assemblies with a material that will ensure the integrity of the fire separation at that location.

A-3.1.8.10.(1) Combination Smoke/Fire Dampers. A combination smoke/fire damper may be used in lieu of a fire damper to meet the requirement of Sentence 3.1.8.10.(3).

A-3.1.8.10.(5) Damper Access. It is intended that an access door be provided in the duct and, if the duct is enclosed with an architectural finish, that a second access door be provided through that finish.

A-3.1.8.18.(1) Wired Glass and Glass Block. The permission to include wired glass and glass block in doors and fire separations between an exit and the adjacent floor area does not permit the inclusion of those items in fire separations between exits and other parts of the building that are not included in the floor area. Examples include other exit facilities and vertical service spaces, including those used for building services and elevator hoistways.

A-3.1.8.19.(1) Fire-Protection Rating for Doors. The provisions in Articles 3.1.8.17., 3.1.8.18. and 3.1.8.19. do not waive a requirement for a door to have a fire-protection rating. To achieve this rating in a door test, it may be necessary to limit the area of glass in the door. If this area is less than the area limits of Article 3.1.8.18., it is the governing criterion. Conversely, if the area limits of Article 3.1.8.18. are less than the area required to achieve a fire-protection rating, then the area limits of this Article govern.

A-3.1.9. Penetrations. In the application of Subsection 3.1.9., a building service is considered to penetrate an assembly if it passes into or through the assembly. In some situations a service item enters an assembly through a membrane at one location, runs within the assembly, and then leaves the assembly through a membrane at another location.

The term “membrane penetration” usually designates an opening made through one side (wall, floor or ceiling membrane) of an assembly, whereas the term “through-penetration” designates an opening that passes through an entire assembly. Fire stopping of membrane penetrations involves installing a material, device or construction to resist for a prescribed time period the passage of flame and heat through openings in a protective membrane caused by cables, cable trays, conduit, tubing, pipes or similar items.

Fire stopping of a through-penetration involves installing an assemblage of specific materials or products that are designed, tested and fire-resistance rated to resist for a prescribed period of time the spread of fire through penetrations.

Products for fire stopping within a barrier are required to address movement of the assembly and to control smoke spread; as such, the flexibility of the material used at the flexible joints as well as the nature of the assembly and its potential movement must be taken into consideration.

A-3.1.9.1.(1)(b) Cast in Place Penetrations. The intention behind the use of the term “cast in place” is to reinforce that there are to be no gaps between the building service or penetrating item and the membrane or assembly it penetrates. The term ”cast in place” describes a typical means of fire stopping for a service penetration through a concrete slab or wall.

A-3.1.9.1.(1)(c) Tightly Fitted Penetrations. The intention behind the term “tightly fitted” is to reinforce that there are to be no substantial gaps between the building service or penetrating item and the membrane or assembly it penetrates.

A-3.1.9.2.(1) Penetration of Fire Separations by Electrical Boxes. The provisions dealing with outlet boxes assume size, quantities and concentrations of partial depth penetrations that would not significantly affect the fire resistance of the assembly, including the temperature rise on the unexposed side of a wall. Sentence 3.1.9.2.(1) is not intended to allow large electrical distribution and control boxes to be recessed into an assembly required to have a fire-resistance rating unless they were incorporated in the assembly at the time of testing.

A-3.1.9.4. Outlet Boxes. For the purposes of Article 3.1.9.4., outlet boxes include, but are not limited to, electrical boxes, junction boxes, high and low voltage outlets, switches, enclosures for electrical equipment, laundry boxes, and shower diverters.

A-3.1.10.2.(4) Firewall Construction. Inherent in the use of a firewall is the intent that this specialized wall construction provide the required fire-resistance rating while also being designed to resist physical damage – arising out of normal use – that would compromise the rating of the assembly. Traditionally, this has been accomplished by prescribing the use of noncombustible materials, which was in fact restricted to concrete or masonry. Sentences 3.1.10.2.(3) and (4) are intended to retain both of the characteristics of firewalls, while permitting greater flexibility in the use of materials and designs. The fire-resistance rating and damage protection attributes of a firewall may be provided by a single fire- and damage-resistant material such as concrete or masonry, by a fire- and damage-resistant membrane on a structural frame, or by separate components – one that provides the fire-resistance rating and another one that protects the firewall against damage.

If the firewall is composed of separate components, the fire-resistance rating of the fire-resistive component needs to be determined for this assembly on its own. In addition, if the damage protection component is physically attached to the fire-resistive component (for example, as a sacrificial layer), then for the purposes of determining the overall performance of the assembly, it is also necessary to determine through testing whether failure of the damage protection component during a fire affects the performance of the fire-resistive component.

A-3.1.11.5.(1) Fire Blocks in Combustible Construction. Combustible construction referred to in Sentence 3.1.11.5.(1) includes all types of construction that do not comply with the requirements for noncombustible construction. All the elements within the concealed space can be combustible, unless required to be of noncombustible materials (e.g., certain categories of pipework and ducts), but the value of the flame-spread rating of the combustible materials determines the permitted extent of the concealed space between fire blocks. The materials to be considered include all construction materials regulated by this By-law, including the framing and building services that are located in the concealed space. When designing fire blocking, consideration should be given to avoid restricting venting capabilities within concealed spaces. (See also Note A-5.6.2.1.)

A-3.1.11.5.(3) Fire Blocks in Concealed Spaces. To reduce the risk of fire spread in combustible concealed spaces within the types of buildings referred to in Sentence 3.1.11.5.(3), fire blocking is required regardless of whether the horizontal concealed space is protected by sprinklers or not, unless the space is filled with noncombustible insulation so that any air gap at the top of the insulation is very small. See also Note A-3.1.11.5.(1) for roof venting.
A 5- or 6-storey building constructed in accordance with Article 3.2.2.50. and buildings constructed in accordance with Article 3.2.2.58. are required to be sprinklered in accordance with NFPA 13, "Installation of Sprinkler Systems" (See Article 3.2.5.12.).

NFPA 13 generally requires sprinklering of any concealed spaces of combustible construction or where large amounts of combustibles are present. However, NFPA 13 allows combustible concealed spaces to be unsprinklered in certain cases, including where concealed spaces are filled almost entirely with noncombustible insulation, where spaces contain only materials with a low flame-spread rating, and where limited access or the size of the space makes it impractical to install sprinklers. For certain types of construction in unsprinklered combustible concealed spaces, NFPA 13 mandates fire blocking beyond the minimum specified in Sentence 3.1.11.5.(3).

A-3.1.11.7.(6) Integrity of Fire Blocks. Sentence 3.1.11.7.(6) together with Article 3.1.9.1., is intended to ensure that the integrity of fire blocks is maintained at areas where they are penetrated. This requirement is satisfied by the use of generic fire stops such as mineral wool, gypsum plaster or Portland cement mortar, as well as rated fire stops.

A-3.1.11.7.(7) Fire Blocks. Figure A-3.1.11.7.(7) shows the location of the semi-rigid fibre insulation board at the intersection between walls and floors in wood-frame construction. The figure is intended to illustrate the fire block detail and not a design of a fire separation.

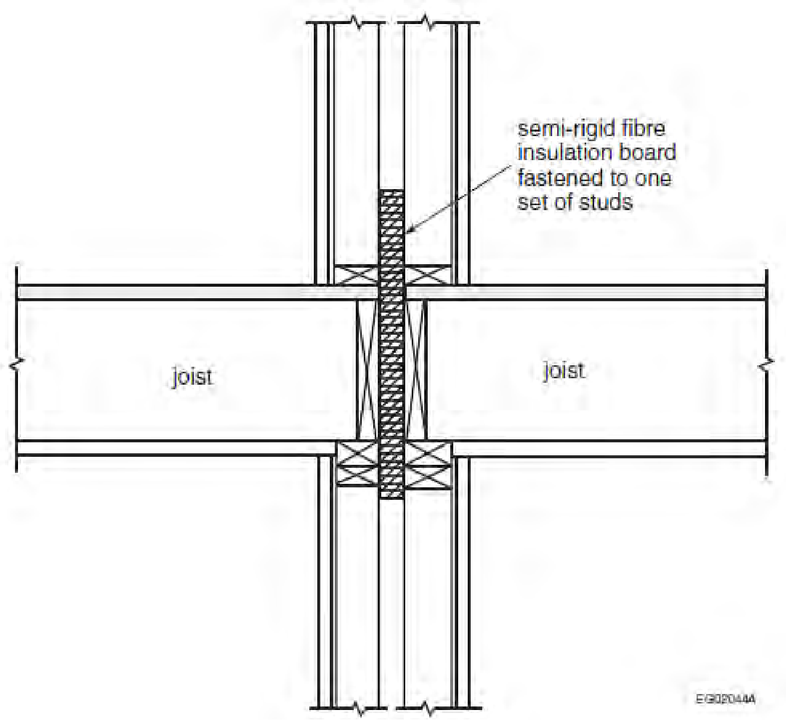


Figure A-3.1.11.7.(7)
Fire block

A-3.1.13.2.(2) Folding Partition. Folding partitions used to divide a space into separate rooms are not considered as doors for the purposes of this Sentence.

A-3.1.14.3. Skylight Glazing. This sentence requires glazing to remain in place when fractured and when subject to impact by flying objects for conditions not regulated elsewhere in this By-law. Other types of glazing such as tempered, annealed or heat strengthened glass have long been recognized as a potential hazard when located overhead and normally requires protective screens to protect occupants below from injury caused by falling glass.

A-3.1.17.1. Exercise Rooms. Fitness centres, yoga studios, tai-chi studios, martial arts training centres and other similar uses are considered exercise rooms. Where an exercise room, without equipment, is exclusively used as a yoga studio, a tai-chi studio or a martial arts training centre an occupant load factor of 4.6m^2 per person is permitted.

A-3.2.1.1.(1) Roof-top Enclosures for Private Residential Decks. Roof-top enclosures containing stairs for the exclusive purpose of providing access to private residential decks may be considered as part of the storey below. Such enclosures may not include spaces that could be otherwise used or occupied. Likewise, the roof deck associated with a private residential suite may not include any enclosed occupiable floor area or the requirements applicable to a storey would apply.

Regardless of whether an enclosure is considered a storey or not, designers must remain aware that the roof-top location of the deck is inherently remote from the remainder of the suite, and consider the ability of the deck occupants to remain aware of conditions within the suite and building below. Measures to promote situational awareness are appropriate and could include the installation of an audible and visual fire alarm signaling device in the vicinity of the egress door, and direct line of sight to the egress door from any location on the deck.

A-3.2.1.1.(3) Mezzanine Area. The following sketches illustrate the intent of this Sentence.

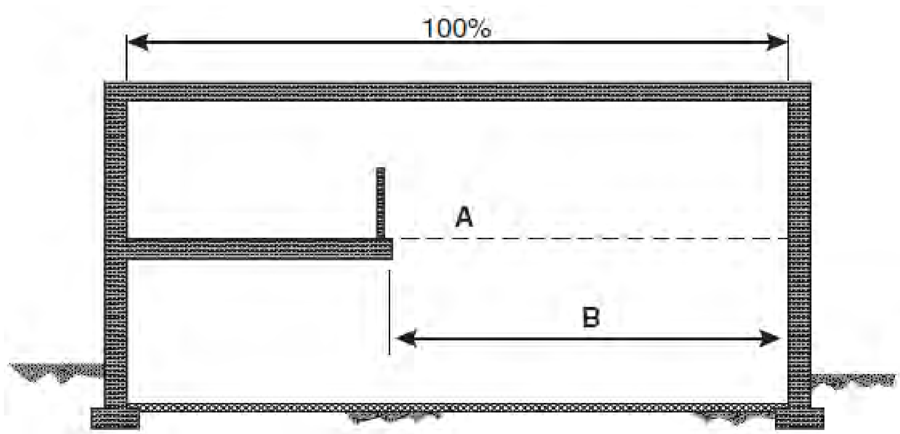


Figure A-3.2.1.1.(3)-A
Concept of Horizontal Plane

Notes to Figure A-3.2.1.1.(3)-A
(1) The horizontal plane (A, the dashed line) is measured at the mezzanine floor finish line.
(2) At least 60% of the horizontal plane (B) must be open to the floorspace below.

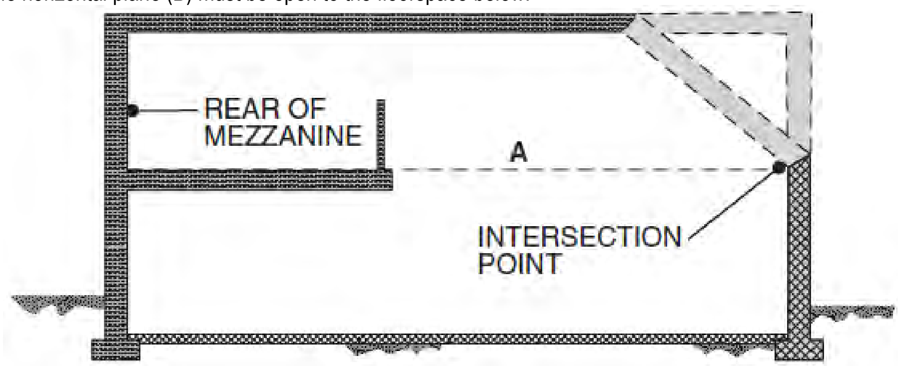


Figure A-3.2.1.1.(3)-B
Intersection Point

Notes to Figure A-3.2.1.1.(3)-B
(1) This Figure describes Clause 3.2.1.1.(3)(a).
(2) The length of the horizontal plane (A) is taken from the rear of the mezzanine to the point at which it intersects a wall, ceiling, roof or other major component.

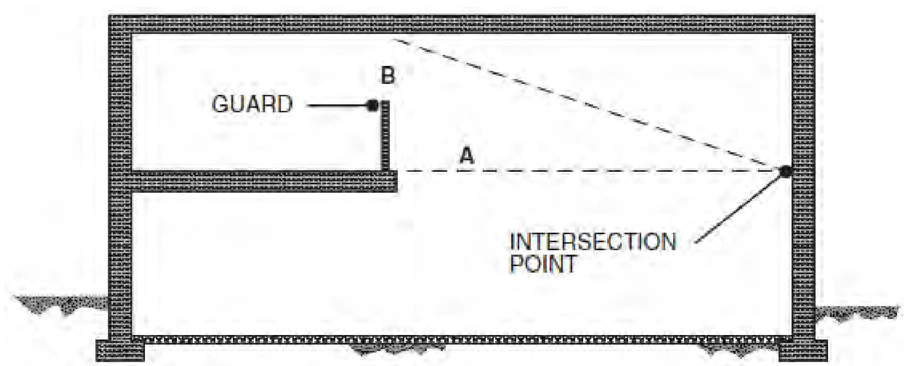


Figure A-3.2.1.1.(3)-C
Projections, Including Guards

Notes to Figure A-3.2.1.1.(3)-C
(1) This Figure describes Clause 3.2.1.1.(3)(b).
(2) Projections should not be permitted below the horizontal plane (A, the dashed line). This includes large beams, trusses, the roofline, or any other projection that will impede vision lines.

(3) Visual obstructions on the mezzanine may include 1 070 mm high guards, and columns, posts and other structural elements of a minor nature.

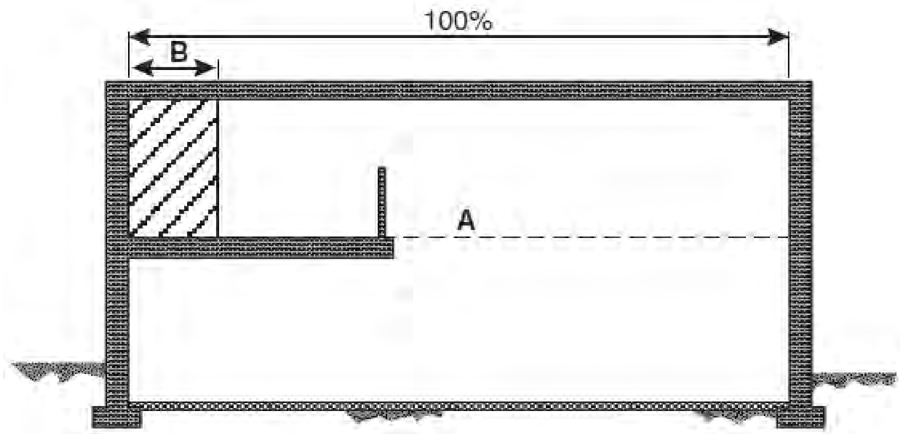


Figure A-3.2.1.1.(3)-D
Enclosed Spaces within a Mezzanine

Notes to Figure A-3.2.1.1.(3)-D
(1) This Figure describes Sentence 3.2.1.1.(7).
(2) The horizontal plane is demonstrated by the dashed line, A.
(3) Up to 10% of the horizontal plane may be enclosed. This must be located so as to avoid contravening the open requirements of Clause 3.2.1.1.(3)(b); in effect no dead areas are permitted.

If a floor has more than one mezzanine, each may be treated individually. For example in a one storey building with five tenancies, each tenant would be permitted to have a mezzanine up to the limits indicated, without the building being considered two storeys in building height. However, should one of the mezzanines exceed any of the limitations, the building would then be considered to be two storeys in building height.

Regarding the floor space under a mezzanine, there are no restrictions on partition construction in this area. The space on the floor beyond the mezzanine, i.e. below the open portion of the horizontal plane, should, with discretion, be visually open to view from the mezzanine.

A-3.2.1.1.(4) Mezzanines in Suites. The defined term “suite” in this case could be equally applicable to a suite in an apartment or commercial building, or even an entire storey such as may occur in a curling rink. There may be more than one enclosed mezzanine in the suite but in no instance can the combined total mezzanine area exceed 10% of the suite in which they are located.

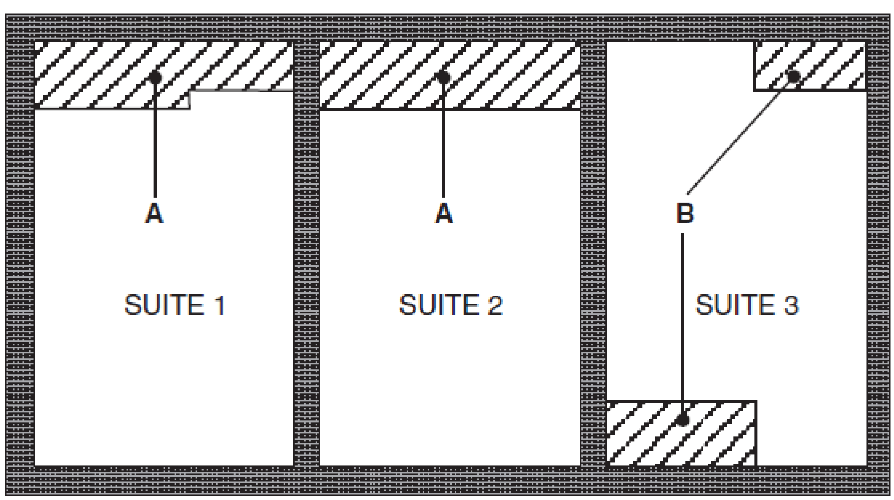


Figure A-3.2.1.1.(4)-A
Mezzanines in Suites

Notes to Figure A-3.2.1.1.(4)-A
(1) This Figure describes Clause 3.2.1.1.(4)(b).
(2) Mezzanines up to 10% of area of a suite (A) may be enclosed.
(3) More than one mezzanine (B) is permitted in a suite provided the total area of mezzanines does not exceed 10% of the suite in which they are located.

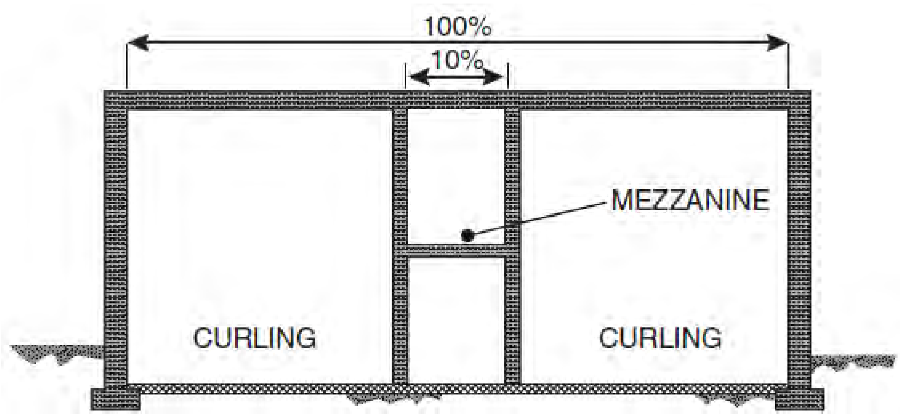


Figure A-3.2.1.1.(4)-B
Mezzanines in Multi-Room Suites

Notes to Figure 3.2.1.1.(4)-B
(1) This Figure describes Clauses 3.2.1.1.(4)(a) and (b)
(2) The curling rink has several 'rooms,' but should be regarded as 'one suite.' The enclosed mezzanine may be up to 10% of the area of the entire suite.

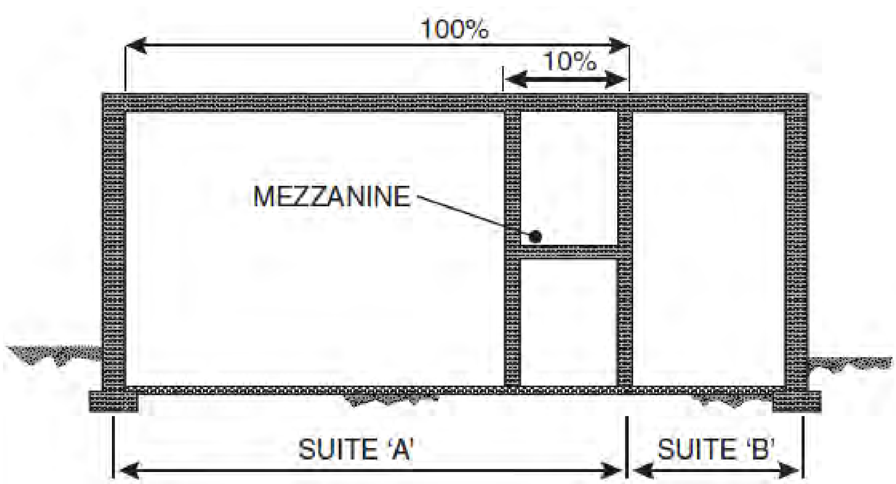


Figure A-3.2.1.1.(4)-C
Mezzanines in Multi-Tenanted Suites

Notes to Figure A-3.2.1.1.(4)-C
(1) This Figure describes Clauses 3.2.1.1.(4)(a) and (b).
(2) In this example, the 10% of the suite area is of Suite 'A' as if it is part of that series of rooms, or suite. It has no user-of-tenancy relationship with Suite 'B.' (Suite 'B' may also have 10% of totally enclosed mezzanines.)

A-3.2.1.1.(8) Accessible Service Space. These service spaces are often referred to as interstitial spaces and are designed to allow service personnel to enter and undertake maintenance or installation within the space. Catwalks or flooring are usually included to provide a walking or access surface. Even when flooring is included, it is not intended that the interstitial space should be considered as a storey for the purposes of the By-law unless the space is used for purposes other than servicing or the storage of materials and equipment to be used for building services within that space.

A-3.2.1.7.(4) Major Occupancies Other than Group C or D in 6 Storey Combustible Buildings. The requirements of 3.2.2.50. and 3.2.2.58 enable the introduction of major occupancies into buildings of predominantly residential or office occupancy that exceed the normal size limits permitted under the present construction requirements of Subsection 3.2.2. In order to ensure that an appropriate level of fire and life safety is being met, additional fire compartmentation and protection of floor areas above the 3rd storey is required by this By-law.

The requirements of 3.2.1.7.(4) are intended to supplement the requirements of 3.2.1.7.(1) by creating further compartmentation subdividing a building into floor areas not exceeding 1,000 m^2. The terminology "horizontal *fire compartment* on each *storey*" is intended to require that floor areas on each *storey* be individually broken up into *fire compartments* that are both horizontal and vertically separated from each other. Furthermore, each compartment thus created is required to have direct access to at least one exit in addition to the applicable requirements of Sections 3.3. and 3.4. of this By-law. In the case of ground level suites, this may be achieved by exits directly to the exterior, in addition to protected exits as otherwise required by this By-law.

A-3.2.1.7.(5) Encapsulated Mass Timber. The provisions of Sentence 3.2.1.7.(5) are intended to provide a pathway for the limited use of mass timber with certain protective features, and in certain specific circumstances. It is not intended to be a general endorsement of construction of mass timber. A great deal of research has been undertaken by the National Research Council of Canada, and general requirements that would permit a broader use of these materials in a building of *noncombustible construction* outside of an alternative solution will require specific construction requirements to be endorsed at the national and provincial levels.

A-3.2.2.2.(1) Special and Unusual Structures. Examples of structures which cannot be identified with the descriptions of buildings in Articles 3.2.2.20. to 3.2.2.90. include grain elevators, refineries and towers. Publications that may be consulted to establish good engineering practice for the purposes of Article 3.2.2.2. include the NFPA "Fire Protection Handbook," Factory Mutual Data Sheets, and publications of the Society for Fire Protection Engineering.

A-3.2.2.7.(2) Fire Separations and Fire-Resistance Ratings. Fire separations and their corresponding fire resistance rating if required may or may not be governed by the structural fire requirements under Subsection 3.2.2. In establishing the fire separation and fire-resistance rating requirements the practitioner must remember to consult all requirements for fire separations and fire resistance ratings as detailed in Division B Sections 3.1, 3.2, 3.3, 3.4, and 3.5. (See Article 3.1.3.1.)

A-3.2.2.15.(2) Storeys below Ground Occupancies located below grade represent an unusual level of challenge for both occupant egress and emergency response since the availability of paths of travel to enter or leave the underground space is usually limited. This may subject occupants to a greater risk of exposure to untenable conditions during evacuation. Similarly, emergency responders must share limited means of egress with occupants which could further impact occupant evacuation, impede an effective response, or expose first responders to unsafe conditions.

It is not the intent of the Building By-law to limit the inclusion of occupancies below grade where they can be shown to demonstrate an appropriate level of fire and life safety. Rather the intent of this requirement is to cause a conscientious review of certain underground occupancies to ensure that they are sufficiently protected, and that the arrangement can provide an acceptable level of emergency response for a variety of conditions. The measures described in Sentence 3.2.2.15.(2) provide a minimum for fire safety under many circumstances, but may not be sufficient to address all potential uses or occupancies below grade. It should be confirmed that the proposed use and building design is acceptable to the Chief Building Official.

A-3.2.2.18.(2) Sprinkler Extent. A literal interpretation of Article 3.2.2.6. and Sentences 3.2.2.4.(1) and (2) could require installation of an automatic sprinkler system throughout all storeys of a building regardless of options in Articles 3.2.2.20. to 3.2.2.90. to construct one or more storeys without installation of sprinklers. It is the intent of the By-law that all storeys below a storey in which an automatic sprinkler system is installed should also be protected by an automatic sprinkler system to ensure that a fire in a lower storey does not incapacitate the automatic sprinkler system or overwhelm an automatic sprinkler system in an upper storey. Persons in an upper storey in which waivers or reductions of other fire safety systems are permitted would be exposed to an increased risk from a fire on a lower storey. This concept also applies to situations in which an automatic sprinkler system has been installed within a floor area in order to modify other safety requirements applying within the floor area. If the uppermost storey or storeys of a building can be constructed without the installation of an automatic sprinkler system it is not necessary that an automatic sprinkler system required in a lower storey be extended into the upper storey or storeys.

A-3.2.2.35.(4) Sprinkler Requirements. Spaces in a building of Group A, Division 4 occupancy that are intended to be equipped with sprinklers include, but are not limited to, dressing and changing rooms, concession stands and areas, toilet rooms, locker rooms, storage areas, service rooms, offices and other spaces that provide service to the building. The enclosure of seating areas with glazing needs special consideration in determining the requirements for sprinklers. For example, if the enclosed area is used for the consumption of food and beverages, it should be classified as Group A, Division 2 and the appropriate requirements of that classification applied. Enclosure of limited spaces above seating areas for press and media purposes is not considered to require the installation of sprinklers.

A-3.2.2.50.(5) and 3.2.2.58.(4) Occupancy Combinations in Buildings of Mixed Construction Hybrid Structures. Buildings conforming to the building height and area limits, as well as the other fire protection requirements of Articles 3.2.2.50. or 3.2.2.58. are permitted to be entirely constructed of combustible construction and incorporate the occupancies specifically permitted by Sentences 3.2.2.50.(5). or 3.2.2.58.(4)., for example, Group A, Division 2 or Group E major occupancies on the first to second storeys, and a parking garage on the first to third storeys. Alternatively, the requirements of Articles 3.2.2.4. to 3.2.2.8. for superimposed major occupancies can be applied, resulting in buildings of mixed (hybrid) construction conforming to the building height and area limits for combustible construction where the lower storeys are of noncombustible construction and the upper storeys are of combustible construction. For example, a Group B, Division 3 or a Group A, Division 2 major occupancy could be located on the first 4 storeys of a 6-storey Group C building constructed in accordance with Article 3.2.2.50., provided that these first 4 storeys are constructed of noncombustible construction in accordance with Article 3.2.2.24. for a Group A, Division 2 major occupancy or Article 3.2.2.42. for a Group B, Division 3 major occupancy. (See also Articles 3.2.2.6. and 3.2.2.7..)

A-3.2.3. Fire Protection Related to Limiting Distance versus Separation Between Buildings. By-law provisions that address protection against fire spread from building to building use the limiting distance (See the definition in Article 1.4.1.2. of Division A.) for a building rather than using the distance between adjacent buildings on separate properties, since this would result in situations where the design and construction of a building on one property affects the design and construction of a building on an adjacent property.

The By-law requirements that deal with reducing the probability of building-to-building fire spread were originally developed based on the assumption that the exposing building faces of adjacent buildings are of similar size and configuration, and are equidistant from the shared property line. Where buildings are of different sizes, the smaller building may be subject to a higher heat flux in the event of a fire compared to the larger building. Where buildings are closely spaced and not equidistant from the property line, the construction of the building with the greater limiting distance does not recognize the proximity of the building with the lesser limiting distance.

The By-law has more stringent requirements for buildings with lesser limiting distance as regards the maximum area and spacing of unprotected openings, and the construction, cladding and fire resistance of walls. This increased stringency recognizes that the fire hazard is greater where buildings are closer together and that adjacent buildings may have exposing building faces of different sizes, configurations or limiting distances, which could further increase the hazard.

The Chief Building Official may also address limiting distances through legal agreements with the parties involved that stipulate that the limiting distance be measured to a line that is not the property line. Such agreements would normally be registered with the titles of both properties.

A-3.2.3.1.(4) Spatial Separation Design. In the application of Sentences 3.2.3.1.(3) and (4), it is intended that Sentence (3) be used first to establish the basic requirements for the exterior wall in terms of fire-resistance rating, type of construction and type of cladding. The percentage of unprotected openings determined from the application of Sentence (3) would be unnecessarily restrictive if the actual unprotected openings occur in a plane that is set back from the front of the building face. Sentence (4) applies to the calculation of the allowable percentage of unprotected openings based upon projection onto a plane that is in front of all unprotected openings. The application of these two Sentences is shown in Figure A-3.2.3.1.(4). The modifications permitted by Article 3.2.3.12. would be applied, if applicable, to the area of unprotected openings derived from Sentence (4).

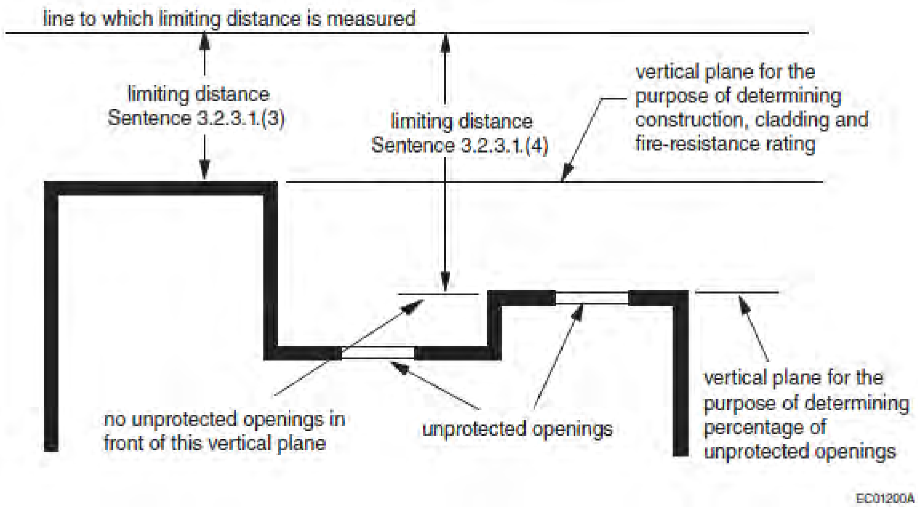


Figure A-3.2.3.1.(4)
Spatial separation design

A-3.2.3.1.(8) Intervention Time and Limiting Distance. The total time from the start of a fire until fire suppression by the fire department depends on the time taken for a series of actions. Sentence 3.2.3.1.(8) is only concerned with the time from receipt of notification of a fire by the fire department until the arrival of the first fire department vehicle at the building. It specifies a 10-min time limit which must be met in more than 90% of the calls to the building served by the fire department. This reliability level and provision for flexibility is essentially consistent with NFPA 1710, “Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments.”

Clause 4.1.2.1 of NFPA 1710 establishes “time objectives” for fire incidents as follows:

- 1 min (60 s) for turn-out of responders after receipt of notification of a fire, and
- 4 min (240 s) or less for arrival of the first arriving engine company at a fire suppression incident and/or 8 min (480 s) or less for the deployment of a full first alarm assignment at a fire suppression incident.

The standard requires that the fire department establish a “performance objective” of not less than 90% for each response time objective. This reliability level is referred to in NFPA 1710 as a “performance objective.”

Where the 10-min limit cannot be met by the fire department at least 90% of the time, Sentence 3.2.3.1.(8) specifies that a value corresponding to half the actual limiting distance be used in requirements that depend on limiting distance to define other criteria. For new subdivisions, legal agreements may be made for the construction of fire stations to serve those areas. The fire department response time in those subdivisions may temporarily exceed 10 min until the fire station is constructed.

See also Sentences 9.10.14.3.(1) and 9.10.15.3.(1).

A-3.2.3.4.(1) Party Walls. By definition, a party wall is a wall jointly owned and used by two parties under easement agreement or by right in law, and is erected at or upon a line that separates two parcels of land that are, or are capable of being, separate real estate entities. With the exception of some Part 9 residential occupancies, both Part 3 and Part 9 of the By-law require that, where party walls are constructed on property lines, they be constructed as a 2- or 4-hour firewall (See also Article 9.10.11.1.).

Buildings on each side of a party wall that is constructed as a firewall are considered as separate buildings (See Article 1.3.3.4. of Division A.).

In a Part 9 residential building that has no dwelling unit above another, a party wall constructed on a property line between two dwelling units need not be constructed as a firewall, but must be constructed as a continuous fire separation that extends from the top of the footings to the underside of the roof, with a fire-resistance rating of at least 1 hour (See Article 9.10.11.2.). These party walls do not create separate buildings.

Where two parties share a party wall on a property line, each party is responsible for fire safety in their unit, but is still subject to possible fire risks from activities in the adjoining units. The separating party wall is intended to provide a significant degree of fire protection between the adjacent units, often exceeding even that required between suites in multiple-unit residential and non-residential occupancies.

When a building spans a property line, constructing a party wall on the property line is not mandated by the By-law, but subdividing the building at the property line is an option the owner can consider. The By-law permits a building constructed on more than one property to be designed as a single undivided building, whether the properties have a common owner or not. However, if a subdividing wall is constructed on the property line within the building for the purpose of separating the two real estate entities and is shared by two different owners, the wall would, by definition, be deemed a party wall. As such, this party wall would need to meet the construction requirements described above, depending on the building's occupancy classification and size.

A building that spans two or more properties, but that does not have a party wall at the property line, may need to address the By-law requirements for party walls in the future.

A-3.2.3.6.(2) Protection of Roof Soffits Near Property Lines. Sentences 3.2.3.6.(2) to (5) and parallel Sentences 9.10.14.5.(5) to (7) and 9.10.15.5.(5) to (7) provide requirements for the protection of soffits where the soffit of the subject building is located close to the property line or to an imaginary line between two buildings on the same property. Fire from inside the roof space of the subject building can exit unprotected soffits and expose the adjacent building to flames.

A-3.2.3.14.(1) Wall Exposed to Another Wall. The requirements of Article 3.2.3.14. are to ensure that the control of fire spread by the interior fire separations between fire compartments is not defeated through the spread of fire by thermal radiation outside the building. Minimum spatial separations are specified between the openings in separate fire compartments where the exterior faces of these compartments are deemed to expose each other to a thermal radiation hazard. This situation may arise where the angle, θ, between the intersecting planes of the exposing building faces is 135° or less. Examples of situations that would be addressed by this Article are shown in Figures A-3.2.3.14.(1)-A, A-3.2.3.14.(1)-B and A-3.2.3.14.(1)-C.

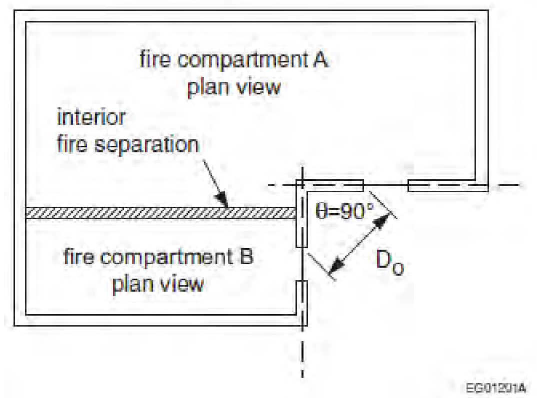


Figure A-3.2.3.14.(1)-A
Openings in walls at a right-angle corner

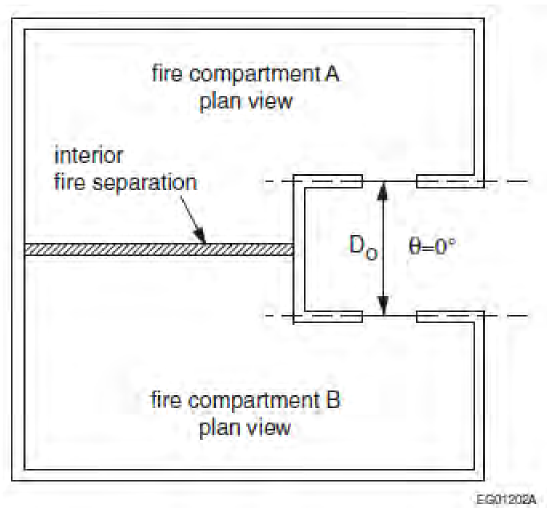


Figure A-3.2.3.14.(1)-B
Openings in walls that are parallel to one another

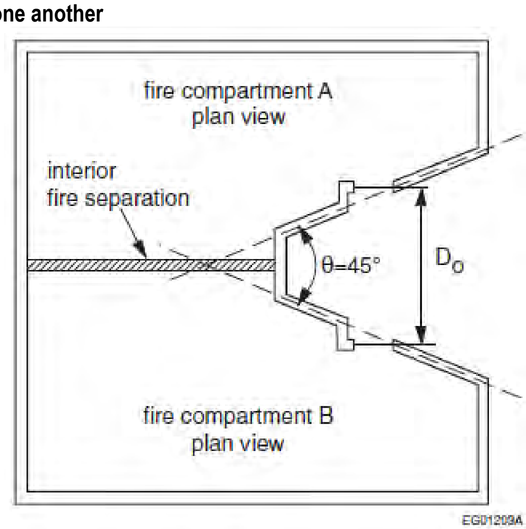


Figure A-3.2.3.14.(1)-C
Openings in walls with an included angle of 45°

A-3.2.4. Fire Alarm System. The term "fire alarm system" used in this Subsection applies to fire alarm systems with or without voice communication capability.

A-3.2.4.4.(1) Single Stage Fire Alarm System. This requirement, in combination with Article 3.2.4.22., is intended to allow for the provision of voice communication capability as an integral part of a single stage fire alarm system.

A-3.2.4.4.(2)(c) Fire Alarm Alert Signal. In a 2-stage fire alarm system described in Sentence 3.2.4.4.(2), the alert signal may be transmitted to audible signal devices in designated locations or to audible signal devices throughout the building. If actuated, the second stage alarm signal in a 2-stage fire alarm system may sound throughout all zones in the building. All manual station key switches would typically initiate the alarm signal.

Sentence 3.2.4.4.(2) also allows the implementation of a "zoned 2-stage" sequence of operation, whereby the alarm signal sounds in the zone of key switch actuation (and perhaps in the adjacent zones, which may be the storey above and the storey below) and the alert signal sounds throughout the rest of the building. This sequencing would be created automatically by the fire alarm control unit. The key or special device referred to in Clause 3.2.4.4.(2)(c) should be immediately available to all persons on duty who have been given authority to sound an alarm signal.

A-3.2.4.4.(2) Two-Stage Fire Alarm System. Sentence 3.2.4.4.(2), in combination with Article 3.2.4.22., is intended to allow for the provision of voice communication capability as an integral part of a 2-stage fire alarm system.

A-3.2.4.6.(2) Access to Silencing Switches. This requirement is intended to prevent easy access to silencing switches. The satisfactory operation of a fire alarm system to alert the occupants of a building to an emergency is predicated on the assumption that the alarm signal will be silenced only after responsible staff have verified that no emergency exists. Details on the emergency procedures to be used in case of fire are contained in the Fire By-law.

A-3.2.4.6.(3) Silencing Alarms. This requirement is intended to provide the Vancouver Fire Department and building management the ability to silence the fire alarm at the main annunciator (in addition to the main control panel). A special keyed switch is considered to meet the intent of this requirement.

A-3.2.4.7.(4) Design and Installation of Fire Department Notification. In some jurisdictions, the fire department may utilize, or have available, a municipal fire alarm system or equipment intended for receiving notification by means of a direct connection. If used, it is expected that these systems and installations conform to the requirements of Sentence (4) so as to achieve and provide a uniform and reliable level of service. It is also intended that a proprietary central station as well as a fire brigade used by a large corporation, university campus or similar site comply with Sentence (4).

CAN/ULC-S561, "Installation and Services for Fire Signal Receiving Centres and Systems," which is referenced in Sentence 3.2.4.7.(4), and CAN/ULC-S524, "Installation of Fire Alarm Systems," which is referenced in Sentence 3.2.4.5.(1), go hand-in-hand: conformity to CAN/ULC-S561 entails conformity with the fire alarm system components required in that standard, which include the fire alarm transmitter (signal transmitting unit), the interconnections, and the communication path.

A-3.2.4.7.(5)(b) Emergency Telephone Number. In many municipalities an emergency telephone number, for example 911, is used for all emergency services and it is preferable to post that number.

A-3.2.4.8.(2) Fire Alarm Zones. Alarm initiating devices referred to in this Sentence include fire detectors, waterflow switches and manual stations. If a room or space in a building extends through more than one storey of the building, as in the case of multi-level dwelling units and machinery rooms, judgment must be exercised in the zoning and annunciation of the fire detectors in that room or space. In general, the lowest storey on which access is provided into the room or space should be indicated on the annunciator to avoid unnecessary delays for the responding firefighters. Consideration should also be given to the use of numbers or letters on the annunciator that correspond to those used in the building elevators.

A-3.2.4.8.(11) Annunciator Zone Indication. Although an alphanumeric display can identify any specific alarm initiating device that is activated or requires maintenance service, an annunciator panel provided with an alphanumeric display only is not acceptable to the fire department in emergency situations. In emergency situations, indicator lamps provide status information of all zones at a single glance without having to scroll through the information provided by an alphanumeric display.

A-3.2.4.9.(3)(f) Supervision for Fire Pumps. Specific electrical supervision for fire pumps is stated in NFPA 20, "Installation of Stationary Pumps for Fire Protection," which is referenced in NFPA 13, "Installation of Sprinkler Systems."

A-3.2.4.11.(1) Smoke Detector Location. In the design and installation of the smoke detection system, consideration must be given to all features which could have a bearing on the location and sensitivity of the detectors, including ceiling height, sloped ceilings, diffusion from air conditioning and ventilating currents, obstructions, baffles, and other pertinent physical configurations that might interfere with the proper operation of the system.

A-3.2.4.11.(3) Visible Signals. If staff located in each zone or compartment can see each sleeping room door, visible signals may be located above each door. If staff cannot see every door, it is intended that the visible signals be provided at the location where the staff are normally in attendance. The audible signal is intended to alert staff of the need to check the visible signals.

A-3.2.4.16.(1) Manual Station. Only one manual station need be provided near a group of doors serving as a principal entrance or as a single exit facility. Egress facilities that are provided for convenience and that do not include all the features of required exits need not be provided with a manual pull station.

A-3.2.4.18. Acoustic Measurement and Terminology. The following notes on acoustic measurement and terminology are intended to assist in the application of the requirements for audibility of fire alarm system sounding devices.
The background or ambient measurement should be a spatial averaged A-weighted equivalent sound level measured for 60 s. This can be obtained using an integrating sound level meter with the integration time set to 60 s. During the measurement period the meter should be slowly moved about so as to sample the space uniformly but coming no closer than 0.5 m from any solid wall, floor or ceiling. Alternatively, measurements can be made at 3 or more positions throughout the space and an energy average calculated.

The measurement of the alarm level depends on the type of alarm signal. If the signal is a continuous signal from a bell or siren, the spatial averaged A-weighted equivalent sound level should be obtained. The integration time should be long enough to obtain a reasonable spatial average of the space, but not less than 10 s.

If the alarm has a temporal pattern, then the A-weighted sound level should be measured using the 'fast' time constant during the 'on' part of the cycle. In this situation it is not appropriate to use an integrating sound level meter. Since the duty cycle of the alarm is only 37.5% at best, that type of meter would give a reading that is 4 or more decibels lower than the level while the alarm is 'on.' A number of measurements should be made about the space in question and the average value used to obtain a good spatial representation.

Strictly speaking, the energy average of the measurements should be used; however, the frequency spectrum associated with most alarms is of a type that should give little variation about the space. If the measured levels don't vary by more than 2 to 3 dB, then an arithmetic average rather than an energy average can be used.

Effect of Furnishings
The final inspection of a fire alarm system is seldom made when the building is furnished and ready for occupancy. This results in measured levels which may be several decibels higher than will be found in the occupied building. The importance of this difference depends on the situation.

If the building is complete except for furnishings, so that the sources of ambient noise are present, then the amount by which the alarm signal exceeds the ambient level will not change appreciably with the introduction of furnishings. In this case both levels will be reduced by about the same amount.

If the primary source of ambient noise will be office equipment and workers, as would be expected in an open plan office, then measurements made prior to occupancy may differ substantially from those made afterwards. This may be true for both the absolute sound levels and the difference between the alarm level and the ambient.
A problem arises in trying to estimate what the absolute sound levels will be after the building is occupied. In general, if the measurement is made in a totally bare room then the level will be about 3 dB higher than if the room were carpeted, assuming a reasonable carpet with an underlay. In most cases this will account for most of the absorption in the room and no further correction will be necessary. Adding heavy drapes and absorptive furnishings to a carpeted room can reduce the sound level by a further 2 to 3 dB.

Commercial buildings are more problematic. For example, if an open plan office is measured before any office screens are installed, there could be a substantial difference in the before and after levels, depending on the distance to the nearest alarm device.

Glossary of Acoustical Terms

Audible: A signal is usually considered to be clearly audible if the A-weighted sound level exceeds the level of ambient noise by 15 dB or more.

Awakening threshold: The level of sound that will awaken a sleeping subject 50% of the time.

A-weighted: A frequency weighting network which emphasizes the middle frequency components similar to the response of the human ear. The A-weighted sound level correlates well with subjective assessment of the disturbing effects of sounds. The quantity is expressed in dBA.

Masked threshold: The level of sound at which a signal is just audible in ambient noise.
Sound level: A sound pressure level obtained using a signal to which a standard frequency-weighting has been applied.

Sound pressure: A fluctuating pressure superimposed on the static pressure by the presence of sound. The unqualified term means the root-mean-square sound pressure. In air, the static pressure is barometric pressure.

Sound pressure level: Ten times the common logarithm of the ratio of the square of the sound pressure under consideration to the square of the standard reference pressure of 20 mPa. The quantity obtained is expressed in decibels.

A-3.2.4.18.(1) Alert and Alarm Signals. Alert signals are part of a 2 stage fire alarm system. The intent of the first, alert, stage is to notify persons in authority of a potential threat to building occupants. If a continuously staffed location is available, the alert signal can be restricted to that location.

A-3.2.4.18.(2) Alarm Signal Temporal Pattern. The temporal pattern of an alarm signal relates to the time during which the signal is produced and the intervals between the individual signal pulses. The international standard ISO 8201, "Acoustics – Audible emergency evacuation signal," includes a pattern that is becoming widely used in different countries and it is appropriate for this pattern to be adopted in Canada. The temporal pattern can be produced on most signalling devices. Most existing alarm systems can be modified, and this pattern could be phased in when the

systems require modification. The characteristic of the pattern is a 3-pulse phase followed by an off phase. The 3 pulses each consist of an on phase lasting for 0.5 ± 0.05 s followed by an off phase lasting for 0.5 ± 0.05 s sounded for 3 successive on periods and then followed by an off phase lasting for 1.5 ± 0.15 s.
Figure A-3.2.4.18.(2)-A indicates the pattern that is intended.

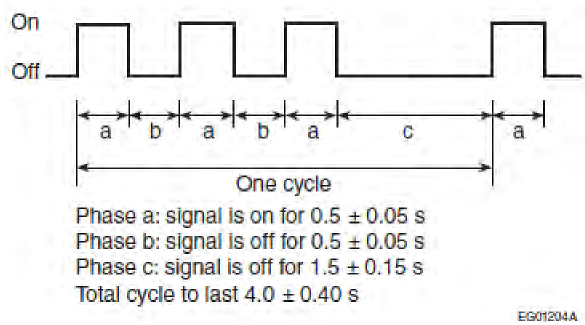


Figure A-3.2.4.18.(2)-A
Temporal pattern for fire alarm signal

Although the diagram shows a square wave form, the wave can have other shapes that produce a similar effect.
If single stroke bells are to be used, the temporal pattern can be produced by having the bell struck three times at a rate of one stroke per second followed by an interval of 2 s of silence. Figure A-3.2.4.18.(2)-B shows the pattern that results.

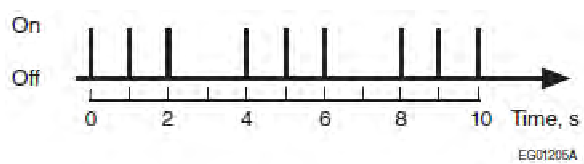


Figure A-3.2.4.18.(2)-B
Temporal pattern imposed on a single stroke bell or chime

Note to Figure A-3.2.4.18.(2)-B:
(1) The on phase represents the time that the striker mechanism is actuated. The sound produced by the bell or chime will continue at a level that decreases until the striker mechanism is re-actuated.

A-3.2.4.18.(3) Audibility of Alarm Systems. It is very difficult to specify exactly what types of sound patterns are considered to be "significantly different" from one another. The intent is to ensure that there is a noticeable or measurable difference between the alert signals and the alarm signals such that it reduces the possibility of confusion.

A-3.2.4.18.(4) Sound Pressure Level. For the purposes of this requirement, an audible signalling device should not produce a sound pressure level more than 110 dBA when measured at a distance of 3 m.

A-3.2.4.18.(5) Residential Sound Level. In a building in which corridors or hallways serve more than one suite or dwelling unit, there will be situations in which an audible signal device cannot be placed in the corridor or hallway to alert persons sleeping in suites and dwelling units, because the sound level in the vicinity of the device would exceed that permitted by Sentence 3.2.4.18.(4).

In these situations it will be necessary to supplement the building fire alarm system with an audible signal device in the suite or dwelling unit. These devices could be piezoelectric devices similar to the sounding units in many smoke alarms, subject to the device emitting the appropriate temporal pattern required by Sentence 3.2.4.18.(2).

A-3.2.4.18.(7) Disconnect Device for Dwelling Units. In order to minimize the annoyance caused by false and unwanted alarms, the disconnect will permit a person to silence the local audible device within the dwelling unit. At that time the person would be aware of sounds from devices in common spaces and could plan appropriate action. The disconnect will reduce the possibility of tampering with the audible devices.

A-3.2.4.18.(8) and (9) Signal Circuits. Clause 3.2.4.18.(8)(a) permits Class A wiring, or Class B wiring with signal circuit isolators located outside of the suites, to serve audible signal devices within residential suites.

Clause 3.2.4.18.(8)(b) permits a separate signal circuit to serve each suite without the need for signal circuit isolators or Class A wiring.

Open circuits and Class A and Class B wiring circuits are terms defined in CAN/ULC-S524, "Installation of Fire Alarm Systems."

A-3.2.4.19.(2) Visual Alarm Signal. CAN/ULC-S526, "Visible Signal Devices for Fire Alarm Systems, Including Accessories," applies to visual signalling units. This document is referenced by the most recent standard for the installation of fire alarm systems and would automatically apply. Current Canadian technology does not integrate visual and audible alarms to have the same temporal pattern. Visual and audible alarms should have as close a temporal pattern as possible but without interference beats that might have a deleterious effect on some persons. Visual signalling devices with the same temporal pattern as required for audible devices are available from some sources and they should become available in Canada. Not all units that comply with the ULC standard will have sufficient power to adequately cover large areas; care will have to be taken to specify units with adequate power when large spaces are being designed.

A-3.2.4.20.(7)(a) Smoke Alarm Installation. CSA C22.1, "Canadian Electrical Code, Part I," which is adopted by the Electrical Safety Regulation, permits a smoke alarm to be installed on most residential circuits that carry lighting outlets and receptacles. It is the intent of the Building By-law that any other item on a circuit with a smoke alarm should be unlikely to be overloaded and trip the breaker with a resultant loss of power that is not sufficiently annoying for the breaker to be restored to the on position. It is considered that an interior bathroom light or a kitchen light fulfills this intent, but that circuits restricted to receptacles do not fulfill this intent.

A-3.2.4.20.(8) Smoke Detectors in lieu of Smoke Alarms. It is intended that the smoke detector in this application will function as per the requirements of a smoke alarm; specifically, it will be a localized alarm to that suite. The advantage of this type of installation is that the detector would be monitored by the fire alarm panel, which would provide notification to supervisory personnel and be inspected as per CAN/ULC-S524, "Installation of Fire Alarm Systems."

A-3.2.4.22.(1)(b) Voice Messages. The concept of intelligibility expressed in Clause 3.2.4.22.(1)(b) is intended to mean that a person with average hearing and cognitive abilities is able to understand the messages that are transmitted into the space occupied by the person. There is no absolute measure to predetermine the effect of loudspeakers and it may be necessary, once the building has been furnished and occupied, to increase the number of loudspeakers to improve the quality of the messages.

The intelligibility of the message depends on the speech level, the background level, and the reverberation time of the space. ISO 7731, "Ergonomics – Danger signals for public and work areas – Auditory danger signals," addresses audibility. The standard suggests that an A-weighted sound level at least 15 dBA above the ambient is required for audibility, but allows for more precise calculations using octave or 1/3 octave band frequencies to tailor the alarm signal for particular ambient noise conditions. Design of the alarm system is limited to ensuring that all areas receive an adequately loud alarm signal.

If a public address system is to be used to convey instructions during an emergency, then the requirements of the system are less straightforward. In general, however, a larger number of speakers operating at lower sound levels would be required.

Additional guidance on how to design and evaluate the intelligibility of a communication system can be found in the following documents:

- IEC 60268-16, "Sound System Equipment – Part 16: Objective Rating of Speech Intelligibility by Speech Transmission Index"
- ISO 7240-19, "Fire Detection and Alarm Systems – Part 19: Design, Installation, Commissioning and Service of Sound Systems for Emergency Purposes"
- NEMA SB 50, "Emergency Communications Audio Intelligibility Applications Guide"
- Annex A.7.4.1.4 of NFPA 72, "National Fire Alarm and Signaling Code"

A-3.2.5.4.(1) Fire Department Access for Detention Buildings. Buildings of Group B, Division 1 used for housing persons who are under restraint include security measures that would prevent normal access by local fire departments. These security measures include fencing around the building site, exterior walls without openings or openings which are either very small or fitted with bars, and doors that are equipped with security hardware that would prevent easy entry. These buildings would have firefighting equipment installed and the staff would be trained to handle any small incipient fires. It is expected that appropriate fire safety planning would be undertaken in conjunction with local fire departments in order that special emergencies could be handled in a cooperative manner.

A-3.2.5.5. Location of Access Routes and Paths of Travel. The national building code and the provincial building code prescriptive requirements for access routes, paths of travel and hydrant locations, currently, do not reflect the operational requirements of the Vancouver Fire and Rescue Services nor the existing City of Vancouver fire hydrant locations. Therefore, the VBBL has been modified from the national and provincial building codes to reflect the unique to Vancouver requirements.

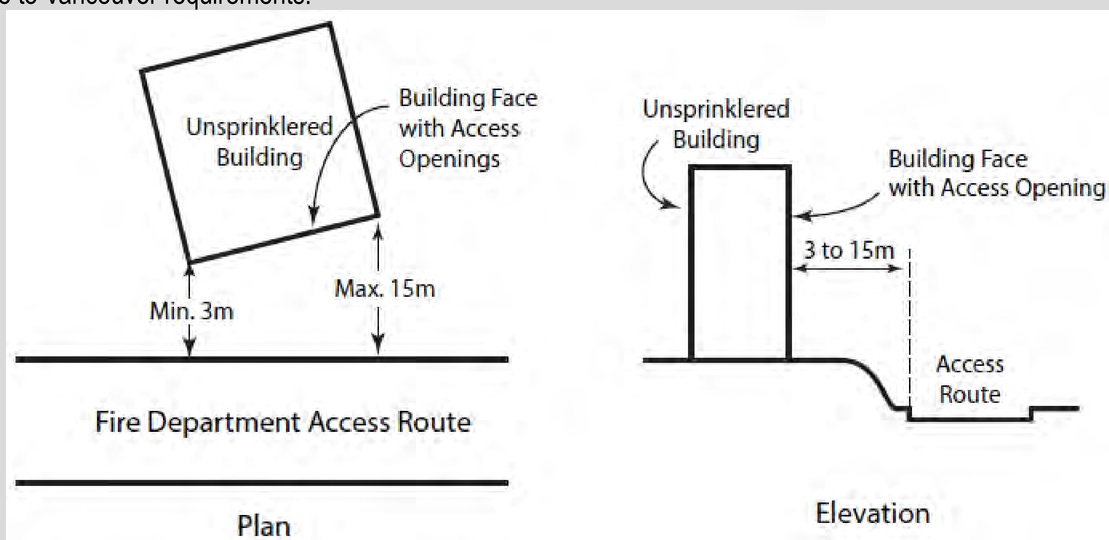


Figure A-3.2.5.5.-A

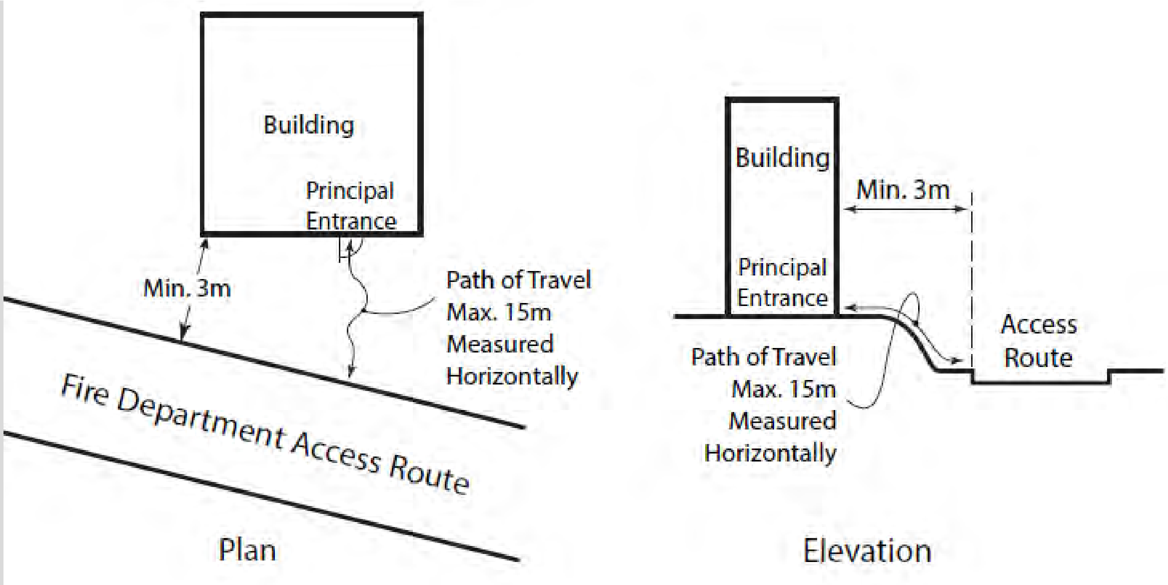


Figure A-3.2.5.5.-B

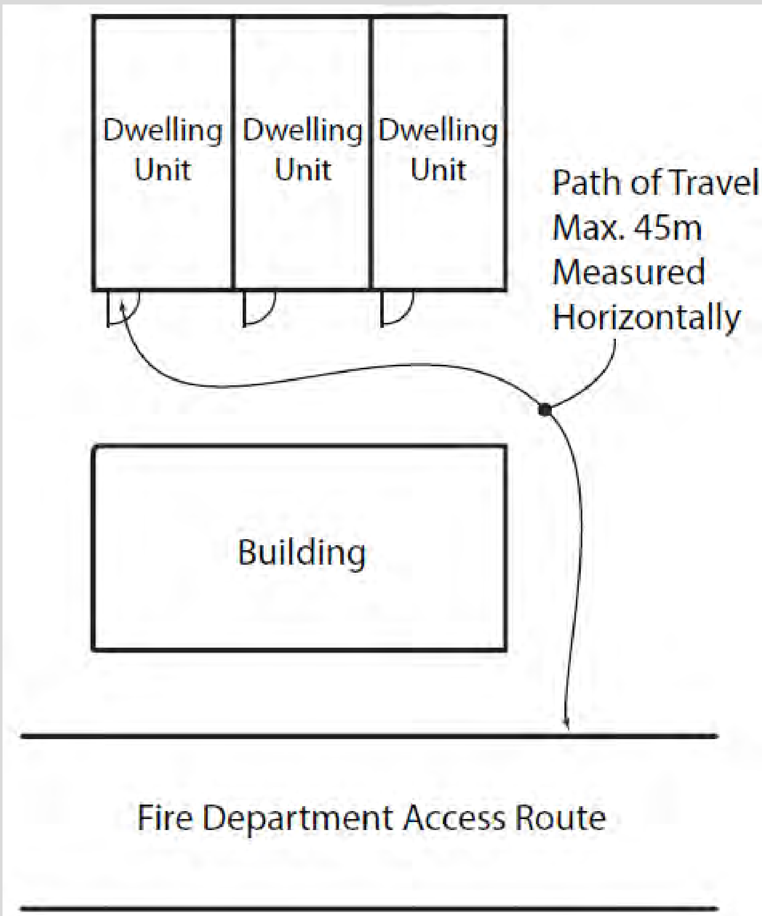


Figure A-3.2.5.5.-C

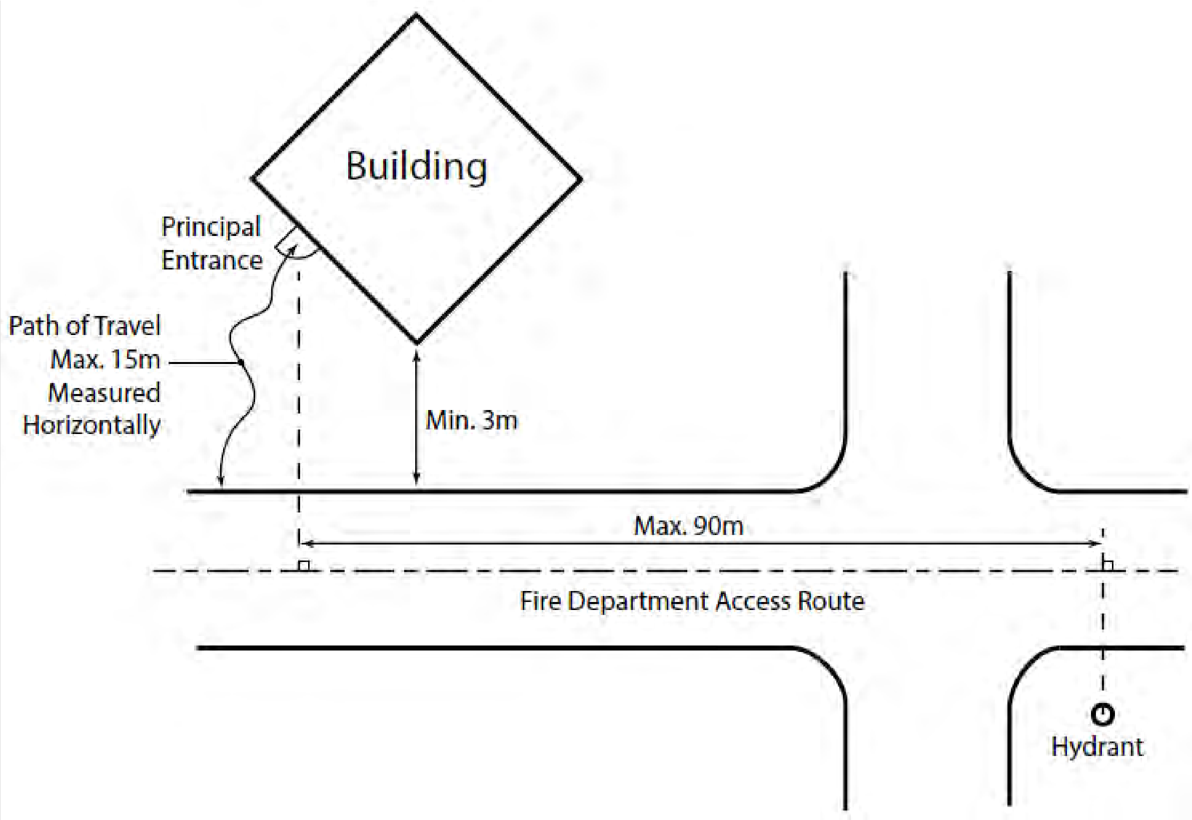


Figure A-3.2.5.5.-D

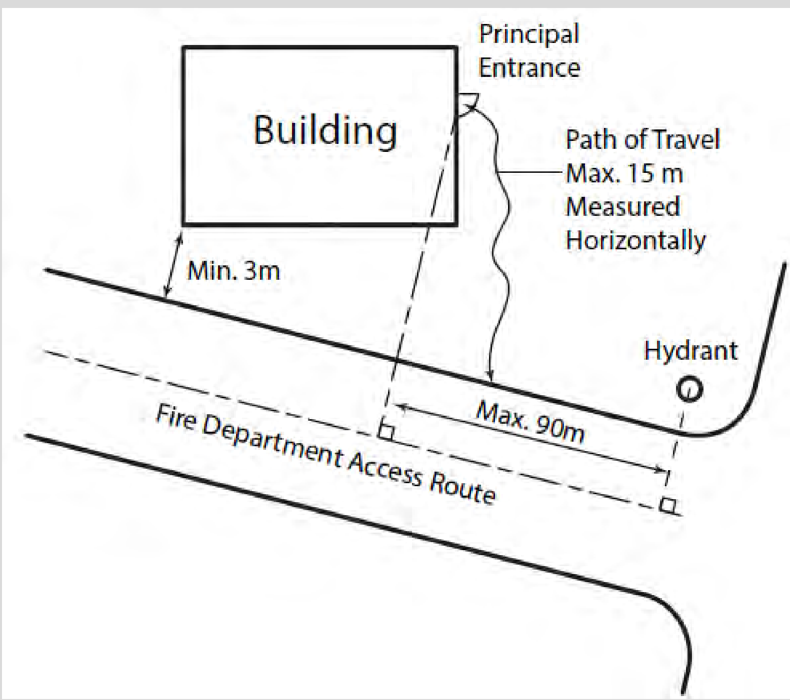


Figure A-3.2.5.5.-E

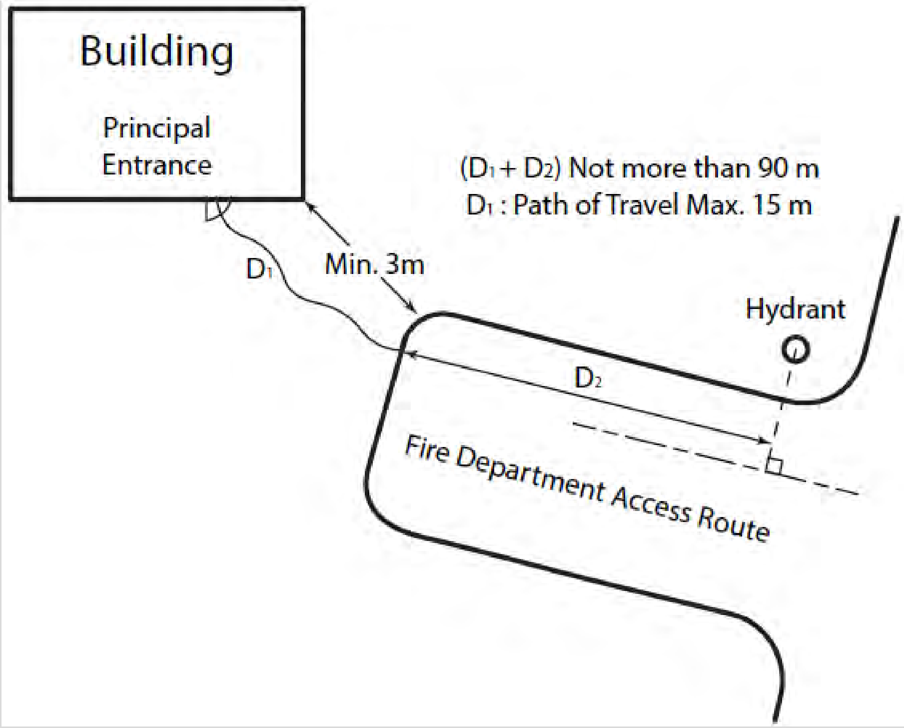


Figure A-3.2.5.5.-F

A-3.2.5.5.(1), (2) and (3)(d) Access Route and Path of Travel Except as indicated below, no building face or portion thereof should be located less than 3m from an access route nor should the principal entrance of each building be located more than 15m from an access route. These provisions are provided to facilitate Fire Department vehicle staging to the building and to provide direct access for fire fighters from the access route to the principal entrance of each building. For sprinklered detached houses or sprinklered residential row houses, the path of travel from the access route to the entrance door of each residential suite may not be more than 45 m. See Figure A-3.2.5.5.-A, Figure A-3.2.5.5.-B and Figure A-3.2.5.5.-C.

A-3.2.5.5.(4), (5) and (6) Location of Hydrant and Principal Entrance In the City of Vancouver, hydrants are normally located at street intersections with typical City block lengths of approximately 200 m. If the principal entrance of a building is located mid-block, then the operational procedures and equipment used by the Fire Department will facilitate the 90 m distance between the hydrant location and the principal entrance location as measured in Figure A-3.2.5.5.-D, Figure A-3.2.5.5.-E and Figure A-3.2.5.5.-F.

A-3.2.5.6.(1) Design of Access Routes and Paths of Travel. The design and construction of fire department access routes involves the consideration of many variables, some of which are specified in the requirements in the By-law. All these variables should be considered in relation to the type and size of fire department vehicles available in the municipality or area where the building will be constructed. It is appropriate, therefore, that the local fire department be consulted prior to the design and construction of access routes.

A-3.2.5.6.(3) Width of Fire Department Access Path. The required unobstructed width of the fire department access path assumes that the access path serving one or more dwelling units may be shared. Portions of a path serving only one dwelling unit (whether principal or ancillary) may be 900 mm in width, but where those path are conjoined thereby serving more than one dwelling unit, the path is to be increased from that point to a minimum 1200 mm until it reaches the curb of the access route.

A-3.2.5.7.(1) Water Supply. The intent of Sentence 3.2.5.7.(1) is that an adequate water supply for firefighting be readily available and of sufficient volume and pressure to enable emergency response personnel to control fire growth so as to enable the safe evacuation of occupants and the conduct of search and rescue operations, prevent the fire from spreading to adjacent buildings, and provide a limited measure of property protection.

The water supply requirements for buildings containing internal fire suppression systems, including sprinkler systems and standpipe systems, are contained in specific standards referenced in the By-law. Compliance with the referenced standard, including any variations made by this By-law, is deemed to satisfy the intent of Sentence 3.2.5.7.(1). However, it will be necessary to verify that an adequate source of water is available at the building site to meet the required quantities and pressures. For a building with no internal fire suppression system, the determination of the minimum requirements applicable to the water supply for firefighting is relevant mainly to building sites not serviced by municipal water supply systems. For building sites serviced by municipal water supply systems, where the water supply duration is not a concern, water supply flow rates at minimum pressures is the main focus of this provision. However, where municipal water supply capacities are limited, it may be necessary for buildings to have supplemental water supplies on site or readily available.

The sources of water supply for firefighting purposes may be natural or developed. Natural sources may include ponds, lakes, rivers, streams, bays, creeks, and springs. Developed sources may include aboveground tanks, elevated gravity tanks, cisterns, swimming pools, wells, reservoirs, aqueducts, artesian wells, tankers, hydrants served by a public or private water system, and canals.

Consideration should be given to ensuring that water sources will be accessible to fire department equipment under all climatic conditions.

The volume of on-site water supply is dependent on the building size, construction, occupancy, exposure and environmental impact potential, and should be sufficient to allow at least 30 minutes of fire department hose stream use.
For the purposes of calculating adequate water supply requirements for fire fighting, the following documents may be useful:

- Insurance Services Office (ISO), “Needed Fire Flow Guide,”
- NFPA 1142, “Standard on Water Supplies for Suburban and Rural Fire Fighting,” and
- American Water Works Association, “Distribution Requirements for Fire Protection.”

A-3.2.5.9.(5)(c) Fire Department Pumping Equipment. Availability of appropriate pumping equipment from the local fire department or, in the case of industrial plants or complexes, from their fire brigade, is considered sufficient to meet the intent of this requirement.

A-3.2.5.11.(2) Hose Stations. A building that is partially sprinklered may have some floor areas where local sprinklers are installed that do not cover the entire floor area. It is intended that hose stations be provided in these floor areas to allow emergency responders to fight fires that cannot be controlled by local sprinklers.

A-3.2.5.12.(1) Sprinkler System Design. In NFPA 13, “Installation of Sprinkler Systems,” reference is made to other NFPA standards that contain additional sprinkler design criteria. These criteria apply to industrial occupancies with high fire loads and industrial occupancies intended for the use, manufacture or storage of highly flammable materials. Therefore, while only NFPA 13 is called up directly by Sentence 3.2.5.12.(1), the additional criteria in the other NFPA standards are included automatically.

In some NFPA standards, certain aspects of sprinkler protection are dependent on the fire-resistance rating of the vertical structural members. In these cases, the sprinkler system design options can be affected by the fire-resistance rating of these elements.

For example, in buildings used for the storage of rubber tires, sprinklers directed at the sides of a column are required if the column does not have the required fire-resistance rating.

Other NFPA standards may require that certain occupancies be sprinklered in conformance with NFPA 13, as in the case of some garages. These requirements do not supersede the requirements in the By-law. An occupancy is required to be sprinklered only when this is specified in the By-law, but when it is so required, it must be sprinklered in conformance with NFPA 13 and its referenced standards.

Additionally, while Part 4 contains seismic force provisions that apply to the design of sprinklers, NFPA 13 contains other structural requirements for sprinklers that are also required to be met.

A-3.2.5.12.(2) Sprinklering of Residential Buildings above a Storage Garage Considered as a Separate Building. For the purpose of determining whether NFPA 13R, "Installation of Sprinkler Systems in Low-Rise Residential Occupancies," applies to a residential building constructed over a storage garage, it is not intended that a storage garage constructed as a separate building in accordance with Article 3.2.1.2. be considered as a storey when determining the building height of the residential building. Similarly, this would not preclude the use of NFPA 13D, "Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes," for any one- or two-family home constructed above such a storage garage.

A-3.2.5.12.(6) Sprinklering of Roof Assemblies. Sprinkler protection for roof assemblies in lieu of fire resistance is based on the assumption that the sprinklers will protect the roof assembly from the effects of fire in spaces below the roof. If a ceiling membrane is installed, the sprinklers would have to be located below the membrane in order to react quickly to the fire. In certain instances, however, sprinklers may be required within the concealed spaces as well as below the membrane. NFPA 13, "Installation of Sprinkler Systems," requires sprinklers in certain concealed spaces.

According to NFPA 13 and 13R, some small rooms and closets within a dwelling unit in a sprinklered building, including those that may be in the storey immediately below the roof assembly, do not require sprinklers. However, the Building By-law requires sprinkler protection within all rooms and closets immediately below the roof so as to control any fire that might start in that space and thereby limit the probability of the fire spreading into the roof assembly.

Moreover, NFPA 13D, "Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes," also allows the omission of sprinklers in such rooms and closets under certain circumstances, provided the building is sprinklered in conformance with this standard. In this case, the Building By-law concurs with the provisions of the NFPA 13D standard.

A-3.2.5.12.(7) Fast-Response Sprinklers. Several types of sprinkler will respond to a fire faster than a conventional standard response sprinkler. The Response Time Index (RTI) is used to quantify the sensitivity of the sprinkler link for any given sprinkler. The RTI for the group of fast-response sprinklers described below will on average range from 22 $s^{0.5}$•$m^{0.5}$ to 33 $s^{0.5}$•$m^{0.5}$. RTI values for standard response sprinklers will typically be in the range of 83 $s^{0.5}$•$m^{0.5}$ to 110 $s^{0.5}$•$m^{0.5}$. Any confusion as to the appropriate type of fast-response sprinkler for different types of building should be alleviated by considering the testing criteria described below and the reference to the appropriate NFPA installation standards.

Although the By-law specifies where fast-response sprinklers are required, it does not prevent the appropriate use of fast-response sprinklers in other occupancies.

Residential sprinklers are tested in accordance with ANSI/UL-1626, "Residential Sprinklers for Fire-Protection Service." They are installed in accordance with NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height," with NFPA 13D, "Installation of Sprinkler Systems in One-and Two-Family Dwellings and Manufactured Homes," and with Section 5-4.5 of NFPA 13, "Installation of Sprinkler Systems," for residential occupancies and for dwelling units.

Quick-response sprinklers are tested in accordance with ANSI/UL-199, "Automatic Sprinklers for Fire-Protection Service." They are installed in accordance with NFPA 13, "Installation of Sprinkler Systems," for spacing, density and location. They are acceptable for limited use as described in NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height," but are not permitted for use under NFPA 13D, "Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes."

Early-suppression fast-response sprinklers are tested in accordance with FM Approvals Class Number 2008, "Approval Standard for Quick Response Storage Sprinklers for Fire Protection." They are installed in accordance with NFPA 13, "Installation of Sprinkler Systems," but are not accepted for use under either NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height," or NFPA 13D, "Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes."

Quick-response extended-coverage sprinklers are tested in accordance with ANSI/UL 199, "Automatic Sprinklers for Fire-Protection Service." They are installed in accordance with NFPA 13, "Installation of Sprinkler Systems," for spacing, density and location. They are acceptable for limited use as permitted by NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height," but are not permitted for use under NFPA 13D, "Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes."

A-3.2.5.12.(8) Balconies and Decks. The intent of Sentence 3.2.5.12.(7) is to suppress or control the spread of a fire originating from a balcony or deck to the roof assembly or other parts of the building.

A-3.2.5.12.(9) Sprinkler Rating. The requirements of this Sentence can be met by using sprinklers with a rating of 79°C to 107°C.

A-3.2.5.13.(1) Hazard Classification for Sprinkler Selection. The reference to light hazard occupancies is based on the descriptions of these occupancies given in NFPA 13, "Installation of Sprinkler Systems," and is intended only for use in the design of sprinkler systems. These descriptions should not be confused with the occupancy classifications in the By-law.

In NFPA 13, a light hazard occupancy is one in which the quantity or combustibility of contents is low and fires with relatively low rates of heat release are expected. Typical buildings or parts of buildings include: churches; clubs; eaves and overhangs, if of combustible construction with no combustibles beneath; educational buildings; hospitals; institutional buildings; libraries, except very large stack rooms; museums; nursing or convalescent homes; offices, including data processing rooms; residential buildings; restaurant seating areas; theatres and auditoria, excluding stages and proscenia; and unused attics.

Although NFPA 13R, "Installation of Sprinkler Systems in Low-Rise Residential Occupancies," and NFPA 13D, "Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes," as referenced by NFPA 13, are concerned with specific types of residential occupancy, namely apartment buildings up to four storeys, houses containing up to two dwelling units, and mobile homes, for the purpose of acceptance of combustible sprinkler piping these occupancies are considered to be included in the category of residential buildings under light hazard occupancies.

A-3.2.5.18.(1) Fire Pumps. In order to ensure an adequate water supply, it may be necessary to install a fire pump for a building that has either a standpipe system or an automatic sprinkler system installed.

A-3.2.5.20. Radio Antenna System. Buildings of noncombustible construction or buildings that have glazing with a low emissivity rating can cause interference with radio signals that are necessary for emergency, firefighting and rescue operations. The installation of a radio antenna system should be shown on drawings submitted for building permit, and related permits. A complete design of the radio antenna system will be required on plans to be submitted for the building permit and should be design in accordance with the general specification provided by Vancouver Fire and Rescue Services. See Fire Department publication "Vancouver Fire Rescue Services Specifications for Radio Antenna System Design, Installation and Acceptance Testing" as updated from time to time. By-law users are advised to keep up-to-date. The technical specifications as of May 2019 are reproduced here for convenience.

Specifications for Radio Antenna System - Design, Installation and Acceptance Testing (May 2019)

1. SCOPE

1.1. This Specification describes the requirements for the design, installation, and acceptance testing of a radio antenna system in a building.

1.2. The installation of radio antenna system equipment and devices not covered by this Specification shall be in accordance with good engineering practice and the manufacturer's installation instructions.

1.3. The work in this section shall be performed under the supervision of a registered professional engineer in British Columbia

2. REQUIREMENTS OF RADIO ANTENNA SYSTEMS

2.1. GENERAL

2.1.1. Radio antenna systems for emergency responders are an integral component of the life safety equipment of a building or structure. The primary function is to provide reliable emergency responder communications at the required signal strength within the specified areas.

2.1.2. Provide an in-building radio antenna system to provide coverage in the building for the public safety agencies as required by the local fire department and other agencies and authorities having jurisdiction. System users shall receive and transmit radio broadcasts from their portable radio units within the building. This shall be accomplished utilizing the following components, which if applicable shall conform to UL 2524 "Standard for In-building 2-Way Emergency Radio Communication Enhancement Systems":

a) Bi Directional Amplifiers (Signal Boosters)
b) Coaxial Cable
c) Frequency filters
d) Donor and discrete antennas
e) Other components and interconnecting circuitry as required

2.1.3. Radio antenna systems shall not rely on mobile repeaters installed on fire department apparatus.

2.1.4. The entire system shall meet with approval of the Fire Chief, Chief Building Official, and Director of Planning for the City of Vancouver (the authorities having jurisdiction, AHJ).

2.1.5. All permits necessary for the installation of the work shall be obtained from the AHJ prior to the commencement of the work. All permit costs and inspection fees shall be included as the part of the required work.

2.2. FEDERAL LICENSE

2.2.1. All active systems shall be licensed by the federal regulator, Innovation, Science & Economic Development Canada (ISED), and shall comply with the applicable Standard Radio Systems Plan (SRSP).

2.2.2. The installing contractor shall arrange to obtain the federal license to operate on behalf of the owner.

2.2.3. The installing contractor shall be responsible for any fees and costs to obtain the federal license for the first year of operation.

2.2.4. Any license required shall be renewed annually by the building owner and the cost of the licensing borne solely by the building owner.

3. PLANS AND SUPPORTING DOCUMENTS

3.1. The plans and supporting documents for the radio antenna system shall include a complete and detailed description of the following:

a) Installation instructions
b) Location of in-building antenna
c) Location of donor antenna
d) Location of riser and trunk on each floor
e) Location of amplifier, repeater, and head-end equipment
f) Connection to the fire alarm system for a common trouble zone
g) Critical locations requiring coverage
h) Method of Acceptance Testing

4. INSTALLATION OF RADIO ANTENNA EQUIPMENT

4.1. AMPLIFIERS, REPEATERS AND HEAD-END EQUIPMENT

4.1.1. Amplifiers, repeaters, and head-end equipment shall be located in a service room that is provided with not less than 1 h fire-resistance rating.

4.1.2. All amplifiers, repeaters, and head-end equipment required by the radio antenna system shall be protected by enclosures rated CSA Type 3 or higher.

4.1.3. All amplifiers, repeaters and head-end equipment shall be provided with drip shield to guard against water spray from fire sprinklers located in the room unless the enclosures are rated CSA Type 4 or higher.

4.2. DISTRIBUTED ANTENNA SYSTEM

4.2.1. One in-building antenna shall be located within 20 m of the elevator door opening at each odd-numbered storey.

4.2.2. One in-building antenna shall be located inside each exit stair shaft at the landing of each even numbered storey.

4.2.3. Additional in-building antennas shall be installed to provide 98 percent radio coverage inside each critical area as described in the Vancouver Building By-law.

4.2.4. Sufficient antenna isolation shall be maintained between the donor antenna and all in-building antenna (D.A.S.) under all operating conditions

4.3. WIRING

4.3.1. Cables and wires shall be FT-4 rated, and where installed inside plenums, cables and wires shall be FT-6 rated.

4.3.2. Except within service rooms containing the amplifiers, repeaters and head-end equipment, cables and wires installed in the risers shall be mechanically protected per the Electrical Code.

4.4. INTERCONNECTION TO THE FIRE ALARM SYSTEM

4.4.1. The radio antenna system shall be monitored by the building fire alarm system for common trouble

4.5. PROVISION FOR RADIO ANTENNA SYSTEM EXPANSION

4.5.1. Raceways shall be installed to allow installation of future in-building antenna in the floor area of each storey not already provided with wiring or horizontal distribution.

5. ACCEPTANCE TESTING

5.1. Adequate Radio Coverage

5.1.1. The intent is to achieve -95 dBm on the current public safety bands. Good design should provide a margin of not less than 10 dB to allow for uncontrolled variables. Based on the foregoing, the design target for indoor coverage should be -85 dBm.

5.1.2. The radio frequency range to be supported shall be any frequencies used by the public safety communications service provider’s network. If signal amplifiers are used, they shall include filters that will protect the amplifiers from overload and the system from interference by out-of-band signals.

5.1.3. In the event that active amplification is required to meet the foregoing communication quality requirements in the building, coordination with the public safety communications service provider is required to ensure that its outdoor radio communication performance is not degraded. If there is a trade-off to be made between maintaining the public safety communications service provider’s outdoor radio communication performance and restoration of signal strength in the building, the trade-off decision shall be made by the public safety communications service provider and communicated to the Fire Chief by the building owner.

5.2. System Verification Procedures

5.2.1. Tests shall be performed by RF technicians under supervision of a professional engineer registered in the Province of British Columbia. Test reports shall bear the seal of the engineer.

5.2.2. If required by the engineer, during the engineer’s acceptance test, portable handheld radios used for speech and coverage acceptance shall be the same type used by Vancouver Fire and Rescue Services.

5.2.3. Acceptance tests and measurements shall be performed after completion of installation of the Radio Antenna System. Tests shall be performed using radio frequencies assigned by the public safety communications service provider, after proper coordination with an authorized representative of that system and with the Fire Chief.

5.2.4. Where the floor area of a critical location is greater than 4,500 m² the area shall be divided into a uniform grid of not more than 15 m on a side, or if the floor area is smaller than 4,500 m² it shall be divided into a uniform grid of approximately 20 equal areas, to a minimum of 9 m², and measurements shall be taken in each grid area. The size of the grids shall also be reduced, or the number of grids increased, upon recommendation of the Fire Chief or inspector in areas where special construction or other obstruction may significantly affect communications.

5.2.5. If the Radio Antenna System fails to provide acceptable communication in any of the critical locations as stipulated in the Building By-law, the building owner shall have the system rectified to meet the 98% coverage requirement for these areas; otherwise the Radio Antenna System will not be accepted.

5.3. Tests for Optimization

5.3.1. The radio antenna system shall be optimized to provide maximum coverage of the remainder of the floor areas while providing 98 % coverage in the critical locations.

5.4. Tests of Power Supply

5.4.1. Backup batteries and power supplies shall be tested under full load using a minimum of a 90% duty cycle for a period of at least one hour. If within the one-hour period, the battery shows no symptom of failure or impending failure, the test shall be continued for additional one-hour periods to determine the integrity of the battery. The battery shall not fail within a four-hour continuous test period.

5.4.2. Alternatively, the power supply may be connected to the building emergency generator with the backup batteries to supply a four-hour continuous power supply.

6. DOCUMENTATION

6.1. DOCUMENTATION REQUIRED

6.1.1. The documentation required by this section shall be maintained on site in a box located in a location acceptable to the Fire Chief.

6.1.2. Documentation for the radio antenna system shall include the following description of the radio antenna system:

a) Instructions for resetting the system
b) Equipment operating instructions or manuals
c) Equipment maintenance instructions
d) Equipment testing instructions
e) Optimization tests
f) Signal strength tests at critical locations
g) Results of battery test
h) Results of testing of connection to the fire alarm system

6.1.3. The designer of the radio antenna system shall prepare the Health SC6 report which certifies the system meets Safety Code 6.

6.1.4. After installation of the radio antenna system is completed, the designer shall provide confirmation that the radio antenna system meets Safety Code 6.

6.1.5. A copy of the annual operating licence issued by Federal communications agency shall be included in the fire safety plan for the building.

A-3.2.6. Smoke Control for High Buildings. Experience with high buildings has shown that the time required for complete evacuation can exceed that which is considered necessary for the safe egress of all occupants. Studies of the “chimney effect” and observations of smoke movement in actual fires have shown that fire compartmentation to contain a fire on any one storey will not usually prevent the movement of smoke through elevator, stair and other vertical shafts to the upper floors of a high building.

Occupants of a high building in which an automatic sprinkler system is not installed, and particularly those on upper storeys, could be faced with severe smoke conditions from fires occurring in storeys below them before their own evacuation is possible.

The requirements of Subsection 3.2.6. are intended to maintain safe conditions for occupants of a high building who may have to remain in the building during a fire, and to assist the firefighters by providing efficient access to the fire floor. The Notes for Subsection 3.2.6. are intended to assist a designer in complying with the requirements of Subsection 3.2.6. The knowledge requirements are well within the capabilities of a competent designer. The designer should appreciate, however, that successful application requires a clear understanding of the principles that govern smoke movement. Subsection 3.2.6. contains only those items that relate to the design and construction of a building; operation of the facilities and recommended actions to be taken by the building owner, occupant and fire department are covered by the Fire By-law.

The designer is cautioned that the tabular and graphical information in the Notes for Subsection 3.2.6. was developed for buildings having conventional configurations. The designer has to judge the extent to which the building under consideration has characteristics that will allow the application of this information; this is particularly true of designs employing air-handling systems for which a realistic assessment of the leakage characteristics of the enclosures of spaces may be critical.

It is assumed that buildings regulated by Subsection 3.2.6. will be in an area served by a fire department capable of an early response and that all firefighting and rescue situations will be under the direct control of the officer-in-charge of the fire department responding to the emergency. It is important that firefighters be provided with a smoke-free access to fire floors below grade. Provisions are included to separate exit stairways serving storeys above grade from those serving storeys below grade, and to limit entry of smoke into these shafts. Similarly, elevator hoistways and service shafts are required to be provided with a separation near grade, or be designed to limit their functioning as paths of smoke movement into upper floor areas from storeys below grade.

It is assumed that in the event of fire, occupants of the floor on which the fire occurs will leave by exit stairs immediately following the sounding of a fire alarm, and that occupants of the floor immediately above the floor on which the fire occurs will be advised to leave by the first fire department officer on the scene or other person assigned this responsibility. Occupants of all other floors may remain on their floors unless otherwise directed. It is also assumed that the owner of the building has complied with the Emergency Planning Section of the Fire By-law by preparing a comprehensive fire safety plan to safeguard the building occupants and that the building supervisory staff are familiar with the requirements of Subsection 3.2.6. and with their responsibilities under the fire safety plan.

The Building By-law requires that a check be made of the smoke control and mechanical venting systems.

Testing will indicate deficiencies caused by inexact estimates of the leakage characteristics or of air supply requirements and, in all but the most extreme cases, will provide an opportunity for appropriate adjustments before the system is put into service.

3.2.6.1.(2) Six Storey Buildings. One of the key concerns for high-buildings is the potential for increased smoke movement in a fire as a consequence of stack-effect. One of the provisions of 3.2.6.1.(2) is to prohibit stairs or elevators from directly connecting more than 6 storeys consecutively. This prohibition is intended to limit the potential for smoke to enter the stairs or elevator shafts and contaminate floor areas above. However, this prohibition is not intended to restrict the potential for stairs or elevators to serve other floors or levels as long as they are provided with acceptable measures to limit the uncontrolled movement of smoke between floor levels. Designers may wish to consider the use of vestibules or other measures described in note A-3.2.6.2.(4) as part of a design solution to control smoke movement.

A-3.2.6.2.(2) Stairway Protection Below Lowest Exit Level. A stairway serving floors below the lowest exit level is considered to comply with the intent of Sentence 3.2.6.2.(2) if the following conditions are satisfied.

1) The stairway has a vent or door to the outdoors at or near the top of the stair shaft that has an openable area of not less than 0.1 m^2 for each storey served by the stairway, less 0.01 m^2 for each weatherstripped door and 0.02 m^2 for each door that is not weatherstripped opening into the stairway.

2) The stairway is enclosed in a shaft that

a) does not pass through the floor above the lowest exit level and is separate from a shaft that contains a stairway serving upper storeys, or

b) contains a stairway serving upper storeys, but is separated from that stairway at the lowest exit level by a fire separation having a fire-resistance rating not less than that required for the shaft enclosure.

3) The stairway is provided with equipment capable of maintaining a flow of air introduced at or near the bottom of the stair shaft, at a rate equal to 0.47 m^3/s for each storey served by the stairway.

A-3.2.6.2.(3) Pressurization of Stair Shafts. The purpose of providing open doors and vents at the bottom of a stair shaft is to create a positive pressure in the shaft relative to adjacent floor areas and thus keep it free of smoke. The pressure depends on the temperature differential between the interior and the exterior of the building which is most pronounced during winter months when stack effect is greatest. If a shaft does not have a direct opening to the exterior, alternative means must be provided to achieve smoke control. If a corridor or vestibule is used as a link between the exit level of an interior stair shaft and the outdoors to provide a venting system, it will be necessary to assess the reliability of the overall system. The probability of all doors or closures being opened at the same time has to be addressed, as well as the size of the vestibule and its impact on the overall smoke control system.

If mechanical methods are used to develop a positive pressure in a stair shaft, a minimum pressure differential of 12 Pa is recommended to prevent smoke migration from floor areas in a sprinklered building where fire temperatures are controlled and smoke movement may be dominated by stack effect in a stair shaft. During a fire emergency, persons will be entering and exiting a stair shaft as they move to a place of safety and under these conditions the number of doors open to the stair shaft cannot be predetermined.

The number will vary depending on the occupancy of the building, population density and the evacuation plan for the building.

It should be assumed that two doors are open. This is based in part as a practical level for most buildings and considers the positive fire experience in sprinklered buildings.

The maximum pressure differential created by a mechanical system should not prevent doors to the stair shafts from being opened.

A specific maximum value cannot be given, as this value will depend on the door opening force and size of the door. These values should be calculated for each specific case. Although a maximum value of 130 N is suggested by research as the force that can be opened by the majority of people in most occupancies, this value is above the maximum value of 90 N generally specified in this By-law.

The use of values below 130 N can create a practical problem in achieving effective smoke control as it is difficult to design for the acceptable minimum and maximum pressure differential range. Special consideration may need to be given for doors located in an accessible path of travel.

Care should be taken by designers and by building and fire officials in implementation of these requirements. Assumptions involved in the design of a smoke control system may be different from final construction conditions. For this reason each system should be tested after installation to ensure that the design intent is met. The minimum pressure differential is not intended to apply to locations in stair shafts when doors in their proximity are open to adjacent floor areas.

A-3.2.6.2.(4) Limiting Smoke Movement. Measures to prevent the migration of smoke from floor areas below the lowest exit storey into upper storeys include the following.

1) An elevator hoistway that passes through the floor above the lowest exit storey should not penetrate the floor of the storey immediately below the lowest exit storey, unless there is a vestibule between the shaft and each floor area below the lowest exit storey that

a) has a fire separation, with a fire-resistance rating not less than 45 min, between the vestibule and any public corridor,

b) has a fire separation, with a fire-resistance rating not less than that required for an exit by Article 3.4.4.1., between the vestibule and any stair or elevator enclosure or any part of a floor area, other than a public corridor, and

c) except for elevator hoistway entrances, has a self-closing device on any door through the fire separation required by Clauses (a) and (b), with the door opening in the direction of travel from the floor area to the exit stairway.

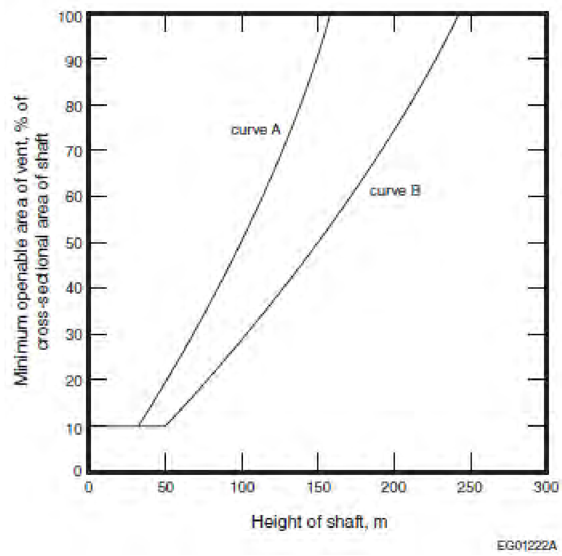


Figure A-3.2.6.2.(4)-A
Vent to a vertical service space with no other pressurized shaft in the building

Notes to Figure A-3.2.6.2.(4)-A:
(1) Curve A applies to a vertical service space that is enclosed by unplastered unit masonry or by plaster and steel stud construction with all openings in the shaft sealed to the degree required by Articles 3.1.9.1. to 3.1.9.5.
(2) Curve B applies to a vertical service space that is enclosed by monolithic concrete or by plastered unit masonry with all openings in the shaft sealed tightly to minimize air leakage.
(3) A shaft having a vent that is 100% of the cross-sectional area of the shaft is acceptable for buildings up to 1.5 times the height shown by the appropriate curve in Figures A-3.2.6.2.(4)-A and A-3.2.6.2.(4)-B.
(4) The total leakage area, based on measurements in typical high buildings, is assumed to be 0.025 m^2 for every 10 m^2 of shaft wall area in the case of Curve A and 0.015 m^2 for every 10 m^2 of shaft wall area in the case of Curve B.

2) A vertical service space, other than an elevator hoistway, that passes through the floor assembly above the lowest exit storey, should be provided with a tight-fitting noncombustible seal or fire stop at the floor assembly of the storey immediately below the lowest exit storey, unless
- a) the vertical service space is vented to the outdoors at the top and the vent has an openable area that is not less than
  - i) that obtained from Figure A-3.2.6.2.(4)-A if the vertical service space is in a building in which other shafts are not mechanically pressurized, or
  - ii) that obtained from Figure A-3.2.6.2.(4)-B if the vertical service space is in a building in which other shafts are mechanically pressurized,
- b) for a shaft that serves floor areas above the lowest exit storey, a vent is located
  - i) at or near the top of the shaft if the shaft is above the mid-height of the building, or
  - ii) at or near the foot of the shaft at or near the exit level if the top of the shaft is below the mid-height of the building, or
- c) for a shaft that serves floor areas below the lowest exit storey, a vent is located at or near the top of the shaft.

3) Any closure provided for a vent opening referred to in Sentence (2) must be openable:
- a) manually,
- b) on a signal from a smoke detector located at or near the top of the shaft, and
- c) by a control device located at the central alarm and control facility.

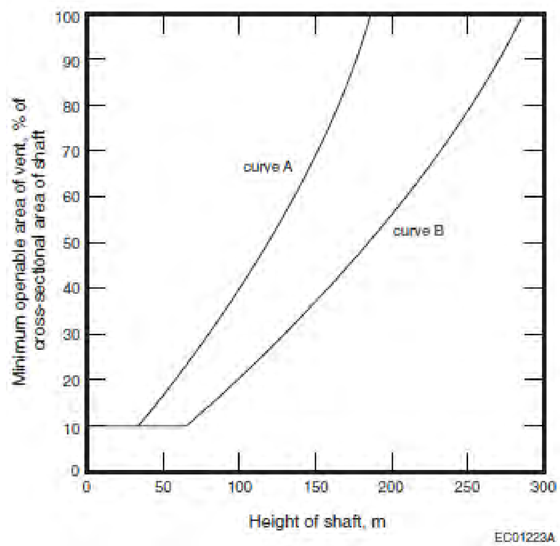


Figure A-3.2.6.2.(4)-B
Vent to a vertical service space with other pressurized shafts in the building

Notes to Figure A-3.2.6.2.(4)-B:
(1) Curve A applies to a vertical service space that is enclosed by unplastered unit masonry or by plaster and steel stud construction with all openings in the shaft sealed to the degree required by Articles 3.1.9.1. to 3.1.9.5.
(2) Curve B applies to a vertical service space that is enclosed by monolithic concrete or by plastered unit masonry with all openings in the shaft sealed tightly to minimize air leakage.
(3) A shaft having a vent that is 100% of the cross-sectional area of the shaft is acceptable for buildings up to 1.5 times the height shown by the appropriate curve in Figures A-3.2.6.2.(4)-A and A-3.2.6.2.(4)-B.
(4) The total leakage area, based on measurements in typical high buildings, is assumed to be 0.025 m^2 for every 10 m^2 of shaft wall area in the case of Curve A and 0.015 m^2 for every 10 m^2 of shaft wall area in the case of Curve B.

A-3.2.6.3.(1) Connected Buildings. The measures described here are intended to prevent movement of smoke from one building to another. They are of particular significance for two buildings of unequal height that are joined together. The techniques suggested are the provision of a large opening to the outdoors in a connecting vestibule so that smoke entering through leakage areas around doors will be vented to the outdoors, or pressurization to maintain a higher pressure in the vestibule than in adjacent spaces, as illustrated in Figures A-3.2.6.3.(1)-A, A-3.2.6.3.(1)-B and A-3.2.6.3.(1)-C.

The provisions for protection of openings are described in terms appropriate to a doorway. Openings other than doorways should be avoided if possible. Openings should be protected by an airlock that gives the same standard of protection as the vestibule referred to below.

The requirement of Article 3.2.6.3. that limits movement of smoke from one building to another may be met by incorporating in the link between the buildings the provisions of Sentences (1) and (2).

1) A firewall conforming to Subsection 3.1.10. is constructed between one building and the other with any opening in the firewall protected against the passage of smoke by a vestibule that has

a) a fire separation between the vestibule and a public corridor with a fire-resistance rating not less than 45 min,
b) a fire separation between the vestibule and the remainder of the floor area, other than a public corridor, with a fire-resistance rating not less than that required by Article 3.4.4.1. for an exit,
c) a fire separation between the vestibule and a stair enclosure or elevator hoistway with a fire-resistance rating not less than that required by Article 3.4.4.1. for an exit, and

d) any door in the fire separation required by Clauses (a), (b) or (c), except for an elevator entrance, provided with a self-closing device as required by Article 3.1.8.13. and opening in the direction of travel from the floor area to the exit stairway.

2) The vestibule referred to in Sentence (1) should have

a) a vent to the outdoors that has a net area of 10(0.023 d + 0.00045 a) m^2, where 'd' is the number of doors having a perimeter not more than 6 m that open into the vestibule, or if the perimeter of doors exceeds 6 m, the value 'd' is increased in direct proportion to the increase in the perimeter, and 'a' is the area in square metres of enclosing walls, floors and ceilings whose outer face is in contact with the outside air, except that where the outer face of a wall is in contact with the ground or fill, it is assumed that there is no leakage through that portion, and the value of 'a' is assumed to be zero, or

b) equipment capable of maintaining a supply of air into the vestibule sufficient to ensure that the air pressure in the vestibule when the doors are closed is higher by at least 12 Pa than that in adjacent floor areas when the outdoor temperature is equal to the January design temperature on a 2.5% basis.

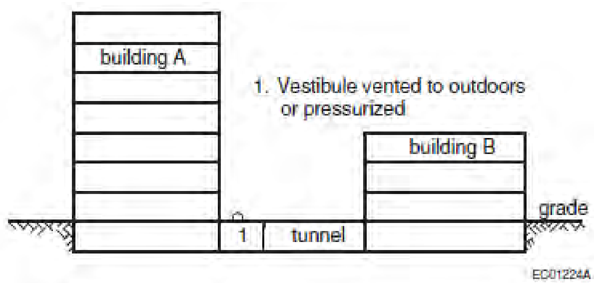


Figure A-3.2.6.3.(1)-A
Buildings connected by a tunnel

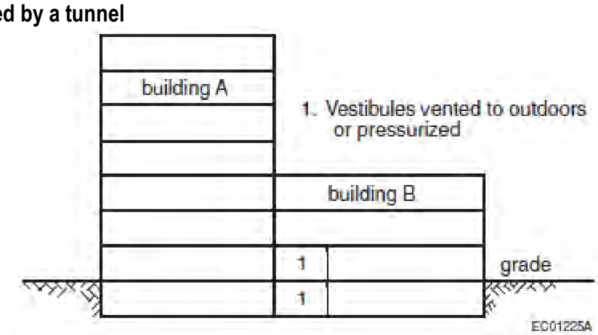


Figure A-3.2.6.3.(1)-B
Buildings connected at a firewall

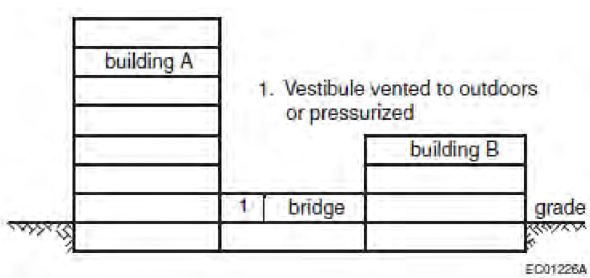


Figure A-3.2.6.3.(1)-C
Buildings connected by a bridge

A-3.2.6.5.(6)(b) Electrical Cable Protection. Electrical cables that provide continuous operation for 1 h when subjected to the fire exposure of the time/temperature curve of CAN/ULC-S101, "Fire Endurance Tests of Building Construction and Materials," do not need additional protection against exposure to fire.

A-3.2.6.6.(1) Venting to Aid Firefighting. The requirements of Sentence 3.2.6.6.(1) are met by incorporating in a floor area windows or wall panels, as described in Sentence (1), by smoke shafts as described in Sentences (2) to (8), or by the use of building exhaust systems as described in Sentence (9).

1) If windows or wall panels are used for venting, they must

a) be uniformly distributed along the exterior wall of each storey,

b) have a total area not less than 1% of the exterior wall area of each storey,

c) be readily openable from the interior without the use of wrenches or keys,

d) be readily identified from the interior, and from the exterior where they are accessible to firefighters, and

e) be designed so that when opened they will not endanger persons outside the building during a fire.

2) If one or more smoke shafts or vertical service spaces are used for venting, they must

a) have an opening or openings into each storey with an aggregate area not less than that obtained from Table A-3.2.6.6.(1)-A for the height of the building and the area of the largest floor area served by the smoke shaft, and the leakage characteristics of the shaft wall and closures obtained from Tables A-3.2.6.6.(1)-B and A-3.2.6.6.(1)-C,

b) have an aggregate unobstructed cross-sectional area equal to that required by Clause (a), and

c) be designed to comply with the requirements of Sentence (3).

3) Each smoke shaft or vertical service space described in Sentence (2) must

a) be separated from the remainder of the building by a fire separation that has a fire-resistance rating not less than that required for the floor assembly through which it passes, or be designed as a chimney conforming to Part 6, except that flue liners need not be provided,

b) have an opening to the outdoors at the top that has an area not less than the cross-sectional area of the shaft, with the opening protected from the weather,

c) terminate not less than 900 mm above the roof surface where it penetrates the roof, and

d) contain no combustible material, fuel lines or services that are required for use in an emergency.

4) Each opening required by Clause (2)(a) must be located so that the top of the opening is not more than 250 mm below the ceiling, except that the opening may be above the ceiling if the ceiling freely allows passage of air.

5) The opening into the smoke shaft must be provided with a closure that

a) has a fire-protection rating conforming to Sentence 3.1.8.4.(2), except that the temperature on the unexposed face of the closure shall be not more than 250 °C after 30 min during the fire test used to determine its rating,

b) is no closer to combustible material, except for paint or tightly-adhering paper covering not more than 1 mm thick applied to a noncombustible backing, than the distances described in Table A-3.2.6.6.(1)-D,

c) can be opened from a remote location such as a stair shaft, the storey immediately below, or the central alarm and control facility, and

d) does not open automatically on any floor, other than the fire floor, when smoke and hot gases pass through the shaft.

6) Closures for openings described in Clause (3)(b) must

a) be openable from outside the shaft, and

b) open automatically

i) on a signal from a smoke detector in the shaft,

ii) by operation of the fire alarm system, and

iii) when the closure required by Sentence (5) opens.

7) A smoke shaft opening referred to in Sentence (2) that is less than 1 070 mm above the floor must conform to
Article 3.3.1.18.
8) If a closure is required to comply with Sentence (5), the leakage area between closure components and between closure and frame must not be more than 3% of the openable area of the closure.
9) The building air handling system may be used for smoke venting, provided
a) the system can maintain an exhaust to the outdoors at the rate of 6 air changes per hour from any floor area, and
b) emergency power to the fans providing the exhaust required by Clause (a) is provided as described in Article 3.2.7.9.

Table A-3.2.6.6.(1)-A
Minimum Size of Vent Openings into Smoke Shafts from Each Floor Area, m²(1)(2)
Forming Part of Note A-3.2.6.6.(1)

Floor Area, m²	Leakage Area, %(3)	Building Height, m								
		18	37	73	110	146	183	220	256	293
200		0.10	0.11	0.13	0.15	0.16	0.18	0.19	0.20	0.22
500		0.22	0.25	0.29	0.32	0.36	0.37	0.39	0.41	0.43
1 000		0.43	0.48	0.53	0.59	0.63	0.67	0.71	0.75	0.77
2 000		0.83	0.91	1.01	1.08	1.16	1.22	1.29	1.34	1.39
3 000	0	1.21	1.33	1.46	1.55	1.67	1.75	1.82	1.90	1.97
4 000		1.62	1.75	1.90	2.02	2.15	2.25	2.35	2.44	2.53
5 000		2.01	2.17	2.34	2.46	2.63	2.74	2.86	2.88	3.07
6 000		2.39	2.57	2.76	2.91	3.10	3.23	3.37	3.47	3.58
200		0.10	0.12	0.15	0.19	0.22	0.27	0.35	0.43	0.55
500		0.23	0.27	0.35	0.40	0.49	0.57	0.69	0.83	1.04
1 000		0.44	0.50	0.71	0.72	0.86	1.01	1.19	1.43	1.73
2 000		0.85	0.97	1.15	1.33	1.56	1.81	2.10	2.48	2.95
3 000	1	1.26	1.42	1.67	1.91	2.23	2.56	2.97	3.47	4.08
4 000		1.66	1.88	2.18	2.49	2.37	3.28	3.79	4.40	5.16
5 000		2.07	2.32	2.69	3.05	3.51	3.99	4.60	5.32	6.21
6 000		2.47	2.76	3.18	3.59	4.14	4.68	5.37	6.20	7.23
200		0.10	0.13	0.18	0.24	0.37	0.61	1.28	4.60	89.57
500		0.24	0.29	0.39	0.52	0.75	1.13	2.10	6.11	94.50
1 000		0.46	0.55	0.72	0.94	1.30	1.90	3.27	8.29	102.11
2 000		0.88	1.05	1.34	1.73	2.32	3.28	5.36	12.14	116.80
3 000	2	1.31	1.53	1.95	2.47	3.29	4.58	7.28	15.63	130.83
4 000		1.73	2.01	2.55	3.20	4.23	5.83	9.12	19.97	144.03
5 000		2.15	2.49	3.13	3.92	5.15	7.05	10.90	22.15	157.05
6 000		2.57	2.96	3.73	4.63	6.07	8.26	12.65	25.39	169.29
200		0.11	0.14	0.21	0.37	0.88	2.06			
500		0.25	0.31	0.47	0.76	1.58	9.00			
1 000		0.47	0.59	0.86	1.33	2.60	11.99			
2 000		0.91	1.12	1.60	2.41	4.47	17.46			
3 000	3	1.35	1.64	2.31	3.43	5.21	22.48			
4 000		1.79	2.17	3.02	4.43	7.91	27.29			
5 000		2.22	2.68	3.71	5.42	9.55	31.95			
6 000		2.65	3.20	4.40	6.39	11.18	36.47			
200		0.11	0.15	0.28	0.70	24.83				
500		0.25	0.34	0.58	1.33	29.18				
1 000		0.49	0.63	1.06	2.27	36.07				
2 000		0.95	1.21	1.97	3.99	48.56				

3 000	4	1.41	1.78	2.84	6.63	60.15				
4 000		1.86	2.34	3.70	7.22	71.15				
5 000		2.21	2.90	4.55	8.79	81.81				
6 000		2.75	3.46	5.40	10.33	90.05				
200		0.11	0.16	0.36	3.33					
500		0.28	0.36	0.76	5.09					
1 000		0.50	0.69	1.37	7.67					
2 000		0.99	1.31	2.54	12.35					
3 000	5	1.46	1.94	3.65	16.75					
4 000		1.92	2.55	4.75	20.99					
5 000		2.40	3.16	5.84	25.11					
6 000		2.87	3.74	6.92	29.11					

Notes to Table A-3.2.6.6.(1)-A:

(1) The minimum size of a vent opening into a smoke shaft is obtained from Table A-3.2.6.6.(1)-A and is dependant on the floor area and total leakage area of the smoke shaft walls and closures. This tal leakage area may be estimated by adding the leakage areas for the shaft wall obtained from Table A-3.2.6.6.(1)-B and for the dampered openings obtained from Table A-3.2.6.6.(1)-C, provided the cross-sectional area of the smoke shaft, the opening into the shaft and the opening to the outdoors at the top of the shaft are equal.

(2) The size of the vent opening refers to the free or unobstructed area of the opening.

(3) Leakage area is the total of the leakage area of smoke shaft wall obtained from Table A-3.2.6.6.(1)-B and the leakage area of openings in smoke shafts obtained from Table A-3.2.6.6.(1)-C.

Table A-3.2.6.6.(1)-B
Leakage Area of Smoke Shaft Wall
Forming Part of Note A-3.2.6.6.(1)

Wall Construction	Leakage Area as % of Wall Area
Monolithic Concrete	0.5
Masonry wall unplastered	1.5
Masonry wall plastered	0.5
Gypsum board on steel stud	1.0

Table A-3.2.6.6.(1)-C
Leakage Area of Closures in Openings into Smoke Shaft
Forming Part of Note A-3.2.6.6.(1)

Type of Closure	Leakage Area as % of Closure Area(1)(2)
Curtain fire damper	2.5
Single-blade fire damper	3.5
Multi-blade fire damper	4.5

Notes to Table A-3.2.6.6.(1)-C:

(1) Values include allowance for 0.5% leakage between frame and wall construction.

(2) These leakage data are based on clearances applicable to closures that have been tested in accordance with CAN/ULC-S112, "Fire Test of Fire Damper Assemblies."

Table A-3.2.6.6.(1)-D
Minimum Distance from Closure to Combustible Material
Forming Part of Note A-3.2.6.6.(1)

Area of Closure(1), m^2	Minimum Distance in Front of or Above Closure, m	Minimum Distance to the Sides or Below Closure, m
0.5	0.35	0.20
1.0	0.50	0.25
1.5	0.60	0.30

2.0	0.70	0.35
2.5[2]	0.80	0.40

Notes to Table A-3.2.6.6.(1)-D:
[1] For closure areas between those given in Table A-3.2.6.6.(1)-D, interpolation may be used to determine the appropriate distances.
[2] For closure areas greater than 2.5 m^2, the minimum distance in front of or above the closure shall be one half of the square root of the closure area, and the minimum distance to the sides or below the closure shall be one quarter of the square root of the closure area.

A-3.2.6.7.(1) Protection of Central Control Room. The design of a room provided for a central alarm and control facility should take into account the nature and sensitivity of the electronic components of the equipment and the room should be adequately protected from fire and smoke. The room should be ventilated with a supply of fresh air so that it has a clean environment and should be provided with adequate lighting.

A-3.2.6.7.(2) Central Control Room Air Control. Depending on the method of mechanical venting and air control that is selected for the building, additional controls may be required at the central alarm and control facility. These additional controls include those with a capability of opening closures to vents in shafts, stopping air-handling systems, and initiating mechanical air supply to stair shafts.

A-3.2.6.9.(1) Testing for Smoke Control. The efficiency of a smoke control system may be checked by measuring pressure differences and the directions of airflow around doors and through separating walls of compartments. A pressure meter can be used to measure pressure differences on either side of a door or partition. Where this is impracticable, a punk stick held near a crack will indicate the direction of airflow. Measurements of airflow may be taken on the intake side of supply fans or in supply ducts to determine whether the specified airflow is being provided. In general, airflow should be from the spaces which may be occupied for various lengths of time during a fire emergency (e.g., vestibules, stair shafts, and elevator hoistways) toward the space in which the fire is assumed to have occurred. Measurements may be taken at certain critical locations to check the overall efficiency of the smoke control system.

In buildings where protection is obtained by venting corridors or vestibules to the outdoors, inspection of the building to determine whether the requirements have been met should be sufficient. Where service shafts are vented to the outdoors at the top, a check may be made of the wall between the shaft and the uppermost occupied floor areas, to ensure that the direction of flow is from each floor area into the shaft, when the vent to the outside is open and the outdoor air temperature is significantly less than that indoors.

Where mechanically pressurized vestibules are used, a check may be made to ensure that the pressure in each vestibule or area of refuge is greater than that in the adjacent floor areas at each floor level.

Doors to stair shafts, elevator hoistways and vestibules in locations subject to pressure differences that may interfere with normal opening should be checked when the outdoor temperature is near the January design temperature, with the air injection system operating and a number of windows open to the outdoors on each floor in turn.

A-3.2.7.4.(1) Emergency Power Reliability. In some areas power outages are frequent and may be of long duration. These local conditions should be taken into account in determining the type of system for supplying emergency power for lighting. This should be studied at the planning stage of a building project in conjunction with the local fire safety and building officials.

A-3.2.7.6.(1) Emergency Power for Treatment Occupancies. CSA Z32, “Electrical Safety and Essential Electrical Systems in Health Care Facilities,” contains requirements for three classes of health care facilities – Class A, Class B and Class C. The intent of Article 3.2.7.6. is to apply specific requirements to emergency equipment for Class A facilities, which are designated as hospitals by the authorities having jurisdiction and where patients are accommodated on the basis of medical need and are provided with continuing medical care and supporting diagnostic and therapeutic services.

A-3.2.7.8.(3) Emergency Power Duration. The times indicated in this Sentence are the durations for which emergency power must be available for a building under fire emergency conditions. Additional fuel for generators or additional battery capacity is required to handle normal testing of the equipment, as indicated in the Fire By-law. If the operation of emergency generators or batteries is intended for other than fire emergency conditions, such as power failures, fuel supplies or battery capacity must be increased to compensate for that use.

A-3.2.7.9.(1) Emergency Power Reliability. In some areas power outages are frequent and may be of long duration. These local conditions should be taken into account in determining the type of system for supplying emergency power for building services. This should be studied at the planning stage of a building project in conjunction with the local fire safety and building officials.

A-3.2.7.10.(1) Electrical Conductors. The intent of this Sentence is to provide protection of riser conductors serving components of a building fire alarm and voice communication system and equipment required for smoke control and smoke venting such as fans and dampers. Conductors supplying fire alarm and voice communication system devices, smoke control and smoke venting equipment on individual floors are not intended to be protected in conformance with this requirement.

Conductors supplying fire-fighters' elevators and fire pumps are intended to be protected in accordance with this requirement from the source of the emergency power supply (emergency generator) to the terminals of the equipment (fire pump or elevator motors).

The following issues for conductor protection are required to be considered:

1. A list of emergency equipment served by the protected conductors,
2. Specific methods of the conductor protection utilized for the project. (See note (a).)
3. Electrical plans indicating the routes for protected conductors from the emergency power supply to the equipment served.
4. The satisfactory operation of electrical equipment supplied by the protected conductors while operating at elevated temperatures (more than 30° C).
5. The protection of riser conductors from potential pressurized hot gases which could travel inside the electrical conduits originating from the fire floor. (See note (b).)
6. Access to electrical riser conductor junctions for maintenance or testing. (See notes (a) & (c).)
   - (a) Acceptable protection methods for electrical conductors to ensure the operation of equipment for a period of at least one (1) hour are illustrated in the table below.
   - (b) Derating of a conductors' ampacity may be required. Where conductors are protected in accordance with methods B to F, as illustrated in the table below and where the conductors are sized to accommodate 110% of the rated load current, then no additional derating of conductors is required. Where conductors are protected in accordance with method A, an assessment of the conductors performance (MI cables) under exposure to fire, would need to be provided by an electrical engineer.
   - (c) Location of riser conductor junctions in exit stairwells is not acceptable.

Submission of the chosen methods of compliance and the submission of a Schedule B Letter of Assurance needs to be provided by the professional electrical engineer responsible for the project at the design stage. Upon completion of the installation, a Schedule C-B Letter of Assurance would be required.

Acceptable methods for the protection of electrical conductors from fire exposure to ensure operation of the emergency equipment for a period of at least one (1) hour (based on a sprinklered building) are illustrated in the table below.

Table A-3.2.7.10.	
	Method of Protection
A	Provide mineral insulated cables or other cables that conform with the ULC S139 circuit integrity test and are marked “ULC S139 2 hr fire rated” cables.
B	Provide a minimum cover over the conduit of at least 100 mm in concrete. floor slabs or walls that form part of fire separations. Cover from the ends of slabs or walls that form part of the fire separations shall be at least 125 mm.
C	Provide a minimum cover over the conduit of at least 125 mm in concrete columns, beams or walls that are not forming part of a fire separation.
D	Enclose conductors in a shaft enclosure of at least two hour fire resistance construction. These shaft enclosure walls can be of concrete or any ULC, cUL or WH listed wall or shaft wall assembly.
E	Any junction boxes or access points required for the protected conductors shall be protected with listed access panels which have been tested to limit the temperature rise on unexposed side to less than 90° C for one (1) hour. An air space shall be provided between the access panel and the conductors, to ensure that there will be no contact.
F	Conduits leading from protected enclosures to branch circuits must be protected at junction boxes at both ends of the connecting conduit. This protection will consist of plugging the conduits to a depth of at least 12 mm with an approved firestop caulking. An acceptable alternative to the above is to use an EYS fitting at the protected enclosure end.

The above provides options for the protection of electrical conductors. Other solutions may be proposed by a Fire Protection Engineer retained to analyze the arrangement and develop a solution on an equivalency basis for acceptance by the Chief Building Official.

A-3.2.7.10.(2)(a) and (3)(a) Protection of Electrical Conductors. It is important to understand that electrical conductors are part of a system that includes – among other components – raceways, conduits, splices, couplings, vertical supports, grounds and pulling lubricants. When selecting electrical conductors to provide a circuit integrity rating, it is therefore important to understand how they will be installed and to know if the fire performance of the system as a whole was tested.

A-3.2.7.10.(5)(b) Electrical Conductors in the Same Room. If the distribution panel and the equipment it serves are within the same room, only the electrical conductors leading up to the distribution panel need to be protected. It is assumed that the distribution panel and the equipment it serves are within sufficient proximity to each other such that a fire in the same area of origin would affect both.

A-3.2.7.10.(7) Fire Alarm Branch Circuits. In order to ensure continuous operation of the fire alarm and voice communication systems in a high-rise building for a sufficient duration of time to control and direct the evacuation of building occupants, a level of protection is required by Sentence 3.2.7.10.(2) for those electrical conductors interconnecting the major elements of the fire alarm system. Sentence 3.2.7.10.(7) permits the protection of electrical conductors to be waived for portions connecting a transponder or fault isolation device to fire alarm input devices (fire detectors, manual stations, etc.) or a voice communication transponder to a fire alarm audible signalling device, provided all circuits or portions of the circuits are contained within the same storey.

A-3.2.8.2.(3) Special Protection of Opening. In manufacturing operations involving the use of conveyor systems to transport material through fire separations, it may not be possible to use standard closure devices. NFPA 80, “Fire Doors and Other Opening Protectives,” includes appendix information concerning protection of openings through vertical fire separations. NFPA 13, “Installation of Sprinkler Systems,” includes methods of protecting openings through floor assemblies, however, it is assumed by that standard that the remainder of the building would be sprinklered. Combinations of methods may be required to ensure that the level of safety inherent in the requirements of the Code is maintained.

A-3.2.8.2.(6)(b) Restriction on Size of Openings Through Floors. The phrase “used only for stairways, escalators or moving walks” is intended to restrict the size of a floor opening to what is necessary to accommodate the stairway, escalator or moving walk.

A-3.2.8.2.(6)(c) Waiver of Occupancy Separation Continuity. The typical application of this Sentence is to buildings with a mixture of occupancies that are randomly located throughout the building. Examples include shopping centres, podia of large commercial and business complexes, and recreational buildings that are combined with mercantile and business operations. A shopping mall with two interconnected storeys is an example that is frequently encountered in many jurisdictions. The permission to breach the floor assembly between the storeys does not override requirements for separation of specific suites or occupancies.

For instance, although storage garages are Group F, Division 3 occupancies, the requirement in Article 3.3.5.6. for the storage garage to be separated from other occupancies by a fire separation with at least a 1.5 h fire-resistance rating must be observed. In a similar manner, a theatre or cinema (Group A, Division 1 occupancy) must be separated from other occupancies in accordance with Sentence 3.3.2.2.(1) and seats in an arena-type building (Group A, Division 3) must be separated from space below in accordance with Sentence 3.3.2.2.(3).

A-3.2.8.4.(1)(c) Contamination of Vestibule. The vestibule should have equipment capable of maintaining a supply of air into the vestibule that is sufficient to ensure that the air pressure in the vestibule when the doors are closed is higher by at least 12 Pa than the air pressure in the adjacent floor areas when the outdoor temperature is equal to the January design temperature on a 2.5% basis.

A-3.2.8.7.(1) Smoke Exhaust System. The mechanical exhaust system is intended as an aid to firefighters in removing smoke and is to be designed to be actuated manually by the responding fire department. Although smoke is normally removed from the top of the interconnected floor space, exhaust outlets at other locations may be satisfactory.

A-3.2.9.1.(1) Testing of Fire Protection and Life Safety Systems. Building owners should verify that fire protection and life safety systems and their components (i.e. fire alarm systems, sprinklers, standpipes, smoke control, ventilation, pressurization, door hold-open devices, elevator recalls, smoke and fire shutters and dampers, emergency power, emergency lighting, fire pumps, generators, etc.), including their interconnections with other building systems, are functioning according to the intent of their design.

CAN/ULC-S1001, “Integrated Systems Testing of Fire Protection and Life Safety Systems,” provides the methodology for verifying and documenting that interconnections between building systems satisfy the intent of their design and that the systems function as intended by the By-law.

Clause 6.1.5 of CAN/ULC-S1001 allows the Integrated Testing Coordinator to accept documented evidence of any tests that have been performed on a system as part of its acceptance testing for the purpose of demonstrating compliance with the integrated testing requirements of that standard, so as to avoid duplication of work.

A-3.3. Safety Within Floor Areas. Section 3.3. regulates safety within floor areas including rooms and other spaces within a building. The requirements are grouped according to the occupancy of the floor area, room or space, which is not necessarily the same as the major occupancy for which the building is classified. For example, a building may be classified by major occupancy as an office building: therefore, the provisions for structural fire protection and fire protection equipment for office buildings prescribed in Section 3.2. apply. However, within that building, a room or floor area may be used for mercantile, care, treatment, detention, business, residential, industrial or other occupancy.

Life safety for the occupants of any floor area depends in the first instance on the use or occupancy of that floor area. The risks to the occupants occur in the early stages of a fire. These special life risks differ from one occupancy to another and, consequently, must be regulated differently. Section 3.3. regulates risks within floor areas: these requirements apply regardless of the major occupancy of the building that contains the floor areas. For example, an assembly room must comply with the requirements for assembly occupancy whether it is contained in an office building, hospital, hotel, theatre, industrial building or other major occupancy.

Since this By-law regulates new construction, alterations and changes of occupancy, the construction of kiosks and similar structures in public corridors must take into consideration all the requirements that apply to the remainder of the building, including structural fire protection, construction type, finish materials, egress widths and sprinkler installations. Special activities of an occasional nature that were not contemplated in the original design of a public corridor and that represent only a temporary change in occupancy are regulated by the Fire By-law. These regulations include maintaining egress paths clear of obstructions, controlling combustible contents and providing measures to ensure quick response for firefighting.

A-3.3.1.2.(1) Hazardous Substances. The term “hazardous substances” refers to dangerous goods that are regulated by TC SOR/2008-34, “Transportation of Dangerous Goods Regulations (TDGR),” or that are classified as “controlled products” under the “Workplace Hazardous Materials Information System (WHMIS)” established to meet the requirements of HC SOR/2015-17, “Hazardous Products Regulations.” It also refers to materials and products that are not regulated by the TDGR or WHMIS, but that pose a fire or explosion hazard due to their own properties or because of the manner in which they are stored, handled or used.

These include combustible products, rubber tires, combustible fibres, combustible dusts, products producing flammable vapours or gases, etc.

A-3.3.1.2.(2) Cooking Equipment Ventilation. Cooking equipment manufactured for use in dwelling units and other residential suites is often installed in buildings used for assembly and care, treatment or detention purposes. It is not obvious from the By-law requirements or those of NFPA 96, “Ventilation Control and Fire Protection of Commercial Cooking Operations,” whether a ventilation and grease removal system is required in all assembly and care, treatment or detention uses. If the equipment is to be used in a manner that will produce grease-laden vapours that are substantially more than would be produced in a normal household environment, then it would be appropriate to apply the requirements of NFPA 96. If the equipment is used primarily for reheating food prepared elsewhere or is used occasionally for demonstration or educational purposes, there would be no expectation of applying the requirements of NFPA 96. In all cases the circumstances should be reviewed with the authority having jurisdiction.

A-3.3.1.9.(4) Obstruction in Corridor. The sweep of a cane used by blind or visually impaired persons normally detects obstructions that are within 680 mm of the floor. Any obstruction above this height would not normally be detected and can, therefore, create a hazard if it projects more than 100 mm into the path of travel.

A-3.3.1.12.(3) Movable Partitions. Should an emergency situation arise outside of normal working hours but when occupants are still in the space, they could be left without a clear way out. This could occur during inventory or after closing time when all occupants have not yet left, but staff close the door to prevent other persons from entering. In many small tenant areas, the movable partitions (store fronts) provide the only way out. There should always be a second way out or a swinging door within or adjacent to the sliding partitions.

A-3.3.1.13.(4) Door Hardware. The permission to have additional door releasing devices is intended to allow the use of a security chain, night latch or dead bolt to supplement the normal door latching device. These are permitted for dwelling units and locations where guests in a hotel or motel require additional security. The height of these items is also governed by the maximum height stipulated in Sentence 3.3.1.13.(5) to ensure that they can be operated by persons with physical disabilities. This additional hardware should not require appreciable dexterity by the user and the general requirements on the ability to operate the device without the use of keys, special tools or specialized knowledge still apply.

A-3.3.1.13.(6) Controlled Egress Doors. It is intended that Sentence 3.3.1.13.(6) apply to doors used at the perimeter of a contained use area or an impeded egress zone. If the contained use area consists of a single room, the requirements would apply to that room. In the case of individual cells within a contained use area, exterior keyed locks could be used on the cell doors consistent with the fire safety plan and continuous supervision by staff who can release the doors in an emergency.

A-3.3.1.13.(7) Electromagnetic Locking Devices. Electromagnetic locks and similar door control security devices are not intended to be used indiscriminately as alternative to proper security design. Where improperly designed or installed, these may inadvertently entrap or delay persons during an emergency as a result of physically impeding egress or confining egress to high traffic areas. Designers and installers wishing to install electromagnetic locking devices are to demonstrate that the requirements of the By-law have been met.

This demonstration is to include a sequence of operation for the installation of any new maglocks and similar security devices that could singly or in combination, prevent, impede, or otherwise delay occupant egress or emergency responder access. This is to be provided to the Chief Building Official for acceptance, along with any necessary supporting documentation to demonstrate by-law compliance. (See also note A-3.4.6.16.(4).)

A-3.3.1.23.(1) Obstructions in Means of Egress. Obstructions including posts, counters or turnstiles should not be located in a manner that would restrict the width of a normal means of egress from a floor area or part of a floor area unless an alternative means of egress is provided adjacent to and plainly visible from the restricted means of egress.

A-3.3.2.1.(2) Use of NFPA 101. The intention of Sentence (2) is to allow By-law users the option of using NFPA 101, "Life Safety Code," to address the following issues: means of egress; egress routes within assembly occupancies; aisles and access serving seating not at tables; guards and railings; life safety evaluation; and smoke-protected assembly seating. However, opting to use NFPA 101 under this application entails adherence to all the provisions listed in Sentence (2): it is not intended that By-law users randomly select and apply a mix of provisions from both the Building By-law and the NFPA.

A-3.3.2.4.(2) Tablet Arms. Although it is intended that the motion to raise the tablet arm be essentially a single fluid motion, it is acceptable that the motion be a compound motion of raising the tablet arm and including an articulation to allow the tablet to fall back alongside the arm rest.

A-3.3.2.10. Installation Configurations of Handrails in Aisles with Steps. Figure A-3.3.2.10. illustrates possible installation configurations of handrails serving aisles with steps.

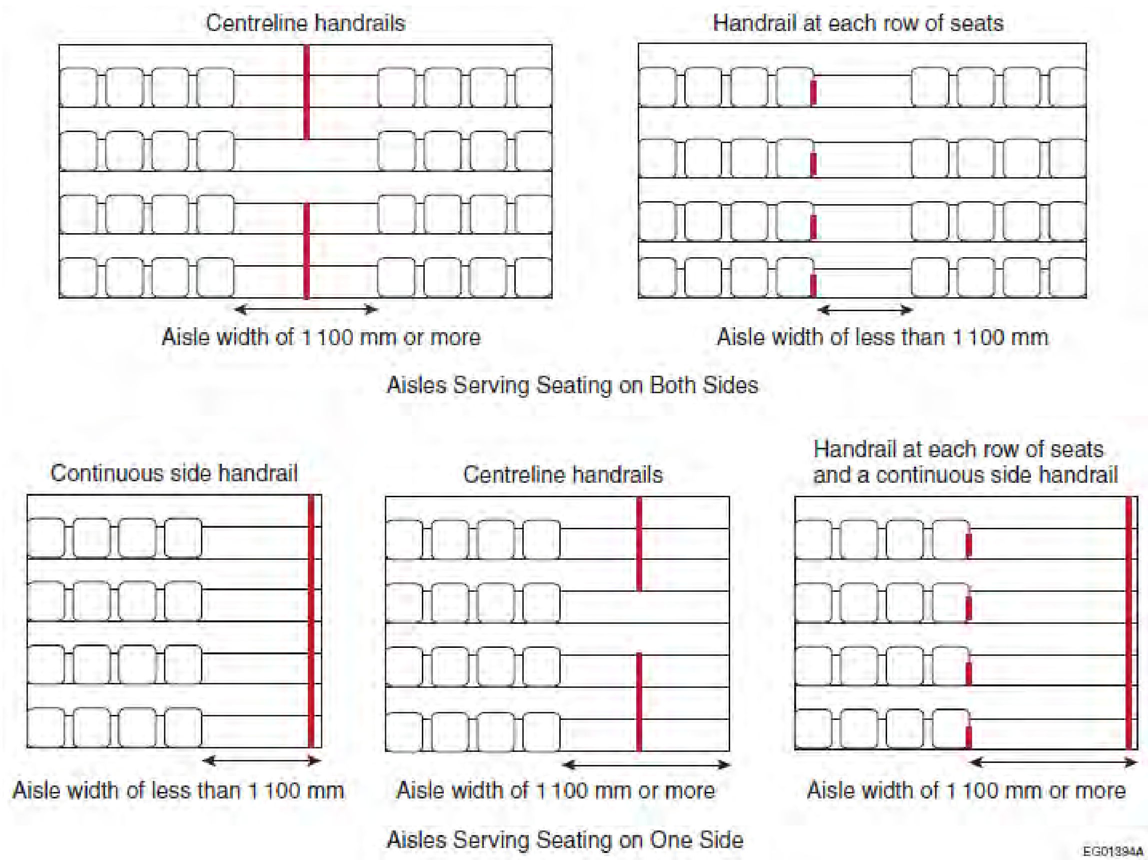


Figure A-3.3.2.10.
Handrail installation configurations

A-3.3.3.1.(1) Safety in Care, Treatment and Detention Occupancies. Fire safety for patients in bedroom areas in hospitals and nursing homes with treatment is predicated on the ability of staff to carry out at all times essential life safety functions in accordance with the fire safety plan. Details for a plan are contained in the Fire By-law.

Many factors may affect the ability of staff to carry out life safety functions, including the mobility of patients who cannot fend for themselves and the built-in protection for patients who cannot be moved except under exceptional circumstances.

Should a patient area in a hospital or nursing home with treatment contain factors which would increase the time normally required for staff to evacuate patients or to undertake other life safety measures, consideration should be given to providing additional fire protection measures to ensure that equivalent safety is available.

A-3.3.3.4.(2) Doorway Width. The 1050 mm minimum clear width of doorways accounts for door stops and, thus, is intended to allow for the use of 1100 mm doors.

A-3.3.3.5.(9) Intercommunicating Rooms. Rooms that are interconnected can include more than one sleeping room, together with ensuite toilet rooms, shower rooms, and storage closets used for the storage of personal items of the persons occupying the sleeping rooms. It is not intended that storage rooms for other purposes be included within the group of interconnected rooms.

A-3.3.3.5.(13) Grilles and Louvres. In order to permit the supply of make-up air to compensate for the removal of exhaust air from these toilet rooms, shower rooms and similar spaces, it is permitted to incorporate grilles and louvres for the transfer of air provided the air movement cannot allow smoke to pass through these spaces to other parts of the building. It is considered that in normal designs the air is exhausted directly to the exterior and is not circulated. If air is to be circulated back to other parts of the building, smoke operated dampers should be included in the air circulating system.

A-3.3.3.5.(17) Fire Damper Activation. This requirement is to ensure that fire dampers are activated by any smoke detector in either zone or fire compartment.

A-3.3.4.4.(1) Landing in Egress Stairway. A landing level used in an egress stairway from a dwelling unit is not considered to be a storey of that dwelling unit if the landing is used only for pedestrian travel purposes.

A-3.3.4.4.(7) Travel Distance in a Dwelling Unit. The egress requirements of 3.3.4.4.(7)(a) are limited by the total travel distance within the dwelling unit. For the purposes of determining this travel distance, only the horizontal component of the travel of travel within the exterior envelope, including any stairs, need be considered.

A-3.3.4.5.(1) Automatic Locking Prohibited. Doors that must be manually reset to lock them when they are opened from the inside meet the intent of this requirement.

A-3.3.6.1.(1) Design of Buildings Containing Dangerous Goods. Subsection 3.3.6. applies to the short- or long-term storage of products, whether raw or waste materials, goods in process, or finished goods.

This Subsection does not deal with products or materials that are directly supplied to appliances, equipment or apparatus through piping, hose, ducts, etc. For example, the gas cylinders that are mounted on propane barbecues are not covered by Subsection 3.3.6.; they are considered to be “in use” as opposed to “in storage” and are not intended to be regulated by the storage requirements stated in the Fire By-law.

A-3.3.6.2.(2) Storage of Reactive Materials. Reactive materials include various classes of unstable or reactive dangerous goods, such as flammable solids, pyrophoric materials, oxidizers, corrosives, water-reactive substances and organic peroxides.

In general, it is unsafe to store highly reactive oxidizers close to liquids with low flash points, combustible products or chemically incompatible products. Quantities of oxidizers or other dangerously reactive materials should therefore be limited and the storage area should be constructed of noncombustible materials, should be kept cool and ventilated, and should not impede egress. In some cases, depending on the quantity and nature of the oxidizing agent, normal fire protection measures (e.g. sprinklers, fire hose and extinguishers) are ineffective due to the self-yielding of oxygen by the oxidizing agent.

When containers of highly reactive oxidizers become damaged or are exposed to excessive heat, humidity or contamination (e.g. sawdust, petroleum products, or other chemicals), a very violent fire or explosion can result. The following oxidizing substances, among others, are known to supply oxygen: organic and inorganic peroxides; pool chemicals (e.g. calcium hypochlorite, sodium dichloroisocyanurate); oxides; permanganates; perrhenates; chlorates; perchlorates; persulfates; organic and inorganic nitrates; bromates; iodates; periodates; perselenates; chromates, dichromates; ozone; perborates.

When containers of dangerously reactive materials become damaged or are exposed to water or humidity, a flammable gas (such as hydrogen, ammonia or methane) or a toxic gas (such as hydrogen chloride, hydrogen bromide or phosphine) can be released.

The following dangerously reactive materials, among others, are known to release a flammable gas in reaction to contact with water or humidity: alkali metals (e.g. sodium, potassium, cesium); reactive metals (e.g. zinc, aluminum, magnesium); metallic hydride (e.g. sodium borohydride, germanium tetrahydride, calcium hydride).

The following dangerously reactive materials, among others, are known to release a toxic gas in reaction to contact with water or humidity: organic and inorganic chloride (e.g. phosphorus trichloride, phosphorus oxide trichloride, acetyl chloride); organic and inorganic bromide (e.g. phosphorus tribromide, aluminum tribromide, acetyl bromide).

A-3.3.6.4.(2) Explosion Venting in Hazardous Locations. When a flammable mixture of air and vapour/gas/dust is ignited and causes an explosion, the exothermic reaction results in the rapid expansion of heated gases and the corresponding pressure waves travel through the mixture at sonic or supersonic velocities. The pressures developed by an explosion very rapidly reach levels that most buildings and equipment cannot withstand unless specifically designed to do so. Explosion venting consists of devices designed to open at a predetermined pressure to relieve internal pressure build-up inside a room or enclosure, hence limiting the structural and mechanical damage.
The major parameters to be considered in designing an explosion venting system for a building are:

- the physical and chemical properties of the flammable air mixture, such as the particle size or the droplet diameter, the moisture content, the minimum ignition temperature and explosive concentration, the burning velocity or explosibility classification, the maximum explosion pressure and the rate of pressure rise,
- the concentration and dispersion of the flammable mixture in the room,
- the turbulence and physical obstructions in the room,
- the size and shape of the room, the type of construction and its ability to withstand internal pressures, and
- the type, size and location of relief panels, which should also be designed to reduce the possibility of injury to people in the immediate vicinity of the panels.

A-3.3.6.5.(1) Measurement of Tire Storage Volume. The volume of tires in a storage area can be determined by measuring to the nearest 0.1 m the length, width and height of the piles or racks intended to contain the tires. In racks, the top shelf is assumed to be loaded to maximum possible height, while observing required clearances between structural elements and sprinklers.

A-3.3.6.6.(6) Products Stored with Ammonium Nitrate. Copper and its alloys should not be used where they can come into contact with ammonium nitrate. The presence of copper represents the single biggest hazard with respect to the accidental detonation of ammonium nitrate during a fire.

Steel and wood can be protected with special coatings such as sodium silicate, epoxy, or polyvinyl chloride. Asphalt and similar hydrocarbon-based roof coverings should not be used. Stored ammonium nitrate may become sensitized during a fire if such roof coverings melt and leak into the interior of the building, causing burning droplets to fall on the stored product.

A-3.3.7.7.(2) Security for Storage Garage The requirements of Sentence 3.3.7.7.(2) are intended to provide improved visibility into or out of a stair tower or vestibule which might otherwise occlude the line of sight of building occupants as a result of intervening construction. Glazing must provide the maximum practical improvement to visibility to improve occupant safety. The term ‘stair tower’ used in this Sentence is intended to apply to vertical stair enclosures connecting more than one floor or containing superimposed flights of stairs.

A-3.3.7.9. Multi-family Residential Mailbox Construction. The direct and indirect cost to persons as a result of mail theft are of increasing significance. The minimum construction requirements of the Building By-law are intended to reduce the risk of letter mail theft by resisting or discouraging this form of crime of opportunity. These requirements are not specifically intended to address parcel theft. The requirements of Article 3.3.7.9. are intended to conform with minimum standards required by Canada Post as required by Schedules II and III of the Federal Mail Receptacles Regulations SOR-83-743 as it pertains to “mail box assemblies” (defined term).

A-3.4.1.1.(1) Type of Exit Facility. The requirements for exits in Section 3.4. were developed for new construction. If alterations are made to an existing building or changes of occupancy occur, other design solutions than those in Section 3.4. may have to be developed to maintain an acceptable level of safety if it is not practicable to fully conform to the requirements of this Section. In some cases the use of fire escapes to supplement the existing exit facilities may be the only practicable solution. Because of the variety of conditions that may be encountered in existing buildings, it is difficult to standardize or codify such requirements.

Alternative means of providing acceptable levels of safety may have to be tailored to the particular building design. In all cases, however, the requirements described in Section 3.4. are intended to provide the level of safety to be achieved. If alternative measures are used, they should develop the level of safety implied in these requirements.

A-3.4.1.6.(2) Sleeping Area. Areas serving patients' sleeping rooms include sleeping areas and areas where patients are taken for treatment.

A-3.4.2.3.(1) Least Distance Between Exits. The least distance measurement does not apply to each combination of exits on a multi-exit storey. It only applies to at least 2 of the required exits from that storey.

A-3.4.3.2.(6) Evacuation of Interconnected Floor Space. This Sentence ensures that egress facilities allow for the simultaneous evacuation of all portions of an interconnected floor space. It does not contemplate the phased evacuation of occupants; thus in buildings where that type of evacuation is intended, fire protection requirements in addition to those prescribed in the By-law may be necessary.

In the first instance, this Sentence provides for cumulative exiting that can accommodate the efficient movement of all occupants in the exit stairs. Clause 3.4.3.2.(6)(a) permits an alternative approach that will accommodate all the occupants in the stairs but will restrict the egress flow rate. Clause 3.4.3.2.(6)(b) provides a second alternative that assumes the occupants must queue before entering the stair. A "protected floor space" conforming to Article 3.2.8.5. is intended to provide an intermediate area of safety that is protected from the hazards of the interconnected floor space. It does not provide a holding or refuge area for all occupants of a floor area for an extended period of time. To ensure that evacuation is not unduly delayed and that queuing of the occupants in the protected floor space can be accommodated, requires careful consideration in the design of the interface between the interconnected floor space/protected floor space/exit.

It is not appropriate, for example, to share a common vestibule in complying with Sentences 3.2.8.4.(1) and 3.2.8.5.(1). Under evacuation conditions, occupants entering the vestibule would flow towards the exit, as opposed to the protected floor space, thus resulting in queuing outside the vestibule and potential exposure to fire. To comply with the intent, it is necessary to design the egress path such that the occupants enter the protected floor space through a vestibule, then in turn enter the exit stair from the protected floor space. In addition, sufficient space should be provided between the vestibule and the exit to allow for the queuing of occupants in the protected floor space.

A-3.4.3.2.(6)(a) Temporary Safety Area. The objective of Clause 3.4.3.2.(6)(a) is to provide an area of temporary safety in the exit stair shafts for the occupants of the interconnected floor space. This requirement is considered to be met if 0.3 m^2 per person is provided in the stair shaft between the floor level served and the floor level immediately beneath it.

A-3.4.3.4. Clear Height and Width. Clear height is intended to be measured from a line tangent to the nosings extended to the underside of the lowest element above the walking surface, over the clear width of the exit (See Figure A-3.4.3.4.). Examples of low elements above the walking surface include light fixtures or sprinkler heads and piping.
Clear width is intended to be measured from a line tangent to horizontal protrusions such as handrails.

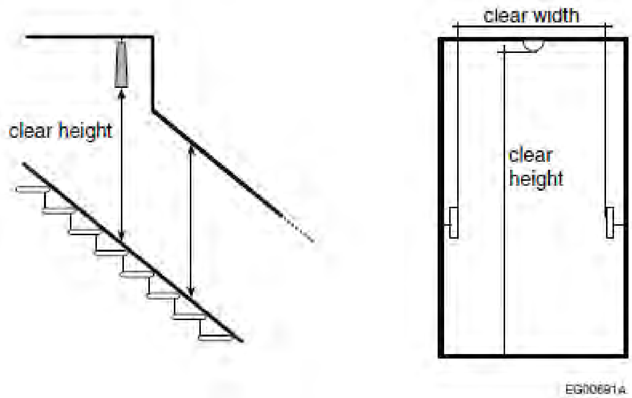


Figure A-3.4.3.4.
Measuring clear height

A-3.4.4.2.(2)(e) Requirements for Lobby. If an exit is permitted to lead through a lobby, the lobby must provide a level of protection approaching that of the exit. As well as meeting the width and height requirements for exits, the lobby must be separated from the remainder of the building by a fire separation having a fire-resistance rating at least equal to that required for the exit, unless one of the exceptions in this Clause is applied.

A-3.4.5.1.(2)(c) Graphical Symbols for Exit Signs. ISO 7010, "Graphical symbols – Safety colours and safety signs – Registered safety signs," identifies the following internationally recognized symbols for use at required exits.

Figure A-3.4.5.1.(2)(c)-A
"E001 Emergency exit (left hand)" (E001) symbol from ISO 7010

Figure A-3.4.5.1.(2)(c)-B
"E005 Direction, arrow (90°-degree directional arrow (E005) increments), safe condition" symbol from ISO 7010

A-3.4.5.1.(3) Internally Illuminated Signs. Photoluminescent signs are not internally illuminated and therefore must conform to Sentence 3.4.5.1.(4).

A-3.4.5.1.(4) Externally Illuminated Signs. An external lighting source is required to properly charge photoluminescent signs. In addition to being continuously illuminated as required by Sentence 3.4.5.1.(4), Tthese types of signs must be lit in conformance with the charging requirements indicated on the exit signs in accordance with CAN/ULC-S572, “Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems.”

A-3.4.6. Application to Means of Egress. The requirements in Subsection 3.4.6. apply to interior and exterior exits, as well as to ramps, stairways and passageways used by the public as access to exit. The treads, risers, landings, handrails and guards for the latter access to exit facilities must thus be provided in conformance with the appropriate requirements for exit facilities.

A-3.4.6.4. Dimensions of Landings. A landing is a floor area provided at the top or bottom of a flight of stairs or a ramp, or a platform built as part of a stairway or ramp. Landings provide a safe surface for users to rest upon, allow design flexibility, and facilitate a change in direction.

Figure A-3.4.6.4. illustrates how to measure the length of a landing for various landing configurations turning less than 90°, including straight landings.

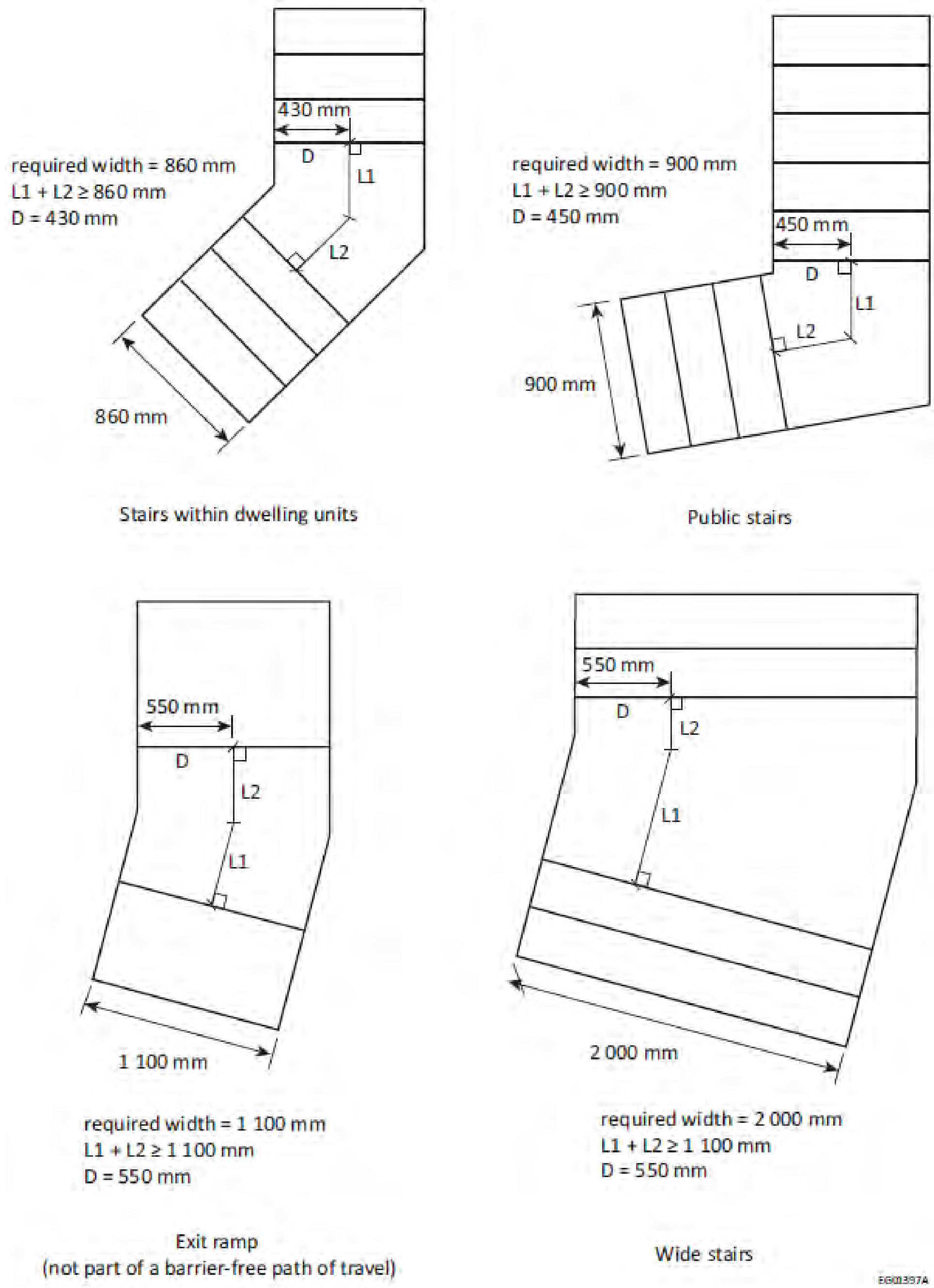


Figure A-3.4.6.4.
Landing configurations

Notes to Figure A-3.4.6.4.:

(1) L1 + L2 = length of the landing = the lesser of the required width of the stair or ramp, or 1 100 mm
See Sentences 3.4.6.4.(2) and 9.8.6.3.(2).
(2) D = distance from the narrow edge where the length of the landing is measured = half the required length of the landing
See Sentences 3.4.6.4.(3) and 9.8.6.3.(3).

A-3.4.6.5.(4) Wider Stairs than Required. The intent of Sentence 3.4.6.5.(4) is that handrails be installed in relation to the required exit width only, regardless of the actual width of the stair and ramp. The required handrails are provided along the assumed natural path of travel to, from and within the building.

A-3.4.6.5.(10) Continuity of Handrail. Blind or visually-impaired persons rely on handrails to guide them on stairways. A continuous handrail will assist them in negotiating stairs at changes in direction. The extended handrail is useful to persons with physical disabilities to steady themselves before using the stairs. Handrails should, however, return to the wall, floor or post, so as not to constitute a hazard to blind or visually-impaired persons.

A-3.4.6.10.(5) Door Swing. Although it is required that the door on the right hand side of a pair of doors shall swing in the direction of travel through the exit, the direction of swing of the door on the left side will depend on the function of the horizontal exit. If the horizontal exit provides for movement from one building to the adjacent building but does not require movement in the reverse direction, both doors must swing in the direction of travel to the adjacent building. If the design is based upon both buildings providing complementary movement in either direction, then the doors must swing in opposite directions. Location of a required exit sign directly above a door that swings in the direction of travel is deemed to meet the intent of Clause 3.4.6.10.(5)(b).

A-3.4.6.11.(4) Exit Concealment. Hangings or draperies placed over exit doors may conceal or obscure them.

A-3.4.6.16.(1) Fastening Device. Turnpieces of a type which must be rotated through an angle of more than 90° before releasing a locking bolt are not considered to be readily openable. The release of a locking bolt should allow the door to open without having to operate other devices on the door.

A-3.4.6.16.(4) Electromagnetic Lock. Electromagnetic locks are intended for use where there is a need for security additional to that provided by traditional exit hardware. They are not intended for indiscriminate use as alternative locking devices.

The design of these devices requires evaluation to ensure that their operation will be fail-safe in allowing exiting in the event of foreseeable emergencies. If more than one locking device is used in a building, it is expected that one switch will release and reset all devices simultaneously.

A-3.4.6.16.(4)(h) Time Delay for Electromagnetic Locks with Proximity Sensors. For the purposes of Clause 3.4.6.16.(4)(h), a door provided with a hardware arrangement complying with Sentence 3.4.6.16.(7) is not considered to have a delay.

A-3.4.6.16.(5) Electromagnetic Locks in Care and Treatment Occupancies. The installation of electromagnetic locks in care and treatment occupancies requires special provisions to address the compromised condition of residents and the nature of daily operations. Accordingly, to reduce the incidence of false operation by residents, transparent boxes that set off an audible signal when opened can be installed to cover the manual stations. Also, one optional additional release device (e.g. swipe card device, key pad) can be installed to facilitate the free movement of staff and visitors in the building.

A-3.4.6.17.(1) Special Security for Doors. The need for security in banks and in mercantile occupancies requires the ability to use positive locking devices on doors that may not readily be opened from inside the building. In a fully sprinklered building, the risk to persons inside the building is substantially reduced. The provisions of Sentences 3.4.6.17.(2) to (9) assume that the area is illuminated and that a means of communication is available to any occupant during times that the doors are locked.

A-3.4.6.19.(1)(d) Colour Contrast. The identification of floor and other signs intended to facilitate orientation for visually-impaired persons should offer maximum colour contrast to be effective. For this reason, it is recommended that white on black or black on white be used, as this combination produces the best legibility. It is also recommended that the sign surfaces be processed to prevent glare.

A-3.5.2.1.(1) Elevator Design. The reference to the Elevating Devices Safety Regulation in this Sentence implies conformance with all requirements of that standard for elevator cars, hoistways, pits and machine rooms, including restrictions on other services in these areas and detailed design criteria.

A-3.5.4.1.(1) Elevator Car Dimensions. In some circumstances it is necessary to maintain a patient on a stretcher in the prone position during transit to a hospital or to treatment facilities. Inclining the stretcher to load it into an elevator could be fatal or at the very least detrimental to the patient's health. Many ambulance services use a mobile patient stretcher whose size is 2010 mm, long and 610 mm wide. As well as space for the stretcher in the elevator, there should be sufficient additional space for at least two attendants who may also be providing treatment during transit. Common elevator units that can satisfy this requirement include:

- a 1134 kg elevator car with minimum interior dimensions of 2032 mm wide and 1295 mm deep with a right or left hand access door. The minimum access door width is 1067 mm and it must be on the 2032 mm side of the car.
- a 1134 kg elevator car with minimum interior dimensions of 2 032 mm deep and 1295 mm wide with a minimum 915 mm wide access door located on the 1295 mm side.

Limited-use/limited-application (LULA) elevators are limited in size, capacity, speed and rise and are not expected to meet the minimum elevator car dimensions stated in Sentence (1).

A-3.6.2.5.(1) Combustible Refuse Storage. Storage of refuse consisting of combustible materials including waste paper, cardboard and plastic, and noncombustible materials such as glass and metallic containers can be accumulated in these rooms for the purpose of recycling. This storage is allowed in consideration of a less stringent collection schedule when compared to that of garbage or refuse, which is collected regularly.

A-3.6.2.7.(5) Explosion Relief. Examples of good engineering practice for this application can be found in NFPA 68, "Explosion Protection by Deflagration Venting," NFPA 69, "Explosion Prevention Systems," and the NFPA "Fire Protection Handbook."

A-3.6.3.1.(1) Vertical Service Spaces. Sentence 3.6.3.1.(1) does not prohibit the internal subdivision of a vertical service space to allow different building services to be installed in physically separated spaces unless other requirements apply (See, for example, Sentences 3.2.7.10.(2) and (3).). Fire separation requirements apply to the perimeter of the group of service spaces.

Article 3.6.3.3. has special requirements for linen chutes and refuse chutes.

A-3.6.3.5. Grease Duct Enclosures. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," presents two options for enclosing grease ducts for commercial cooking equipment: the first option is to use continuous fire-rated building component assemblies to enclose the ducts and the second one consists of installing proprietary, fire-rated, field-applied or factory-built grease duct assemblies in accordance with the manufacturer's instructions. These types of enclosure assemblies are evaluated for their resistance to fire and their ability to protect adjacent combustibles through reduced clearances.

Although NFPA 96 references other standards that deal with grease duct assemblies, Sentence 3.6.3.5.(2) requires that CAN/ULC-S144, "Fire Resistance Test – Grease Duct Assemblies," be used to determine the fire-resistance rating of factory-built and field-applied grease duct assemblies.

A-3.6.4.2.(2) Ceiling Membrane Rating. In construction assemblies that utilize membrane ceiling protection and have been assigned a fire-resistance rating on the basis of a fire test, the membrane is only one of the elements that contribute to the performance of the assembly and does not in itself provide the protection implied by the rating. For the fire-resistance rating of membrane materials used in this form of construction, reference should be made to the results of fire tests which have been conducted to specifically evaluate the performance of this element.

A-3.6.5.6.(2) Clearance for Warm-Air Supply Ducts. Applicable to forced-air furnaces where permissible clearance C above plenum is 75 mm or less.

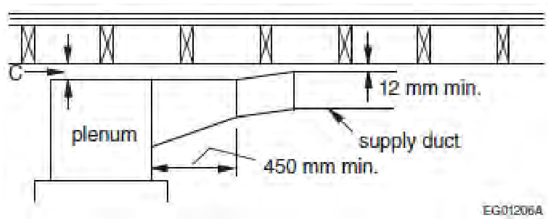


Figure A-3.6.5.6.(2)
Clearance for warm-air supply ducts

A-3.6.5.6.(3) Clearance for Warm-Air Supply Ducts. Applicable to forced-air furnaces where permissible clearance C above plenum is more than 75 mm but not more than 150 mm.

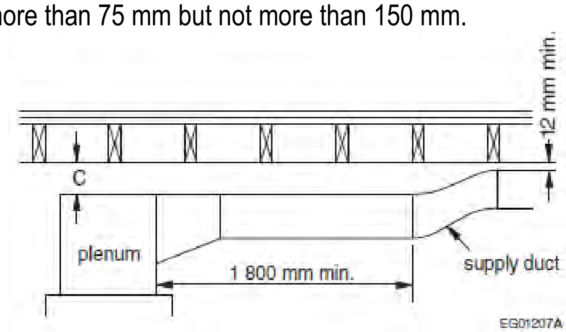


Figure A-3.6.5.6.(3)
Clearance for warm-air supply ducts

A-3.6.5.6.(4) Clearance for Warm-Air Supply Ducts. Applicable to forced-air furnaces where permissible clearance C above plenum is more than 150 mm.

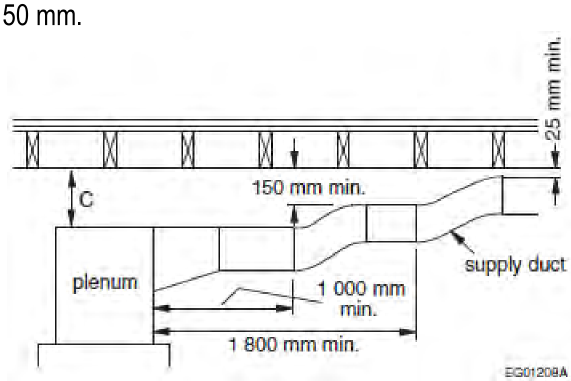


Figure A-3.6.5.6.(4)
Clearance for warm-air supply ducts

A-3.7.2.2.(1) Water Closets. Other than where gender neutral washrooms (See 3.7.2.11.) are provided, Sentence 3.7.2.2.(1) assumes that there will be a sufficient number of persons in the building to justify the provision of separate water closet facilities for both males and females. In some circumstances overall low occupant loads would not require more than one water closet for males and one water closet for females and yet the building has more than one storey.

It is deemed that rooms each containing a single water closet available for both males and females would satisfy the intent of the By-law. The total number of water closets must be adequate for the total number of occupants. In the case of universal and gender neutral washroom facilities, the acceptable number of water closets should be based upon the equivalent number of fixtures that would otherwise be provided.

Requirements for accessibility also need to be considered. If the entrance storey is accessible and the upper storeys are not required to be accessible, a room in the accessible storey must meet the requirements of Section 3.8. and can serve both males and females. If provided, a nonaccessible room, designed to serve both males and females, in each nonaccessible upper storey would be acceptable. Sentence 3.7.2.2.(4) permits a single water closet to serve both males and females if the total occupant load is low.

A-3.7.2.11. Gender Neutral Washroom Requirements The gender neutral washroom requirements of the Building Bylaw introduce a new option for owners, operators, and employers to provide washroom facilities that do not impose unreasonable restrictions on persons who wish to use the washroom facility. The requirements of the Building Bylaw represent the minimum level of performance necessary to achieve the goals of personal security and functionality for all persons.

The intent of the gender neutral washroom is that they may replace washrooms that would otherwise be required by the Building By-law. Where gender neutral washrooms are provided, these are to be assigned proportionally as male or female, for the purposes of determining the building washroom capacity under Section 3.7 of the Building By-law. It is not intended that the gender neutral washrooms be assigned solely as contributing to the male or female washroom capacity exclusively, nor were these to be considered supplemental to the minimum washroom requirements of the building.

Signage for gender neutral washrooms are to reflect the intended use not only by persons outside the gender binary, but also by people with disabilities, the elderly, and anyone else who may require the assistance from someone of another gender. As such, signage denoting this use is recommended to be neutral in tone and nature. Likewise, the iconography associated with these signs is also suggested to be indicative of the facility usage and function, and not of the individual who may use the facility.

The provision of regulations for gender neutral washrooms does not mean the elimination of gender-type washrooms. Typed washrooms, such as men’s or women’s multi-stall washrooms, and universal single-user washrooms may remain. It is up to each person to self-determine which washroom is most appropriate for them based on their gender identity. Further clarifying text may be added to washroom signage to signal that all persons are welcome.

A-3.8. Accessible Design Assumptions. This Section contains minimum provisions to persons with disabilities.

Building Access Handbook

An illustrated guide and commentary has been produced to assist users of Section 3.8. and other access requirements of the British Columbia Building Code. This handbook contains the entire text of Section 3.8. and other access requirements, and is supplemented by commentary and illustrations on specific requirements.

A-3.8.2.1. Accessibility. Industrial buildings often pose a greater risk to their occupants due to the presence of significant quantities of dangerous materials or the use of hazardous processes. For example, plants which are classified as Group F, Division 2 or 3, may store and use toxic or highly flammable substances in significant quantities, or house processes which involve very high temperatures and which have a high degree of automation. In some facilities, particularly in primary industries such as forestry and metallurgy, the construction normally used and the operations carried out within the space can make compliance with the requirements of Section 3.8. impracticable. It is therefore intended that these requirements be applied with discretion in buildings of Group F, Division 2 or 3 major occupancy. However, where industrial buildings contain subsidiary occupancies, such as offices or showrooms, it is reasonable to require that accessibility be provided in these spaces.

A-3.8.2.1.(1)(f) and (g) Access to Small Storeys. Elevators and elevating devices can be expensive and in small buildings may form a significant percentage of a building's cost. This Clause is intended to exempt such small second storeys or basements from access requirements when they are self-contained or contain the same facilities as on the accessible storey. An example where access is not required is the second storey of a restaurant which contains only additional seating. If, on the other hand, the restaurant's washrooms are in the less than 600 m² basement there must be access to them as they are an integral part of the principle function and occupancy on the accessible storey. Likewise, staff lunchrooms and washrooms are integral with the principle function and when they are on a small second storey or mezzanine they must be accessible when a person with disabilities could reasonably be expected to be
employed there.

This exemption applies to buildings with not more than one storey above the first storey. A building with two or more storeys above the first storey must be fully accessible. Mezzanines that are not considered as storeys for the purposes of determining building height are considered storeys for the purposes of applying Clauses 3.8.2.1.(1)(f) and (g).

A-3.8.2.2. Entrances. An accessible route should exist from the sidewalk or roadway and parking area to an accessible building entrance. This route should be located so that persons with physical disabilities do not have to pass through dedicated smoking areas or behind parked cars. Accessible routes should coordinate with the routes to other buildings and to public transportation stops.

To provide more general access to buildings, not less than 50% of the pedestrian entrances are required to be accessible. This should include a principal entrance. If the 50% calculation results in a fraction, the number of accessible entrances should be the next higher unit value. For the purpose of determining the number of entrances to a building, several adjacent doors in a bank of doors are considered to be a single entrance. If an intercom system is provided, the system shall comply with the requirements for controls and should be useable by persons who communicate using visual language such as a video system.

A-3.8.2.3. Access to Rooms and Facilities. If access is required into suites or rooms in Subsection 3.8.2., it is intended that access be provided, with some exceptions identified in Sentence 3.8.2.3.(2), throughout each room or suite including access to all facilities and areas. Some examples of where access is required are as follows:

- within each suite (subject to Clauses 3.8.2.3.(2)(h) to (j).),
- within rooms or areas that serve the public or are designated for use by visitors, including interview rooms, holding rooms, changing rooms, areas in assembly occupancies with fixed seats so as to provide viewing of any entertainment areas, display areas and merchandising departments,
- within each type of membership facility,
- within rooms or areas for student use in assembly occupancies,
- within general work areas, including office areas and areas with lockers,
- within general use or general service areas, including shared laundry areas in residential occupancies, recreational areas, cafeterias, lounge rooms, lunch rooms and infirmaries,
- within sleeping rooms in hospitals and nursing homes with treatment,
- (if installed), into at least one passenger elevator or elevating device conforming to Articles 3.5.2.1. and 3.8.3.7.,
- into washrooms described in Sentences 3.8.2.8.(1) to (3),
- to any facility required by this Section to be designed to accommodate persons with physical disabilities,
- onto every balcony provided in conformance with Clause 11.3.7.1.(1)(c),
- to service counters used by the general public (examples include sales counters, refreshment stands, drinking fountains, cafeteria counters, checkout counters and bank service counters), and

- to equipment designed to serve the public including self-serve kiosks, automated banking machines and night deposit boxes.

Where one or more hairdressing sinks are provided in barber shops, hairdressing shops and beauty parlors, at least one shall be useable by persons using in wheelchairs. Where fitting rooms are provided in a store, an accessible fitting room is required. An enclosure not less than 1 500 mm by 1 500 mm is suggested.

The permission to waive an accessible path of travel for wheelchair access to certain specified areas of a building is not intended to waive accessibility requirements for persons whose physical disabilities do not require special provision for access to raised or sunken levels. Persons with vision impairments or who are deaf or hard of hearing that do not require the use of a wheelchair can be expected to move throughout a building.

The concept of providing similar amenities and facilities applies, among other things, to food, beverage, and entertainment facilities within restaurants, to smoking and non-smoking areas permitted in accordance with local regulations, and to window areas providing a view of an exterior attraction.

Availability of specific spaces depends on reservation policy and the sequence in which patrons arrive at a restaurant or other facility, and therefore is beyond the scope of this By-law.

Accessibility "within" a floor area means that in general all normally occupied spaces and levels are to be accessible, except those areas which are deemed not to require access. Examples of normally occupied floor areas include lobbies and passageways where persons are intended to use or pass through, but do not include spaces that are not normally used by the occupants such as storage platforms in industrial and other occupancies.

Further, an accessible path of travel should be provided where buildings are networked together and as a connection to public transportation stops.

A-3.8.2.4.(1) Path of Travel to Storeys Served by Escalators and Moving Walks. In some buildings, escalators and inclined moving walks are installed to provide transportation from one floor level to another floor level so as to increase the capacity to move large numbers of persons. Some buildings located on a sloping site are accessible from street level on more than one storey and an escalator or inclined moving walk is provided for internal movement from floor to floor. In both these situations, a person with a physical disability must be provided with an equally convenient means of moving between the same floor levels within the building. This can be accomplished by providing elevators or a platform-equipped passenger-elevating device.

A-3.8.2.5. Parking Areas. In localities where local regulations or bylaws do not govern the provision of or dimensions of accessible parking spaces, the following provides guidance to determine appropriate provisions. If more than 50 parking spaces are provided, parking spaces for use by persons with physical disabilities should be provided in the ratio of one for every 100 parking spaces or part thereof. Where parking spaces are provided, parking spaces for use by persons with physical disabilities should also be provided for each accessible viewing position and for each accessible sleeping room or bed space. Parking spaces for use by persons with physical disabilities should
(1) be not less than 2400 mm wide and provided on one side with an access aisle not less than 1500 mm wide,
(2) have a firm, slip-resistant and level surface,
(3) be located close to an entrance required to conform to Article 3.8.2.2.,
(4) be clearly marked as being for the use of persons with physical disabilities, and
(5) be identified by a sign located not less than 1500 mm above ground level, with the International Symbol of Access (Figure A-3.8.2.5.-A).

Figure A-3.8.2.5.-A
International Symbol of Access" sign

Asphalt, concrete and firm, compacted gravel are acceptable parking surfaces. Curb ramps should be not less than 1,500 mm wide. Parallel parking spaces should be not less than 7,000 mm long. If more than one parking space is provided for persons with physical disabilities, a single access aisle can serve two adjacent parking spaces. The arrangement shown in Figure A-3.8.2.5.-B allows the shared use of an access aisle to serve two adjacent parking spaces provided for use by persons with physical disabilities. Parking to accommodate vans and other vehicles equipped with platform lifts or side ramps should be provided greater dedicated space.

The design of the path of travel should accommodate loading to and from lifts and ramps, where intended. Vertical clearance must also be considered.

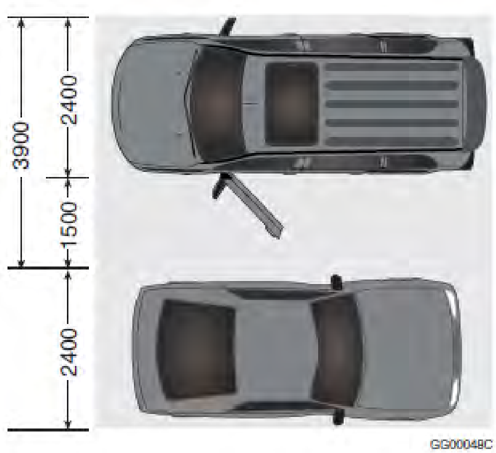


Figure A-3.8.2.5.-B
Shared access aisle

A-3.8.2.5.(1) Path of Travel to Parking. It is not intended that a separate accessible entrance must be provided from the parking area. The designer may choose to designate the entrance leading to the parking area as the required entrance or to provide a properly identified and unobstructed path of travel from the parking area to the entrance which is accessible. The entrance chosen should, in any case, be the closest entrance to the parking area and one normally used by the occupants of the building. Long paths of travel are not recommended.

A-3.8.2.6.(1) Application to Security Access Systems. Sentence 3.8.2.6.(1) is not intended to reduce the functionality of security devices that limit access to secure areas and are addressed by other Sections of the Building By-law.

A-3.8.2.6.(2) Electrical Outlets. Electrical outlets intended for occupant use shall be located so that their height above the finished floor is not a barrier to use. Outlets that are dedicated for specific equipment or functions and not intended to be readily available to occupants need not conform to the location requirements.

A-3.8.2.8.(1) to (3) Washrooms. The primary intent of this requirement is that all regular washrooms be made accessible to
all persons, including persons with disabilities, primarily persons who must use a wheelchair. Well-designed washrooms which can accommodate persons with disabilities need not be much larger than conventional washrooms.
The exception in Clause 3.8.2.8.(2)(b) recognizes situations where several washrooms may be provided on a large floor area. In such a case, not all washrooms need to be accessible, provided that an accessible washroom is available within a reasonable distance (45 m) of one that is not and that the location of that accessible washroom is clearly indicated as required by Sentence 3.8.2.10.(2). However, where several washrooms are provided in an area together, the accessible washrooms should be included among them.

Clause 3.8.2.8.(2)(d) is intended to address “strip malls” (a shopping mall with no public corridor). Section 3.7., which requires plumbing facilities, does not address the concept of suite and could permit, for instance, a shopping mall containing only mercantile occupancies to have only one washroom for each sex located in any one of the suites. It is desirable, however, that washrooms be located so as to be accessible at all times, since the owner or tenant of one suite has no control over the activities of another. These buildings may have either public accessible washrooms in a central location or washrooms which can accommodate persons with physical disabilities in each suite. This arrangement relieves any one tenant from having to provide “public” washrooms. Hence, the exception is meant as a relaxation to avoid an unnecessary burden on small facilities but should not be construed as meaning that these buildings need not provide accessible Sentence (3) requires an accessible universal washroom in every building required to have water closets. There are a significant number of persons with disabilities whose daily lives depend on assistance from their spouse or a care giver of the opposite sex. Providing this assistance in multiple stall public washrooms can be an added challenge. The universal washroom not only solves this problem but also serves the needs of other persons with disabilities who simply prefer the relative ease of using a universal washroom. It can also serve as a washroom for parents with small children and, with the addition of a counter, as a changing room for infants.

A-3.8.2.8.(9) Drinking Fountains. Similar to drinking fountains designed and located to be accessible, bottle filling stations should also be designed and located to be accessible. Drinking fountains and bottle filling stations should be indicated with appropriate signage.

A-3.8.2.9. Assistive Listening Devices. Assistive listening devices may be used where audible communication is expected but may be obstructed, such as at screened ticket windows or service counters in noisy areas. Available assistive listening devices should be indicated with appropriate signage.

A-3.8.2.11.(1) Counters with Work Surfaces. It is not intended that all counters be accessible, but that sufficient accessible counter space be available. Examples of counters that should be accessible for the purposes of extended business transactions include teller counters in financial institutions and reception areas as well as any counter at which processing and signing of documents takes place. The provision is not intended to apply to the simple exchange of money for goods or services such as at a retail check-out counter or check-in counters where tickets are presented, or to work surfaces in industrial occupancies.

A-3.8.3.1.(2) Enhanced Accessiblity for Residential Buildings. These measures are designed to provide a series of modest accessibility improvements to multi-unit residential buildings at minimal cost, using some of the concepts of universal design. They are designed to enable disabled persons to visit and socialize with people in their homes. They also include simple provisions which will facilitate future adaptation of a dwelling unit so that the unit may be occupied by a person with a range of physical mobility restrictions, and are intended to extend the length of time that elderly persons may remain safely in their own homes.

It should be noted that these improvements apply only to newly constructed multi-unit residential buildings containing three or more suites and served by an elevator and a common corridor. They are NOT intended to provide full accessibility and do not, except where explicitly stated, require conformance to Article 3.7.2.10. and Articles 3.8.1.1. to 3.8.2.3.

A-3.8.3.1.(1) Accessible Design Standards. By-law users who opt to apply the CSA B651 provisions listed in Table 3.8.3.1. must do so without exception: they cannot randomly select and apply a mix of provisions from the Building By-law and that standard.

A-3.8.3.2.(2) Surfaces in an Accessible Path of Travel. Floor finishes, including walk-off matts and carpet, should be selected, installed and securely fixed to provide a firm and stable surface so that persons using wheelchairs, walkers or other mobility aids can easily travel over them without tripping or expending undue energy. Other than very high-density, short-pile carpeting, most carpeting does not meet these criteria.

Furthermore, where the path of travel is exposed to intense light conditions, such as daylight or directional lighting, a low-glare or matte floor surface should be selected, as glare from floor surfaces can influence all users' perception and be particularly problematic for persons with low vision. For the same reasons, heavily patterned flooring should also be avoided.

A-3.8.3.2.(3) Passenger-Elevating Devices. Inclined moving walkways that are used to provide access should not have a running slope steeper than 1 in 20.

A-3.8.3.2.(6)(a) Mechanical Lifts. The provisions for mechanical lifts are not intended for general use to provide accessibility in an exterior location due to its susceptibility to weather or lack of maintenance. It is therefore intended that these be installed only where topography or other similar existing site constraints necessitate the use of a platform lift as the only feasible alternative. US ADA While the site constraint must reflect exterior conditions, the lift can be installed in the interior of a building. For example, a new building constructed between and connected to two existing buildings may have insufficient space to coordinate floor levels and also to provide ramped entry from the public way. In this example, an exterior or interior platform lift could be used to provide an accessible entrance or to coordinate one or more interior floor levels.

A-3.8.3.4.(2) Parking Requirements for Persons with Disabilities. The number, size and headroom clearance required for parking stalls for persons with disabilities must comply with the City of Vancouver Parking By-law. It should be noted that under the authority of the Parking By-law, the number of parking stalls for persons with disabilities may be relaxed by the Director of Planning. Unless specifically relaxed by the Director of Planning, the following table outlines the required number of parking stalls for persons with disabilities in accordance with Section 4 of the Parking By-law:

> In accordance with Section 4 of the Parking By-law, all parking stalls for persons with disabilities are required to be provided with a minimum width of 4.0 m, a length of 5.5 m and a vertical clearance of 2.3 m. The minimum 2.3 m vertical clearance must be provided above the disability parking stall as well as above the entrance and drive aisle providing access to the required disability parking space in accordance with Section 4 of the Parking By-law. These requirements are intended to apply to existing buildings only where it is reasonable. In cases where no development permit is required, the Chief Building Official, in consultation with the Director of Planning and the City Engineer, may relax the length, width and vertical clearance

requirements for existing buildings where the provisions cannot be reasonably accommodated. Relaxations for the size and vertical height clearance of disabled parking stalls may be granted to development permit applications by the Director of Planning in consultation with the Chief Building Official and City Engineer.

Table A-3.8.3.4.(2)
Table of Required Disability Parking Spaces

Required Number of Disability Parking Spaces	Total Number of Parking Spaces Provided		
	Column 1	Column 2	Column 3
0	0 – 9	0	0 - 24
1	10 - 39	1	25 - 74
2	40 - 74	2 - 29	75 - 149
3	75 - 124	30 - 44	150 - 249
4	125 - 174	45 - 59	250 - 349
One additional disability parking space	For any portion of each additional 50 parking spaces	For any portion of each additional 15 parking spaces	For any portion of each additional 100 parking spaces

Notes to Table A-3.8.3.4.(2):
Column 1 – Multiple dwelling units, retail uses, hospitals, health care offices, health enhancement centres, animal clinics, hotels, churches, chapels, funeral homes, places of worship or similar places of assembly.
Column 2 – Special Needs Residential Facilities - Community Care - Class B and Special Needs Residential Facilities - Congregate Housing for Seniors.
Column 3 – Office, theatre uses and all other uses not mentioned for Columns 1 and 2.

A-3.8.3.5.(1)(b) Ramp Slopes. Ramps with a slope of more than 1 in 16 can be very difficult for persons with certain physical disabilities to manage. Even though they pose less of a problem for persons using motorized wheelchairs, these ramps can be unsafe to descend, especially in cold climates. Although Article 3.8.3.5. permits slopes on ramps as great as 1 in 12 for distances of up to 9 m, slopes of 1 in 20 are safer and less strenuous. When limited space is available, as may be the case during renovations, ramps with a slope of up to 1 in 12 should be restricted to lengths not exceeding 3 m whenever possible. A strip contrasting in colour and texture should be used at the top and bottom of ramps to warn persons with low or no vision.

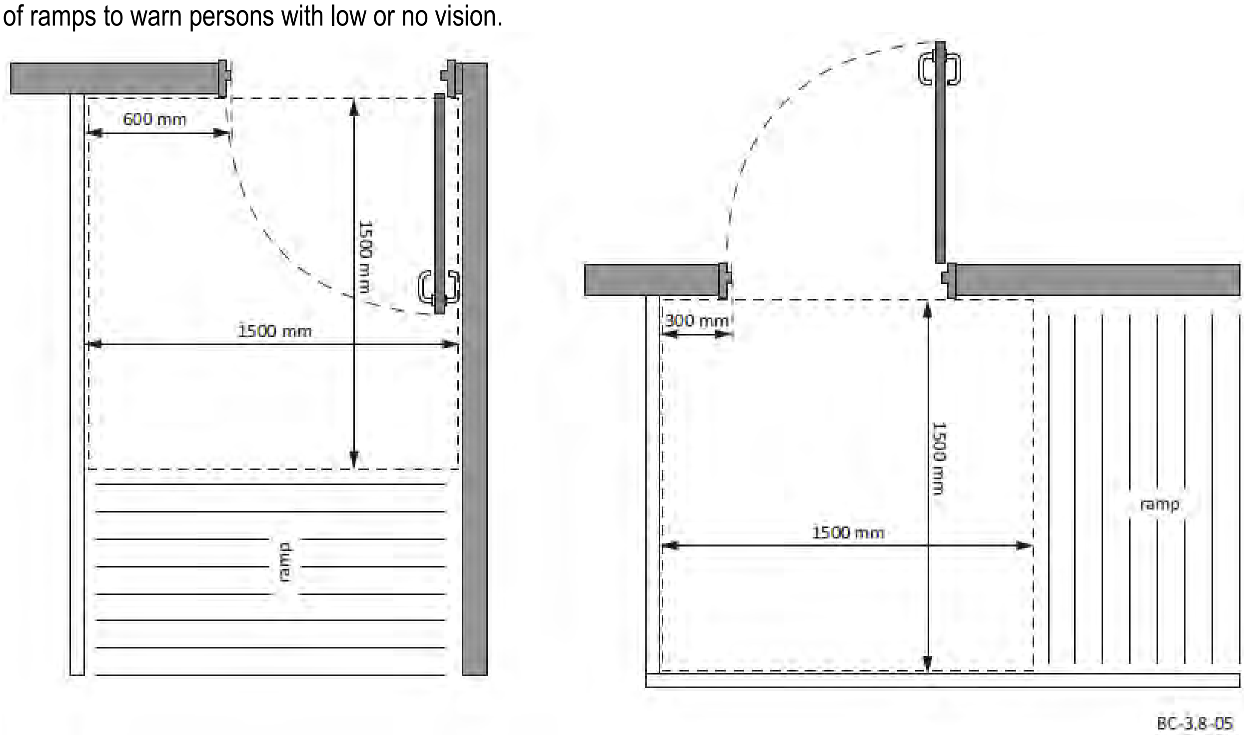


Figure A-3.8.3.5.(1)(c)
Landing design at doorways leading to ramps

A-3.8.3.5.(4)(a) Surface of Ramps. Sentence 3.8.3.2.(2) requires that all walking surfaces in an accessible path of travel be stable and firm to limit the effort required by persons using wheelchairs or other mobility aids. Therefore, Sentence 3.8.3.5.(4) requires that hard or resilient flooring be used on the surfaces of steeper ramps. Furthermore, carpet and like materials should not be installed on any ramp.

A-3.8.3.6.(2) Doorway Width. Standard wheelchair width specifications indicate a range of sizes from 584 mm overall to 685 mm overall. Every doorway that is located in an accessible path of travel must have a clear width of not less than 850 mm when the door is in the open position and therefore it is important that this dimension be measured correctly. Figure A-3.8.3.6.(2) shows a door opened to 90°. It is clear that the door, and to a lesser extent the stop, impinges on the space within the door frame. The clear width of not less than 850 mm is measured from the face of the door in the open position of 90° to the doorway to the outside edge of the stop on the door frame. It is not sufficient just to measure the inside width of the door frame. The hardware selected on sliding doors, such as d-shaped handles, may result in a clear width being substantially less than the inside dimension of the door frame. The clear width for sliding doors is measured from the edge of the open door to the outside edge of the stop on the door frame. Other factors, including location of door stops other than on the door frame, and the installation of door closers and exit devices, should be taken into account. The intrusion of a door handle or an exit device into the space is of lesser
importance because its height above the floor does not typically obstruct passage of a wheelchair. It is recognized that there are many types of door frame and door mounts but the overall objective is to maintain a clear width of not less than 850 mm. The diagram Figure 3.8.3.6.(2) depicts a somewhat restrictive scenario, as many doors can open wider than 90°, however, a door smaller than 914 mm would not likely be wide enough to ensure the minimum clear width of 800850 mm that is required. Swing of a door beyond 90° may be of less benefit as extended reach to close the door may be required once the doorway is passed through.

In a doorway with multiple swinging leaves, the active leaf must be capable of providing the required clear width in the open position. The clear width is then measured from the face of the active leaf, in the open position of 90° to the doorway, to the outside edge of the adjacent leaf when the adjacent leaf is in the closed position.

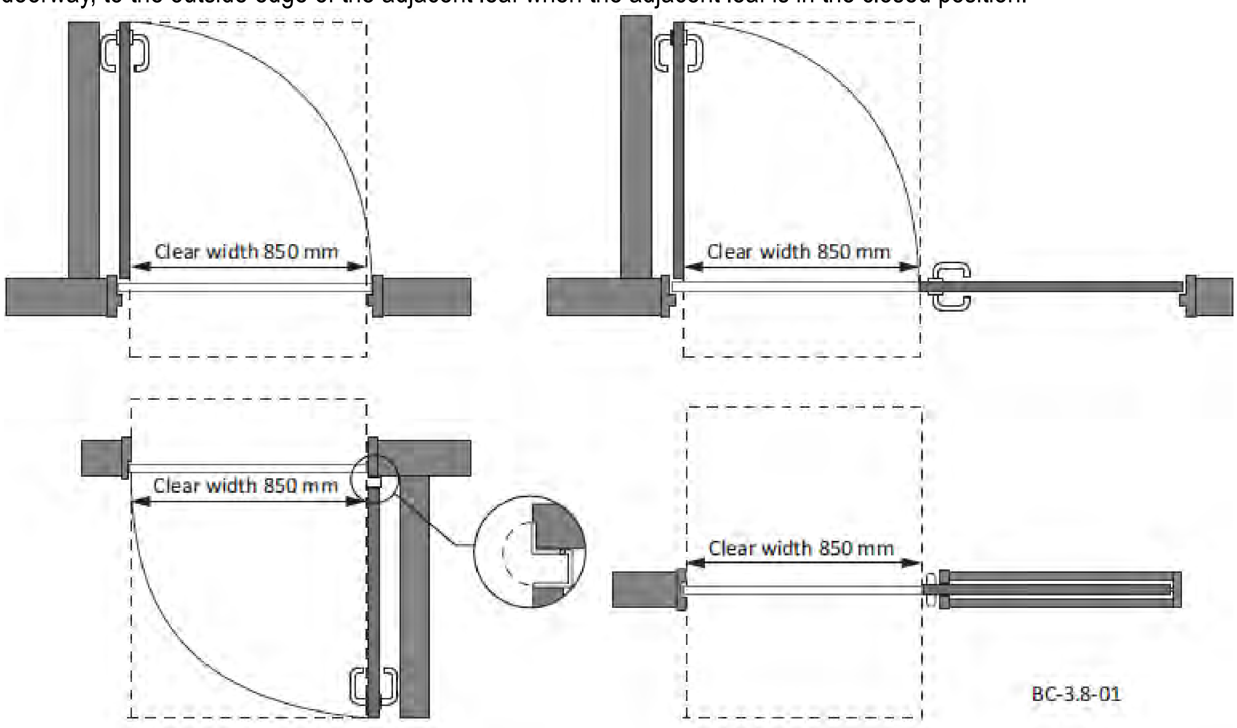


Figure A-3.8.3.6.(2)
Clear doorway width

A-3.8.3.6.(3) Washrooms in Residential Occupancies. This requirement ensures that the doorway to the washroom in a dwelling unit or a hotel or motel suite is at least large enough to accommodate someone using a wheelchair. The By-law does not require these washrooms to be accessible, in order to avoid a set of prescriptive requirements which could limit design flexibility.

However, it is relatively simple to make washrooms accessible through careful planning and positioning of fixtures and this can be achieved in an area not much larger than that of conventional washrooms.

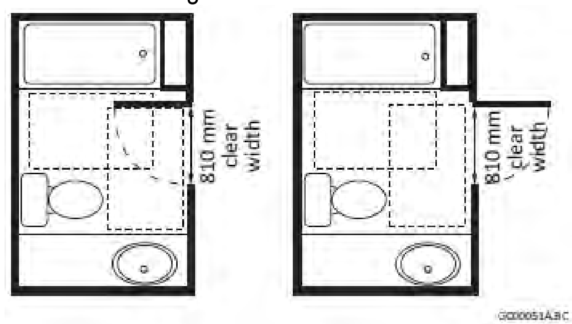


Figure A-3.8.3.6.(3)
Residential washrooms

A-3.8.3.6.(4) Lever Handles. Lever handles are usable by most persons with limited hand mobility and will meet the intent of this requirement. Lever handles with an end return towards the door are less prone to catch the clothing of someone passing through the doorway. Large D-shaped handles should be used on sliding doors.

A-3.8.3.6.(6) and (7) Doors with Power Operators. Doors equipped with a power operator actuated by a pressure plate identified with the international symbol for accessibility or, where security is required, by a key, card or radio transmitter, and that can otherwise be opened manually, meet the intent of the requirement. The location of these actuating devices should ensure that a wheelchair will not interfere with the operation of the door once it is actuated. Swinging doors equipped with power operators which are actuated automatically and open into passing pedestrian traffic should be provided with a guard or other device designed to prevent pedestrians from stepping in the swing area of the door. These guards or devices should be detectable by blind persons. For example, inverted U-shaped guards should have an additional rail at a height not more than 680 mm so that it is detectable by the long cane. These doors should also have a device (mat or other sensor) on the swing side to prevent the door from opening if someone is standing in the swing area.

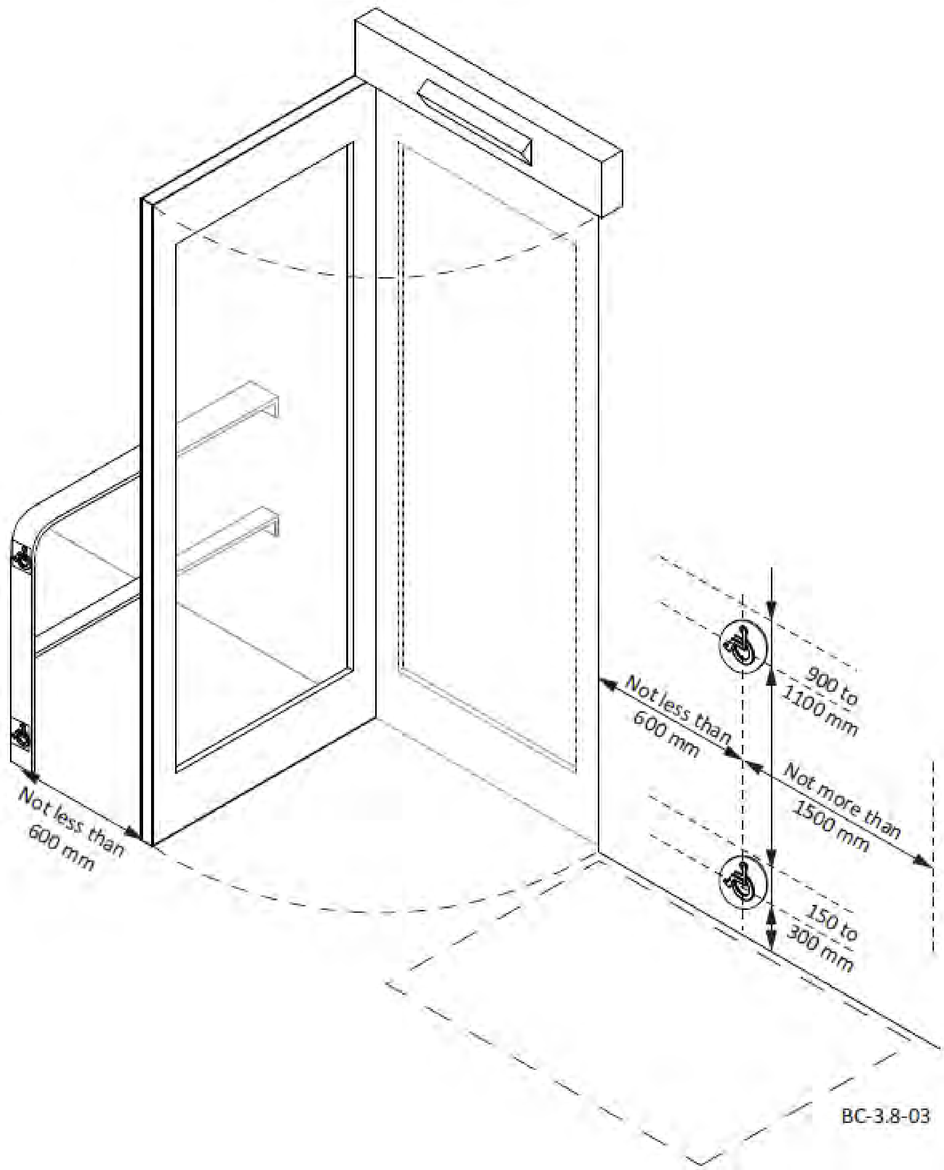


Figure A-3.8.3.6.(6) and (7)
Power operated doors

A-3.8.3.6.(9) Air Pressure Differences. Differences in air pressure on opposite sides of a door may be due to the operation of mechanical systems such as those associated with smoke control. So-called “stack action” in buildings in winter can also cause differential pressures due to the buoyancy of warm air. Stack action is usually most noticeable between stairwells and the remainder of the building, and at the entrances to buildings; the taller the building, the greater the effect. Doors with automatic closers have to operate with sufficient opening force to allow the return action to overcome the differential pressure.

A-3.8.3.6.(10) Delayed Action on Door Closers. In some circumstances, closers with a delay feature which keeps the door open for several seconds before it begins to close might be desirable. However, closers with this feature have limited back-check, a feature of a normal door closer where resistance to opening increases as the door reaches the full arc of swing. Doors equipped with a to force it closed, thinking the closer has failed to operate. Delayed action closers are not recommended for such occupancies as schools.

A-3.8.3.6.(11) Clearance at Doorways. Sufficient clearance must be provided on the latch side of doors for a user to operate the door-opening mechanism and open the door without interference from the wheelchair. This is particularly important for a door swinging towards the approach side. See Figure A-3.8.3.6.(11).

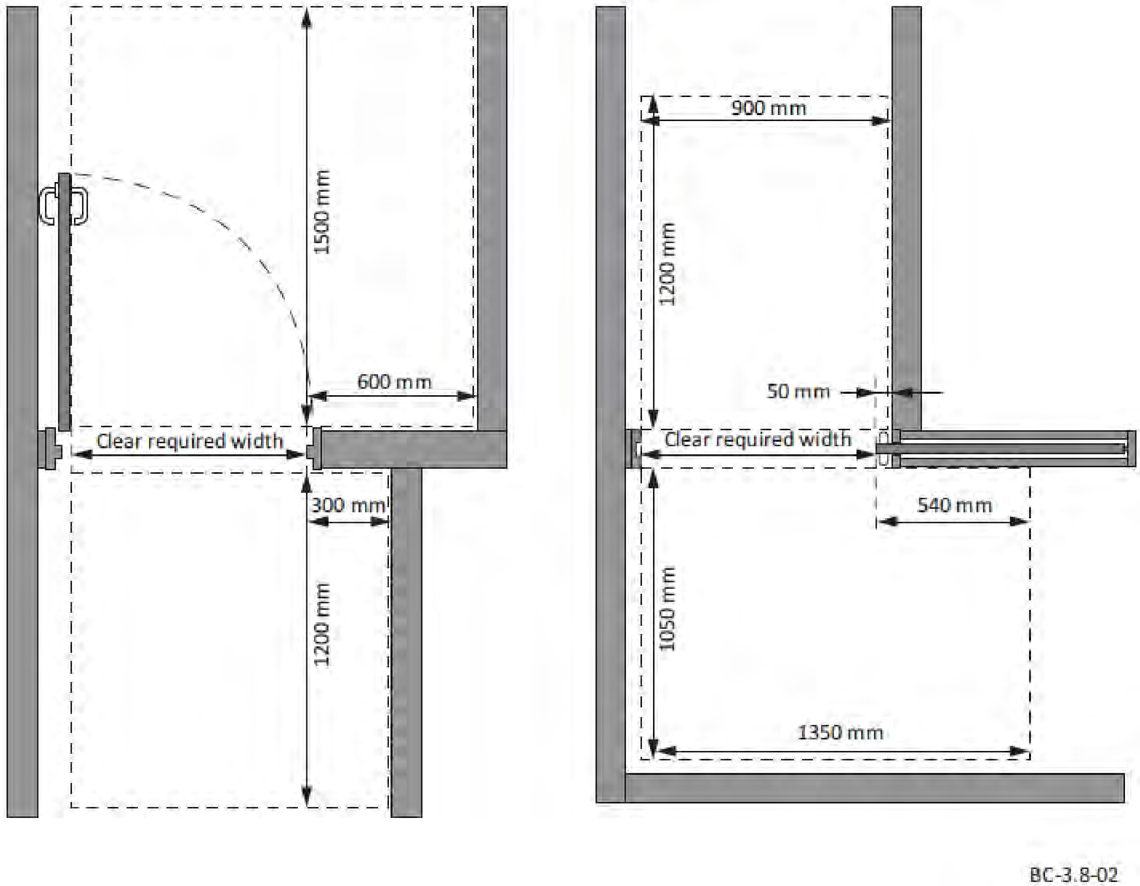


Figure A-3.8.3.6.(11)
Doorway clearance

A-3.8.3.9.(1) Accessibility Signs. The International Symbol of Access shown in Figure A-3.8.3.9.(1)-A indicates to persons with physical disabilities that they will have reasonable freedom of movement within a building so signed. The symbol is usually white on a blue background; where these colours do not stand out, the sign can be set on a white background. An arrow can be added to indicate direction or the location of an accessible space or facility.

Figure A-3.8.3.9.(1)-A
Signs indicating accessible facilities

The International Symbol of Access for Hearing Loss shown in Figure A-3.8.3.9.(1)-B, which indicates accessibility for persons who are deaf or hard of hearing, should be used to indicate the availability of variable volume controls on telephones, assistive listening systems, and text telephones (TT). These latter devices may also be referred to as teletypewriters (TTY) or telecommunications devices for the deaf (TDD).

Figure A-3.8.3.9.(1)-B
Signs for assistive listening facilities

When characters are used on signs to indicate accessible features, Arabic numerals and sans-serif letters with a stroke width to height ratio from 1 in 6 to 1 in 10 and a character width to height ratio from 3 in 5 to 1 in 1 should be used. Characters identifying doors and openings that lead from public areas and through which the public is permitted to pass should consist of Arabic numerals or sans-serif letters or both, be not less than 25 mm high and raised between 0.7 mm and 3 mm with a stroke to height ratio for ease of reading by touch. This identification should be located at the side of the doors or openings, centred 1 350 mm above the finished floor and within 150 mm of the jamb.

A-3.8.3.9.(5) Tactile Walking Surface Indicators. Figure 3.8.3.9.(5) illustrates acceptable designs of tactile walking surface indicators.

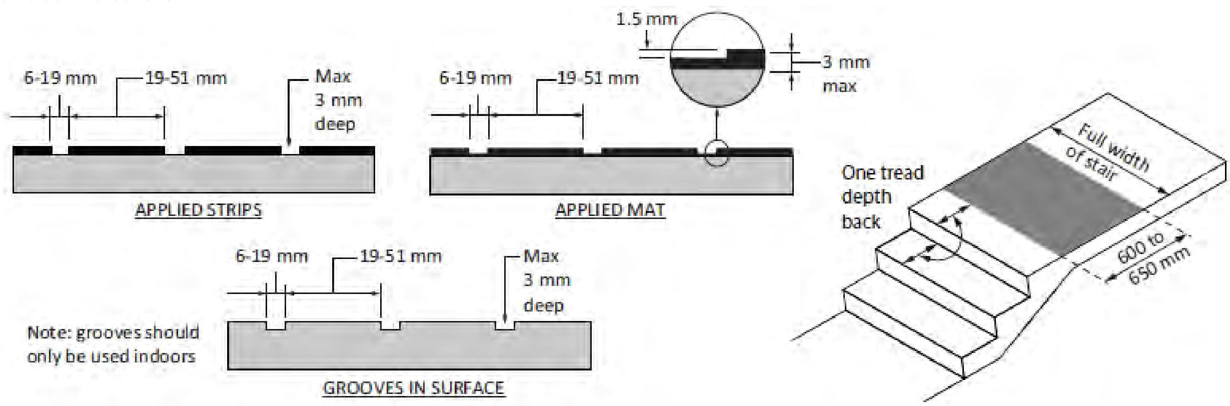


Figure A-3.8.3.9.(5)
Tactile walking surface indicators

A-3.8.3.11.(1)(c)(v) Water-closet Stalls. Doors to water-closet stalls for persons with physical disabilities should swing outward, preferably against a side wall.

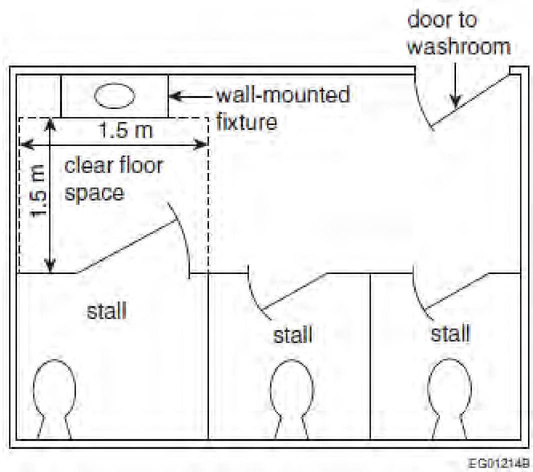


Figure A-3.8.3.11.(1)(c)(v)
Water-closet stalls

A-3.8.3.11.(1)(c)(vi) Door Pulls. The door pull should consist of a D-shaped handle mounted horizontally. The centre lines are the lines drawn through the long axis and the short axis of the handle. The midpoint of the handle must be located horizontally at 200 to 300 mm from the hinged side of the door and vertically at 900 to 1 100 mm above the finished floor surface.

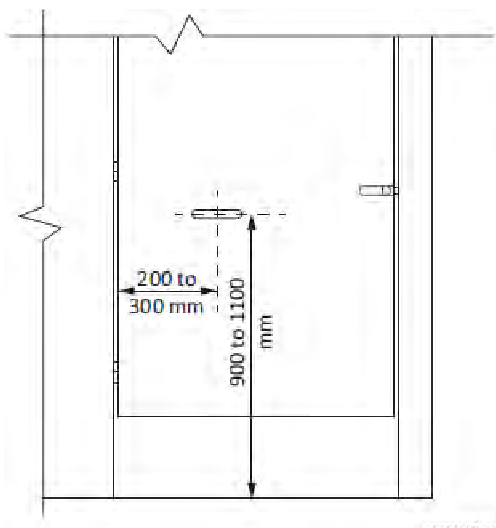


Figure A-3.8.3.11.(1)(c)(vi)-A
Door pull location

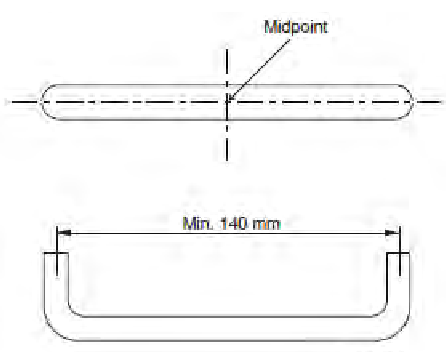


Figure A-3.8.3.11.(1)(c)(vi)-B
Door pull details

A-3.8.3.11.(1)(e)(ii) Additional Grab Bars. It is the designer's prerogative to exceed the minimum requirements found in the Building By-law and specify the installation of additional grab bars in other locations. These additional grab bars may be of different configurations and can be installed in other orientations.

A-3.8.3.12. Universal Washrooms. Unobstructed areas in front of the lavatory, in front of the water closet and on one side of the water closet are necessary for maneuverability of a wheelchair. Fixtures, including additional fixtures, should be located so as to be useable and also to provide maneuverability for persons using wheelchairs. Wall-mounted fixtures may project into the required floor space, provided that such projections do not restrict the maneuvering space required for persons using wheelchairs. Although power operated and outward swinging doors are preferable for accessibility, manually operated as well as inward swinging doors are also permitted. Figures A-3.8.3.12.-A and A-3.8.3.12.-B show design options that meet the intent of Article 3.8.3.12.

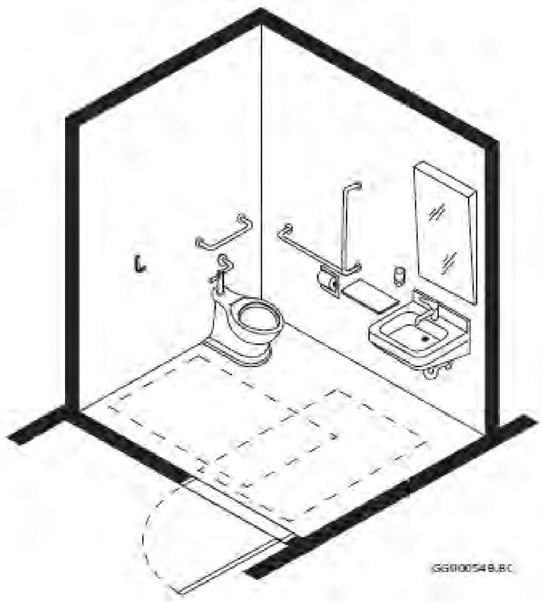


Figure A-3.8.3.12.-A
Universal washroom with outward swinging door

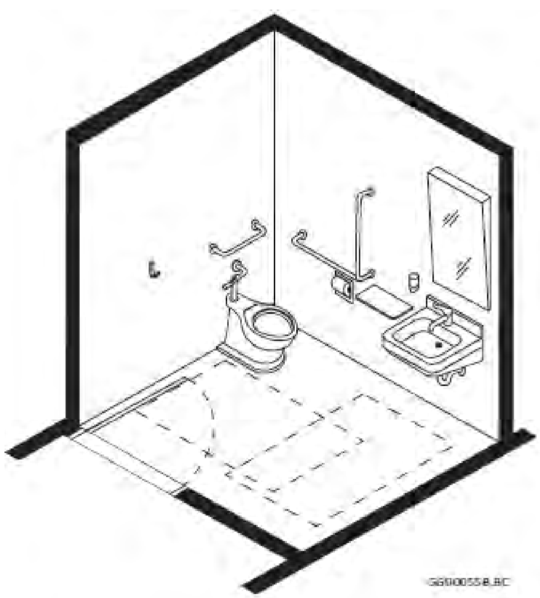


Figure A-3.8.3.12.-B

Universal washroom with inward swinging door

A-3.8.3.13.(1) Water Closets. Wall- or floor-mounted water closets with recessed bases are preferable because they provide the least amount of obstruction.

Wheelchair users generally require a higher water closet seat to facilitate transfer from their chair to the water closet. Removable high-lift seats are not recommended in public washrooms as they could be removed or damaged by vandals. Permanently installed vandal resistant high-lift seats are available for installation on standard height water closets and these could be considered in place of the high bowl required.

A-3.8.3.15.(1)(d) Clearances Beneath a Lavatory.

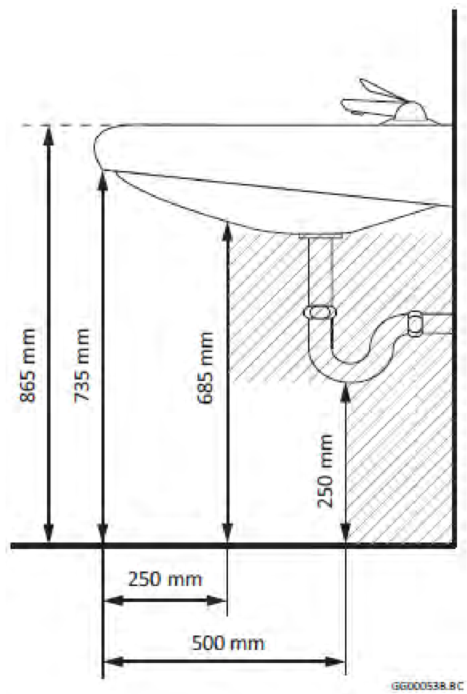


Figure A-3.8.3.15.(1)(d)
Clearances beneath a lavatory

A-3.8.3.15.(1)(e) Pipe Protection. The pipes referred to in Clause 3.8.3.15.(1)(e) include both supply and waste pipes. The hazard can be prevented by insulating the pipes, by locating the pipes in enclosures, or avoided by limiting the temperature of the hot water to a maximum of 45°C.

A-3.8.3.15.(1)(f) Soap Dispenser Location. The location of accessories, such as soap dispensers and faucets, serving accessible lavatories should be established while taking into consideration that their controls must be usable by and within the direct reach of a person in a seated position directly in front of the accessible lavatory.

A-3.8.3.16.(1)(b) Clear Space at Entrances to Showers. The clear space at the entrance to a shower may be encroached upon by fixtures such as a wall hung sink which does not interfere with the leg rests of the wheelchair. However, this sink could restrict movement for persons who need to make a lateral transfer if it were installed at the seat end of the shower.

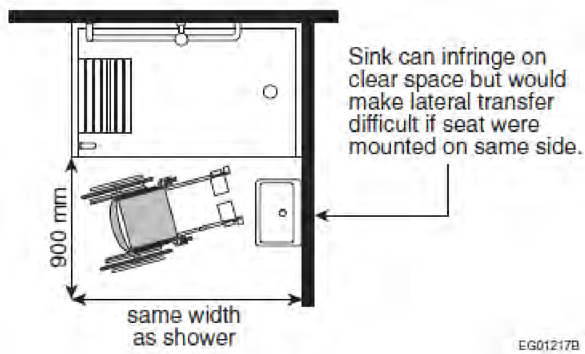


Figure A-3.8.3.16.(1)(b)
Shower design

A-3.8.3.16.(1)(f) Grab Bars. One L-shaped grab bar is required to be installed on the wall next to the seat. A grab bar behind the seat would prevent the user from leaning back against the wall, while one located on the wall opposite the seat cannot be reached from the seated position. The seat itself may be used in conjunction with the bar for transfer. If design flexibility is required, fold away grab bars can be used as an alternative.

A-3.8.3.17. Bathtubs. Hand showers should be located at the same end of the bath as the controls and accessories such as soap holders should be located and useable within direct reach of a person in a seated position.

A-3.8.3.18. Assistive Listening Systems. Wireless sound transmission systems, including FM, infrared or magnetic induction loop systems, improve sound reception for persons who are deaf or hard of with hearing disabilities by providing amplification which can be adjusted by each user while blocking out unwanted background noise. These systems transmit a signal that is picked up by a special receiver available for use by a person who is deaf or hard of with a hearing disability, whether or not a hearing aid is used. Neither system interferes with the listening enjoyment of others.

The transmitter can be jacked into an existing P.A. system amplifier or used independently with microphones. The induction loop system requires users to sit in the area circumscribed by the loop; though installation of the loop is relatively simple, the installer should be knowledgeable about these systems if proper functioning is to be achieved. FM or infrared systems can be designed to broadcast signals which cover the entire room and thus do not restrict seating to any one area. Figures A-3.8.3.18.-A and A-3.8.3.18.-B show the general configuration of FM and infrared systems. Although portable systems (FM in particular) are available, these are best suited to small audiences. Generally, the systems installed in church halls, auditoria, theatres and similar places of assembly are not easily portable, as they are installed in a fixed location by a sound technician and form an integral part of the P.A. system of the room
or building.
Hard-wired systems (where a jack is provided at a particular seat) will not meet this requirement unless adequate provisions are made to accommodate persons with hearing aids. In choosing the most appropriate system, a number of factors must be taken into account including cost, installation and maintenance, suitability to the audience, ease of operation and the need for privacy. Information on designers and suppliers of these systems may be obtained from the Canadian Hearing Society.

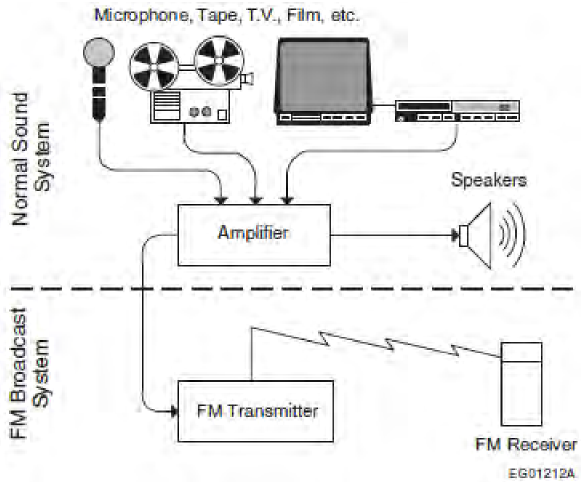


Figure A-3.8.3.18.-A
FM sound transmission system

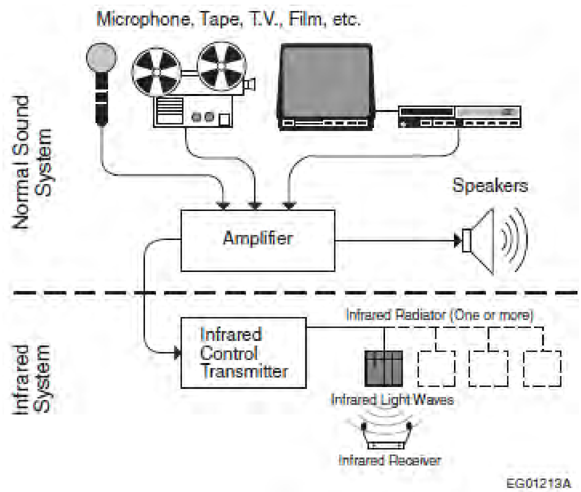


Figure A-3.8.3.18.-B
Infrared sound transmission system

A-3.8.3.20. Telephone Shelves or Counters. Built-in shelves or counters for public telephones must be designed to accommodate persons using text telephones (TT). These devices may also be referred to as teletypewriters (TTY) or telecommunication devices for the deaf (TDD). These devices require a level surface at least 305 mm deep by 250 mm wide with no obstruction above that space within 250 mm. If a wall-hung telephone or other obstruction extends to less than 250 mm from the shelf or counter, an equivalent clear space must be provided on either side of each telephone. At least one telephone should be equipped with a volume control on a receiver that generates a magnetic field compatible with the T-switch of a hearing aid. The lower portion of the shelf or counter is intended for persons using a wheelchair; therefore all parts of the operating mechanism of the telephone above this portion should be within reach of a wheelchair user.

Signage should identify accessible public telephones as being useable by persons using wheelchairs and persons who are deaf or hard of hearing.

A-3.8.3.22. Sleeping Rooms and Bed Spaces. Figure A-3.8.3.22. illustrates an acceptable layout of an accessible sleeping area.

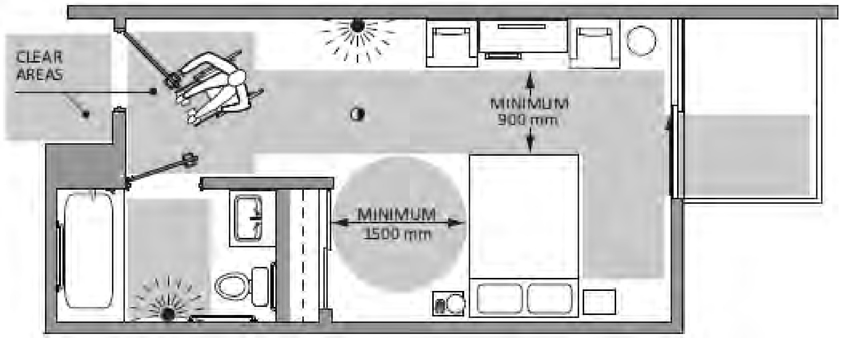


Figure A-3.8.3.22.
Sleeping rooms and bed spaces

A-3.8.5.3.(1) Entrance Doors to Dwelling Units. The Chief Building Official will accept the addition of one or two peepholes in a listed door in order to meet the requirements of Clause (1)(a) and to meet the required fire protection rating.

A-3.8.5.4.(1). Adaptable Dwelling Unit Doorways. Where sliding doors are used to provide access, it is necessary to consider the door hardware when determining clear width. Accessible hardware described in Sentence 3.8.3.6.(4) may result in a sliding door standing out from the jamb when in the open position. If not provided with the door during initial construction, accessible hardware when installed must not reduce the clear width of opening to less than required for access.

A-3.8.5.5. Adaptable Dwelling Unit Bathrooms. Figure A-3.8.5.5. illustrates an acceptable layout of an adaptable dwelling unit bathroom.

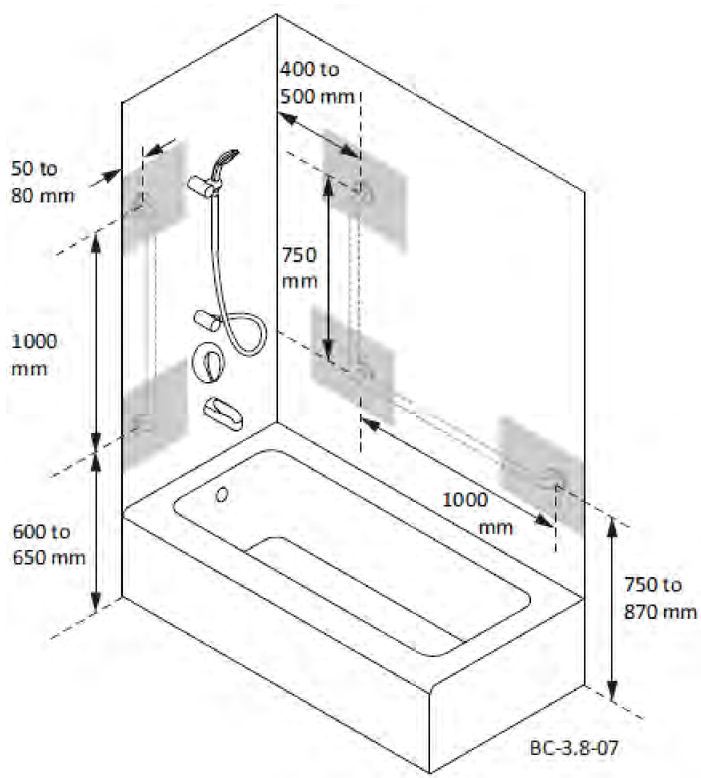


Figure A-3.8.5.5.
Adaptable Dwelling Unit Bathrooms

Despite the requirements of Article 3.8.5.5., the Chief Building Official may accept a lesser standard.

A-3.8.5.5.(3) Grab Bar Installation. This provision is intended to ensure there is adequate backing for the installation of grab bars by the occupant of the adaptable dwelling unit in the future. For example, plywood or solid lumber behind the wall finish and encompassing the location of future grab bars located as described in Clause 3.8.3.11.(1)(e) and Clause 3.8.3.16.(1)(f) or 3.8.3.17.(1)(f) would provide suitable backing for the grab bar fasteners

Part 4
Structural Design

Section 4.1. Structural Loads and Procedures

4.1.1. General

4.1.1.1. Scope

1) The scope of this Part shall be as described in Subsection 1.3.3. of Division A.

4.1.1.2. Definitions

1) Words that appear in italics in this Part are defined in Article 1.4.1.2. of Division A.

4.1.1.3. Design Requirements

1) *Buildings* and their structural members and connections, including formwork and falsework, shall be designed to have sufficient structural capacity and structural integrity to safely and effectively resist all loads, effects of loads and influences that may reasonably be expected, having regard to the expected service life of *buildings*, and shall in any case satisfy the requirements of this Section. (See Note A-4.1.1.3.(1).)

2) *Buildings* and their structural members shall be designed for serviceability, in accordance with Articles 4.1.3.4., 4.1.3.5. and 4.1.3.6. (See Note A-4.1.1.3.(2).)

3) All permanent and temporary structural members, including the formwork and falsework of a *building*, shall be protected against loads exceeding the specified loads during the construction period except when, as verified by analysis or test, temporary overloading of a structural member would result in no impairment of that member or any other member.

4) Falsework, scaffolding, and formwork shall be designed in conformance with

a) CSA S269.1, "Falsework for Construction Purposes,"

b) CAN/CSA-S269.2-M, "Access Scaffolding for Construction Purposes," or

c) CAN/CSA-S269.3-M, "Concrete Formwork."

5) Precautions shall be taken during all phases of construction to ensure that the *building* is not damaged or distorted due to loads applied during construction.

4.1.1.4. Structural Drawings and Related Documents

1) Structural drawings and related documents shall conform to the appropriate requirements of Section 2.2. of Division C. (See Subsection 2.2.4. of Division C.)

4.1.1.5. Design Basis

1) Except as provided in Sentence (2), *buildings* and their structural members shall be designed in conformance with the procedures and practices provided in this Part.

2) Provided the design is carried out by a person especially qualified in the specific methods applied and provided the design demonstrates a level of safety and performance in accordance with the requirements of Part 4, *buildings* and their structural components falling within the scope of Part 4 that are not amenable to analysis using a generally established theory may be designed by

a) evaluation of a full-scale structure or a prototype by a loading test, or

b) studies of model analogues.

(See Note A-4.1.1.5.(2).)

4.1.2. Specified Loads and Effects

4.1.2.1. Loads and Effects

(See Note A-4.1.2.1.)

1) Except as provided in Article 4.1.2.2., the following categories of loads, specified loads and effects shall be taken into consideration in the design of a *building* and its structural members and connections:

- D — *dead load* – a permanent load due to the weight of building components, as specified in Subsection 4.1.4.,
- E — earthquake load and effects – a rare load due to an earthquake, as specified in Subsection 4.1.8.,
- H — a permanent load due to lateral earth pressure, including *groundwater*,
- L — *live load* – a variable load due to intended use and *occupancy* (including loads due to cranes and the pressure of liquids in containers), as specified in Subsection 4.1.5.,
- L_{XC} — *live load* exclusive of crane loads,
- C — *live load* due to cranes including self weight,
- C_d — self weight of all cranes positioned for maximum effects,
- C_7 — crane bumper impact load,
- P — permanent effects caused by pre-stress,
- S — variable load due to snow, including ice and associated rain, as specified in Article 4.1.6.2., or due to rain, as specified in Article 4.1.6.4.,
- T — effects due to contraction, expansion, or deflection caused by temperature changes, shrinkage, moisture changes, creep, ground settlement, or a combination thereof (See Note A-4.1.2.1.(1).), and
- W — wind load – a variable load due to wind, as specified in Subsection 4.1.7.,

where

a) load means the imposed deformations (i.e. deflections, displacements or motions that induce deformations and forces in the structure), forces and pressures applied to the *building* structure,

b) permanent load is a load that changes very little once it has been applied to the structure, except during repair,

c) variable load is a load that frequently changes in magnitude, direction or location, and

d) rare load is a load that occurs infrequently and for a short time only.

2) Minimum specified values of the loads described in Sentence (1), as set forth in Subsections 4.1.4. to 4.1.8., shall be increased to account for dynamic effects where applicable.

3) For the purpose of determining specified loads S, W or E in Subsections 4.1.6., 4.1.7. and 4.1.8., *buildings* shall be assigned an Importance Category based on intended use and *occupancy*, in accordance with Table 4.1.2.1. (See Note A-4.1.2.1.(3).)

Table 4.1.2.1.
Importance Categories for Buildings
Forming Part of Sentence 4.1.2.1.(3)

Use and *Occupancy*	Importance Category
Buildings that represent a low direct or indirect hazard to human life in the event of failure, including: • low human-*occupancy buildings*, where it can be shown that collapse is not likely to cause injury or other serious consequences • minor storage *buildings*	Low(1)
All *buildings* except those listed in Importance Categories Low, High and Post-disaster	Normal
Buildings that are likely to be used as post-disaster shelters, including *buildings* whose primary use is: • as an elementary, middle or secondary school	High

• as a community centre Manufacturing and storage facilities containing toxic, explosive or other hazardous substances in sufficient quantities to be dangerous to the public if released[(1)]	
Post-disaster buildings are *buildings* that are essential to the provision of services in the event of a disaster, and include: • hospitals, emergency treatment facilities and blood banks • telephone exchanges power generating stations and electrical substations • control centres for air, land and marine transportation • public water treatment and storage facilities, and pumping stations • sewage treatment facilities and *buildings* having critical national defence functions • *buildings* of the following types, unless exempted from this designation by the Chief Building Official:[(2)] o emergency response facilities o fire, rescue and police stations, and housing for vehicles, aircraft or boats used for such purposes o communications facilities, including radio and television stations	Post-disaster

Notes to Table 4.1.2.1.:
[(1)] See Note A-Table 4.1.2.1.
[(2)] See Note A-1.4.1.2.(1), Post-disaster Buildings, in Division A.

4.1.2.2. Loads Not Listed

1) Where a *building* or structural member can be expected to be subjected to loads, forces or other effects not listed in Article 4.1.2.1., such effects shall be taken into account in the design based on the most appropriate information available.

4.1.3. Limit States Design

(See Note A-4.1.3.)

4.1.3.1. Definitions

1) In this Subsection, the term

a) limit states means those conditions of a *building* structure that result in the *building* ceasing to fulfill the function for which it was designed (those limit states concerning safety are called ultimate limit states (ULS) and include exceeding the load-carrying capacity, overturning, sliding and fracture; those limit states that restrict the intended use and *occupancy* of the *building* are called serviceability limit states (SLS) and include deflection, vibration, permanent deformation and local structural damage such as cracking; and those limit states that represent failure under repeated loading are called fatigue limit states),
b) specified loads (**C**, **D**, **E**, **H**, **L**, **P**, **S**, **T** and **W**) means those loads defined in Article 4.1.2.1.,
c) principal load means the specified variable load or rare load that dominates in a given load combination,
d) companion load means a specified variable load that accompanies the principal load in a given load combination,
e) service load means a specified load used for the evaluation of a serviceability limit state,
f) principal-load factor means a factor applied to the principal load in a load combination to account for the variability of the load and load pattern and the analysis of its effects,
g) companion-load factor means a factor that, when applied to a companion load in the load combination, gives the probable magnitude of a companion load acting simultaneously with the factored principal load,

h) importance factor, I, means a factor applied in Subsections 4.1.6., 4.1.7. and 4.1.8. to obtain the specified load and take into account the consequences of failure as related to the limit state and the use and *occupancy* of the *building*,
i) factored load means the product of a specified load and its principal-load factor or companion-load factor,
j) effects refers to forces, moments, deformations or vibrations that occur in the structure,
k) nominal resistance, R, of a member, connection or structure, is based on the geometry and on the specified properties of the structural materials,
l) resistance factor, ϕ, means a factor applied to a specified material property or to the resistance of a member, connection or structure, and that, for the limit state under consideration, takes into account the variability of dimensions and material properties, workmanship, type of failure and uncertainty in the prediction of resistance, and
m) factored resistance, ϕR, means the product of nominal resistance and the applicable resistance factor.

4.1.3.2. Strength and Stability

1) A *building* and its structural components shall be designed to have sufficient strength and stability so that the factored resistance, ϕR, is greater than or equal to the effect of factored loads, which shall be determined in accordance with Sentence 4.1.3.2.(2).
2) Except as provided in Sentence (3), the effect of factored loads for a *building* or structural component shall be determined in accordance with the requirements of this Article and the following load combination cases, the applicable combination being that which results in the most critical effect:
a) for load cases without crane loads, the load combinations listed in Table 4.1.3.2.-A, and
b) for load cases with crane loads, the load combinations listed in Table 4.1.3.2.-B.
(See Note A-4.1.3.2.(2).)
3) Other load combinations that must also be considered are the principal loads acting with the companion loads taken as zero.
4) Where the effects due to lateral earth pressure, **H**, restraint effects from pre-stress, **P**, and imposed deformation, **T**, affect the structural safety, they shall be taken into account in the calculations, with load factors of 1.5, 1.0 and 1.25 assigned to **H**, **P** and **T** respectively. (See Note A-4.1.3.2.(4).)
5) Except as provided in Sentence 4.1.8.16.(2), the counteracting factored *dead load* – 0.9**D** in load combination cases 2, 3 and 4 and 1.0**D** in load combination case 5 in Table 4.1.3.2.-A, and 0.9**D** in load combination cases 1 to 5 and 1.0**D** in load combination case 6 in Table 4.1.3.2.-B – shall be used when the *dead load* acts to resist overturning, uplift, sliding, failure due to stress reversal, and to determine anchorage requirements and the factored resistance of members. (See Note A-4.1.3.2.(5).)
6) The principal-load factor 1.5 for *live loads* L in Table 4.1.3.2.-A and L_{XC} in Table 4.1.3.2.-B may be reduced to 1.25 for liquids in tanks.
7) The companion-load factor for *live loads* L in Table 4.1.3.2.-A and L_{XC} in Table 4.1.3.2.-B shall be increased by 0.5 for storage areas, and equipment areas and *service rooms* referred to in Table 4.1.5.3.

Table 4.1.3.2.-A
Load Combinations Without Crane Loads for Ultimate Limit States
Forming Part of Sentences 4.1.3.2.(2) and (5) to (10)

Case	Load Combination(1)	
	Principal Loads	Companion Loads
1	1.4**D**(2)	–

2	(1.25**D**(3) or 0.9**D**(4)) + 1.5**L**(5)	1.0**S**(6) or 0.4**W**
3	(1.25**D**(3) or 0.9**D**(4)) + 1.5**S**	1.0**L**(6)(7) or 0.4**W**
4	(1.25**D**(3) or 0.9**D**(4)) + 1.4**W**	0.5**L**(7) or 0.5**S**
5	1.0**D**(4) + 1.0**E**(8)	0.5**L**(6)(7) + 0.25**S**(6)

Notes to Table 4.1.3.2.-A:
(1) See Sentences 4.1.3.2.(2), (3) and (4).
(2) See Sentence 4.1.3.2.(9).
(3) See Sentence 4.1.3.2.(8).
(4) See Sentence 4.1.3.2.(5).
(5) See Sentence 4.1.3.2.(6).
(6) See Article 4.1.5.5.
(7) See Sentence 4.1.3.2.(7).
(8) See Sentence 4.1.3.2.(10).

Table 4.1.3.2.-B
Load Combinations With Crane Loads for Ultimate Limit States
Forming Part of Sentences 4.1.3.2.(2), (5) to (8), and (10)

Case	Load Combination(1)	
	Principal Loads	Companion Loads
1	(1.25**D**(2) or 0.9**D**(3)) + (1.5**C** + 1.0$\mathbf{L}_{XC}$)	1.0**S**(4) or 0.4**W**
2	(1.25**D**(2) or 0.9**D**(3)) + (1.5$\mathbf{L}_{XC}$(5) + 1.0**C**)	1.0**S**(4) or 0.4**W**
3	(1.25**D**(2) or 0.9**D**(3)) + 1.5**S**	1.0**C** + 1.0$\mathbf{L}_{XC}$(4)(6))
4	(1.25**D**(2) or 0.9**D**(3)) + 1.4**W**	(1.0**C**(7) + 0.5$\mathbf{L}_{XC}$(4)(6))
5	(1.25**D**(2) or 0.9**D**(3)) + $\mathbf{C}_7$	–
6	1.0**D**(3) + 1.0**E**(8)	1.0$\mathbf{C}_d$ + 0.5$\mathbf{L}_{XC}$(4)(6)+ 0.25**S**(4)

Notes to Table 4.1.3.2.-B:
(1) See Sentences 4.1.3.2.(2), (3) and (4).
(2) See Sentence 4.1.3.2.(8).
(3) See Sentence 4.1.3.2.(5).
(4) See Article 4.1.5.5.
(5) See Sentence 4.1.3.2.(6).
(6) See Sentence 4.1.3.2.(7).
(7) Side thrust due to cranes need not be combined with full wind load.
(8) See Sentence 4.1.3.2.(10).

8) Except as provided in Sentence (9), the load factor 1.25 for *dead load*, **D**, for *soil*, superimposed earth, plants and trees given in Tables 4.1.3.2.-A and 4.1.3.2.-B shall be increased to 1.5, except that when the *soil* depth exceeds 1.2 m, the factor may be reduced to 1 + 0.6/h_s but not less than 1.25, where h_s is the depth of soil in metres supported by the structure.
9) A principal-load factor of 1.5 shall be applied to the weight of saturated *soil* used in load combination case 1 of Table 4.1.3.2.-A.

10) Earthquake load, **E**, in load combination cases 5 of Table 4.1.3.2.-A and 6 of Table 4.1.3.2.-B includes horizontal earth pressure due to earthquake determined in accordance with Sentence 4.1.8.16.(7).
11) Provision shall be made to ensure adequate stability of the structure as a whole and adequate lateral, torsional and local stability of all structural parts.
12) Sway effects produced by vertical loads acting on the structure in its displaced configuration shall be taken into account in the design of *buildings* and their structural members.

4.1.3.3. Fatigue

1) A *building* and its structural components, including connections, shall be checked for fatigue failure under the effect of cyclical loads, as required in the standards listed in Section 4.3. (See Note A-4.1.3.3.(1).)
2) Where vibration effects, such as resonance and fatigue resulting from machinery and equipment, are likely to be significant, a dynamic analysis shall be carried out. (See Note A-4.1.3.3.(2).)

4.1.3.4. Serviceability

1) A *building* and its structural components shall be checked for serviceability limit states as defined in Clause 4.1.3.1.(1)(a) under the effect of service loads for serviceability criteria specified or recommended in Articles 4.1.3.5. and 4.1.3.6. and in the standards listed in Section 4.3. (See Note A-4.1.3.4.(1).)

4.1.3.5. Deflection

1) In proportioning structural members to limit serviceability problems resulting from deflections, consideration shall be given to

a) the intended use of the *building* or member,
b) limiting damage to non-structural members made of materials whose physical properties are known at the time of design,
c) limiting damage to the structure itself, and
d) creep, shrinkage, temperature changes and pre-stress.

(See Note A-4.1.3.5.(1).)
2) The lateral deflection of *buildings* due to service wind and gravity loads shall be checked to ensure that structural elements and non-structural elements whose nature is known at the time the structural design is carried out will not be damaged.
3) Except as provided in Sentence (4), the total drift per *storey* under service wind and gravity loads shall not exceed 1/500 of the *storey* height unless other drift limits are specified in the design standards referenced in Section 4.3. (See Note A-4.1.3.5.(3).)
4) The deflection limits required in Sentence (3) do not apply to industrial *buildings* or sheds if experience has proven that greater movement will have no significant adverse effects on the strength and function of the *building*.
5) The *building* structure shall be designed for lateral deflection due to **E**, in accordance with Article 4.1.8.13.

4.1.3.6. Vibration

1) Floor systems susceptible to vibration shall be designed so that vibrations will have no significant adverse effects on the intended *occupancy* of the *building*. (See Note A-4.1.3.6.(1).)
2) Where the fundamental vibration frequency of a structural system supporting an *assembly occupancy* used for rhythmic activities, such as dancing, concerts, jumping exercises or gymnastics, is less than 6 Hz, the effects of resonance shall be investigated by means of a dynamic analysis. (See Note A-4.1.3.6.(2).)
3) A *building* susceptible to lateral vibration under wind load shall be designed in accordance with Article 4.1.7.1. so that the vibrations will have no significant adverse effects on the intended use and *occupancy* of the *building*. (See Note A-4.1.3.6.(3).)

4.1.4. Dead Loads

4.1.4.1. Dead Loads

1) The specified *dead load* for a structural member consists of

a) the weight of the member itself,

b) the weight of all materials of construction incorporated into the *building* to be supported permanently by the member,

c) the weight of *partitions*,

d) the weight of permanent equipment, and

e) the vertical load due to earth, plants and trees.

2) Except as provided in Sentence (5), in areas of a *building* where *partitions*, other than permanent *partitions*, are shown on the drawings, or where *partitions* might be added in the future, allowance shall be made for the weight of such *partitions*.

3) The *partition* weight allowance referred to in Sentence (2) shall be determined from the actual or anticipated weight of the *partitions* placed in any probable position, but shall be not less than 1 kPa over the area of floor being considered.

4) *Partition loads* used in design shall be shown on the drawings as provided in Clause 2.2.4.3.(1)(d) of Division C.

5) In cases where the *dead load* of the *partition* is counteractive, the load allowances referred to in Sentences (2) and (3) shall not be included in the design calculations.

6) Except for structures where the *dead load* of *soil* is part of the load-resisting system, where the *dead load* due to *soil*, superimposed earth, plants and trees is counteractive, it shall not be included in the design calculations. (See Note A-4.1.4.1.(6).)

4.1.5. Live Loads Due to Use and Occupancy

4.1.5.1. Loads Due to Use of Floors and Roofs

1) Except as provided in Sentence (2), the specified *live load* on an area of floor or roof depends on the intended use and *occupancy*, and shall not be less than either the uniformly distributed load patterns listed in Article 4.1.5.3., the loads due to the intended use and *occupancy*, or the concentrated loads listed in Article 4.1.5.9., whichever produces the most critical effect. (See Note A-4.1.5.1.(1).)

2) For *buildings* in the Low Importance Category as described in Table 4.1.2.1., a factor of 0.8 may be applied to the *live load*.

4.1.5.2. Uses Not Stipulated

1) Except as provided in Sentence (2), where the use of an area of floor or roof is not provided for in Article 4.1.5.3., the specified *live loads* due to the use and *occupancy* of the area shall be determined from an analysis of the loads resulting from the weight of

a) the probable assembly of persons,

b) the probable accumulation of equipment and furnishings, and

c) the probable storage of materials.

2) For *buildings* in the Low Importance Category as described in Table 4.1.2.1., a factor of 0.8 may be applied to the *live load*.

4.1.5.3. Full and Partial Loading

1) The uniformly distributed *live load* shall be not less than the value listed in Table 4.1.5.3., which may be reduced as provided in Article 4.1.5.8., applied uniformly over the entire area or on any portions of the area, whichever produces the most critical effects in the members concerned.

Table 4.1.5.3.
Specified Uniformly Distributed Live Loads on an Area of Floor or Roof
Forming Part of Sentence 4.1.5.3.(1)

Use of Area of Floor or Roof	Minimum Specified Load, kPa
Assembly Areas	
a) Except for the areas listed under b), c), d) and e), assembly areas with or without fixed seats including	
Arenas(1) (areas without fixed seats that have backs)	
Auditoria	
Churches (areas without fixed seats that have backs)	
Dance floors	
Dining areas(2)	
Foyers and entrance halls	
Grandstands(1) (areas without fixed seats that have backs), reviewing stands and bleachers	4.8
Gymnasia	
Lecture halls(1) (areas without fixed seats that have backs)	
Museums	
Promenades	
Rinks	
Stadia(1) (areas without fixed seats that have backs)	
Theatres (areas without fixed seats that have backs)	
Other areas with similar uses	
b) Classrooms and courtrooms with or without fixed seats(1)	2.4
c) Portions of assembly areas with fixed seats that have backs for the following uses:	
Arenas	2.9(1)
Grandstands	
Stadia	
d) Portions of assembly areas with fixed seats that have backs for the following uses:	
Churches	2.4
Lecture halls(1)	

Theatres	
e) Vomitories, *exits*, lobbies and corridors[1]	4.8
Attics[1]	
Accessible by a stairway in *residential occupancies* only	1.4
Having limited accessibility so that there is no storage of equipment or material	0.5
Balconies	
Exterior	4.8
Interior and *mezzanines* that could be used by an assembly of people as a viewing area[1]	4.8
Interior and *mezzanines* other than above	[3]
Corridors, lobbies and aisles[1]	
Other than those listed below	4.8
Not more than 1 200 mm in width and all upper floor corridors of residential areas only of apartments, hotels and motels (that cannot be used by an assembly of people as a viewing area)[1]	[1][3]
Equipment areas and *service rooms* including	3.6[4]
Generator rooms	
Mechanical equipment exclusive of elevators	
Machine rooms	
Pump rooms	
Transformer vaults	
Ventilating or air-conditioning equipment	
Exits and fire escapes	4.8
Factories	6.0[4]
Footbridges	4.8
Garages for	
Vehicles not exceeding 4 000 kg gross weight	2.4
Vehicles exceeding 4 000 kg but not exceeding 9 000 kg gross weight	6.0
Vehicles exceeding 9 000 kg gross weight	12.0[1]
Kitchens (other than residential)	4.8

Libraries	
Stack rooms	7.2
Reading and study rooms	2.9
Office areas (not including record storage and computer rooms) located in	
Basement and the *first storey*	4.8
Floors above the *first storey*	2.4
Operating rooms and laboratories	3.6
Patients' bedrooms	1.9
Recreation areas that cannot be used for assembly purposes including	3.6
Billiard rooms	
Bowling alleys	
Pool rooms	
Residential areas (within the scope of Article 1.3.3.2. of Division A)	
Sleeping and living quarters in apartments, hotels, motels, boarding schools and colleges	1.9
Residential areas (within the scope of Article 1.3.3.3. of Division A)	
Bedrooms	1.9
Other areas	1.9
Stairs within *dwelling units*	1.9
Retail and wholesale areas	4.8
Roofs	1.0(1)(5)
Sidewalks and driveways over areaways and *basements*	12.0(1)(5)
Storage areas	4.8(4)
Toilet areas	2.4
Underground slabs with earth cover	(5)
Warehouses	4.8(4)

Notes to Table 4.1.5.3.:
(1) See Note A-Table 4.1.5.3.
(2) See Article 4.1.5.6.
(3) See Article 4.1.5.4.
(4) See Sentence 4.1.5.1.(1).
(5) See Article 4.1.5.5.

4.1.5.4. Loads for Occupancy Served

1) The following shall be designed to carry not less than the specified load required for the *occupancy* they serve, provided they cannot be used by an assembly of people as a viewing area:

a) corridors, lobbies and aisles not more than 1 200 mm wide,

b) all corridors above the *first storey* of residential areas of apartments, hotels and motels, and

c) interior balconies and *mezzanines*.

4.1.5.5. Loads on Exterior Areas

(See Note A-4.1.5.5.)

1) Exterior areas accessible to vehicular traffic shall be designed for their intended use, including the weight of firefighting equipment, but not for less than the snow and rain loads prescribed in Subsection 4.1.6.

2) Except as provided in Sentences (3) and (4), roofs shall be designed for either the uniform *live loads* specified in Table 4.1.5.3., the concentrated *live loads* listed in Table 4.1.5.9., or the snow and rain loads prescribed in Subsection 4.1.6., whichever produces the most critical effects in the members concerned.

3) Exterior areas accessible to pedestrian traffic, but not vehicular traffic, shall be designed for their intended use, but not for less than the greater of

a) the *live load* prescribed for assembly areas in Table 4.1.5.3., or

b) the snow and rain loads prescribed in Subsection 4.1.6.

4) Roof parking decks shall be designed for either the uniformly distributed *live loads* specified in Table 4.1.5.3., the concentrated *live loads* listed in Table 4.1.5.9., or the roof snow load, whichever produces the most critical effect in the members concerned.

4.1.5.6. Loads for Dining Areas

1) The minimum specified *live load* listed in Table 4.1.5.3. for dining areas may be reduced to 2.4 kPa for areas in *buildings* that are being converted to dining areas, provided that the *floor area* does not exceed 100 m^2 and the dining area will not be used for other assembly purposes, including dancing.

4.1.5.7. More Than One Occupancy

1) Where an area of floor or roof is intended for 2 or more *occupancies* at different times, the value to be used from Table 4.1.5.3. shall be the greatest value for any of the *occupancies* concerned.

4.1.5.8. Variation with Tributary Area

(See Note A-4.1.5.8.)

1) An area used for *assembly occupancies* designed for a *live load* of less than 4.8 kPa and roofs designed for the minimum loading specified in Table 4.1.5.3. shall have no reduction for tributary area.

2) Where a structural member supports a tributary area of a floor or a roof, or a combination thereof, that is greater than 80 m^2 and either used for *assembly occupancies* designed for a *live load* of 4.8 kPa or more, or used for storage, manufacturing, retail stores, garages or as a footbridge, the specified *live load* due to use and *occupancy* is the load specified in Article 4.1.5.3. multiplied by

$$0.5 + \sqrt{20/A}$$

where A is the tributary area in square metres for this type of use and *occupancy*.

3) Where a structural member supports a tributary area of a floor or a roof, or a combination thereof, that is greater than 20 m^2 and used for any use or *occupancy* other than those indicated in Sentences (1) and (2), the specified *live load* due to use and *occupancy* is the load specified in Article 4.1.5.3. multiplied by

$$0.3 + \sqrt{9.8/B}$$

where B is the tributary area in square metres for this type of use and occupancy.

4) Where the specified *live load* for a floor is reduced in accordance with Sentence (2) or (3), the structural drawings shall indicate that a *live load* reduction factor for tributary area has been applied.

4.1.5.9. Concentrated Loads

1) The specified *live load* due to possible concentrations of load resulting from the use of an area of floor or roof shall not be less than that listed in Table 4.1.5.9. applied over the loaded area noted and located so as to cause maximum effects, except that for *occupancies* not listed in Table 4.1.5.9., the concentrations of load shall be determined in accordance with Article 4.1.5.2.

Table 4.1.5.9.
Specified Concentrated Live Loads on an Area of Floor or Roof
Forming Part of Sentence 4.1.5.9.(1)

Area of Floor or Roof	Minimum Specified Concentrated Load, kN	Loaded Area, mm x mm
Roof surfaces	1.3	200 x 200
Floors of classrooms	4.5	750 x 750
Floors of offices, manufacturing *buildings*, hospital wards and *stages*	9.0	750 x 750
Floors and areas used by vehicles not exceeding 4 000 kg gross weight	18	120 x 120
Floors and areas used by vehicles exceeding 4 000 kg but not exceeding 9 000 kg gross weight	36	120 x 120
Floors and areas used by vehicles exceeding 9 000 kg gross weight	54(1)	250 x 600(1)
Driveways and sidewalks over areaways and *basements*	54(1)	250 x 600(1)

Notes to Table 4.1.5.9.:
(1) See Note A-Table 4.1.5.9.

4.1.5.10. Sway Forces in Assembly Occupancies

1) The floor assembly and other structural elements that support fixed seats in any *building* used for *assembly occupancies* accommodating large numbers of people at one time, such as grandstands, stadia and *theatre* balconies, shall be designed to resist a horizontal force equal to not less than 0.3 kN for each metre length of seats acting parallel to each row of seats, and not less than 0.15 kN for each metre length of seats acting at right angles to each row of seats, based on the assumption that these forces are acting independently of each other.

4.1.5.11. Crane-Supporting Structures and Impact of Machinery and Equipment

(See Note A-4.1.5.11.)

1) The minimum specified load due to equipment, machinery or other objects that may produce impact shall be the sum of the weight of the equipment or machinery and its maximum lifting capacity, multiplied by an appropriate factor listed in Table 4.1.5.11.

2) Crane-supporting structures shall be designed for the appropriate load combinations listed in Article 4.1.3.2.

3) Crane runway structures shall be designed to resist a horizontal force applied normal to the top of the rails equal to not less than 20% of the sum of the weights of the lifted load and the crane trolley (excluding other parts of the crane).

4) The force described in Sentence (3) shall be equally distributed on each side of the runway and shall be assumed to act in either direction.
5) Crane runway structures shall be designed to resist a horizontal force applied parallel to the top of the rails equal to not less than 10% of the maximum wheel loads of the crane.

Table 4.1.5.11.
Factors for the Calculation of Impact Loads
Forming Part of Sentence4.1.5.11.(1)

Cause of Impact	Factor
Operation of cab or radio-operated cranes	1.25
Operation of pendant or hand-operated cranes	1.10
Operation of elevators	(1)
Supports for light machinery, shaft or motor-driven	1.20
Supports for reciprocating machinery (e.g. compressors)	1.50
Supports for power-driven units (e.g. piston engines)	1.50

Notes to Table 4.1.5.11.:
(1) See the Elevating Devices Safety Regulation

4.1.5.12. Bleachers

1) Bleacher seats shall be designed for a uniformly distributed *live load* of 1.75 kN for each linear metre or for a concentrated load of 2.2 kN distributed over a length of 0.75 m, whichever produces the most critical effect on the supporting members.
2) Bleachers shall be checked by the erector after erection to ensure that all structural members, including bracing specified in the design, have been installed.
3) Telescopic bleachers shall be provided with locking devices to ensure stability while in use.

4.1.5.13. Helicopter Landing Areas

1) Helicopter landing areas on roofs shall be constructed in conformance with the requirements for heliports contained in TC SOR/96-433, "Canadian Aviation Regulations – Part III."

4.1.5.14. Loads on Guards and Handrails

(See Note A-4.1.5.14. and 4.1.5.15.(1).)
1) The minimum specified horizontal load applied outward at the minimum required height of every required *guard* shall be

a) 3.0 kN/m for open viewing stands without fixed seats and for *means of egress* in grandstands, stadia, bleachers and arenas,
b) a concentrated load of 1.0 kN applied at any point, so as to produce the most critical effect, for access ways to equipment platforms, contiguous stairs and similar areas where the gathering of many people is improbable, and
c) 0.75 kN/m or a concentrated load of 1.0 kN applied at any point so as to produce the most critical effect, whichever governs for locations other than those described in Clauses (a) and (b).

2) The minimum specified horizontal load applied inward at the minimum required height of every required *guard* shall be half that specified in Sentence (1).
3) Individual elements within the *guard*, including solid panels and pickets, shall be designed for a load of 0.5 kN applied outward over an area of 100 mm by 100 mm located at any point in the element or elements so as to produce the most critical effect.
4) The size of the opening between any two adjacent vertical elements within a *guard* shall not exceed the limits required by Part 3 when each of these elements is subjected to a specified *live load* of 0.1 kN applied in opposite directions in the in-plane direction of the *guard* so as to produce the most critical effect.
5) The loads required in Sentence (3) need not be considered to act simultaneously with the loads provided for in Sentences (1), (2) and (6).
6) The minimum specified load applied vertically at the top of every required *guard* shall be 1.5 kN/m and need not be considered to act simultaneously with the horizontal load provided for in Sentence (1).
7) Handrails and their supports shall be designed and constructed to withstand the following loads, which need not be considered to act simultaneously:

a) a concentrated load not less than 0.9 kN applied at any point and in any direction for all handrails, and

b) a uniform load not less than 0.7 kN/m applied in any direction to handrails not located within *dwelling units*.

4.1.5.15. Loads on Vehicle Guardrails

1) Vehicle guardrails shall be designed for a concentrated load of 22 kN applied horizontally outward at any point 500 mm above the floor surface so as to produce the most critical effect. (See Note A-4.1.5.14. and 4.1.5.15.(1).)
2) The loads required in Sentence (1) need not be considered to act simultaneously with the loads provided for in Article 4.1.5.14.

4.1.5.16. Loads on Walls Acting As Guards

1) Where the floor elevation on one side of a wall, including a wall around a shaft, is more than 600 mm higher than the elevation of the floor or ground on the other side, the wall shall be designed to resist the appropriate outward lateral design loads prescribed elsewhere in Subsection 4.1.5. or 0.5 kPa acting outward, whichever produces the more critical effect.

4.1.5.17. Firewalls

(See Note A-4.1.5.17.)
1) *Firewalls* shall be designed to resist the maximum effect due to

a) the appropriate lateral design loads prescribed elsewhere in this Section, or

b) a factored lateral load of 0.5 kPa under fire conditions, as described in Sentence (2).

2) Under fire conditions, where the *fire-resistance rating* of the structure is less than that of the *firewall*,

a) lateral support shall be assumed to be provided by the structure on one side only, or

b) another structural support system capable of resisting the loads imposed by a fire on either side of the *firewall* shall be provided.

4.1.5.18. Loads for Building Maintenance

1) *Buildings* shall be designed to support the loads and forces required to support building maintenance equipment.

4.1.6. Loads Due to Snow and Rain

4.1.6.1. Specified Load Due to Rain or to Snow and Associated Rain

1) The specified load on a roof or any other *building* surface subject to snow and associated rain shall be the snow load specified in Article 4.1.6.2., or the rain load specified in Article 4.1.6.4., whichever produces the more critical effect.

4.1.6.2. Specified Snow Load

(See Note A-4.1.6.2.)

1) The specified load, S, due to snow and associated rain accumulation on a roof or any other *building* surface subject to snow accumulation shall be calculated using the formula

$$S = I_s [S_s (C_b C_w C_s C_a) + S_r]$$

where

I_s = importance factor for snow load as provided in Table 4.1.6.2.-A,

S_s = 1-in-50-year ground snow load, in kPa, determined in accordance with Subsection 1.1.3.,

C_b = basic roof snow load factor in Sentence (2),

C_w = wind exposure factor in Sentences (3) and (4),

C_s = slope factor in Sentences (5), (6) and (7),

Ca = accumulation factor in Sentence (8), and

S_r = 1-in-50-year associated rain load, in kPa, determined in accordance with Subsection 1.1.3., but not greater than $S_s(C_b C_w C_s C_a)$.

Table 4.1.6.2.-A
Importance Factor for Snow Load, I_S
Forming Part of Sentence 4.1.6.2.(1)

Importance Category	Importance Factor, Is	
	ULS	SLS
Low	0.8	0.9
Normal	1	0.9
High	1.15	0.9
Post-disaster	1.25	0.9

2) The basic roof snow load factor, C_b, shall

a) be determined as follows:

i) $C_b = 0.8 \text{ for } l_c \leq \left(\frac{70}{C_w^2}\right)$, and

ii) $C_b = \frac{1}{C_w}\left[1 - (1 - 0.8C_w)\exp\left(-\frac{l_c C_w^2 - 70}{100}\right)\right] \text{ for } l_c > \left(\frac{70}{C_w^2}\right)$

where

l_c = characteristic length of the upper or lower roof, defined as $2w - w^2/l$, in m,

w = smaller plan dimension of the roof, in m, and

l = larger plan dimension of the roof, in m, or

b) conform to Table 4.1.6.2.-B, using linear interpolation for intermediate values of $l_c C_w^2$.

(See Note A-4.1.6.2.(2).)

3) Except as provided for in Sentence (4), the wind exposure factor, C_w, shall be 1.0.

4) For *buildings* in the Low and Normal Importance Categories as set out in Table 4.1.2.1., the wind exposure factor, C_w, given in Sentence (3) may be reduced to 0.75 for rural areas only, or to 0.5 for exposed areas north of the treeline, where

a) the *building* is exposed on all sides to wind over open terrain as defined in Clause 4.1.7.3.(5)(a), and is expected to remain so during its life,

b) the area of roof under consideration is exposed to the wind on all sides with no significant obstructions on the roof, such as parapet walls, within a distance of at least 10 times the difference between the height of the obstruction and $C_bC_wS_s/\gamma$ metres, where γ is the specific weight of snow on roofs as specified in Article 4.1.6.13., and

c) the loading does not involve the accumulation of snow due to drifting from adjacent surfaces.

5) Except as provided for in Sentences (6) and (7), the slope factor, C_s, shall be

a) 1.0 where the roof slope, α, is equal to or less than 30°,

b) $(70° - \alpha)/40°$ where α is greater than 30° but not greater than 70°, and

c) 0 where α exceeds 70°.

Table 4.1.6.2.-B
Basic Roof Snow Load Factor for $I_c > (70/C_w^2)$
Forming Part of Sentence 4.1.6.2.(2)

Value of $I_cC_w^2$	Value of C_w		
	1.0	0.75	0.5
	Value of C_b		
70	0.80	0.80	0.80
80	0.82	0.85	0.91
100	0.85	0.94	1.11
120	0.88	1.01	1.27
140	0.90	1.07	1.40
160	0.92	1.12	1.51
180	0.93	1.16	1.60
200	0.95	1.19	1.67
220	0.96	1.21	1.73
240	0.96	1.24	1.78
260	0.97	1.25	1.82
280	0.98	1.27	1.85
300	0.98	1.28	1.88
320	0.98	1.29	1.90
340	0.99	1.30	1.92
360	0.99	1.30	1.93

380	0.99	1.31	1.95
400	0.99	1.31	1.96
420	0.99	1.32	1.96
440	1.00	1.32	1.97
460	1.00	1.32	1.98
480	1.00	1.32	1.98
500	1.00	1.33	1.98
520	1.00	1.33	1.99
540	1.00	1.33	1.99
560	1.00	1.33	1.99
580	1.00	1.33	1.99
600	1.00	1.33	1.99
620	1.00	1.33	2.00

6) The slope factor, Cs, for unobstructed slippery roofs where snow and ice can slide completely off the roof shall be

a) 1.0 where the roof slope, α, is equal to or less than 15°,
b) (60° − α)/45° where α is greater than 15° but not greater than 60°, and
c) 0 where α exceeds 60°.

7) Unless otherwise stated in this Subsection, the slope factor, C_s, shall be 1.0 when used in conjunction with accumulation factors for increased snow loads.

8) The accumulation factor, C_a, shall be 1.0, which corresponds to the uniform snow load case, except that where appropriate for the shape of the roof, it shall be assigned other values that account for

a) increased non-uniform snow loads due to snow drifting onto a roof that is at a level lower than other parts of the same *building* or at a level lower than another *building* within 5 m of it horizontally, as prescribed in Articles 4.1.6.5., 4.1.6.6. and 4.1.6.8.,
b) increased non-uniform snow loads on areas adjacent to roof projections, such as penthouses, large *chimneys* and equipment, as prescribed in Articles 4.1.6.7. and 4.1.6.8.,
c) non-uniform snow loads on gable, arch or curved roofs and domes, as prescribed in Articles 4.1.6.9. and 4.1.6.10.,
d) increased snow or ice loads due to snow sliding as prescribed in Article 4.1.6.11.,
e) increased snow loads in roof valleys, as prescribed in Article 4.1.6.12., and
f) increased snow or ice loads due to meltwater draining from adjacent *building* elements and roof projections.

9) For shapes not addressed in Sentence (8), C_a corresponding to the non-uniform snow load case shall be established based on applicable field observations, special analyses including local climatic effects, appropriate model tests, or a combination of these methods.

4.1.6.3. Full and Partial Loading

1) A roof or other *building* surface and its structural members subject to loads due to snow accumulation shall be designed for the specified load given in Sentence 4.1.6.2.(1), distributed over the entire loaded area.

2) In addition to the distribution mentioned in Sentence (1), flat roofs and shed roofs, gable roofs of 15° slope or less, and arch or curved roofs shall be designed for the specified uniform snow load indicated in Sentence 4.1.6.2.(1), which shall be calculated using the accumulation factor C_a = 1.0, distributed on any one portion of the loaded area and half of this load on the remainder of the loaded area, in such a way as to produce the most critical effects on the member concerned. (See Note A-4.1.6.3.(2).)

4.1.6.4. Specified Rain Load

1) Except as provided in Sentence (4), the specified load, S, due to the accumulation of rainwater on a surface whose position, shape and deflection under load make such an accumulation possible, is that resulting from the one-day rainfall determined in conformance with Subsection 1.1.3. and applied over the horizontal projection of the surface and all tributary surfaces. (See Note A-4.1.6.4.(1).)
2) The provisions of Sentence (1) apply whether or not the surface is provided with a means of drainage, such as rainwater leaders.
3) Except as provided in Sentence 4.1.6.2.(1), loads due to rain need not be considered to act simultaneously with loads due to snow. (See Note A-4.1.6.4.(3).)
4) Where scuppers are provided and where the position, shape and deflection of the loaded surface make an accumulation of rainwater possible, the loads due to rain shall be the lesser of either the one-day rainfall determined in conformance with Subsection 1.1.3. or a depth of rainwater equal to 30 mm above the level of the scuppers, applied over the horizontal projection of the surface and tributary areas.

4.1.6.5. Multi-level Roofs

1) The drifting load of snow on a roof adjacent to a higher roof shall be taken as trapezoidal, as shown in Figure 4.1.6.5.-A, and the accumulation factor, C_a, shall be determined as follows:

$$C_a = C_{a0} - (C_{a0} - 1)\left(\frac{x}{x_d}\right) \text{ for } 0 \le x \le x_d \text{ , or}$$

$$C_a = 1.0 \text{ for } x > x_d$$

where

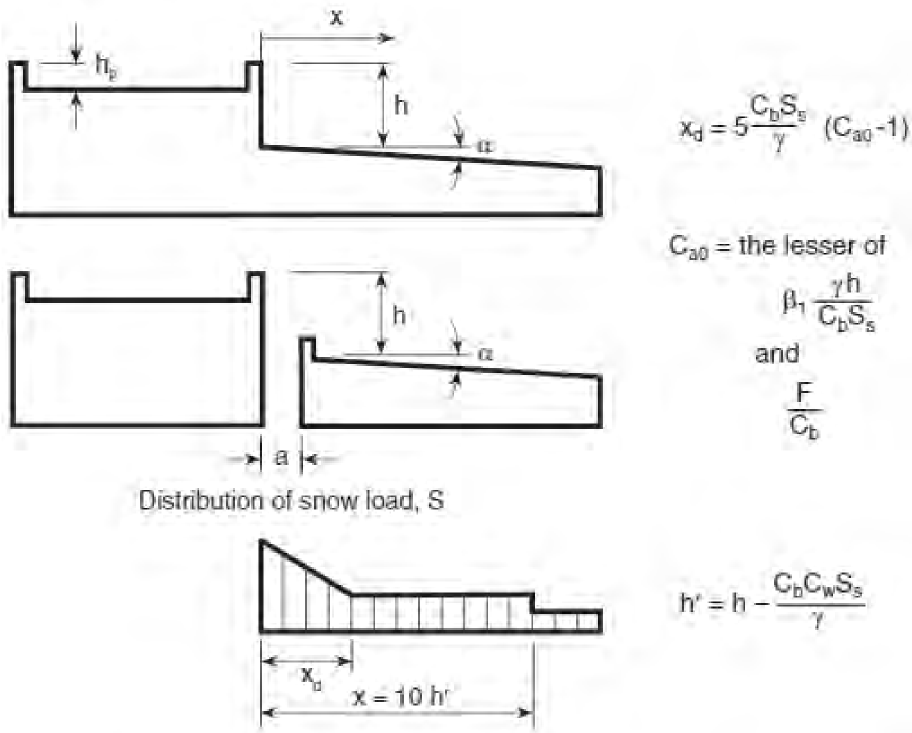
C_{a0} = peak value of C_a at x = 0 determined in accordance with Sentences (3) and (4) and as shown in Figure 4.1.6.5.-B,
x = distance from roof step as shown in Figure 4.1.6.5.-A, and
x_d = length of drift determined in accordance with Sentence (2) and as shown in Figure 4.1.6.5.-A.

2) The length of the drift, x_d, shall be calculated as follows:

$$x_d = 5\frac{C_b S_s}{\gamma}(C_{a0} - 1)$$

where

γ = specific weight of snow as specified in Article 4.1.6.13.



x	Factors[1]		
	C_w	C_s[2]	C_a
0	1.0	f(α)	C_{a0}
$0 < x \le x_d$	1.0	f(α)	$C_{a0} - (C_{a0} - 1)\frac{x}{x_d}$
$x_d < x \le 10\,h'$	1.0	f(α)	1.0
$x > 10\,h'$	1.0 for non-exposed roof areas 0.75 for exposed roof areas 0.5 for exposed roof areas north of tree line	f(α)	1.0

EG01301B

Figure 4.1.6.5.-A
Snow load factors for lower level roofs
Forming Part of Sentences 4.1.6.5.(1) and (3) and 4.1.6.6.(1)

Notes to Figure 4.1.6.5.-A:
(1) If a > 5 m or $h \le 0.8S_s/\gamma$, drifting from the higher roof need not be considered.
(2) For lower roofs with parapets, Cs = 1.0, otherwise it varies as a function of slope α as defined in Sentences 4.1.6.2.(5) and (6).

3) The value of C_{a0} for each of Cases I, II, and III shall be the lesser of

$$C_{a0} = \beta \frac{\gamma h}{C_b S_s}$$

and

$$C_{a0} = \frac{F}{C_b}$$

where

β = 1.0 for Case I, and 0.67 for Cases II and III,

h = difference in elevation between the lower roof surface and the top of the parapet on the upper roof as shown in Figure 4.1.6.5.-A, and

$$F = 0.35\beta\sqrt{\frac{\gamma(l_{cs} - 5h_p')}{S_s}} + C_b, \text{but } F \leq 5 \text{ for } C_{ws} = 1.0$$

where

C_{ws} = value of C_w applicable to the source of drifting,

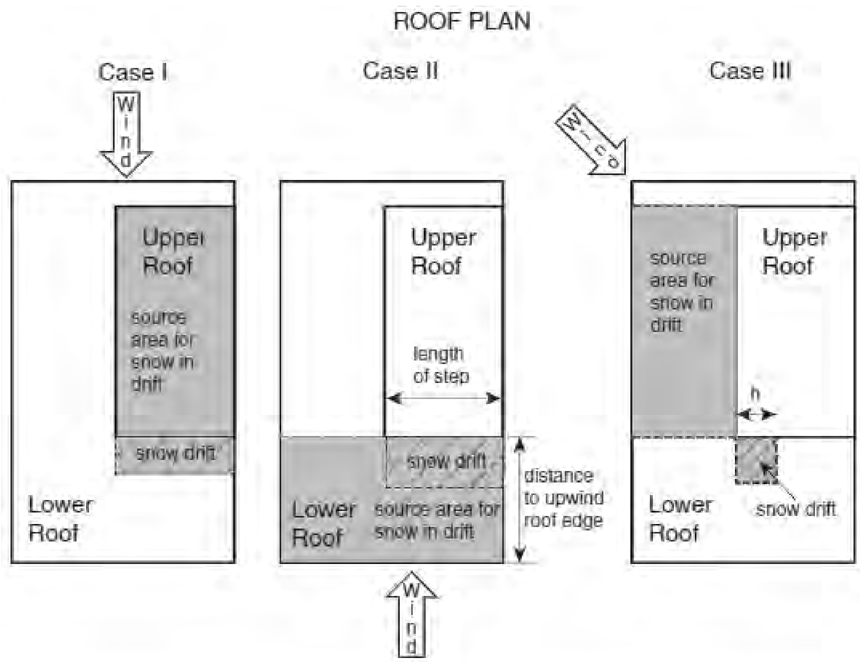
l_{cs} = characteristic length of the source area for drifting, defined as $l_{cs} = 2w_s - \frac{w_s^2}{l_s}$, where w_s and l_s are respectively the shorter and longer dimensions of the relevant source areas for snow drifting shown in Figure 4.1.6.5.-B for Cases I, II and III, and

$$h_p' = h_p - \left(\frac{0.8S}{\gamma}\right), \text{but } 0 \leq h_p' \leq \left(\frac{l_{cs}}{5}\right)$$

where

h_p = height of the roof perimeter parapet of the source area, to be taken as zero unless all the roof edges of the source area have parapets.

4) The value of C_{a0} shall be the highest of Cases I, II and III, considering the different roof source areas for drifting snow, as specified in Sentence (3) and Figure 4.1.6.5.-B.



Parameter	Case I	Case II	Case III
β	1.0	0.67	0.67
h_p	parapet height of upper-roof source area	parapet height of lower-roof source area	parapet height of lower-roof source area
$l_{cs} = 2w_s - \frac{w_s^2}{l_s}$	with w_s and l_s being the shorter and longer dimensions of the upper roof	with w_s and l_s being the shorter and longer dimensions of source area on lower roof for upwind facing step	with w_s and l_s being the shorter and longer dimensions of the source area on the lower roof for downwind facing step

EG01302B

Figure 4.1.6.5.-B
Snow load cases I, II and III for lower level roofs
Forming Part of Sentences 4.1.6.5.(1), (3) and (4)

4.1.6.6. Horizontal Gap between a Roof and a Higher Roof

1) Where the roof of one *building* is separated by a distance, a, from an adjacent *building* with a higher roof as shown in Figure 4.1.6.5.-A, the influence of the adjacent *building* on the value of the accumulation factor, C_a, for the lower roof shall be determined as follows:

a) if a > 5 m, the influence of the adjacent *building* on C_a for the lower roof can be ignored, and

b) if a ≤ 5 m, C_a for the lower roof shall be calculated in accordance with Article 4.1.6.5. for values of x ≥ a.

4.1.6.7. Areas Adjacent to Roof Projections

1) Except as provided in Sentences (2) and (3), the accumulation factor, C_a, for areas adjacent to roof-mounted vertical projections shall be calculated in accordance with Sentence 4.1.6.5.(1) using the following values for the peak accumulation factor, C_{a0}, and the drift length, x_d:

a) C_{a0} shall be taken as the lesser of

$$0.67\frac{\gamma h}{C_b S_S} \text{ and } \frac{\gamma l_0}{7.5 C_b S_S} + 1, \text{ and}$$

b) x_d shall be taken as the lesser of 3.35h and (2/3)l_0, where

h = height of the projection, and

l_0 = longest horizontal dimension of the projection.

(See Note A-4.1.6.7.(1).)

2) C_a is permitted to be calculated in accordance with Article 4.1.6.5. for larger projections. (See Note A-4.1.6.7.(2).)

3) Where the longest horizontal dimension of the roof projection, l_0, is less than 3 m, the drift surcharge adjacent to the projection need not be considered.

4.1.6.8. Snow Drift at Corners

1) The drift loads on the lower level roof against the two faces of an outside corner of an upper level roof or roof obstruction shall be extended radially around the corner as shown in Figure 4.1.6.8.-A and may be taken as the least severe of the drift loads lying against the two faces of the corner.

2) The drift loads on the lower level roof against the two faces of an inside corner of an upper level roof or a parapet shall be calculated for each face and applied as far as the bisector of the corner angle as shown in Figure 4.1.6.8.-B.

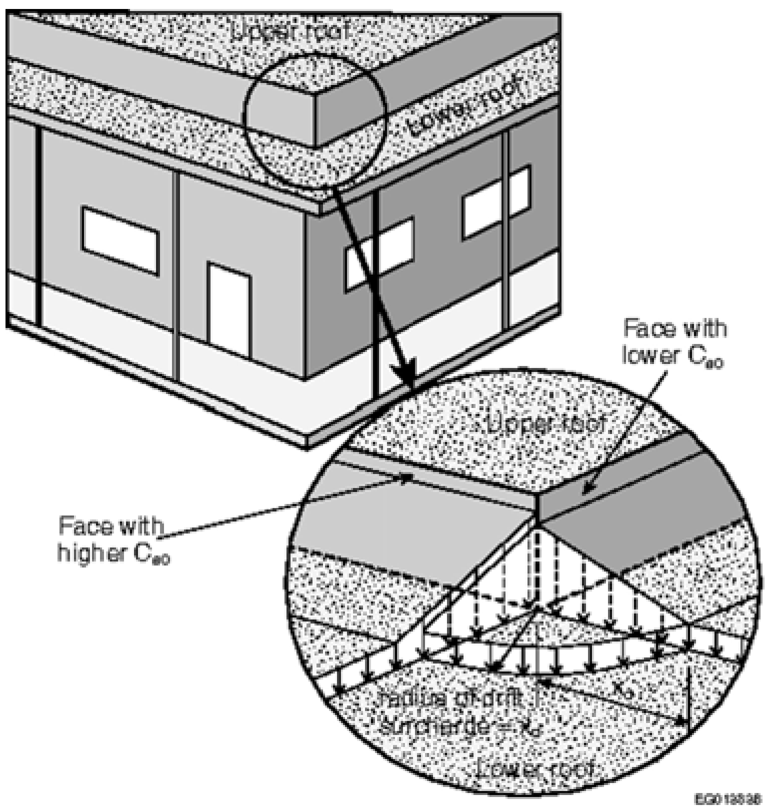


Figure 4.1.6.8.-A
Snow load at outside corner
Forming Part of Sentence 4.1.6.8.(1)

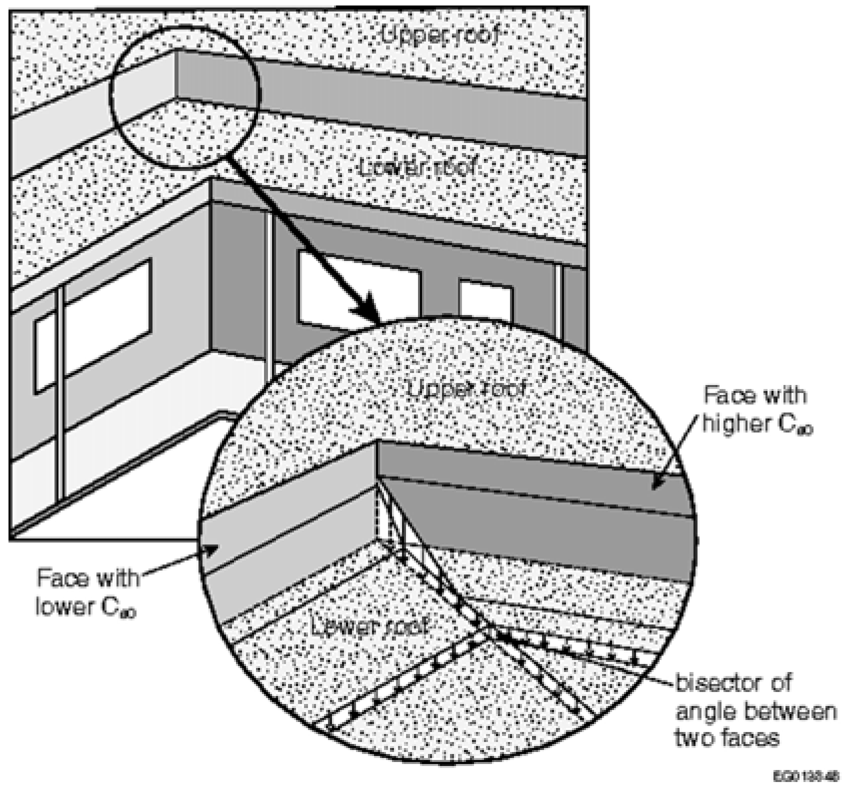


Figure 4.1.6.8.-B
Snow load at inside corner
Forming Part of Sentence 4.1.6.8.(2)

4.1.6.9. Gable Roofs

(See Note A-4.1.6.9.)

1) For all gable roofs, the full and partial load cases defined in Article 4.1.6.3. shall be considered.

2) For gable roofs with a slope $\alpha > 15°$, the unbalanced load case shall also be considered by setting the values of the accumulation factor, C_a, as follows:

a) on the upwind side of the roof peak, C_a shall be taken as 0, and

b) on the downwind side of the roof peak, C_a shall be taken as

i) $0.25 + \alpha/20$, where $15° \leq \alpha \leq 20°$, and

ii) 1.25, where $20° < \alpha \leq 90°$.

3) For all gable roofs, the slope factor, C_s, shall be as prescribed in Sentences 4.1.6.2.(5) and (6).

4) For all gable roofs, the wind exposure factor, C_w, shall be

a) as prescribed in Sentences 4.1.6.2.(3) and (4) for the full and partial load cases, and

b) 1.0 for the unbalanced load case referred to in Sentence (2).

4.1.6.10. Arch Roofs, Curved Roofs and Domes

1) For all arch roofs, curved roofs and domes, the full and partial load cases defined in Article 4.1.6.3. shall be considered.

2) For arch roofs, curved roofs and domes with a rise-to-span ratio $h/b > 0.05$ (See Figure 4.1.6.10.-A), the load cases provided in Sentences (3) to (7) shall also be considered.

3) For arch roofs with a slope at the edge $\alpha_e \leq 30°$ (See Figure 4.1.6.10.-A and Table 4.1.6.10.), C_a shall be

a) taken as 0 on the upwind side of the peak, and

b) on the downwind side of the peak, taken as

$$C_a = \frac{xh}{0.03\,C_b b^2} \text{ for } 0.05 < \frac{h}{b} \leq 0.12 \text{ and}$$

$$C_a = \frac{4x}{C_b b} \text{ for } \frac{h}{b} > 0.12$$

where

x = horizontal distance from the roof peak,
h = height of arch, and
b = width of arch.

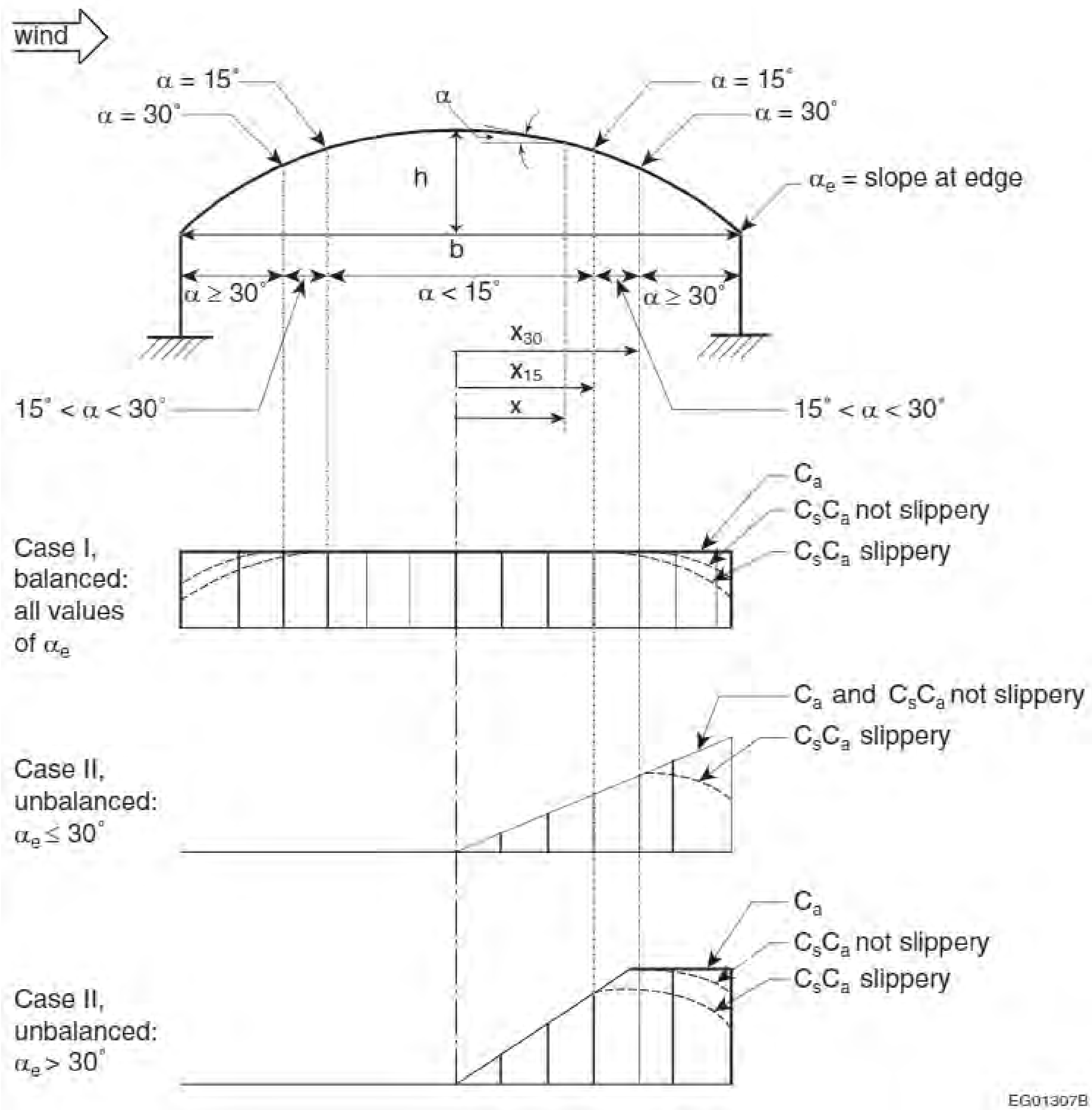


Figure 4.1.6.10.-A
Accumulation factors for arch roofs and curved roofs
Forming Part of Sentences 4.1.6.10.(2) to (4)

Note to Figure 4.1.6.10.-A:
(1) Refer to Table 4.1.6.10. for applicable values of C_w and Sentences 4.1.6.2.(5) and (6) for applicable values of C_s.

4) For arch roofs with a slope at the edge α_e > 30° (See Figure 4.1.6.10.-A and Table 4.1.6.10.), C_a shall be
a) taken as 0.0 on the upwind side of the peak, and
b) on the downwind side of the peak,
i) for the part of the roof between the peak and point where the slope α = 30°, taken as

$$C_a = \frac{xh}{0.06\,C_b x_{30} b} \text{ for } 0.05 < \frac{h}{b} \le 0.12 \text{ and}$$

$$C_a = \frac{2x}{C_b x_{30}} \text{ for } \frac{h}{b} > 0.12$$

where

x, h, b = as specified in Sentence (2), and

x_{30} = value of x where the slope $\alpha = 30°$, and

ii) for the part of the roof where the slope $\alpha > 30°$, taken as

$$C_a = \frac{h}{0.06\,C_b b} \text{ for } 0.05 < \frac{h}{b} \le 0.12 \text{ and}$$

$$C_a = \frac{2}{C_b} \text{ for } \frac{h}{b} > 0.12$$

5) Except as provided in Sentence (6), C_a for curved roofs shall be determined in accordance with the requirements for arch roofs stated in Sentences (3) and (4).

Table 4.1.6.10.
Load Cases for Arch Roofs, Curved Roofs and Domes
Forming Part of Sentences 4.1.6.10.(3), (4) and (9)

Load Case	Range of Application	Factors			
		All Arch or Curved Roofs and Domes	Arch and Curved Roofs		Domes
		C_w	C_a UpType equation here.wind Side	C_a Downwind Side	C_a Downwind Side
Case I	All values of h/b	As stated in 4.1.6.2.(3) and (4)	1.0	1.0	1.0
Case II	Slope at edge ≤ 30° h/b > 0.05 all values of x	1.0	0.0	$C_a = \frac{xh}{0.03C_b b^2}$ for $\frac{h}{b} \le 0.12$ $C_a = \frac{4x}{C_b b}$ for $\frac{h}{b} > 0.12$	$C_a(x,y) = C_a(x,0)\left(1 - \frac{y}{r}\right)$
	Slope at edge > 30° h/b > 0.05 $0 < x < x_{30}$	1.0	0.0	$C_a = \frac{xh}{0.06C_b x_{30} b}$ for $\frac{h}{b} \le 0.12$ $C_a = \frac{2x}{C_b x_{30}}$ for $\frac{h}{b} > 0.12$	
	Slope at edge >30° h/b > 0.05 $x \ge x_{30}$	1.0	0.0	$C_a = \frac{xh}{0.06C_b b}$ for $\frac{h}{b} \le 0.12$ $C_a = \frac{2}{C_b}$ for $\frac{h}{b} > 0.12$	

6) Where the slope, α, of a curved roof at its peak is greater than 10°, C_a shall be determined in accordance with the requirements for gable roofs stated in Article 4.1.6.9. using a slope equal to the mean slope of the curved roof.

7) For domes of circular plan form (See Figure 4.1.6.10.-B), C_a shall

a) along the central axis parallel to the wind, vary in the same way as for an arch roof with the same rise-to-span ratio, h/b, and

b) off this axis, vary according to

$$C_a(x,y) = C_a(x,0)\left(1 - \frac{y}{r}\right)$$

where

$C_a(x,y)$	=	value of C_a at location (x,y),
$C_a(x,0)$	=	value of C_a on the central axis parallel to the wind,
x	=	distance along the central axis parallel to the wind,
y	=	horizontal coordinate normal to the x direction, and
r	=	radius of dome.

8) For all arch roofs, curved roofs and domes, the slope factor, C_s, shall be as prescribed in Sentences 4.1.6.2.(5) and (6).

9) For all arch roofs, curved roofs and domes, the wind exposure factor, C_w, shall be as prescribed in Table 4.1.6.10.

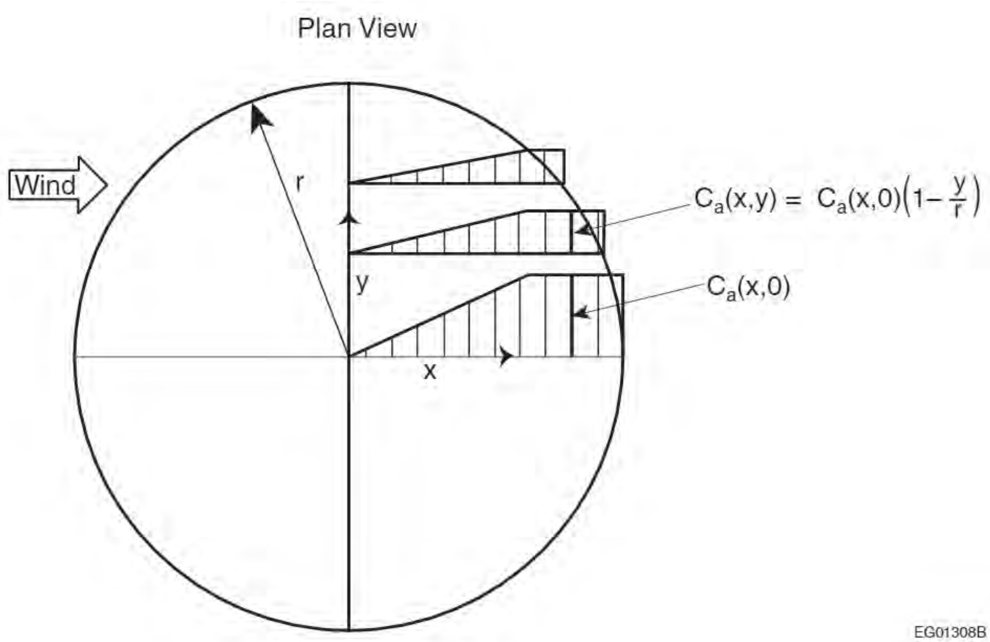


Figure 4.1.6.10.-B
Unbalanced snow accumulation factor on a circular dome
Forming Part of Sentence 4.1.6.10.(7)

Notes to Figure 4.1.6.10.-B:
(1) Refer to Table 4.1.6.10. for applicable values of C_w and Sentences 4.1.6.2.(5) and (6) for applicable values of C_s.
(2) Refer to Sentences 4.1.6.10.(3) and (4) for the calculation of $C_a(x,0)$.

4.1.6.11. Snow Loads Due to Sliding

1) Except as provided in Sentence (2), where an upper roof, or part thereof, slopes downwards with a slope α > 0 towards a lower roof, the snow load, S, on the lower roof, determined in accordance with Articles 4.1.6.2. and 4.1.6.5., shall be augmented in accordance with Sentence (3) to account for the additional load resulting from sliding snow.

2) Sentence (1) need not apply where

a) snow from the upper roof is prevented from sliding by a parapet or other effective means, or

b) the upper roof is not considered slippery and has a slope of less than 20°.

3) The total weight of additional snow resulting from sliding shall be taken as half the total weight of snow resulting from the uniform load case prescribed in Article 4.1.6.2. with

a) the accumulation factor C_a = 1.0 for the relevant part of the upper roof,

b) the slope factor, C_s, based on the slope of the lower roof, as prescribed in Sentences 4.1.6.2.(5) and (6), and

c) the sliding snow distributed on the lower roof such that it is a maximum for x = 0 and decreases linearly to 0 at $x = x_d$, as shown in Figure 4.1.6.11., where x and x_d are as defined in Article 4.1.6.5.

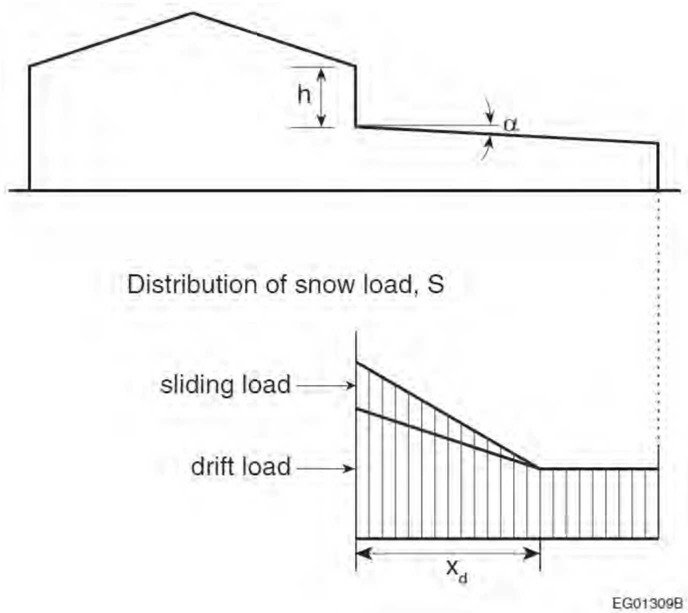


Figure 4.1.6.11.
Snow distribution on lower roof with sloped upper roof
Forming Part of Sentence 4.1.6.11.(3)

4.1.6.12. Valleys in Curved or Sloped Roofs

1) For valleys in curved or sloped roofs with a slope α > 10°, in addition to the full and partial load cases defined in Article 4.1.6.3., the non-uniform load cases II and III presented in Sentences (2) and (3) shall be considered to account for sliding, creeping and movement of meltwater.

2) For case II (See Figure 4.1.6.12.), the accumulation factor, C_a, shall be calculated as follows:

$$C_a = \frac{1}{C_b} \text{for } 0 < x \leq b/4 \text{ , and}$$
$$C_a = \frac{0.5}{C_b} \text{ for } b/4 < x \leq b/2$$

where

x = horizontal distance from the bottom of the valley, and

b = twice the horizontal distance between the bottom of the valley and the peak of the roof surface in question.

3) For case III (See Figure 4.1.6.12.), C_a shall be calculated as follows:

$$C_a = \frac{1.5}{C_b} \text{ for } 0 < x \leq b/8 \text{ , and}$$

$$C_a = \frac{0.5}{C_b} \text{ for } b/8 < x \leq b/2$$

where

x, b = as specified in Sentence (2).

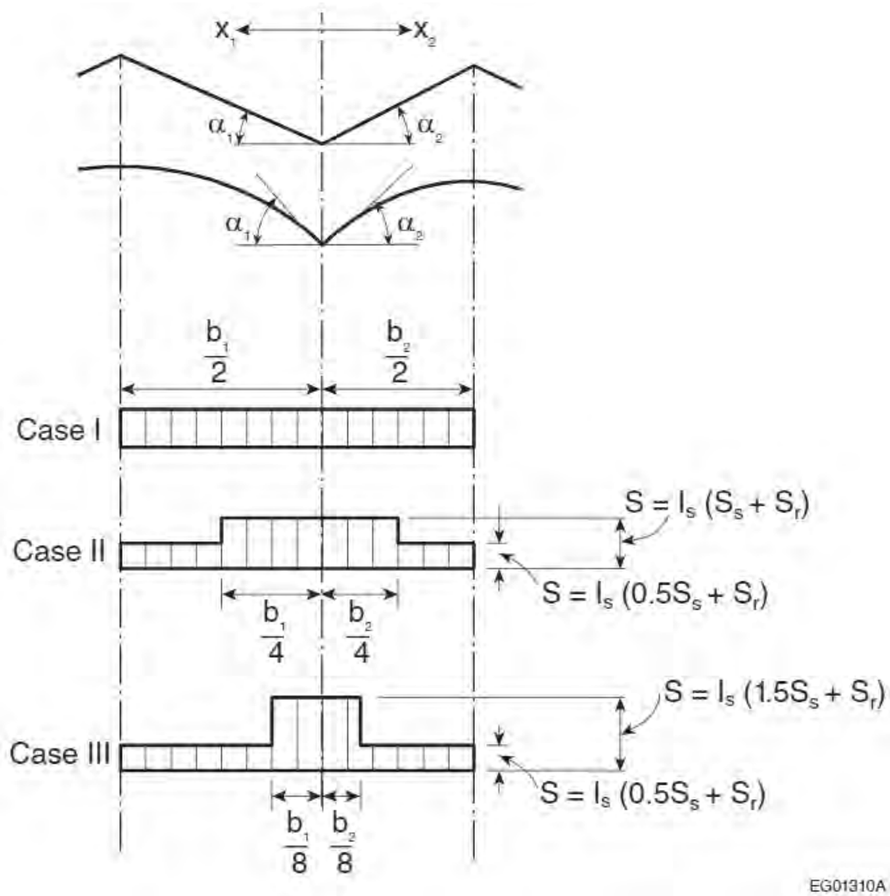


Figure 4.1.6.12.
Snow loads in valleys of sloped or curved roofs
Forming Part of Sentences 4.1.6.12.(2) and (3)

Notes to Figure 4.1.6.12.:
(1) C_w = 1, as per Sentence 4.1.6.2.(3).
(2) C_s = 1, as per Sentence 4.1.6.2.(7).

4.1.6.13. Specific Weight of Snow

1) For the purposes of calculating snow loads in drifts, the specific weight of snow, γ, shall be taken as 4.0 kN/m³ or $0.43S_S$ + 2.2 kN/m³, whichever is lesser.

4.1.6.14. Snow Removal

1) Snow removal by mechanical, thermal, manual or other means shall not be used as a rationale to reduce design snow loads.

4.1.6.15. Ice Loading of Structures

1) For lattice structures connected to the building, and other building components or appurtenances involving small width elements subject to significant ice accretion, the weight of ice accretion and the effective area presented to wind shall be as prescribed in CSA S37, "Antennas, Towers, and Antenna-Supporting Structures."

4.1.7. Wind Load

4.1.7.1. Specified Wind Load

1) The specified wind loads for a building and its components shall be determined using the Static, Dynamic or Wind Tunnel Procedure as stated in Sentences (2) to (5).

2) For the design of *buildings* that are not dynamically sensitive, as defined in Sentence 4.1.7.2.(1), one of the following procedures shall be used to determine the specified wind loads:

a) the Static Procedure described in Article 4.1.7.3.,
b) the Dynamic Procedure described in Article 4.1.7.8., or
c) the Wind Tunnel Procedure described in Article 4.1.7.12.

3) For the design of *buildings* that are dynamically sensitive, as defined in Sentence 4.1.7.2.(2), one of the following procedures shall be used to determine the specified wind loads:

a) the Dynamic Procedure described in Article 4.1.7.8., or
b) the Wind Tunnel Procedure described in Article 4.1.7.12.

4) For the design of *buildings* that may be subject to wake buffeting or channelling effects from nearby *buildings*, or that are very dynamically sensitive, as defined in Sentence 4.1.7.2.(3), the Wind Tunnel Procedure described in Article 4.1.7.12., shall be used to determine the specified wind loads.

5) For the design of cladding and secondary structural members, one of the following procedures shall be used to determine the specified wind loads:

a) the Static Procedure described in Article 4.1.7.3., or
b) the Wind Tunnel Procedure described in Article 4.1.7.12.

6) Computational fluid dynamics shall not be used to determine the specified wind loads for a *building* and its components. (See Note A-4.1.7.1.(6).)

4.1.7.2. Classification of Buildings

1) Except as provided in Sentences (2) and (3), a *building* is permitted to be classified as not dynamically sensitive.

2) A *building* shall be classified as dynamically sensitive if

a) its lowest natural frequency is less than 1 Hz and greater than 0.25 Hz,
b) its height is greater than 60 m, or
c) its height is greater than 4 times its minimum effective width, where the effective width, w, of a building shall be taken as

$$w = \frac{\sum h_i w_i}{\sum h_i}$$

where the summations are over the height of the *building* for a given wind direction, h_i is the height above grade to level i, and w_i is the width normal to the wind direction at height h_i; the minimum effective width is the lowest value of the effective width considering all wind directions.

3) A *building* shall be classified as very dynamically sensitive if

a) its lowest natural frequency is less than or equal to 0.25 Hz, or
b) its height is more than 6 times its minimum effective width as defined in Clause (2)(c).

4.1.7.3. Static Procedure

1) The specified external pressure or suction due to wind on part or all of a surface of a *building* shall be calculated as follows:

$$p = I_w q C_e C_t C_g C_p$$

where

p = specified external pressure acting statically and in a direction normal to the surface, considered positive when the pressure acts towards the surface and negative when it acts away from the surface,

I_W = importance factor for wind load, as provided in Table 4.1.7.3.,
q = reference velocity pressure, as provided in Sentence (4),
C_e = exposure factor, as provided in Sentences (5) and (7),
C_t = topographic factor, as provided in Article 4.1.7.4.,
C_g = gust effect factor, as provided in Sentence (8), and
C_p = external pressure coefficient, as provided in Articles 4.1.7.5. and 4.1.7.6.

Table 4.1.7.3.
Importance Factor for Wind Load, I_W
Forming Part of Sentences 4.1.7.3.(1) and (3)

Importance Category	Importance Factor, I_W	
	ULS	SLS
Low	0.8	0.75
Normal	1	0.75
High	1.15	0.75
Post-disaster	1.25	0.75

2) The net wind load for the *building* as a whole shall be the algebraic difference of the loads on the windward and leeward surfaces, and in some cases, may be calculated as the sum of the products of the external pressures or suctions and the areas of the surfaces over which they are averaged as provided in Sentence (1).
3) The net specified pressure due to wind on part or all of a surface of a *building* shall be the algebraic difference, such as to produce the most critical effect, of the external pressure or suction calculated in accordance with Sentence (1) and the specified internal pressure or suction due to wind calculated as follows:

$$p_i = I_w q C_{ei} C_t C_{gi} C_{pi}$$

where

p_i = specified internal pressure acting statically and in a direction normal to the surface, either as a pressure directed towards the surface or as a suction directed away from the surface,

I_W, q, C_t = as defined in Sentence (1),
C_{ei} = exposure factor for internal pressure, as provided in Sentence (7),
C_{gi} = internal gust effect factor, as provided in Sentence (10), and
C_{pi} = internal pressure coefficient, as provided in Article 4.1.7.7.

4) The reference velocity pressure, q, shall be the appropriate value determined in conformance with Subsection 1.1.3., based on a probability of being exceeded in any one year of 1 in 50.
5) The exposure factor, C_e, shall be based on the reference height, h, determined in accordance with Sentence (6), for the surface or part of the surface under consideration and shall be

a) $(h/10)^{0.2}$ but not less than 0.9 for open terrain, where open terrain is level terrain with only scattered *buildings*, trees or other obstructions, open water or shorelines thereof,
b) $0.7(h/12)^{0.3}$ but not less than 0.7 for rough terrain, where rough terrain is suburban, urban or wooded terrain extending upwind from the *building* uninterrupted for at least 1 km or 20 times the height of the *building*, whichever is greater, or

c) an intermediate value between the two exposures defined in Clauses (a) and (b) in cases where the site is less than 1 km or 20 times the height of the *building* from a change in terrain conditions, whichever is greater, provided an appropriate interpolation method is used. (See Note A-4.1.7.3.(5)(c).)

6) The reference height, h, shall be determined as follows:

a) for *buildings* whose height is less than or equal to 20 m and less than the smaller plan dimension, h shall be the mid-height of the roof above *grade*, but not less than 6 m,

b) for other *buildings*, h shall be

i) the actual height above *grade* of the point on the windward wall for which external pressures are being calculated,

ii) the mid-height of the roof for pressures on surfaces parallel to the wind direction, and

iii) the mid-height of the *building* for pressures on the leeward wall, and

c) for any structural element exposed to wind, h shall be the mid-height of the element above the ground.

7) The exposure factor for internal pressures, C_{ei}, shall be determined as follows:

a) for *buildings* whose height is greater than 20 m and that have a dominant opening, C_{ei} shall be equal to the exposure factor for external pressures, C_e, calculated at the mid-height of the dominant opening, and

b) for other *buildings*, C_{ei} shall be the same as the exposure factor for external pressures, C_e, calculated for a reference height, h, equal to the mid-height of the *building* or 6 m, whichever is greater.

8) Except as provided in Sentences (9) and 4.1.7.6.(1), the gust effect factor, C_g, shall be one of the following values:

a) 2.0 for the *building* as a whole and main structural members, or

b) 2.5 for external pressures and suctions on secondary structural members, including cladding.

9) For cases where C_g and C_p are combined into a single product, C_pC_g, the values of C_p and C_g need not be independently specified. (See Article 4.1.7.6.)

10) The internal gust effect factor, C_{gi}, shall be 2.0, except it is permitted to be calculated using the following equation for large structures enclosing a single large unpartitioned volume that does not have numerous overhead doors or openings:

$$C_{gi} = 1 + \frac{1}{\sqrt{1 + \frac{V_o}{6950A}}}$$

where

V_0 = internal volume, in m^3, and

A = total area of all exterior openings of the volume, in m^2.

(See Note A-4.1.7.3.(10).)

4.1.7.4. Topographic Factor

1) Except as provided in Sentence (2), the topographic factor, C_t, shall be taken as 1.0.

2) For *buildings* on hills or escarpments with a slope, $H_h/(2L_h)$, greater than 0.1 (See Figure 4.1.7.4.), the topographic factor, C_t, shall be calculated as follows:

$$C_t = \left(1 + \frac{\Delta S}{C_g}\right)(1 + \Delta S)$$

where

$$\Delta S = \Delta S_{max}\left(1 - \frac{|x|}{kL_h}\right)\exp(-\propto z/L_h)$$

where

ΔS_{max} = applicable value from Table 4.1.7.4.,

x = horizontal distance from the peak of the hill or escarpment,

L_h = horizontal distance upwind from the peak to the point where the ground surface lies at half the height of the hill or escarpment, or $2H_h$ (where H_h = height of hill or escarpment), whichever is greater,
z = height above ground, and
k and α = applicable constants from Table 4.1.7.4. based on shape of hill or escarpment.

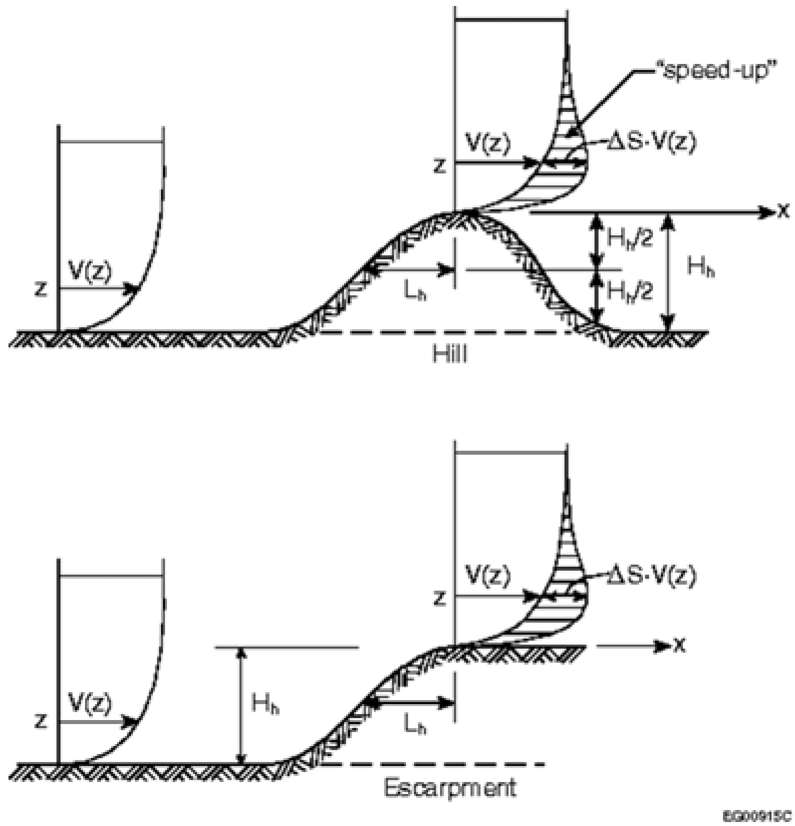


Figure 4.1.7.4.
Speed-up of mean velocity on a hill or escarpment
Forming Part of Sentence 4.1.7.4.(2)

Note to Figure 4.1.7.4.:
(1) $V_{(z)}$ = wind speed

Table 4.1.7.4.
Parameters for Maximum Speed-up Over Hills and Escarpments
Forming Part of Sentence 4.1.7.4.(2)

Shape of Hill or Escarpment	ΔS_{max}(1)	α	k	
			x < 0	x ≥ 0
2-dimensional hill	2.2 H_h/L_h	3	1.5	1.5
2-dimensional escarpment	1.3 H_h/L_h	2.5	1.5	4
3-dimensional axi-symmetrical hill	1.6 H_h/L_h	4	1.5	1.5

Notes to Table 4.1.7.4.:
For $H_h/L_h > 0.5$, assume $H_h/L_h = 0.5$ and substitute 2 H_h for L_h in the equation for ΔS.

4.1.7.5. External Pressure Coefficients

1) Applicable values of external pressure coefficients, C_p, are provided in

a) Sentences (2) to (5), and

b) Article 4.1.7.6. for certain shapes of low *buildings*.

2) For the design of the main structural system, the value of C_p shall be established as follows, where H is the height of the building and D is the width of the building parallel to the wind direction:

a) on the windward face,

C_p = 0.6 for $H/D < 0.25$
= $0.27(H/D + 2)$ for $0.25 \le H/D < 1.0$, and
= 0.8 for $H/D \ge 1.0$,

b) on the leeward face,

C_p = –0.3 for $H/D < 0.25$,
= $-0.27(H/D + 0.88)$ for $0.25 \le H/D < 1.0$, and
= –0.5 for $H/D \ge 1.0$, and

c) on the walls parallel to the wind, $C_p = -0.7$.

(See Note A-4.1.7.5.(2) and (3).)

3) For the design of roofs, the value of C_p shall be established as follows, where x is the distance from the upwind edge of the roof:

a) for $H/D \ge 1.0$, $C_p = -1.0$, and

b) for $H/D < 1.0$,

C_p = –1.0 for $x \le H$, and
= –0.5 for $x > H$.

(See Note A-4.1.7.5.(2) and (3).)

4) For the design of the cladding and of secondary structural elements supporting the cladding, the value of C_p shall be established as follows, where W and D are the widths of the *building*:

a) on walls, C_p shall be taken as ±0.9, except that within a distance equal to the larger of 0.1D and 0.1W from a *building* corner, the negative value of C_p shall be taken as –1.2,

b) on walls where vertical ribs deeper than 1 m are placed on the facade, C_p shall be taken as ±0.9, except that, within a distance equal to the larger of 0.2D and 0.2W from a *building* corner, the negative value of C_p shall be taken as –1.4, and

c) on roofs, C_p shall be taken as –1.0, except that

i) within a distance equal to the larger of 0.1D and 0.1W from a roof edge, C_p shall be taken as –1.5,

ii) in a zone that is within a distance equal to the larger of 0.2W and 0.2D from a roof corner, C_p shall be taken as –2.3 but is permitted to be taken as –2.0 for roofs with perimeter parapets that are higher than 1 m, and

iii) on lower levels of flat stepped roofs, positive pressure coefficients established for the walls of the steps apply for a distance b (See Figure 4.1.7.6.-D for the definition of b).

(See Note A-4.1.7.5.(4).)

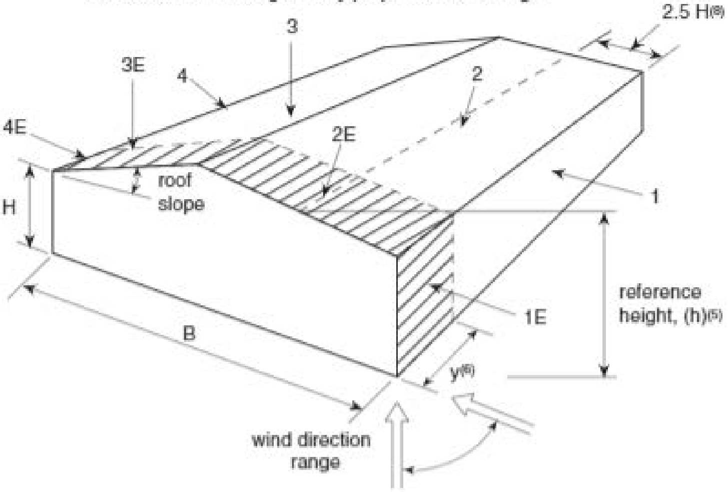
5) For the design of balcony *guards*, the internal pressure coefficient, C_{pi}, shall be taken as zero and the value of C_p shall be taken as ±0.9, except that within a distance equal to the larger of 0.1W and 0.1D from a *building* corner, C_p shall be taken as ±1.2.

4.1.7.6. External Pressure Coefficients for Low Buildings

1) For the design of *buildings* with a height, H, that is both less than or equal to 20 m and less than the smaller plan dimension, the values of the product of the pressure coefficient and gust factor, C_pC_g, provided in Sentences (2) to (9) are permitted to be used.

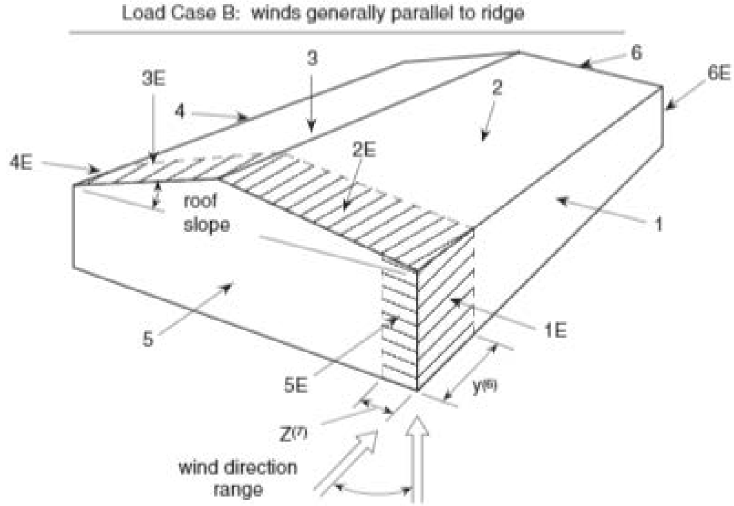
2) For the design of the main structural system of the *building*, which is affected by wind pressures on more than one surface, the values of C_pC_g are provided in Figure 4.1.7.6.-A.

Load Case A: winds generally perpendicular to ridge



Roof Slope	Building Surfaces							
	1	1E	2	2E	3	3E	4	4E
0° to 5°	0.75	1.15	-1.3	-2.0	-0.7	-1.0	-0.55	-0.8
20°	1.0	1.5	-1.3	-2.0	-0.9	-1.3	-0.8	-1.2
30° to 45°	1.05	1.3	0.4	0.5	-0.8	-1.0	-0.7	-0.9
90°	1.05	1.3	1.05	1.3	-0.7	-0.9	-0.7	-0.9

Load Case B: winds generally parallel to ridge



Roof Slope	Building Surfaces											
	1	1E	2	2E	3	3E	4	4E	5	5E	6	6E
0° to 90°	-0.85	-0.9	-1.3	-2.0	-0.7	-1.0	-0.85	-0.9	0.75	1.15	-0.55	-0.8

EG00920E

Figure 4.1.7.6.-A
External peak values of C_pC_g for primary structural actions arising from wind load acting simultaneously on all surfaces of low buildings (H ≤ 20 m)
Forming Part of Sentence 4.1.7.6.(2)

Notes to Figure 4.1.7.6.-A:

(1) The *building* must be designed for all wind directions. Each corner must be considered in turn as the windward corner shown in the sketches. For all roof slopes, Load Case A and Load Case B are required as two separate loading conditions to generate the wind actions, including torsion, to be resisted by the structural system.

(2) For values of roof slope not shown, the coefficient (C_pC_g) can be interpolated linearly.

(3) Positive coefficients denote forces toward the surface, whereas negative coefficients denote forces away from the surface.

(4) For the design of *foundations*, exclusive of anchorages to the frame, only 70% of the effective load is to be considered.
(5) The reference height, h, for pressures is the mid-height of the roof or 6 m, whichever is greater. The eave height, H, may be substituted for the mid-height of the roof if the roof slope is less than 7°.
(6) End-zone width y should be the greater of 6 m or 2z, where z is the width of the gable-wall end zone defined for Load Case B below. Alternatively, for *buildings* with frames, the end zone y may be the distance between the end and the first interior frame.
(7) End-zone width z is the lesser of 10% of the least horizontal dimension and 40% of height, H, but not less than 4% of the least horizontal dimension or 1 m.
(8) For B/H > 5 in Load Case A, the listed negative coefficients on surfaces 2 and 2E should only be applied on an area whose width is 2.5H measured from the windward eave. The pressures on the remainder of the windward roof should be reduced to the pressures for the leeward roof.

3) For the design of individual walls and wall cladding, the values of C_pC_g are provided in Figure 4.1.7.6.-B.
4) For the design of roofs with a slope less than or equal to 7°, the values of C_pC_g are provided in Figure 4.1.7.6.-C.
5) For the design of flat roofs with steps in elevation, the values of C_pC_g are provided in Figure 4.1.7.6.-D.
6) For the design of gabled or hipped, single-ridge roofs with a slope greater than 7°, the values of C_pC_g are provided in Figure 4.1.7.6.-E.
7) For the design of gabled, multi-ridge roofs, the values of C_pC_g are provided in
- a) Figure 4.1.7.6.-C for roofs with a slope less than or equal to 10°, and
- b) Figure 4.1.7.6.-F for roofs with a slope greater than 10°.

8) For monosloped roofs, the values of C_pC_g are provided in
- a) Figure 4.1.7.6.-C for roofs with a slope less than or equal to 3°, and
- b) Figure 4.1.7.6.-G for roofs with a slope greater than 3° and less than or equal to 30°.

9) For sawtooth roofs, the values of C_pC_g are provided in
- a) Figure 4.1.7.6.-C for roofs with a slope less than or equal to 10°, and
- b) Figure 4.1.7.6.-H for roofs with a slope greater than 10°.

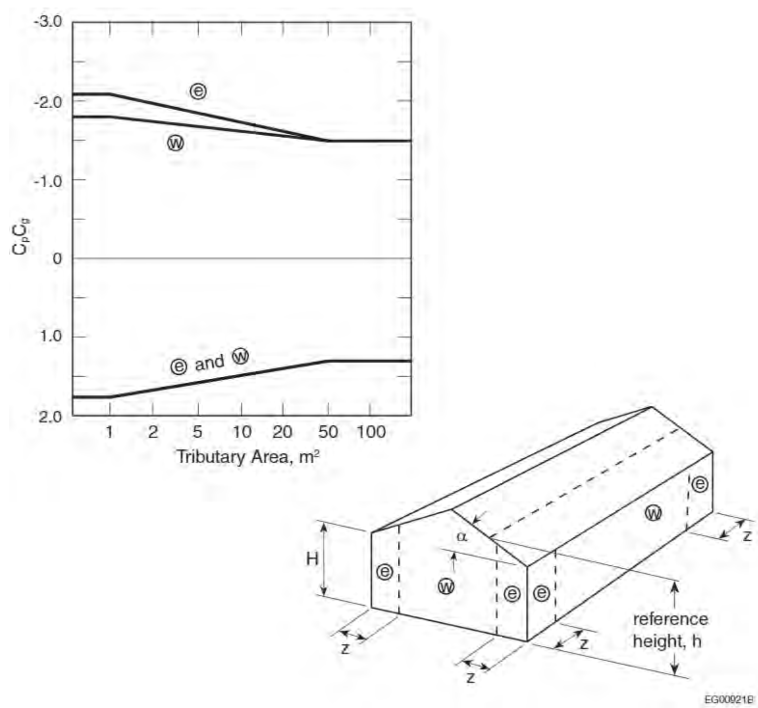


Figure 4.1.7.6.-B
External peak values of C_pC_g on individual walls for the design of cladding and secondary structural members
Forming Part of Sentence 4.1.7.6.(3)

Notes to Figure 4.1.7.6.-B:
(1) These coefficients apply for any roof slope, α.

(2) End-zone width z is the lesser of 10% of the least horizontal dimension and 40% of height, H, but not less than 4% of the least horizontal dimension or 1 m.
(3) Combinations of external and internal pressures must be evaluated to obtain the most severe loading.
(4) Positive coefficients denote forces toward the surface, whereas negative coefficients denote forces away from the surface. Each structural element must be designed to withstand forces of both signs.
(5) Pressure coefficients generally apply for facades with architectural features; however, where vertical ribs deeper than 1 m are placed on a facade, a local C_pC_g of –2.8 applies to zone e.

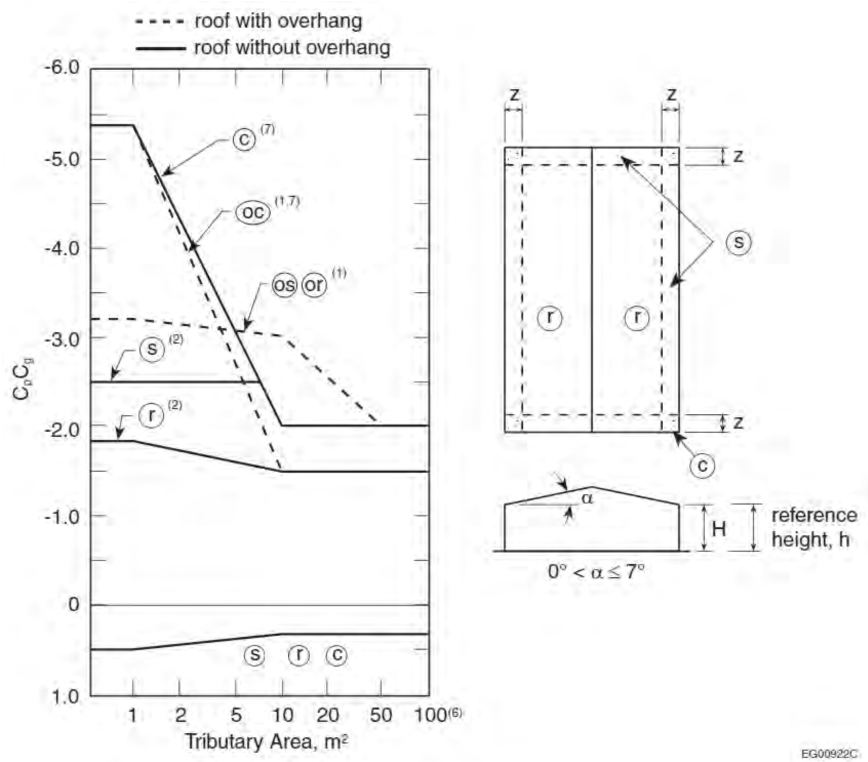


Figure 4.1.7.6.-C
External peak values of C_pC_g on roofs with a slope of 7° or less for the design of structural components and cladding
Forming Part of Sentences 4.1.7.6.(4), (7), (8) and (9)

Notes to Figure 4.1.7.6.-C:
(1) Coefficients for overhung roofs have the prefix “o” and refer to the same roof areas as referred to by the corresponding symbol without a prefix. They include contributions from both upper and lower surfaces. In the case of overhangs, the walls are inboard of the roof outline.
(2) s and r apply to both roofs and upper surfaces of canopies.
(3) End-zone width z is the lesser of 10% of the least horizontal dimension and 40% of height, H, but not less than 4% of the least horizontal dimension or 1 m.
(4) Combinations of external and internal pressures must be evaluated to obtain the most severe loading.
(5) Positive coefficients denote forces toward the surface, whereas negative coefficients denote forces away from the surface. Each structural element must be designed to withstand forces of both signs.
(6) For calculating the uplift forces on tributary areas larger than 100 m^2 on unobstructed nearly-flat roofs with low parapets, and where the centre of the tributary area is at least twice the height of the *building* from the nearest edge, the value of C_pC_g may be reduced from –1.5 to –1.1 at /H = 2 and further reduced linearly to –0.6 at x/H = 5, where x is the distance to the nearest edge and H is the height of the *building*.
(7) For roofs having a perimeter parapet with a height of 1 m or greater, the corner coefficients C_pC_g for tributary areas less than 1 m^2 can be reduced from –5.4 to –4.4.

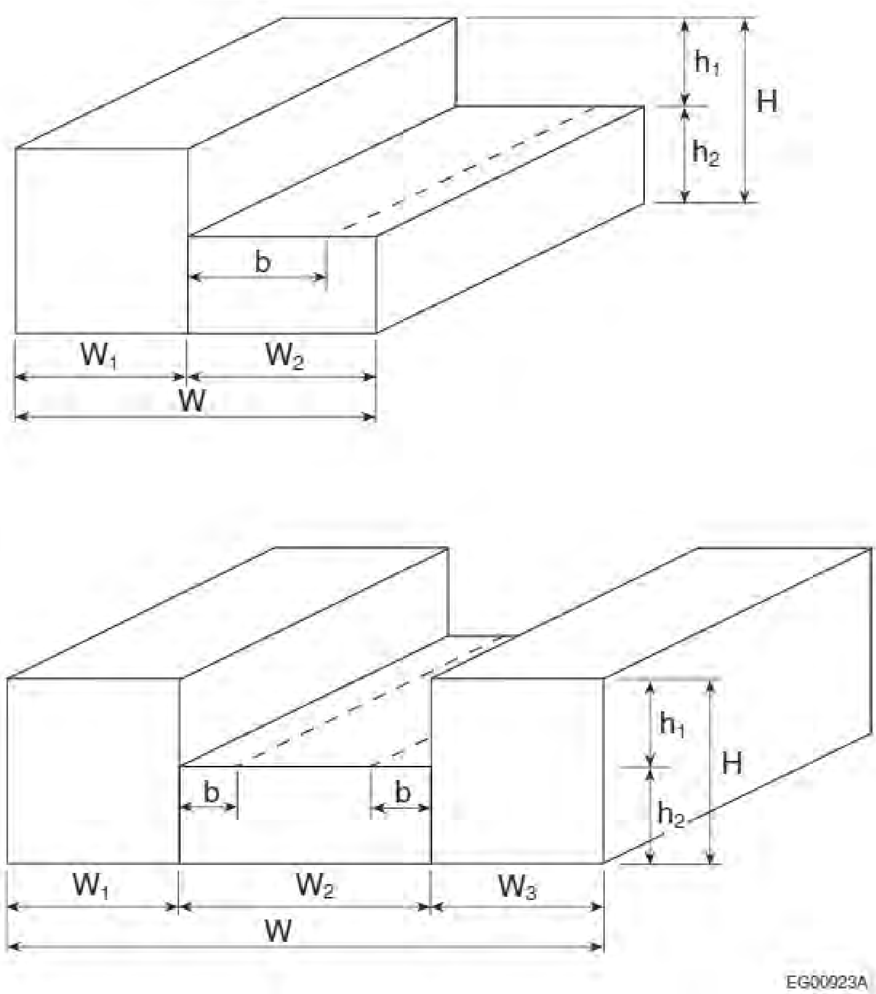


Figure 4.1.7.6.-D
External peak values of C_pC_g for the design of the structural components and cladding of buildings with stepped roofs
Forming Part of Sentence 4.1.7.6.(5)

Notes to Figure 4.1.7.6.-D:

(1) The zone designations, pressure-gust coefficients and notes provided in Figure 4.1.7.6.-C apply on both the upper and lower levels of flat stepped roofs, except that on the lower levels, positive pressure-gust coefficients equal to those in Figure 4.1.7.6.-B for walls apply for a distance, b, where b is equal to $1.5h_1$ but not greater than 30 m. For all walls in Figure 4.1.7.6.-D, zone designations and pressure coefficients provided for walls in Figure 4.1.7.6.-B apply.

(2) Note (1) above applies only when the following conditions are met: $h_1 \geq 0.3H$, $h_1 \geq 3$ m, and W_1, W_2, or W_3 is greater than 0.25W but not greater than 0.75W.

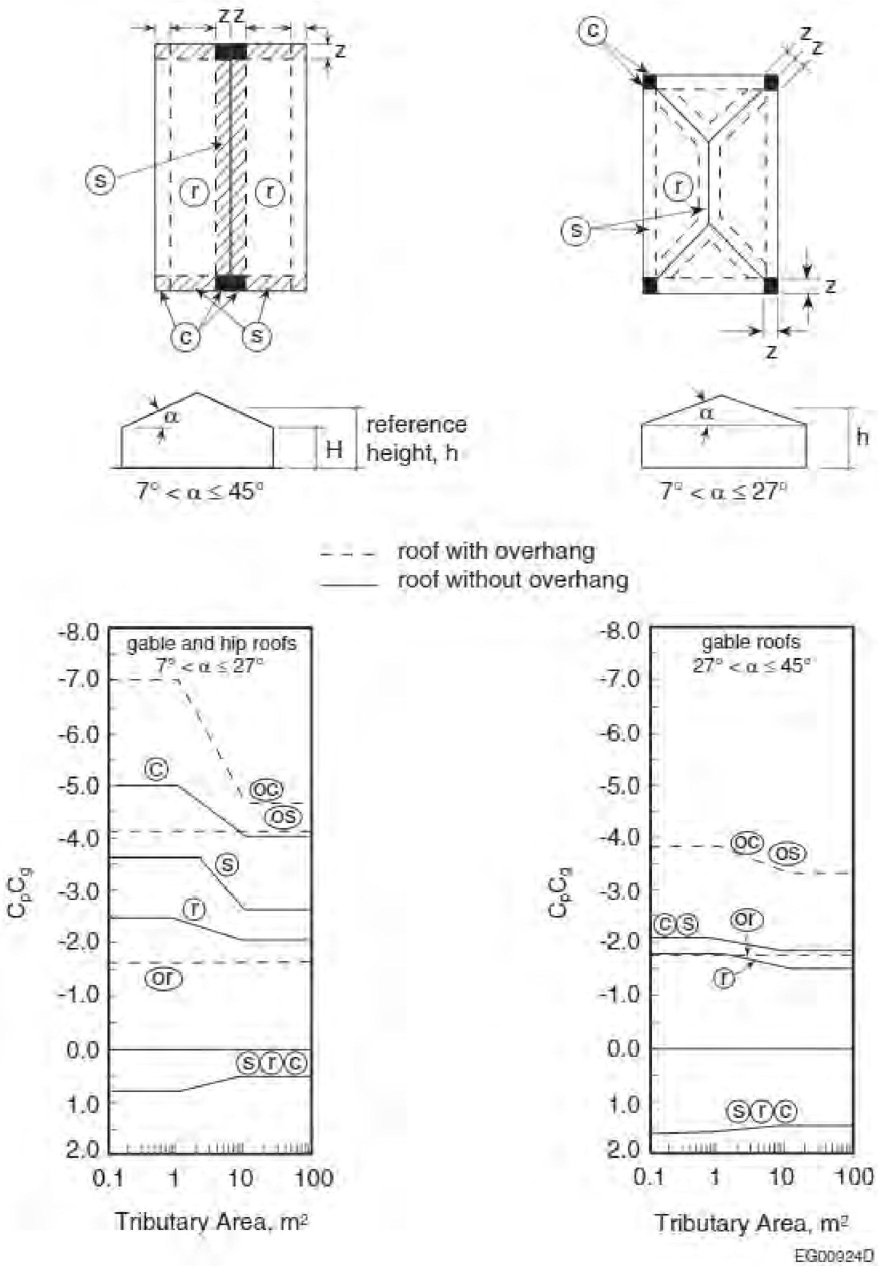


Figure 4.1.7.6.-E
External peak values of C_pC_g on single-span gabled and hipped roofs with a slope greater than 7° for the design of structural components and cladding
Forming Part of Sentence 4.1.7.6.(6)

Notes to Figure 4.1.7.6.-E:
(1) Coefficients for overhung roofs have the prefix "o" and refer to the same roof areas as referred to by the corresponding symbol without a prefix. They include contributions from both upper and lower surfaces.
(2) End-zone width z is the lesser of 10% of the least horizontal dimension and 40% of height, H, but not less than 4% of the least horizontal dimension or 1 m.
(3) Combinations of external and internal pressures must be evaluated to obtain the most severe loading.
(4) Positive coefficients denote forces towards the surface, whereas negative coefficients denote forces away from the surface. Each structural element must be designed to withstand forces of both signs.
(5) For hipped roofs with 7° < α ≤ 27°, edge/ridge strips and pressure-gust coefficients for ridges of gabled roofs apply along each hip.

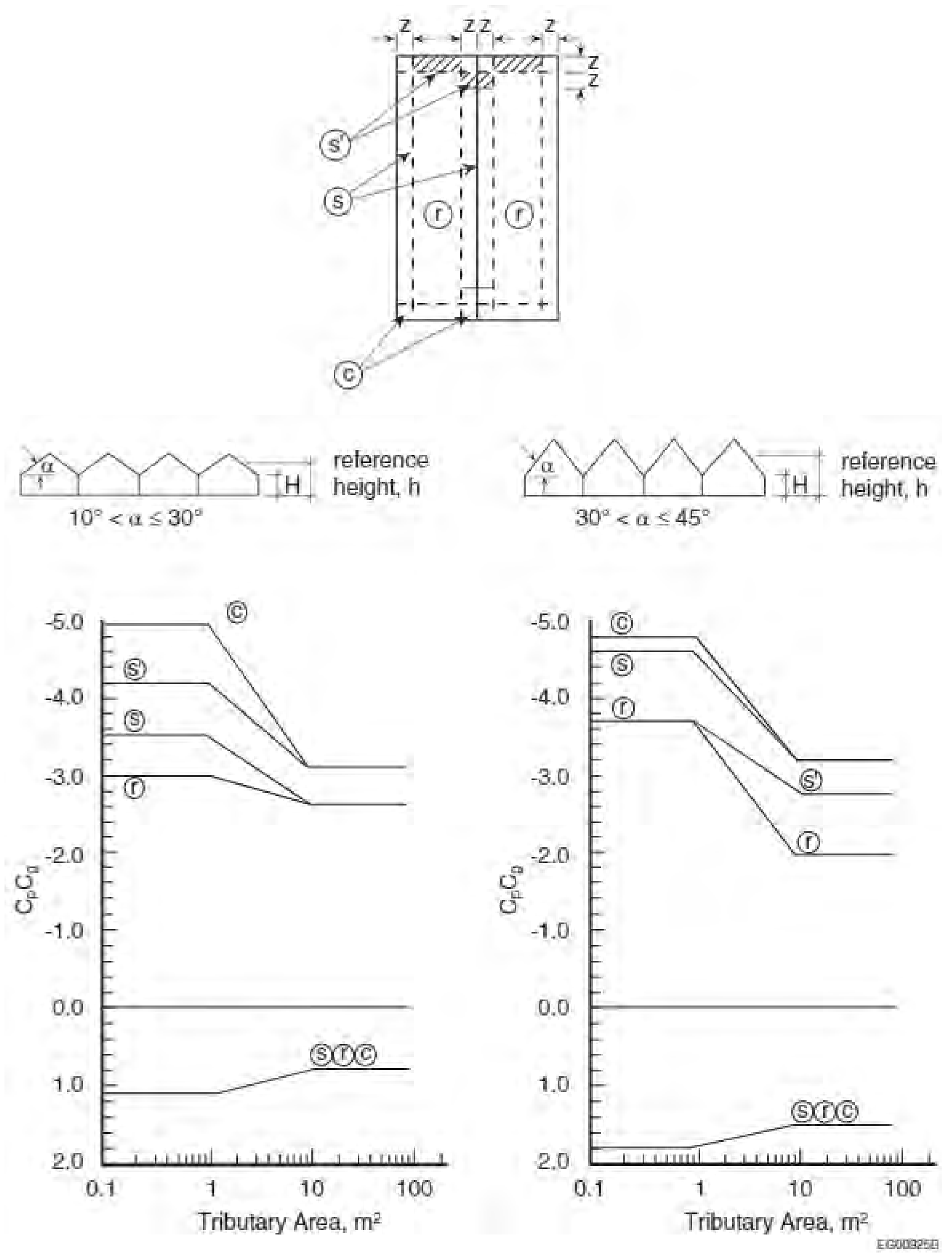


Figure 4.1.7.6.-F
External peak values of C_pC_g on multi-span gabled (folded) roofs with a slope greater than 10° for the design of structural components and cladding
Forming Part of Sentence 4.1.7.6.(7)

Notes to Figure 4.1.7.6.-F:

(1) End-zone width z is the lesser of 10% of the least horizontal dimension and 40% of height, H, but not less than 4% of the least horizontal dimension or 1 m.
(2) Combinations of external and internal pressures must be evaluated to obtain the most severe loading.
(3) Positive coefficients denote forces towards the surface, whereas negative coefficients denote forces away from the surface. Each structural element must be designed to withstand forces of both signs.
(4) For α ≤ 10°, the coefficients given in Figure 4.1.7.6.-C apply, but for cases where α > than 7°, use α = 7°.

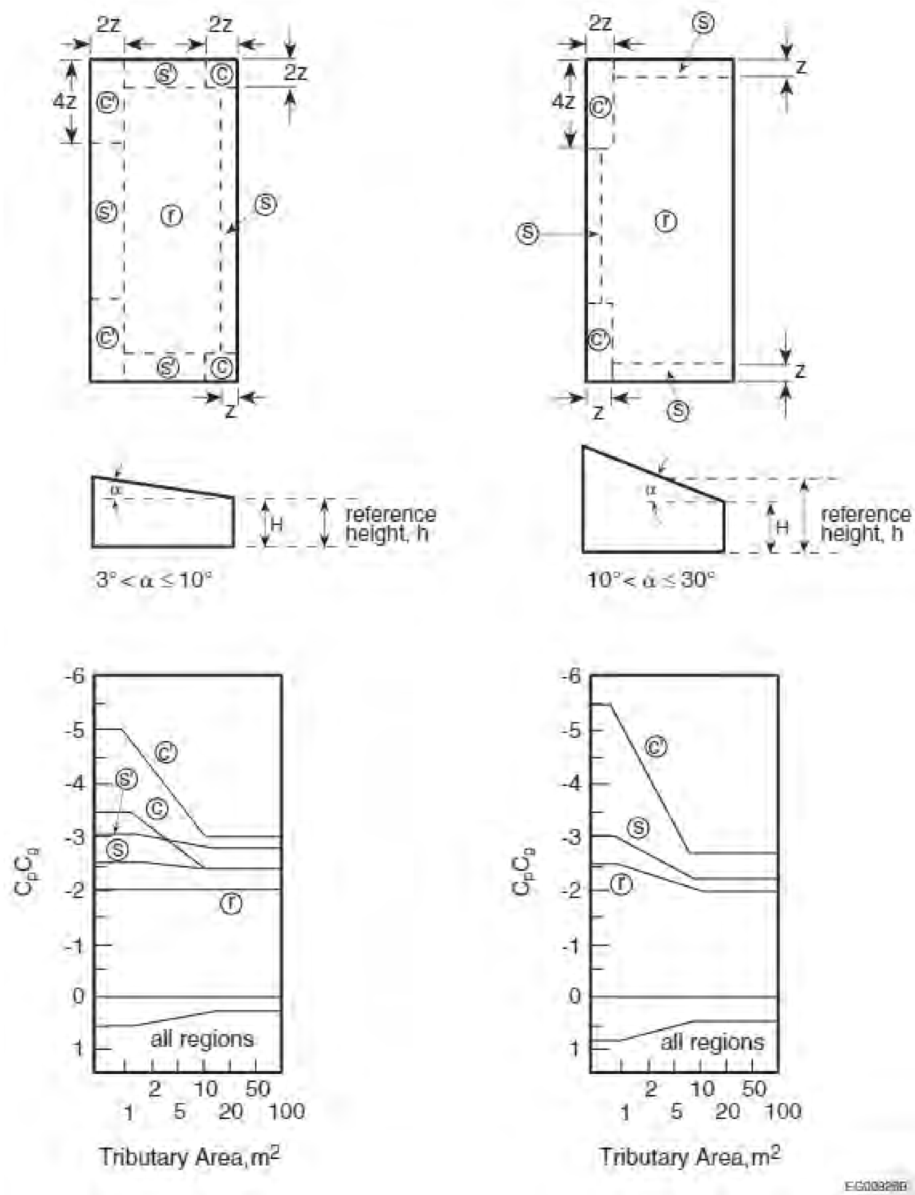


Figure 4.1.7.6.-G
External peak values of C_pC_g on monoslope roofs for the design of structural components and cladding
Forming Part of Sentence 4.1.7.6.(8)

Notes to Figure 4.1.7.6.-G:

(1) End-zone width z is the lesser of 10% of the least horizontal dimension and 40% of height, H, but not less than 4% of the least horizontal dimension or 1 m.

(2) Combinations of external and internal pressures must be evaluated to obtain the most severe loading.

(3) Positive coefficients denote forces towards the surface, whereas negative coefficients denote forces away from the surface. Each structural element must be designed to withstand forces of both signs.

(4) For α ≤ 3°, the coefficients given in Figure 4.1.7.6.-C apply.

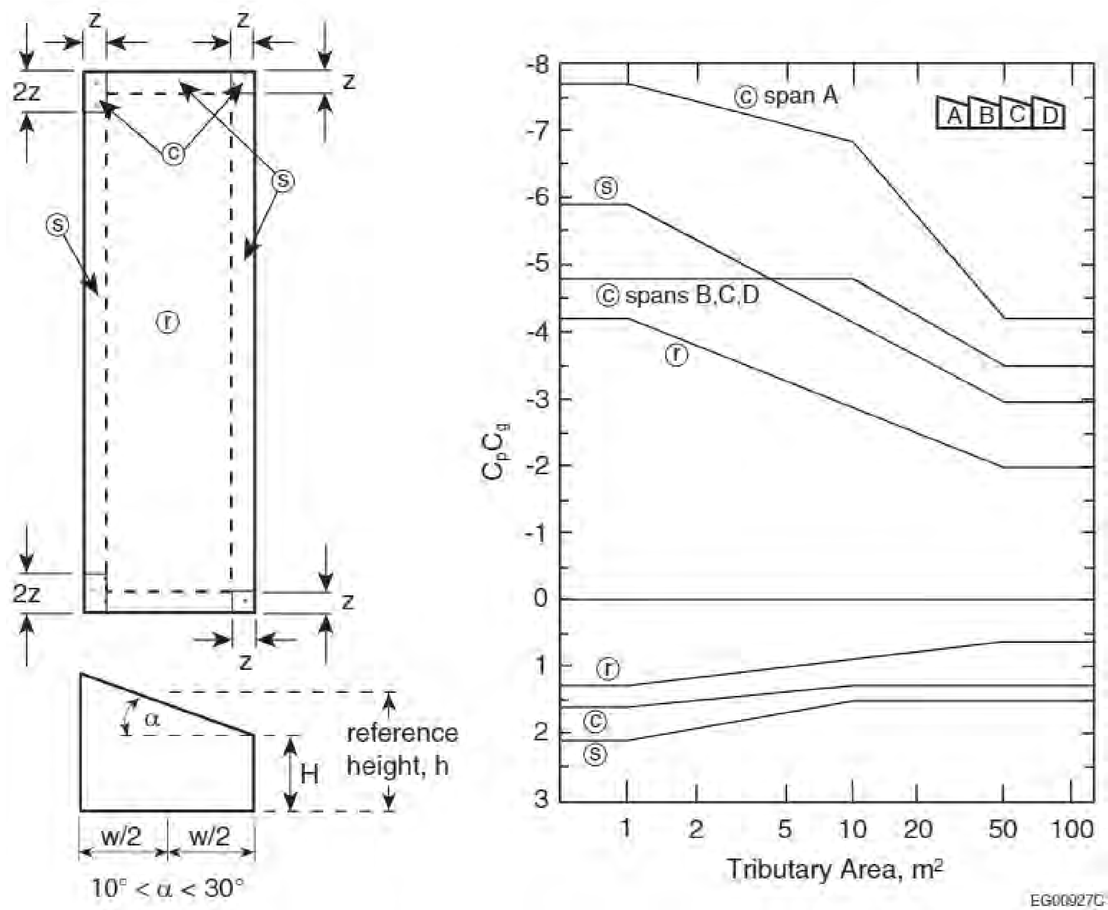


Figure 4.1.7.6.-H
External peak values of C_pC_g on sawtooth roofs with a slope greater than 10° for the design of structural components and cladding
Forming Part of Sentence 4.1.7.6.(9)

Notes to Figure 4.1.7.6.-H:

(1) End-zone width z is the lesser of 10% of the least horizontal dimension and 40% of height, H, but not less than 4% of the least horizontal dimension or 1 m.
(2) Combinations of external and internal pressures must be evaluated to obtain the most severe loading.
(3) Positive coefficients denote forces towards the surface, whereas negative coefficients denote forces away from the surface. Each structural element must be designed to withstand forces of both signs.
(4) Negative coefficients on the corner zones of Span A differ from those on Spans B, C, and D.
(5) For α ≤ 10°, the coefficients given in Figure 4.1.7.6.-C apply, but for cases where α > than 7°, use α = 7°.

4.1.7.7. Internal Pressure Coefficient

1) The internal pressure coefficient, C_{pi}, shall be as prescribed in Table 4.1.7.7.

Table 4.1.7.7.
Internal Pressure Coefficients
Forming Part of Sentence 4.1.7.7.(1)

Building Openings	Values for C_{pi}
Uniformly distributed small openings amounting to less than 0.1% of the total surface area of the building	–0.15 to 0.0
Non-uniformly distributed openings of which none is significant or significant openings that are wind-resistant and closed during storms	–0.45 to +0.30

Large openings likely to remain open during storms	–0.70 to +0.70

4.1.7.8. Dynamic Procedure

1) For the application of the Dynamic Procedure, the provisions of Article 4.1.7.3. shall be followed, except that the exposure factor, C_e, shall be as prescribed in Sentences (2) and (3), and the gust effect factor, C_g, shall be as prescribed in Sentence (4), when determining the wind loads on the main structural system.

2) For *buildings* in open terrain, as defined in Clause 4.1.7.3.(5)(a), the value of C_e for the design of the main structural system shall be calculated as follows:

$$C_e = \left(\frac{h}{10}\right)^{0.28}, \text{ but } 1.0 \leq C_e \leq 2.5$$

(See Note A-4.1.7.8.(2) and (3).)

3) For *buildings* in rough terrain, as defined in Clause 4.1.7.3.(5)(b), the value of C_e for the design of the main structural system shall be calculated as follows:

$$C_e = 0.5\left(\frac{h}{12.7}\right)^{0.5}, \text{ but } 0.5 \leq C_e \leq 2.5$$

(See Note A-4.1.7.8.(2) and (3).)

4) For the design of the main structural system, C_g shall be calculated as follows:

$$C_g = 1 + g_p\frac{\sigma}{\mu}$$

where

g_p = peak factor calculated as $\sqrt{2\ln(vT)} + \frac{0.577}{\sqrt{2\ln(vT)}}$, and

$$\sigma/\mu = \sqrt{\frac{K}{C_{eH}}\left(B + \frac{sF}{\beta}\right)},$$

where

ν = average fluctuation rate calculated as $f_{nD}\sqrt{\frac{sF}{sF+\beta B}}$,

T = 3 600 s,

K = 0.08 for open terrain and 0.10 for rough terrain,

C_{eH} = exposure factor evaluated at reference height h = H,

B = background turbulence factor, a function of w/H determined from Figure 4.1.7.8.,

S = size reduction factor calculated as $\frac{\pi}{3}\left[\frac{1}{1+\frac{8f_nH}{3V_H}}\right]\left[\frac{1}{1+\frac{10f_nW}{V_H}}\right]$,

F = gust energy ratio calculated as $\frac{x_0^2}{(1+x_0^2)^{4/3}}$, where $x_0 = (1\,220\, f_n/V_H)$, and

β = damping ratio, which shall be determined by a rational method, or may be taken to be 0.01 for steel structures, 0.02 for concrete structures, and 0.015 for composite structures,

where

f_{nD} = natural frequency of vibration of the building in the along-wind direction, in Hz,

f_n = lowest natural frequency of the building, in Hz, as defined in Sentences 4.1.7.2.(2) and (3),

H = height of the building,

w = effective width of windward face of the *building* calculated as $\frac{\sum h_i w_i}{\sum h_i}$, where w_i = width normal to wind direction at height h_i, and

V_H = mean wind speed at the top of the structure, in m/s, calculated as $\overline{V}\sqrt{C_{eH}}$,

where

$\overline{V}$ = reference wind speed at a height of 10 m, in m/s, calculated as $\sqrt{\frac{2I_wq}{\rho}C_{eH}}$,

where

I_W = importance factor,

q = reference velocity pressure, in Pa, and

ρ = air density = 1.2929 kg/m^3.

(See Note A-4.1.7.8.(4).)

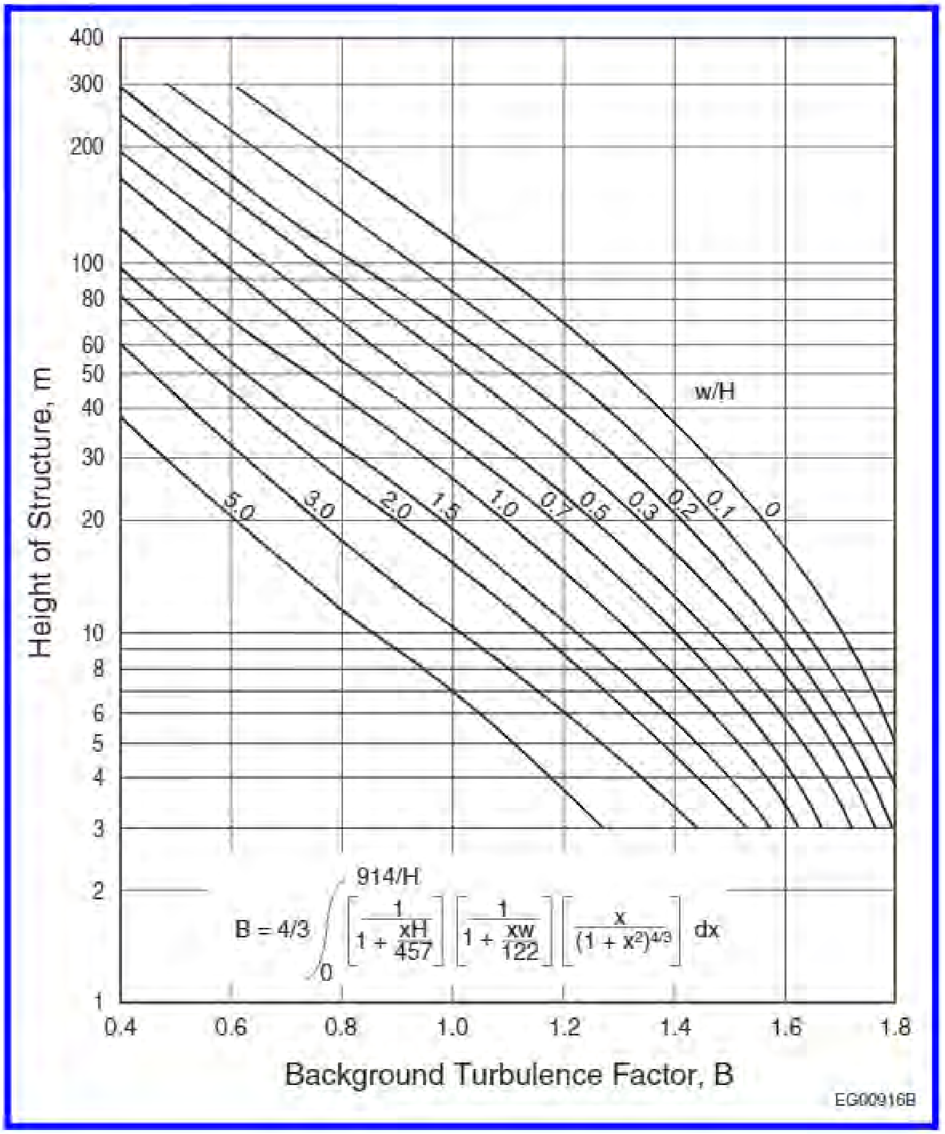


Figure 4.1.7.8.
Background turbulence factor, B
Forming Part of Sentence 4.1.7.8.(4)

4.1.7.9. Full and Partial Wind Loading

1) Except where the wind loads are derived from the combined C_pC_g values determined in accordance with Article 4.1.7.6., *buildings* and structural members shall be capable of withstanding the effects of the following loads:

a) the full wind loads acting along each of the 2 principal horizontal axes considered separately,

b) the wind loads described in Clause (a) but with 100% of the load removed from any one portion of the area,

c) the wind loads described in Clause (a) but with both axes considered simultaneously at 75% of their full value, and

d) the wind loads described in Clause (c) but with 50% of these loads removed from any portion of the area.

(See Note A-4.1.7.9.(1).)

4.1.7.10. Interior Walls and Partitions

1) In the design of interior walls and *partitions*, due consideration shall be given to differences in air pressure on opposite sides of the wall or *partition* which may result from

a) pressure differences between the windward and leeward sides of a *building*,

b) stack effects due to a difference in air temperature between the exterior and interior of the *building*, and

c) air pressurization by the mechanical services of the *building*.

4.1.7.11. Exterior Ornamentations, Equipment and Appendages

(See Note A-4.1.7.11.)

1) The effects of wind loads on exterior ornamentations, equipment and appendages, including the increase in exposed area as a result of ice buildup as prescribed in CSA S37, “Antennas, Towers, and Antenna-Supporting Structures,” shall be considered in the structural design of the connections and the *building*.

2) Where there are a number of similar components, the net increase in force is permitted to be based on the total area for all similar components as opposed to the summation of forces of individual elements.

4.1.7.12. Wind Tunnel Procedure

1) Except as provided in Sentences (2) and (3), wind tunnel tests on scale models to determine wind loads on *buildings* shall be conducted in accordance with ASCE/SEI 49, “Wind Tunnel Testing for Buildings and Other Structures.”

2) Where an adjacent *building* provides substantial sheltering effect, the wind loads for the main structural system shall be no lower than 80% of the loads determined from tests referred to in Sentence (1) with the effect of the sheltering *building* removed as applied to

a) the base shear force for *buildings* with a ratio of height to minimum effective width, as defined in Sentence 4.1.7.2.(2), less than or equal to 1.0, or

b) the base moment for *buildings* with a ratio of height to minimum effective width greater than 1.0.

3) For the design of cladding and secondary structural members, the exterior wind loads determined from the wind tunnel tests shall be no less onerous than those determined by analysis in accordance with Article 4.1.7.3. using the following assumptions:

a) $C_p = \pm 0.72$ and $C_g = 2.5$, where the *building*’s height is greater than 20 m or greater than its minimum effective width, and

b) C_pC_g = 80% of the values for zones w and r provided in Article 4.1.7.6., where the *building’s* height is less than or equal to 20 m and no greater than its minimum effective width.

4.1.8. Earthquake Load and Effects

4.1.8.1. Analysis

1) Except as permitted in Sentence (2), the deflections and specified loading due to earthquake motions shall be determined according to the requirements of Articles 4.1.8.2. to 4.1.8.22.

2) Where $I_EF_sS_a(0.2)$ and $I_EF_sS_a(2.0)$ are less than 0.16 and 0.03 respectively, the deflections and specified loading due to earthquake motions are permitted to be determined in accordance with Sentences (3) to (15), where

a) I_E is the earthquake importance factor and has a value of 0.8, 1.0, 1.3 and 1.5 for *buildings* of Low, Normal, High and Post-Disaster importance respectively,

b) F_s is the site coefficient based on the average N_{60} or S_u, as defined in Article 4.1.8.2., for the top 30 m of *soil* below the footings, pile caps, or mat *foundations* and has a value of

i) 1.0 for *rock* sites or when $N_{60} > 50$ or $S_u > 100$ kPa,

ii) 1.6 when $15 \le N_{60} \le 50$ or 50 kPa $\le S_u \le$ 100 kPa, and

iii) 2.8 for all other cases, and

c) $S_a(T)$ is the 5% damped spectral response acceleration value for period T, determined in accordance with Subsection 1.1.3.

3) The structure shall have a clearly defined

a) Seismic Force Resisting System (SFRS) to resist the earthquake loads and their effects, and

b) load path (or paths) that will transfer the inertial forces generated by the earthquake to the *foundations* and supporting ground.

4) An unreinforced masonry SFRS shall not be permitted where

a) I_E is greater than 1.0, or

b) the height above *grade* is greater than or equal to 30 m.

5) The height above *grade* of SFRS designed in accordance with CSA S136, "North American Specification for the Design of Cold-Formed Steel Structural Members," shall be less than 15 m.

6) Earthquake forces shall be assumed to act horizontally and independently about any two orthogonal axes.

7) The minimum lateral earthquake design force, V_s, at the base of the structure in the direction under consideration shall be calculated as follows:

$$V_s = F_s S_a(T_s) I_E W_t / R_s$$

where

$S_a(T_s)$ = value of S_a at T_s determined by linear interpolation between the value of S_a at 0.2 s, 0.5 s, and 1.0 s, and

= $S_a(0.2)$ for $T_s \le 0.2$ s,

W_t = sum of W_i over the height of the *building*, where W_i is defined in Article 4.1.8.2., and

R_s = 1.5, except $R_s = 1.0$ for structures where the *storey* strength is less than that in the *storey* above and for an unreinforced masonry SFRS,

where

T_s = fundamental lateral period of vibration of the *building*, as defined in Article 4.1.8.2.,

= $0.085(h_n)^{3/4}$ for steel moment frames,

= $0.075(h_n)^{3/4}$ for concrete moment frames,

= 0.1 N for other moment frames,

= $0.025h_n$ for braced frames, and

= $0.05(h_n)^{3/4}$ for shear walls and other structures,

where

h_n = height above the base, in m, as defined in Article 4.1.8.2.,

except that V_s shall not be less than $F_s S_a(1.0) I_E W_t / R_s$ and, in cases where $R_s = 1.5$, V_s need not be greater than $F_s S_a(0.5) I_E W_t / R_s$.

8) The total lateral earthquake design force, V_s, shall be distributed over the height of the *building* in accordance with the following formula:

$$F_x = V_s W_x h_x / \left(\sum_{i=1}^{n} W_i h_i \right)$$

where

F_x = force applied through the centre of mass at level x,

W_x, W_i = portion of W that is located at or is assigned to level x or i respectively, and

h_x, h_i = height, in m, above the base of level x and level i as per Article 4.1.8.2.

9) Accidental torsional effects applied concurrently with F_x shall be considered by applying torsional moments about the vertical axis at each level for each of the following cases considered separately:

a) $+0.1D_{nx}F_x$, and

b) $-0.1D_{nx}F_x$.

10) Deflections obtained from a linear analysis shall include the effects of torsion and be multiplied by R_s/I_E to get realistic values of expected deflections.

11) The deflections referred to in Sentence (10) shall be used to calculate the largest inter*storey* deflection, which shall not exceed

a) $0.01h_s$ for *post-disaster buildings*,

b) $0.02h_s$ for High Importance Category *buildings*, and

c) $0.025h_s$ for all other *buildings*,

where h_s is the inter*storey* height as defined in Article 4.1.8.2.

12) When earthquake forces are calculated using $R_s = 1.5$, the following elements in the SFRS shall have their design forces due to earthquake effects increased by 33%:

a) diaphragms and their chords, connections, struts and collectors,

b) tie downs in wood or drywall shear walls,

c) connections and anchor bolts in steel- and wood-braced frames,

d) connections in precast concrete, and

e) connections in steel moment frames.

13) Except as provided in Sentence (14), where cantilever parapet walls, other cantilever walls, exterior ornamentation and appendages, towers, chimneys or penthouses are connected to or form part of a *building*, they shall be designed, along with their connections, for a lateral force, V_{sp}, distributed according to the distribution of mass of the element and acting in the lateral direction that results in the most critical loading for design using the following equation:

$$V_{sp} = 0.1F_sI_EW_p$$

where W_p = weight of a portion of a structure as defined in Article 4.1.8.2.

14) The value of V_{sp} shall be doubled for unreinforced masonry elements.

15) Structures designed in accordance with this Article need not comply with the seismic requirements stated in the applicable design standard referenced in Section 4.3.

4.1.8.2. Notation

1) In this Subsection

A_r = response amplification factor to account for type of attachment of mechanical/electrical equipment, as defined in Sentence 4.1.8.18.(1),

A_x = amplification factor at level x to account for variation of response of mechanical/electrical equipment with elevation within the *building*, as defined in Sentence 4.1.8.18.(1),

B_x = ratio at level x used to determine torsional sensitivity, as defined in Sentence 4.1.8.11.(10),

B = maximum value of B_x, as defined in Sentence 4.1.8.11.(10),

C_p = seismic coefficient for mechanical/electrical equipment, as defined in Sentence 4.1.8.18.(1),

D_{nx} = plan dimension of the *building* at level x perpendicular to the direction of seismic loading being considered,

e_x = distance measured perpendicular to the direction of earthquake loading between centre of mass and centre of rigidity at the level being considered (See Note A-4.1.8.2.(1).),

F_a = site coefficient for application in Subsection 4.1.8., as defined in Sentence 4.1.8.4.(7),

F(PGA) = site coefficient for PGA, as defined in Sentence 4.1.8.4.(5),

F(PGV) = site coefficient for PGV, as defined in Sentence 4.1.8.4.(5),

F_s = site coefficient as defined in Sentence 4.1.8.1.(2) for application in Article 4.1.8.1.,

F(T) = site coefficient for spectral acceleration, as defined in Sentence 4.1.8.4.(5),

F_t = portion of V to be concentrated at the top of the structure, as defined in Sentence 4.1.8.11.(7),

F_v = site coefficient for application in Subsection 4.1.8., as defined in Sentence 4.1.8.4.(7),

F_x = lateral force applied to level x, as defined in Sentence 4.1.8.11.(7),

h_i, h_n, h_x = the height above the base (i = 0) to level i, n, or x respectively, where the base of the structure is the level at which horizontal earthquake motions are considered to be imparted to the structure,
h_s = inter*storey* height (h_i - h_i-1),
I_E = earthquake importance factor of the structure, as described in Sentence 4.1.8.5.(1),
J = numerical reduction coefficient for base overturning moment, as defined in Sentence 4.1.8.11.(6),
J_x = numerical reduction coefficient for overturning moment at level x, as defined in Sentence 4.1.8.11.(8),
Level i = any level in the *building*, i = 1 for first level above the base,
Level n = level that is uppermost in the main portion of the structure,
Level x = level that is under design consideration,
M_v = factor to account for higher mode effect on base shear, as defined in Sentence 4.1.8.11.(6),
M_x = overturning moment at level x, as defined in Sentence 4.1.8.11.(8),
N = total number of *storeys* above exterior *grade* to level n,
$\overline{N}_{60}$ = Average Standard Penetration Resistance for the top 30 m, corrected to a rod energy efficiency of 60% of the theoretical maximum,
PGA = Peak Ground Acceleration expressed as a ratio to gravitational acceleration, as defined in Sentence 4.1.8.4.(1),
PGA_{ref} = reference PGA for determining F(T), F(PGA) and F(PGV), as defined in Sentence 4.1.8.4.(4),
PGV = Peak Ground Velocity, in m/s, as defined in Sentence 4.1.8.4.(1),
PI = plasticity index for clays,
R_d = ductility-related force modification factor reflecting the capability of a structure to dissipate energy through reversed cyclic inelastic behaviour, as given in Article 4.1.8.9.,
R_o = overstrength-related force modification factor accounting for the dependable portion of reserve strength in a structure designed according to these provisions, as defined in Article 4.1.8.9.,
R_s = combined overstrength and ductility-related modification factor, as defined in Sentence 4.1.8.1.(7), for application in Article 4.1.8.1.,
S_p = horizontal force factor for part or portion of a *building* and its anchorage, as given in Sentence 4.1.8.18.(1),
S(T) = design spectral response acceleration, expressed as a ratio to gravitational acceleration, for a period of T, as defined in Sentence 4.1.8.4.(9),
$S_a(T)$ = 5% damped spectral response acceleration, expressed as a ratio to gravitational acceleration, for a period of T, as defined in Sentence 4.1.8.4.(1),
SFRS = Seismic Force Resisting System(s) is that part of the structural system that has been considered in the design to provide the required resistance to the earthquake forces and effects defined in Subsection 4.1.8.,
s_u = average undrained shear strength in the top 30 m of *soil*,
T = period in seconds,
T_a = fundamental lateral period of vibration of the *building* or structure, in s, in the direction under consideration, as defined in Sentence 4.1.8.11.(3),
T_s = fundamental lateral period of vibration of the *building* or structure, in s, in the direction under consideration, as defined in Sentence 4.1.8.1.(7),
T_x = floor torque at level x, as defined in Sentence 4.1.8.11.(11),
TDD = Total Design Displacement of any point in a seismically isolated structure, within or above the isolation system, obtained by calculating the mean + (I_E × the standard deviation) of the peak horizontal displacements from all sets of ground motion histories analyzed, but not less than $\sqrt{I_E}$ ×

the mean, where the peak horizontal displacement is based on the vector sum of the two orthogonal horizontal displacements considered for each time step,

V = lateral earthquake design force at the base of the structure, as determined by Article 4.1.8.11.,

V_d = lateral earthquake design force at the base of the structure, as determined by Article 4.1.8.12.,

V_e = lateral earthquake elastic force at the base of the structure, as determined by Article 4.1.8.12.,

V_{ed} = lateral earthquake design elastic force at the base of the structure, as determined by Article 4.1.8.12.,

V_p = lateral force on a part of the structure, as determined by Article 4.1.8.18.,

V_s = lateral earthquake design force at the base of the structure, as determined by Sentence 4.1.8.1.(7), for application in Article 4.1.8.1.,

$\overline{V}_{s30}$ = average shear wave velocity in the top 30 m of *soil* or *rock,*

W = *dead load*, as defined in Article 4.1.4.1., except that the minimum *partition* load as defined in Sentence 4.1.4.1.(3) need not exceed 0.5 kPa, plus 25% of the design snow load specified in Subsection 4.1.6., plus 60% of the storage load for areas used for storage, except that *storage garages* need not be considered storage areas, and the full contents of any tanks (See Note A-4.1.8.2.(1).),

W_i, W_x = portion of W that is located at or is assigned to level i or x respectively,

W_p = weight of a part or portion of a structure, e.g., cladding, *partitions* and appendages,

W_t = sum of W_i over the height of the *building*, for application in Sentence 4.1.8.1.(7),

δ_{ave} = average displacement of the structure at level x, as defined in Sentence 4.1.8.11.(10), and

δ_{max} = maximum displacement of the structure at level x, as defined in Sentence 4.1.8.11.(10).

4.1.8.3. General Requirements

1) The *building* shall be designed to meet the requirements of this Subsection and of the design standards referenced in Section 4.3.

2) Structures shall be designed with a clearly defined load path, or paths, that will transfer the inertial forces generated in an earthquake to the supporting ground.

3) The structure shall have a clearly defined Seismic Force Resisting System(s) (SFRS), as defined in Article 4.1.8.2.

4) The SFRS shall be designed to resist 100% of the earthquake loads and their effects. (See Note A-4.1.8.3.(4).)

5) All structural framing elements not considered to be part of the SFRS must be investigated and shown to behave elastically or to have sufficient non-linear capacity to support their gravity loads while undergoing earthquake-induced deformations calculated from the deflections determined in Article 4.1.8.13.

6) Stiff elements that are not considered part of the SFRS, such as concrete, masonry, brick or precast walls or panels, shall be

a) separated from all structural elements of the *building* such that no interaction takes place as the *building* undergoes deflections due to earthquake effects as calculated in this Subsection, or

b) made part of the SFRS and satisfy the requirements of this Subsection.

(See Note A-4.1.8.3.(6).)

7) Stiffness imparted to the structure from elements not part of the SFRS, other than those described in Sentence (6), shall not be used to resist earthquake deflections but shall be accounted for

a) in calculating the period of the structure for determining forces if the added stiffness decreases the fundamental lateral period by more than 15%,

b) in determining the irregularity of the structure, except the additional stiffness shall not be used to make an irregular SFRS regular or to reduce the effects of torsion (See Note A-4.1.8.3.(7)(b) and (c).), and

c) in designing the SFRS if inclusion of the elements not part of the SFRS in the analysis has an adverse effect on the SFRS (See Note A-4.1.8.3.(7)(b) and (c).).

8) Structural modelling shall be representative of the magnitude and spatial distribution of the mass of the *building* and of the stiffness of all elements of the SFRS, including stiff elements that are not separated in accordance with Sentence 4.1.8.3.(6), and shall account for

a) the effect of cracked sections in reinforced concrete and reinforced masonry elements,
b) the effect of the finite size of members and joints,
c) sway effects arising from the interaction of gravity loads with the displaced configuration of the structure, and
d) other effects that influence the lateral stiffness of the *building*.

(See Note A-4.1.8.3.(8).)

4.1.8.4. Site Properties

1) The peak ground acceleration (PGA), peak ground velocity (PGV), and the 5% damped spectral response acceleration values, $S_a(T)$, for the reference ground conditions (Site Class C in Table 4.1.8.4.-A) for periods T of 0.2 s, 0.5 s, 1.0 s, 2.0 s, 5.0 s and 10.0 s shall be determined in accordance with Subsection 1.1.3. and are based on a 2% probability of exceedance in 50 years.

Table 4.1.8.4.-A
Site Classification for Seismic Site Response
Forming Part of Sentences 4.1.8.4.(1) to (3)

Site Class	Ground Profile Name	Average Properties in Top 30 m, as per Note A-4.1.8.4.(3) and Table 4.1.8.4.-A		
		Average Shear Wave Velocity, $\overline{V}_{s30}$, m/s	Average Standard Penetration Resistance, $\overline{N}_{60}$	*Soil* Undrained Shear Strength, s_u
A	Hard *rock*(1)(2)	$\overline{V}_{s30} > 1500$	n/a	n/a
B	*Rock*(1)	$760 < \overline{V}_{s30} \leq 1500$	n/a	n/a
C	Very dense *soil* and soft *rock*	$360 < \overline{V}_{s30} < 760$	$\overline{N}_{60} > 50$	$s_u > 100$ kPa
D	Stiff *soil*	$180 < \overline{V}_{s30} < 360$	$15 \leq \overline{N}_{60} \leq 50$	50 kPa $< s_u \leq 100$ kPa
E	Soft *soil*	$\overline{V}_{s30} < 180$	$\overline{N}_{60} < 15$	$s_u < 50$ kPa
		Any profile with more than 3 m of *soil* with the following characteristics: plasticity index: PI > 20 moisture content: $w \geq 40\%$, and undrained shear strength: $s_u < 25$ kPa		
F	Other *soils*(3)	Site-specific evaluation required		

Notes to Table 4.1.8.4.-A:

(1) Site Classes A and B, hard *rock* and *rock*, are not to be used if there is more than 3 m of softer materials between the *rock* and the underside of footing or mat *foundations*. The appropriate Site Class for such cases is determined on the basis of the average properties of the total thickness of the softer materials (See Note A-4.1.8.4.(3) and Table 4.1.8.4.-A).

(2) Where $\overline{V}_{s30}$ has been measured in-situ, the F(T) values for Site Class A derived from Tables 4.1.8.4.-B to 4.1.8.4.-G are permitted to be multiplied by the factor $0.04 + (1500/\overline{V}_{s30})^{1/2}$.

(3) Other *soils* include:

a) liquefiable *soils*, quick and highly sensitive clays, collapsible weakly cemented *soils*, and other *soils* susceptible to failure or collapse under seismic loading,
b) peat and/or highly organic clays greater than 3 m in thickness,

c) highly plastic clays (PI > 75) more than 8 m thick, and
d) soft to medium stiff clays more than 30 m thick.

2) Site classifications for ground shall conform to Table 4.1.8.4.-A and shall be determined using $\overline{V}_{s30}$, or where $\overline{V}_{s30}$ is not known, using Sentence (3).

3) If average shear wave velocity, $\overline{V}_{s30}$, is not known, Site Class shall be determined from energy-corrected Average Standard Penetration Resistance, $\overline{N}_{60}$, or from *soil* average undrained shear strength, s_u, as noted in Table 4.1.8.4.-A, $\overline{N}_{60}$ and s_u being calculated based on rational analysis. (See Note A-4.1.8.4.(3) and Table 4.1.8.4.-A.)

4) For the purpose of determining the values of F(T) to be used in the calculation of design spectral acceleration, S(T), in Sentence (9), and the values of F(PGA) and F(PGV), the value of PGA_{ref} to be used with Tables 4.1.8.4.-B to 4.1.8.4.-I shall be taken as

a) 0.8 PGA, where the ratio $S_a(0.2)/PGA < 2.0$, and
b) PGA, otherwise.

5) The values of the site coefficient for design spectral acceleration at period T, F(T), and of similar coefficients F(PGA) and F(PGV) shall conform to Tables 4.1.8.4.-B to 4.1.8.4.-I using linear interpolation for intermediate values of PGA_{ref}.

6) Site-specific evaluation is required to determine F(T), F(PGA) and F(PGV) for Site Class F. (See Note A-4.1.8.4.(3) and Table 4.1.8.4.-A.)

7) For all applications in Subsection 4.1.8., $F_a = F(0.2)$ and $F_v = F(1.0)$.

8) For structures with a fundamental period of vibration equal to or less than 0.5 s that are built on liquefiable *soils*, Site Class and the corresponding values of F(T) may be determined as described in Tables 4.1.8.4.-A, 4.1.8.4.-B, and 4.1.8.4.-C by assuming that the soils are not liquefiable. (See Note A-4.1.8.4.(3) and Table 4.1.8.4.-A.)

9) The design spectral acceleration values of S(T) shall be determined as follows, using linear interpolation for intermediate values of T:

$$
\begin{aligned}
S(T) &= F(0.2)S_a(0.2) \text{ or } F(0.5)S_a(0.5), \text{ whichever is larger, for } T \le 0.2\text{ s} \\
&= F(0.5)S_a(0.5) \text{ for } T = 0.5\text{ s} \\
&= F(1.0)S_a(1.0) \text{ for } T = 1.0\text{ s} \\
&= F(2.0)S_a(2.0) \text{ for } T = 2.0\text{ s} \\
&= F(5.0)S_a(5.0) \text{ for } T = 5.0\text{ s} \\
&= F(10.0)S_a(10.0) \text{ for } T \ge 10.0\text{ s}
\end{aligned}
$$

Table 4.1.8.4.-B
Values of F(0.2) as a Function of Site Class and PGA_{ref}
Forming Part of Sentences 4.1.8.4.(4) and (5)

Site Class	Values of F(0.2)				
	$PGA_{ref} \le 0.1$	$PGA_{ref} = 0.2$	$PGA_{ref} = 0.3$	$PGA_{ref} = 0.4$	$PGA_{ref} \ge 0.5$
A	0.69	0.69	0.69	0.69	0.69
B	0.77	0.77	0.77	0.77	0.77
C	1.00	1.00	1.00	1.00	1.00
D	1.24	1.09	1.00	0.94	0.90
E	1.64	1.24	1.05	0.93	0.85
F	(1)	(1)	(1)	(1)	(1)

Notes to Table 4.1.8.4.-B:

See Sentence 4.1.8.4.(6).

Table 4.1.8.4.-C
Values of F(0.5) as a Function of Site Class and PGA_{ref}
Forming Part of Sentences 4.1.8.4.(4) and (5)

Site Class	Values of F(0.5)				
	$PGA_{ref} \le 0.1$	$PGA_{ref} = 0.2$	$PGA_{ref} = 0.3$	$PGA_{ref} = 0.4$	$PGA_{ref} \ge 0.5$
A	0.57	0.57	0.57	0.57	0.57
B	0.65	0.65	0.65	0.65	0.65
C	1.00	1.00	1.00	1.00	1.00
D	1.47	1.30	1.20	1.14	1.10
E	2.47	1.80	1.48	1.30	1.17
F	(1)	(1)	(1)	(1)	(1)

Notes to Table 4.1.8.4.-C:
See Sentence 4.1.8.4.(6).

Table 4.1.8.4.-D
Values of F(1.0) as a Function of Site Class and PGA_{ref}
Forming Part of Sentences 4.1.8.4.(4) and (5)

Site Class	Values of F(1.0)				
	$PGA_{ref} \le 0.1$	$PGA_{ref} = 0.2$	$PGA_{ref} = 0.3$	$PGA_{ref} = 0.4$	$PGA_{ref} \ge 0.5$
A	0.57	0.57	0.57	0.57	0.57
B	0.63	0.63	0.63	0.63	0.63
C	1.00	1.00	1.00	1.00	1.00
D	1.55	1.39	1.31	1.25	1.21
E	2.81	2.08	1.74	1.53	1.39
F	(1)	(1)	(1)	(1)	(1)

Notes to Table 4.1.8.4.-D:
See Sentence 4.1.8.4.(6).

Table 4.1.8.4.-E
Values of F(2.0) as a Function of Site Class and PGA_{ref}
Forming Part of Sentences 4.1.8.4.(4) and (5)

Site Class	Values of F(2.0)				
	$PGA_{ref} \le 0.1$	$PGA_{ref} = 0.2$	$PGA_{ref} = 0.3$	$PGA_{ref} = 0.4$	$PGA_{ref} \ge 0.5$

A	0.58	0.58	0.58	0.58	0.58
B	0.63	0.63	0.63	0.63	0.63
C	1.00	1.00	1.00	1.00	1.00
D	1.57	1.44	1.36	1.31	1.27
E	2.90	2.24	1.92	1.72	1.58
F	(1)	(1)	(1)	(1)	(1)

Notes to Table 4.1.8.4.-E:
See Sentence 4.1.8.4.(6).

Table 4.1.8.4.-F
Values of F(5.0) as a Function of Site Class and PGA_{ref}
Forming Part of Sentences 4.1.8.4.(4) and (5)

Site Class	Values of F(5.0)				
	$PGA_{ref} \leq 0.1$	$PGA_{ref} = 0.2$	$PGA_{ref} = 0.3$	$PGA_{ref} = 0.4$	$PGA_{ref} \geq 0.5$
A	0.61	0.61	0.61	0.61	0.61
B	0.64	0.64	0.64	0.64	0.64
C	1.00	1.00	1.00	1.00	1.00
D	1.58	1.48	1.41	1.37	1.34
E	2.93	2.40	2.14	1.96	1.84
F	(1)	(1)	(1)	(1)	(1)

Notes to Table 4.1.8.4.-F:
See Sentence 4.1.8.4.(6).

Table 4.1.8.4.-G
Values of F(10.0) as a Function of Site Class and PGA_{ref}
Forming Part of Sentences 4.1.8.4.(4) and (5)

Site Class	Values of F(10.0)				
	$PGA_{ref} \leq 0.1$	$PGA_{ref} = 0.2$	$PGA_{ref} = 0.3$	$PGA_{ref} = 0.4$	$PGA_{ref} \geq 0.5$
A	0.67	0.67	0.67	0.67	0.67
B	0.69	0.69	0.69	0.69	0.69
C	1.00	1.00	1.00	1.00	1.00
D	1.49	1.41	1.37	1.34	1.31
E	2.52	2.18	2.00	1.88	1.79

F	(1)	(1)	(1)	(1)	(1)

Notes to Table 4.1.8.4.-G:

See Sentence 4.1.8.4.(6).

Table 4.1.8.4.-H
Values of F(PGA) as a Function of Site Class and PGA_{ref}
Forming Part of Sentences 4.1.8.4.(4) and (5)

Site Class	Values of F(PGA)				
	$PGA_{ref} \leq 0.1$	$PGA_{ref} = 0.2$	$PGA_{ref} = 0.3$	$PGA_{ref} = 0.4$	$PGA_{ref} \geq 0.5$
A	0.90	0.90	0.90	0.90	0.90
B	0.87	0.87	0.87	0.87	0.87
C	1.00	1.00	1.00	1.00	1.00
D	1.29	1.10	0.99	0.93	0.88
E	1.81	1.23	0.98	0.83	0.74
F	(1)	(1)	(1)	(1)	(1)

Notes to Table 4.1.8.4.-H:

See Sentence 4.1.8.4.(6).

Table 4.1.8.4.-I
Values of F(PGV) as a Function of Site Class and PGA_{ref}
Forming Part of Sentences 4.1.8.4.(4) and (5)

Site Class	Values of F(PGV)				
	$PGA_{ref} \leq 0.1$	$PGA_{ref} = 0.2$	$PGA_{ref} = 0.3$	$PGA_{ref} = 0.4$	$PGA_{ref} \geq 0.5$
A	0.62	0.62	0.62	0.62	0.62
B	0.67	0.67	0.67	0.67	0.67
C	1.00	1.00	1.00	1.00	1.00
D	1.47	1.30	1.20	1.14	1.10
E	2.47	1.80	1.48	1.30	1.17
F	(1)	(1)	(1)	(1)	(1)

Notes to Table 4.1.8.4.-I:

See Sentence 4.1.8.4.(6).

4.1.8.5. Importance Factor

1) The earthquake importance factor, I_E, shall be determined according to Table 4.1.8.5.

Table 4.1.8.5.
Importance Factor for Earthquake Loads and Effects, I_E
Forming Part of Sentence 4.1.8.5.(1)

Importance Category	Importance Factor, I_E	
	ULS	SLS(1)
Low	0.8	(2)
Normal	1.0	
High	1.3	
Post-disaster	1.5	

Notes to Table 4.1.8.5.:
(1) See Article 4.1.8.13.
(2) See Note A-Table 4.1.8.5.

4.1.8.6. Structural Configuration

1) Structures having any of the features listed in Table 4.1.8.6. shall be designated irregular.
2) Structures not classified as irregular according to Sentence 4.1.8.6.(1) may be considered regular.
3) Except as required by Article 4.1.8.10., in cases where $I_E F_a S_a(0.2)$ is equal to or greater than 0.35, structures designated as irregular must satisfy the provisions referenced in Table 4.1.8.6.

Table 4.1.8.6.
Structural Irregularities(1)
Forming Part of Sentence 4.1.8.6.(1)

Type	Irregularity Type and Definition	Notes
1	**Vertical Stiffness Irregularity** Vertical stiffness irregularity shall be considered to exist when the lateral stiffness of the SFRS in a *storey* is less than 70% of the stiffness of any adjacent *storey*, or less than 80% of the average stiffness of the three *storeys* above or below.	(2)(3)(4)
2	**Weight (mass) Irregularity** Weight irregularity shall be considered to exist where the weight, W_i, of any *storey* is more than 150% of the weight of an adjacent *storey*. A roof that is lighter than the floor below need not be considered.	(2)
3	**Vertical Geometric Irregularity** Vertical geometric irregularity shall be considered to exist where the horizontal dimension of the SFRS in any *storey* is more than 130% of that in an adjacent *storey*.	(2)(3)(4)(5)
4	**In-Plane Discontinuity in Vertical Lateral-Force-Resisting Element** Except for braced frames and moment-resisting frames, an in-plane discontinuity shall be considered to exist where there is an offset of a lateral-force-resisting element of the SFRS or a reduction in lateral stiffness of the resisting element in the *storey* below.	(2)(3)(4)(5)
5	**Out-of-Plane Offsets** Discontinuities in a lateral force path, such as out-of-plane offsets of the vertical elements of the	(2)(3)(4)(5)

	SFRS.	
6	**Discontinuity in Capacity – Weak Storey** A weak *storey* is one in which the *storey* shear strength is less than that in the *storey* above. The *storey* shear strength is the total strength of all seismic-resisting elements of the SFRS sharing the *storey* shear for the direction under consideration.	(2)(3)
7	**Torsional Sensitivity (to be considered when diaphragms are not flexible)** Torsional sensitivity shall be considered to exist when the ratio B calculated according to Sentence 4.1.8.11.(10) exceeds 1.7.	(2)(3)(4)(6)
8	**Non-orthogonal Systems** A non-orthogonal system irregularity shall be considered to exist when the SFRS is not oriented along a set of orthogonal axes.	(2)(4)(7)
9	**Gravity-Induced Lateral Demand Irregularity** Gravity-induced lateral demand irregularity on the SFRS shall be considered to exist where the ratio, α, calculated in accordance with Sentence 4.1.8.10.(5), exceeds 0.1 for an SFRS with self-centering characteristics and 0.03 for other systems.	(2)(3)(4)(7)

Notes to Table 4.1.8.6.:
(1) One-*storey* penthouses with a weight of less than 10% of the level below need not be considered in the application of this Table.
(2) See Article 4.1.8.7.
(3) See Article 4.1.8.10.
(4) See Note A-Table 4.1.8.6.
(5) See Article 4.1.8.15.
(6) See Sentences 4.1.8.11.(10), (11) and 4.1.8.12.(4).
(7) See Article 4.1.8.8.

4.1.8.7. Methods of Analysis

1) Analysis for design earthquake actions shall be carried out in accordance with the Dynamic Analysis Procedure described in Article 4.1.8.12. (See Note A-4.1.8.7.(1).), except that the Equivalent Static Force Procedure described in Article 4.1.8.11. may be used for structures that meet any of the following criteria:

a) in cases where $I_E F_a S_a(0.2)$ is less than 0.35,
b) regular structures that are less than 60 m in height and have a fundamental lateral period, T_a, less than 2 s in each of two orthogonal directions as defined in Article 4.1.8.8., or
c) structures with structural irregularity, of Type 1, 2, 3, 4, 5, 6 or 8 as defined in Table 4.1.8.6., that are less than 20 m in height and have a fundamental lateral period, T_a, less than 0.5 s in each of two orthogonal directions as defined in Article 4.1.8.8.

4.1.8.8. Direction of Loading

1) Earthquake forces shall be assumed to act in any horizontal direction, except that the following shall be considered to provide adequate design force levels in the structure:

a) where components of the SFRS are oriented along a set of orthogonal axes, independent analyses about each of the principal axes of the structure shall be performed,
b) where the components of the SFRS are not oriented along a set of orthogonal axes and $I_E F_a S_a(0.2)$ is less than 0.35, independent analyses about any two orthogonal axes is permitted, or
c) where the components of the SFRS are not oriented along a set of orthogonal axes and $I_E F_a S_a(0.2)$ is equal to or greater than 0.35, analysis of the structure independently in any two orthogonal directions for 100% of the prescribed earthquake loads applied in one direction plus 30% of the prescribed earthquake loads in the perpendicular direction, with the combination requiring the greater element strength being used in the design.

4.1.8.9. SFRS Force Reduction Factors, System Overstrength Factors, and General Restrictions

1) Except as provided in Sentence 4.1.8.20.(7), the values of R_d and R_o and the corresponding system restrictions shall conform to Table 4.1.8.9. and the requirements of this Subsection.

2) When a particular value of R_d is required by this Article, the corresponding R_o shall be used.

3) For combinations of different types of SFRS acting in the same direction in the same *storey*, R_dR_o shall be taken as the lowest value of R_dR_o corresponding to these systems.

4) For vertical variations of R_dR_o, excluding rooftop structures not exceeding two *storeys* in height whose weight is less than the greater of 10% of W and 30% of W_i of the level below, the value of R_dR_o used in the design of any *storey* shall be less than or equal to the lowest value of R_dR_o used in the given direction for the *storeys* above, and the requirements of Sentence 4.1.8.15.(6) must be satisfied. (See Note A-4.1.8.9.(4).)

5) If it can be demonstrated through testing, research and analysis that the seismic performance of a structural system is at least equivalent to one of the types of SFRS mentioned in Table 4.1.8.9., then such a structural system will qualify for values of R_d and R_o corresponding to the equivalent type in that Table. (See Note A-4.1.8.9.(5).)

Table 4.1.8.9.
SFRS Ductility-Related Force Modification Factors, R_d, Overstrength-Related Force Modification Factors, R_o, and General Restrictions[(1)]
Forming Part of Sentence 4.1.8.9.(1)

Type of SFRS	R_d	R_o	Restrictions[(2)]				
			Cases Where $I_EF_aS_a(0.2)$				Cases Where $I_EF_vS_a(1.0)$
			< 0.2	≥ 0.2 to < 0.35	≥ 0.35 to ≤ 0.75	> 0.75	> 0.3
Steel Structures Designed and Detailed According to CSA S16[(3)(4)]							
Ductile moment-resisting frames	5.0	1.5	NL	NL	NL	NL	NL
Moderately ductile moment-resisting frames	3.5	1.5	NL	NL	NL	NL	NL
Limited ductility moment-resisting frames	2.0	1.3	NL	NL	60	30	30
Moderately ductile concentrically braced frames							
Tension-compression braces	3.0	1.3	NL	NL	40	40	40
Tension only braces	3.0	1.3	NL	NL	20	20	20
Limited ductility concentrically braced frames							
Tension-compression braces	2.0	1.3	NL	NL	60	60	60
Tension only braces	2.0	1.3	NL	NL	40	40	40
Ductile buckling-restrained braced frames	4.0	1.2	NL	NL	40	40	40
Ductile eccentrically braced frames	4.0	1.5	NL	NL	NL	NL	NL
Ductile plate walls	5.0	1.6	NL	NL	NL	NL	NL

Limited ductility plate walls	2.0	1.5	NL	NL	60	60	60
Conventional construction of moment-resisting frames, braced frames or plate walls							
Assembly occupancies	1.5	1.3	NL	NL	15	15	15
Other *occupancies*	1.5	1.3	NL	NL	60	40	40
Other steel SFRS(s) not defined above	1.0	1.0	15	15	NP	NP	NP
Concrete Structures Designed and Detailed According to CSA A23.3							
Ductile moment-resisting frames	4.0	1.7	NL	NL	NL	NL	NL
Moderately ductile moment-resisting frames	2.5	1.4	NL	NL	60	40	40
Ductile coupled walls	4.0	1.7	NL	NL	NL	NL	NL
Moderately ductile coupled walls	2.5	1.4	NL	NL	NL	60	60
Ductile partially coupled walls	3.5	1.7	NL	NL	NL	NL	NL
Moderately ductile partially coupled walls	2.0	1.4	NL	NL	NL	60	60
Ductile shear walls	3.5	1.6	NL	NL	NL	NL	NL
Moderately ductile shear walls	2.0	1.4	NL	NL	NL	60	60
Conventional construction							
Moment-resisting frames	1.5	1.3	NL	NL	20	15	10(5)
Shear walls	1.5	1.3	NL	NL	40	30	30
Two-way slabs without beams	1.3	1.3	20	15	NP	NP	NP
Tilt-up construction							
Moderately ductile walls and frames	2.0	1.3	30	25	25	25	25
Limited ductility walls and frames	1.5	1.3	30	25	20	20	20(6)
Conventional walls and frames	1.3	1.3	25	20	NP	NP	NP
Other concrete SFRS(s) not listed above	1.0	1.0	15	15	NP	NP	NP
Timber Structures Designed and Detailed According to CSA O86							
Shear walls							
Nailed shear walls: wood-based panel	3.0	1.7	NL	NL	30	20	20
Shear walls: wood-based and gypsum panels in combination	2.0	1.7	NL	NL	20	20	20
Braced or moment-resisting frames with ductile connections							

Moderately ductile Limited ductility	2.0 1.5	1.5 1.5	NL NL	NL NL	20 15	20 15	20 15
Other wood- or gypsum-based SFRS(s) not listed above	1.0	1.0	15	15	NP	NP	NP
Masonry Structures Designed and Detailed According to CSA S304							
Ductile shear walls	3.0	1.5	NL	NL	60	40	40
Moderately ductile shear walls	2.0	1.5	NL	NL	60	40	40
Conventional construction Shear walls Moment-resisting frames	 1.5 1.5	 1.5 1.5	 NL NL	 60 30	 30 NP	 15 NP	 15 NP
Unreinforced masonry	1.0	1.0	30	15	NP	NP	NP
Other masonry SFRS(s) not listed above	1.0	1.0	15	NP	NP	NP	NP
Cold-Formed Steel Structures Designed and Detailed According to CSA S136							
Shear walls Screw-connected shear walls – wood-based panels Screw-connected shear walls – wood-based and gypsum panels in combination	 2.5 1.5	 1.7 1.7	 20 20	 20 20	 20 20	 20 20	 20 20
Diagonal strap concentrically braced walls Limited ductility Conventional construction	 1.9 1.2	 1.3 1.3	 20 15	 20 15	 20 NP	 20 NP	 20 NP
Other cold-formed SFRS(s) not defined above	1.0	1.0	15	15	NP	NP	NP

Notes to Table 4.1.8.9.:
(1) See Article 4.1.8.10.
(2) NP = system is not permitted.
NL = system is permitted and not limited in height as an SFRS.
Numbers in this Table are maximum height limits above *grade*, in m.
Height may be limited in other Parts of the By-law.
The most stringent requirement governs.
(3) Higher design force levels are prescribed in CSA S16 for some heights of *buildings*.
(4) See Note A-Table 4.1.8.9.
(5) Frames limited to a maximum of 2 *storeys*.
(6) Frames limited to a maximum of 3 *storeys*.

4.1.8.10. Additional System Restrictions

1) Except as required by Clause (2)(b), structures with a Type 6 irregularity, Discontinuity in Capacity – Weak Storey, as described in Table 4.1.8.6., are not permitted unless $I_E F_a S_a(0.2)$ is less than 0.2 and the forces used for design of the SFRS are multiplied by $R_d R_o$.

2) *Post-disaster buildings* shall

a) not have any irregularities conforming to Types 1, 3, 4, 5, 7 and 9 as described in Table 4.1.8.6., in cases where $I_EF_aS_a(0.2)$ is equal to or greater than 0.35,

b) not have a Type 6 irregularity as described in Table 4.1.8.6.,

c) have an SFRS with an R_d of 2.0 or greater, and

d) have no *storey* with a lateral stiffness that is less than that of the *storey* above it.

3) For *buildings* having fundamental lateral periods, T_a, of 1.0 s or greater, and where $I_EF_vS_a(1.0)$ is greater than 0.25, shear walls that are other than wood-based and form part of the SFRS shall be continuous from their top to the *foundation* and shall not have irregularities of Type 4 or 5 as described in Table 4.1.8.6.

4) For *buildings* constructed with more than 4 *storeys* of continuous wood construction and where $I_EF_aS_a(0.2)$ is equal to or greater than 0.35, timber SFRS consisting of shear walls with wood-based panels or of braced or moment-resisting frames as defined in Table 4.1.8.9. within the continuous wood construction shall not have Type 4 or Type 5 irregularities as described in Table 4.1.8.6. (See Note A-4.1.8.10.(4).)

5) The ratio, α, for a Type 9 irregularity as described in Table 4.1.8.6. shall be determined independently for each orthogonal direction using the following equation:

$$x = Q_G / Q_y$$

where

Q_G = gravity-induced lateral demand on the SFRS at the critical level of the yielding system, and

Q_y = the resistance of the yielding mechanism required to resist the minimum earthquake loads, which need not be taken as less than R_o multiplied by the minimum lateral earthquake force as determined in Article 4.1.8.11. or 4.1.8.12., as appropriate.

(See Note A-4.1.8.10.(5).)

6) For *buildings* with a Type 9 irregularity as described in Table 4.1.8.6. and where $I_EF_aS_a(0.2)$ is equal to or greater than 0.5, deflections determined in accordance with Article 4.1.8.13. shall be multiplied by 1.2.

7) Structures where the value of α, as determined in accordance with Sentence (5), exceeds twice the limits specified in Table 4.1.8.6. for a Type 9 irregularity, and where $I_EF_aS_a(0.2)$ is equal to or greater than 0.5 are not permitted unless determined to be acceptable based on non-linear dynamic analysis studies. (See Note A-4.1.8.10.(7).)

4.1.8.11. Equivalent Static Force Procedure for Structures Satisfying the Conditions of Article 4.1.8.7.

1) The static loading due to earthquake motion shall be determined according to the procedures given in this Article.

2) Except as provided in Sentence (12), the minimum lateral earthquake force, V, shall be calculated using the following formula:

$$V = S(T_a)M_vI_EW/(R_dR_o)$$

except

a) for walls, coupled walls and wall-frame systems, V shall not be less than

$$S(4.0)M_vI_EW/(R_dR_o)$$

b) for moment-resisting frames, braced frames, and other systems, V shall not be less than

$$S(2.0)M_vI_EW/(R_dR_o)$$

c) for *buildings* located on a site other than Class F and having an SFRS with an R_d equal to or greater than 1.5, V need not be greater than the larger of

$$\frac{2}{3}S(0.2)I_EW/(R_dR_o) \text{ and}$$

$$S(0.5)I_EW/(R_dR_o)$$

3) Except as provided in Sentence (4), the fundamental lateral period, T_a, in the direction under consideration in Sentence (2), shall be determined as:

a) for moment-resisting frames that resist 100% of the required lateral forces and where the frame is not enclosed by or adjoined by more rigid elements that would tend to prevent the frame from resisting lateral forces, and where h_n is in metres:

i) $0.085 (h_n)^{3/4}$ for steel moment frames,

ii) $0.075 (h_n)^{3/4}$ for concrete moment frames, or

iii) 0.1 N for other moment frames,

b) $0.025h_n$ for braced frames where h_n is in metres,

c) $0.05 (h_n)^{3/4}$ for shear wall and other structures where h_n is in metres, or

d) other established methods of mechanics using a structural model that complies with the requirements of Sentence 4.1.8.3.(8), except that

i) for moment-resisting frames, T_a shall not be taken greater than 1.5 times that determined in Clause (a),

ii) for braced frames, T_a shall not be taken greater than 2.0 times that determined in Clause (b),

iii) for shear wall structures, T_a shall not be taken greater than 2.0 times that determined in Clause (c),

iv) for other structures, T_a shall not be taken greater than that determined in Clause (c), and

v) for the purpose of calculating the deflections, the period without the upper limit specified in Subclauses (d)(i) to (d)(iv) may be used, except that, for walls, coupled walls and wall-frame systems, T_a shall not exceed 4.0 s, and for moment-resisting frames, braced frames, and other systems, T_a shall not exceed 2.0 s.

(See Note A-4.1.8.11.(3).)

4) For single-*storey buildings* with steel deck or wood roof diaphragms, the fundamental lateral period, T_a, in the direction under consideration is permitted to be taken as

a) $0.05 (h_n)^{3/4} + 0.004$ L for shear walls,

b) $0.035 h_n + 0.004$ L for steel moment frames and steel braced frames, or

c) the value obtained from methods of mechanics using a structural model that complies with the requirements of Sentence 4.1.8.3.(8), except that T_a shall not be greater than 1.5 times the value determined in Clause (a) or (b), as applicable,

where L is the shortest length of the diaphragm, in m, between adjacent vertical elements of the SFRS in the direction perpendicular to the direction under consideration.

5) The weight, W, of the *building* shall be calculated using the following formula:

$$W = \sum_{i=1}^{n} W_i$$

6) The higher mode factor, M_v, and its associated base overturning moment reduction factor, J, shall conform to Table 4.1.8.11.

7) The total lateral seismic force, V, shall be distributed such that a portion, F_t, shall be assumed to be concentrated at the top of the *building*, where F_t is equal to $0.07\,T_aV$ but need not exceed 0.25 V and may be considered as zero where the fundamental lateral period, T_a, does not exceed 0.7 s; the remainder, V - F_t, shall be distributed along the height of the *building*, including the top level, in accordance with the following formula:

$$F_x = (V - F_t)W_x h_x / \left(\sum_{i=1}^{n} W_i h_i\right)$$

Table 4.1.8.11.
Higher Mode Factor, Mv, and Base Overturning Reduction Factor, J(1)(2)(3)(4)
Forming Part of Sentence 4.1.8.11.(6)

S(0.2)/S(5.0)	M_v for $T_a \le$ 0.5	M_v for T_a = 1.0	M_v for T_a = 2.0	M_v for $T_a \ge$ 5.0	J for $T_a \le$ 0.5	J for T_a = 1.0	J for T_a = 2.0	J for $T_a \ge$ 5.0
Moment-Resisting Frames								
5	1	1	1	(5)	1	0.97	0.92	(5)
20	1	1	1	(5)	1	0.93	0.85	(5)
40	1	1	1	(5)	1	0.87	0.78	(5)
65	1	1	1.03	(5)	1	0.80	0.70	(5)
Coupled Walls(6)								
5	1	1	1	1(7)	1	0.97	0.92	0.80(8)
20	1	1	1	1.08(7)	1	0.93	0.85	0.65(8)
40	1	1	1	1.30(7)	1	0.87	0.78	0.53(8)
65	1	1	1.03	1.49(7)	1	0.80	0.70	0.46(8)
Braced Frames								
5	1	1	1	(5)	1	0.95	0.89	(5)
20	1	1	1	(5)	1	0.85	0.78	(5)
40	1	1	1	(5)	1	0.79	0.70	(5)
65	1	1.04	1.07	(5)	1	0.71	0.66	(5)
Walls, Wall Frame Systems								
5	1	1	1	1.25(7)	1	0.97	0.85	0.55(8)
20	1	1	1.18	2.30(7)	1	0.80	0.60	0.35(8)
40	1	1.19	1.75	3.70(7)	1	0.63	0.46	0.28(8)
65	1	1.55	2.25	4.65(7)	1	0.51	0.39	0.23(8)
Other Systems								
5	1	1	1	(5)	1	0.97	0.85	(5)
20	1	1	1.18	(5)	1	0.80	0.60	(5)
40	1	1.19	1.75	(5)	1	0.63	0.46	(5)
65	1	1.55	2.25	(5)	1	0.51	0.39	(5)

Notes to Table 4.1.8.11.:
(1) For intermediate values of the spectral ratio S(0.2)/S(5.0), M_v and J shall be obtained by linear interpolation.
(2) For intermediate values of the fundamental lateral period, T_a, $S(T_a)M_v$ shall be obtained by linear interpolation using the values of M_v obtained in

accordance with Note (1).
(3) For intermediate values of the fundamental lateral period, T_a, J shall be obtained by linear interpolation using the values of J obtained in accordance with Note (1).
(4) For a combination of different seismic force resisting systems (SFRS) not given in Table 4.1.8.11. that are in the same direction under consideration, use the highest M_v factor of all the SFRS and the corresponding value of J.
(5) For fundamental lateral periods, T_a, greater than 2.0 s, use the 2.0 s values obtained in accordance with Note (1). See Clause 4.1.8.11.(2)(b).
(6) A "coupled" wall is a wall system with coupling beams, where at least 66% of the base overturning moment resisted by the wall system is carried by the axial tension and compression forces resulting from shear in the coupling beams.
(7) For fundamental lateral periods, T_a, greater than 4.0 s, use the 4.0 s values of $S(T_a)M_v$ obtained by interpolation between 2.0 s and 5.0 s using the value of M_v obtained in accordance with Note (1). See Clause 4.1.8.11.(2)(a).
(8) For fundamental lateral periods, T_a, greater than 4.0 s, use the 4.0 s values of J obtained by interpolation between 2.0 s and 5.0 s using the value of J obtained in accordance with Note (1). See Clause 4.1.8.11.(2)(a).

8) The structure shall be designed to resist overturning effects caused by the earthquake forces determined in Sentence (7) and the overturning moment at level x, M_x, shall be determined using the following equation:

$$M_x = J_x \sum_{i-x}^{n} F_i (h_i - h_x)$$

where

J_x = 1.0 for $h_x \geq 0.6h_n$, and

J_x = $J + (1 - J)(h_x / 0.6h_n)$ for $h_x < 0.6h_n$

where

J = base overturning moment reduction factor conforming to Table 4.1.8.11.

9) Torsional effects that are concurrent with the effects of the forces mentioned in Sentence (7) and are caused by the simultaneous actions of the following torsional moments shall be considered in the design of the structure according to Sentence (11):

a) torsional moments introduced by eccentricity between the centres of mass and resistance and their dynamic amplification, and

b) torsional moments due to accidental eccentricities.

10) Torsional sensitivity shall be determined by calculating the ratio B_x for each level x according to the following equation for each orthogonal direction determined independently:

$$B_x = \delta_{max}/\delta_{ave}$$

where

B = maximum of all values of B_x in both orthogonal directions, except that the B_x for one-*storey* penthouses with a weight less than 10% of the level below need not be considered,

δ_{max} = maximum *storey* displacement at the extreme points of the structure, at level x in the direction of the earthquake induced by the equivalent static forces acting at distances ± 0.10 D_{nx} from the centres of mass at each floor, and

δ_{ave} = average of the displacements at the extreme points of the structure at level x produced by the above-mentioned forces.

11) Torsional effects shall be accounted for as follows:

a) for a *building* with B ≤ 1.7 or where $I_E F_a S_a(0.2)$ is less than 0.35, by applying torsional moments about a vertical axis at each level throughout the *building*, derived for each of the following load cases considered separately:

i) $T_x = F_x(e_x + 0.10\, D_{nx})$, and

ii) $T_x = F_x(e_x - 0.10\, D_{nx})$

where F_x is the lateral force at each level determined according to Sentence (7) and where each element of the *building* is designed for the most severe effect of the above load cases, or

b) for a *building* with B > 1.7, in cases where $I_E F_a S_a(0.2)$ is equal to or greater than 0.35, by a Dynamic Analysis Procedure as specified in Article 4.1.8.12.

12) Where the fundamental lateral period, T_a, is determined in accordance with Clause (3)(d) and the *building* is constructed with more than 4 *storeys* of continuous wood construction and has a timber SFRS consisting of shear walls with wood-based panels or of braced or moment-resisting frames as defined in Table 4.1.8.9., the lateral earthquake force, V, as determined in accordance with Sentence (2) shall be multiplied by 1.2 but need not exceed the value determined by using Clause (2)(c). (See Note A-4.1.8.10.(4).)

4.1.8.12. Dynamic Analysis Procedure

1) Except as provided in Articles 4.1.8.19. and 4.1.8.21., the Dynamic Analysis Procedure shall be in accordance with one of the following methods:

a) Linear Dynamic Analysis by either the Modal Response Spectrum Method or the Numerical Integration Linear Time History Method using a structural model that complies with the requirements of Sentence 4.1.8.3.(8) (See Note A-4.1.8.12.(1)(a).), or

b) Non-linear Dynamic Analysis, in which case a special study shall be performed. (See Note A-4.1.8.12.(1)(b).)

2) The spectral acceleration values used in the Modal Response Spectrum Method shall be the design spectral acceleration values, S(T), defined in Sentence 4.1.8.4.(9).

3) The ground motion histories used in the Numerical Integration Linear Time History Method shall be compatible with a response spectrum constructed from the design spectral acceleration values, S(T), defined in Sentence 4.1.8.4.(9). (See Note A-4.1.8.12.(3).)

4) The effects of accidental torsional moments acting concurrently with the lateral earthquake forces that cause them shall be accounted for by the following methods:

a) the static effects of torsional moments due to ($\pm$ 0.10 D_{nx})F_x at each level x, where F_x is either determined from the elastic dynamic analysis or determined from Sentence 4.1.8.11.(7) multiplied by R_dR_o/I_E, shall be combined with the effects determined by dynamic analysis (See Note A-4.1.8.12.(4)(a).), or

b) if B, as defined in Sentence 4.1.8.11.(10), is less than 1.7, it is permitted to use a three-dimensional dynamic analysis with the centres of mass shifted by a distance of –0.05 D_{nx} and + 0.05 D_{nx}.

5) Except as provided in Sentence (6), the design elastic base shear, V_{ed}, shall be equal to the elastic base shear, V_e, obtained from a Linear Dynamic Analysis.

6) For structures located on sites other than Class F that have an SFRS with R_d equal to or greater than 1.5, the elastic base shear obtained from a Linear Dynamic Analysis may be multiplied by the larger of the following factors to obtain the design elastic base shear, V_{ed}:

$$\frac{2S(0.2)}{3S(T_a)} \leq 1.0 \text{ and}$$

$$S(0.5)/S(T_a) \leq 1.0$$

7) The design elastic base shear, V_{ed}, shall be multiplied by the importance factor, I_E, as determined in Article 4.1.8.5., and shall be divided by R_dR_o, as determined in Article 4.1.8.9., to obtain the design base shear, V_d.

8) Except as required by Sentence (9) or (12), if the base shear, V_d, obtained in Sentence (7) is less than 80% of the lateral earthquake design force, V, of Article 4.1.8.11., V_d shall be taken as 0.8 V.

9) For irregular structures requiring dynamic analysis in accordance with Article 4.1.8.7., V_d shall be taken as the larger of the V_d determined in Sentence (7) and 100% of V.

10) Except as required by Sentence (11), the values of elastic *storey* shears, *storey* forces, member forces, and deflections obtained from the Linear Dynamic Analysis, including the effect of accidental torsion determined in Sentence (4), shall be multiplied by V_d/V_e to determine their design values, where V_d is the base shear.

11) For the purpose of calculating deflections, it is permitted to use a value for V based on the value for T_a determined in Clause 4.1.8.11.(3)(d) to obtain V_d in Sentences (8) and (9).

12) For *buildings* constructed with more than 4 *storeys* of continuous wood construction, having a timber SFRS consisting of shear walls with wood-based panels or braced or moment-resisting frames as defined in

Table 4.1.8.9., and whose fundamental lateral period, T_a, is determined in accordance with Clause 4.1.8.11.(3)(d), the design base shear, V_d, shall be taken as the larger value of V_d determined in accordance with Sentence (7) and 100% of V. (See Note A-4.1.8.10.(4).)

4.1.8.13. Deflections and Drift Limits

1) Except as provided in Sentences (5) and (6), lateral deflections of a structure shall be calculated in accordance with the loads and requirements defined in this Subsection.
2) Lateral deflections obtained from a linear elastic analysis using the methods given in Articles 4.1.8.11. and 4.1.8.12. and incorporating the effects of torsion, including accidental torsional moments, shall be multiplied by R_dR_o/I_E and increased as required in Sentences 4.1.8.10.(6) and 4.1.8.16.(1) to give realistic values of anticipated deflections.
3) Based on the lateral deflections calculated in Sentences (2), (5) and (6), the largest inter*storey* deflection at any level shall be limited to 0.01 h_s for *post-disaster buildings*, 0.02 h_s for High Importance Category *buildings*, and 0.025 h_s for all other *buildings*.
4) The deflections calculated in Sentence (2) shall be used to account for sway effects as required by Sentence 4.1.3.2.(12). (See Note A-4.1.8.13.(4).)
5) The lateral deflections of a seismically isolated structure shall be calculated in accordance with Article 4.1.8.20.
6) The lateral deflections of a structure with supplemental energy dissipation shall be calculated in accordance with Article 4.1.8.22.

4.1.8.14. Structural Separation

1) Adjacent structures shall either be separated by the square root of the sum of the squares of their individual deflections calculated in Sentence 4.1.8.13.(2), or shall be connected to each other.
2) The method of connection required in Sentence (1) shall take into account the mass, stiffness, strength, ductility and anticipated motion of the connected *buildings* and the character of the connection.
3) Rigidly connected *buildings* shall be assumed to have the lowest R_dR_o value of the *buildings* connected.
4) *Buildings* with non-rigid or energy-dissipating connections require special studies.

4.1.8.15. Design Provisions

1) Except as provided in Sentences (2) and (3), diaphragms, collectors, chords, struts and connections shall be designed so as not to yield, and the design shall account for the shape of the diaphragm, including openings, and for the forces generated in the diaphragm due to the following cases, whichever one governs (See Note A-4.1.8.15.(1).):

- a) forces due to loads determined in Article 4.1.8.11. or 4.1.8.12. applied to the diaphragm are increased to reflect the lateral load capacity of the SFRS, plus forces in the diaphragm due to the transfer of forces between elements of the SFRS associated with the lateral load capacity of such elements and accounting for discontinuities and changes in stiffness in these elements, or
- b) a minimum force corresponding to the design-based shear divided by N for the diaphragm at level x.

2) Steel deck roof diaphragms in *buildings* of less than 4 *storeys* or wood diaphragms that are designed and detailed according to the applicable referenced design standards to exhibit ductile behaviour shall meet the requirements of Sentence (1), except that they may yield and the forces shall be

- a) for wood diaphragms acting in combination with vertical wood shear walls, equal to the lateral earthquake design force,
- b) for wood diaphragms acting in combination with other SFRS, not less than the force corresponding to R_dR_o = 2.0, and
- c) for steel deck roof diaphragms, not less than the force corresponding to R_dR_o = 2.0.

3) Where diaphragms are designed in accordance with Sentence (2), the struts shall be designed in accordance with Clause 4.1.8.15.(1)(a) and the collectors, chords and connections between the diaphragms and the vertical elements of the SFRS shall be designed for forces corresponding to the capacity of the diaphragms in accordance with the applicable CSA standards. (See Note A-4.1.8.15.(3).)

4) For single-*storey buildings* with steel deck or wood roof diaphragms designed with a value of R_d greater than 1.5 and where the calculated maximum relative deflection, Δ_D, of the diaphragm under lateral loads exceeds 50% of the average storey drift, Δ_B, of the adjoining vertical elements of the SFRS, dynamic magnification of the inelastic response due to the in-plane diaphragm deformations shall be accounted for in the design as follows:

a) the vertical elements of the SFRS shall be designed and detailed to any one of the following:

i) to accommodate the anticipated magnified lateral deformations taken as $R_oR_d(\Delta_B + \Delta_D) - R_o\Delta_D$,

ii) to resist the forces magnified by $R_d(1 + \Delta_D/\Delta_B)/(R_d + \Delta_D/\Delta_B)$, or

iii) by a special study, and

b) the roof diaphragm and chords shall be designed for in-plane shears and moments determined while taking into consideration the inelastic higher mode response of the structure.

(See Note A-4.1.8.15.(4).)

5) In cases where $I_EF_aS_a(0.2)$ is equal to or greater than 0.35, the elements supporting any discontinuous wall, column or braced frame shall be designed for the lateral load capacity of the components of the SFRS they support. (See Note A-4.1.8.15.(5).)

6) Where structures have vertical variations of R_dR_o satisfying Sentence 4.1.8.9.(4), the elements of the SFRS below the level where the change in R_dR_o occurs shall be designed for the forces associated with the lateral load capacity of the SFRS above that level. (See Note A-4.1.8.15.(6).)

7) Where earthquake effects can produce forces in a column or wall due to lateral loading along both orthogonal axes, account shall be taken of the effects of potential concurrent yielding of other elements framing into the column or wall from all directions at the level under consideration and as appropriate at other levels. (See Note A-4.1.8.15.(7).)

8) The design forces associated with the lateral capacity of the SFRS need not exceed the forces determined in accordance with Sentence 4.1.8.7.(1) with R_dR_o taken as 1.0, unless otherwise provided by the applicable referenced design standards for elements, in which case the design forces associated with the lateral capacity of the SFRS need not exceed the forces determined in accordance with Sentence 4.1.8.7.(1) with R_dR_o taken as less than or equal to 1.3. (See Note A-4.1.8.15.(8).)

9) *Foundations* need not be designed to resist the lateral load overturning capacity of the SFRS, provided the design and the R_d and R_o for the type of SFRS used conform to Table 4.1.8.9. and that the *foundation* is designed in accordance with Sentence 4.1.8.16.(4).

10) *Foundation* displacements and rotations shall be considered as required by Sentence 4.1.8.16.(1).

4.1.8.16. Foundation Provisions

1) The increased displacements of the structure resulting from *foundation* movement shall be shown to be within acceptable limits for both the SFRS and the structural framing elements not considered to be part of the SFRS. (See Note A-4.1.8.16.(1).)

2) Except as provided in Sentences (3) and (4), *foundations* shall be designed to have factored shear and overturning resistances greater than the lateral load capacity of the SFRS. (See Note A-4.1.8.16.(2).)

3) The shear and overturning resistances of the *foundation* determined using a bearing stress equal to 1.5 times the factored bearing strength of the soil or rock and all other resistances equal to 1.3 times the factored resistances need not exceed the design forces determined in Sentence 4.1.8.7.(1) using R_dR_o = 1.0, except that the factor of 1.3 shall not apply to the portion of the resistance to uplift or overturning resulting from gravity loads.

4) A *foundation* is permitted to have a factored overturning resistance less than the lateral load overturning capacity of the supported SFRS, provided the following requirements are met:

a) neither the *foundation* nor the supported SFRS are constrained against rotation, and

b) the design overturning moment of the *foundation* is

i) not less than 75% of the overturning capacity of the supported SFRS, and

ii) not less than that determined in Sentence 4.1.8.7.(1) using R_dR_o = 2.0.

(See Note A-4.1.8.16.(4).)

5) The design of *foundations* shall be such that they are capable of transferring earthquake loads and effects between the building and the ground without exceeding the capacities of the *soil* and *rock*.

6) In cases where $I_EF_aS_a(0.2)$ is equal to or greater than 0.35, the following requirements shall be satisfied:

a) *piles* or *pile* caps, drilled piers, and *caissons* shall be interconnected by continuous ties in not less than two directions (See Note A-4.1.8.16.(6)(a).),

b) *piles*, drilled piers, and *caissons* shall be embedded a minimum of 100 mm into the *pile* cap or structure, and

c) *piles*, drilled piers, and *caissons*, other than wood *piles*, shall be connected to the *pile* cap or structure for a minimum tension force equal to 0.15 times the factored compression load on the *pile*.

7) At sites where $I_EF_aS_a(0.2)$ is equal to or greater than 0.35, *basement* walls shall be designed to resist earthquake lateral pressures from backfill or natural ground. (See Note A-4.1.8.16.(7).)

8) At sites where $I_EF_aS_a(0.2)$ is greater than 0.75, the following requirements shall be satisfied:

a) *piles*, drilled piers, or *caissons* shall be designed and detailed to accommodate cyclic inelastic behaviour when the design moment in the element due to earthquake effects is greater than 75% of its moment capacity (See Note A-4.1.8.16.(8)(a).), and

b) spread footings founded on soil defined as Site Class E or F shall be interconnected by continuous ties in not less than two directions.

9) Each segment of a tie between elements that is required by Clauses (6)(a) or (8)(b) shall be designed to carry by tension or compression a horizontal force at least equal to the greatest factored *pile* cap or column vertical load in the elements it connects, multiplied by a factor of 0.10 $I_EF_aS_a(0.2)$, unless it can be demonstrated that equivalent restraints can be provided by other means. (See Note A-4.1.8.16.(9).)

10) The potential for liquefaction of the *soil* and its consequences, such as significant ground displacement and loss of *soil* strength and stiffness, shall be evaluated based on the ground motion parameters referenced in Subsection 1.1.3., as modified by Article 4.1.8.4., and shall be taken into account in the design of the structure and its *foundations*. (See Note A-4.1.8.16.(10).)

4.1.8.17. Site Stability

1) The potential for slope instability and its consequences, such as slope displacement, shall be evaluated based on site-specific material properties and ground motion parameters referenced in Subsection 1.1.3., as modified by Article 4.1.8.4., and shall be taken into account in the design of the structure and its *foundations*. (See Note A-4.1.8.17.(1).)

4.1.8.18. Elements of Structures, Non-structural Components and Equipment

(See Note A-4.1.8.18.)

1) Except as provided in Sentences (2), (7) and (16), elements and components of *buildings* described in Table 4.1.8.18. and their connections to the structure shall be designed to accommodate the *building* deflections calculated in accordance with Article 4.1.8.13. and the element or component deflections calculated in accordance with Sentence (9), and shall be designed for a lateral force, V_p, distributed according to the distribution of mass:

$$V_p = 0.3F_aS_a(0.2)I_ES_pW_p$$

where

F_a = as defined in Sentence 4.1.8.4.(7),

$S_a(0.2)$ = spectral response acceleration value at 0.2 s, as defined in Sentence 4.1.8.4.(1),

I_E = importance factor for the *building*, as defined in Article 4.1.8.5.,

S_p = $C_pA_rA_x/R_p$ (the maximum value of S_p shall be taken as 4.0 and the minimum value of S_p shall be taken as 0.7), where

C_p = element or component factor from Table 4.1.8.18.,

A_r = element or component force amplification factor from Table 4.1.8.18.,

A_x = height factor $(1 + 2\,h_x / h_n)$,
R_p = element or component response modification factor from Table 4.1.8.18., and
W_p = weight of the component or element.

Table 4.1.8.18.
Elements of Structures and Non-structural Components and Equipment[1]
Forming Part of Sentences 4.1.8.18.(1), (2), (3), (6) and (7)

Category	Part or Portion of Building	C_p	A_r	R_p
1	All exterior and interior walls except those in Category 2 or 3	1.00	1.00	2.50
2	Cantilever parapet and other cantilever walls except retaining walls	1.00	2.50	2.50
3	Exterior and interior ornamentations and appendages	1.00	2.50	2.50
4	Floors and roofs acting as diaphragms[2]	–	–	–
5	Towers, chimneys, smokestacks and penthouses when connected to or forming part of a *building*	1.00	2.50	2.50
6	Horizontally cantilevered floors, balconies, beams, etc.	1.00	1.00	2.50
7	Suspended ceilings, light fixtures and other attachments to ceilings with independent vertical support	1.00	1.00	2.50
8	Masonry veneer connections	1.00	1.00	1.50
9	Access floors	1.00	1.00	2.50
10	Masonry or concrete fences more than 1.8 m tall	1.00	1.00	2.50
11	Machinery, fixtures, equipment and tanks (including contents)			
	that are rigid and rigidly connected	1.00	1.00	1.25
	that are flexible or flexibly connected	1.00	2.50	2.50
12	Machinery, fixtures, equipment and tanks (including contents) containing toxic or explosive materials, materials having a flash point below 38°C or firefighting fluids			
	that are rigid and rigidly connected	1.50	1.00	1.25
	that are flexible or flexibly connected	1.50	2.50	2.50
13	Flat bottom tanks (including contents) attached directly to a floor at or below *grade* within a *building*	0.70	1.00	2.50
14	Flat bottom tanks (including contents) attached directly to a floor at or below *grade* within a *building* containing toxic or explosive materials, materials having a *flash point* below 38°C or firefighting fluids	1.00	1.00	2.50
15	Pipes, ducts (including contents)	1.00	1.00	3.00
16	Pipes, ducts (including contents) containing toxic or explosive materials	1.50	1.00	3.00
17	Electrical cable trays, bus ducts, conduits	1.00	2.50	5.00

18	Rigid components with ductile material and connections	1.00	1.00	2.50
19	Rigid components with non-ductile material or connections	1.00	1.00	1.00
20	Flexible components with ductile material and connections	1.00	2.50	2.50
21	Flexible components with non-ductile material or connections	1.00	2.50	1.00
22	Elevators and escalators(3)			
	machinery and equipment	as per category 11		
	elevator rails	1.00	1.00	2.50
23	Floor-mounted steel pallet storage racks(4)	1.00	2.50	2.50
24	Floor-mounted steel pallet storage racks on which are stored toxic or explosive materials or materials having a flash point below 38°C(4).	1.50	2.50	2.50

Notes to Table 4.1.8.18.:
(1) See Note A-Table 4.1.8.18..
(2) See Sentence (8).
(3) See also the Elevating Devices Safety Regulation
(4) See Sentence (13) and Note A-Table 4.1.8.18.

2) For *buildings* other than *post-disaster buildings*, seismically isolated *buildings*, and *buildings* with supplemental energy dissipation systems, where $I_EF_aS_a(0.2)$ is less than 0.35, the requirements of Sentence (1) need not apply to Categories 6 through 22 of Table 4.1.8.18.
3) For the purpose of applying Sentence (1) for Categories 11 and 12 of Table 4.1.8.18., elements or components shall be assumed to be flexible or flexibly connected unless it can be shown that the fundamental period of the element or component and its connection is less than or equal to 0.06 s, in which case the element or component is classified as being rigid or rigidly connected.
4) The weight of access floors shall include the *dead load* of the access floor and the weight of permanent equipment, which shall not be taken as less than 25% of the floor *live load*.
5) When the mass of a tank plus its contents or the mass of a flexible or flexibly connected piece of machinery, fixture or equipment is greater than 10% of the mass of the supporting floor, the lateral forces shall be determined by rational analysis.
6) Forces shall be applied in the horizontal direction that results in the most critical loading for design, except for Category 6 of Table 4.1.8.18., where the forces shall be applied up and down vertically.
7) Connections to the structure of elements and components listed in Table 4.1.8.18. shall be designed to support the component or element for gravity loads, shall conform to the requirements of Sentence (1), and shall also satisfy these additional requirements:

a) friction due to gravity loads shall not be considered to provide resistance to seismic forces,
b) R_p for non-ductile connections, such as adhesives or power-actuated fasteners, shall be taken as 1.0,
c) R_p for anchorage using shallow expansion, chemical, epoxy or cast-in-place anchors shall be 1.5, where shallow anchors are those with a ratio of embedment length to diameter of less than 8,
d) power-actuated fasteners and drop-in anchors shall not be used for tension loads,
e) connections for non-structural elements or components of Category 1, 2 or 3 of Table 4.1.8.18. attached to the side of a *building* and above the first level above *grade* shall satisfy the following requirements:

i) for connections where the body of the connection is ductile, the body shall be designed for values of C_p, A_r and R_p given in Table 4.1.8.18., and all of the other parts of the connection, such as anchors, welds, bolts and inserts, shall be capable of developing 2.0 times the nominal yield resistance of the body of the connection, and

ii) connections where the body of the connection is not ductile shall be designed for values of C_p = 2.0, R_p = 1.0 and A_r given in Table 4.1.8.18., and

f) a ductile connection is one where the body of the connection is capable of dissipating energy through cyclic inelastic behaviour.

8) Floors and roofs acting as diaphragms shall satisfy the requirements for diaphragms stated in Article 4.1.8.15.

9) Lateral deflections of elements or components shall be based on the loads defined in Sentence (1) and lateral deflections obtained from an elastic analysis shall be multiplied by R_p/I_E to give realistic values of the anticipated deflections.

10) The elements or components shall be designed so as not to transfer to the structure any forces unaccounted for in the design, and rigid elements such as walls or panels shall satisfy the requirements of Sentence 4.1.8.3.(6).

11) Seismic restraint for suspended equipment, pipes, ducts, electrical cable trays, etc. shall be designed to meet the force and displacement requirements of this Article and be constructed in a manner that will not subject hanger rods to bending.

12) Isolated suspended equipment and components, such as pendent lights, may be designed as a pendulum system provided that adequate chains or cables capable of supporting 2.0 times the weight of the suspended component are provided and the deflection requirements of Sentence (10) are satisfied.

13) Free-standing steel pallet storage racks are permitted to be designed to resist earthquake effects using rational analysis, provided the design achieves the minimum performance level required by Subsection 4.1.8. (See Note A-4.1.8.18.(14).)

14) Except as provided in Sentence (15), the relative displacement of glass in glazing systems, $D_{fallout}$, shall be equal to the greater of

a) $D_{fallout} \geq 1.25 I_E D_p$, where

$D_{fallout}$ = relative displacement at which glass fallout occurs, and

D_p = relative earthquake displacement that the component must be designed to accommodate, calculated in accordance with Article 4.1.8.13. and applied over the height of the glass component, or

b) 13 mm.

(See Note A-4.1.8.18.(15) and (16)(c).)

15) Glass need not comply with Sentence (14), provided at least one of the following conditions is met:

a) $I_E F_a S_a(0.2) < 0.35$,

b) the glass has sufficient clearance from its frame such that $D_{clear} \geq 1.25\ D_p$ calculated as follows:

$$D_{clear} = 2C_1\left(1 + h_p C_2/(b_p C_1)\right)$$

Where

D_{clear} = relative horizontal displacement measured over the height of the glass panel, which causes initial glass-to-frame contact,

C_1 = average of the clearances on both sides between the vertical glass edges and the frame,

h_p = height of the rectangular glass panel,

C_2 = averages of the top and bottom clearances between the horizontal glass edges and the frame, and

b_p = width of the rectangular glass panel,

c) the glass is fully tempered, monolithic, installed in a non-*post-disaster building*, and no part of the glass is located more than 3 m above a walking surface (See Note A-4.1.8.18.(15) and (16)(c).), or

d) the glass is annealed or heat-strengthened laminated glass in a single thickness with an interlayer no less than 0.76 mm and captured mechanically in a wall system glazing pocket with the perimeter secured to the frame by a wet, glazed, gunable, curing, elastomeric sealant perimeter bead of 13 mm minimum glass contact width.

16) For structures with supplemental energy dissipation, the following criteria shall apply:

a) the value of $S_a(0.2)$ used in Sentence (1) shall be determined from the mean 5% damped floor spectral acceleration values at 0.2 s by averaging the individual 5% damped floor spectra at the base of the structure determined using Non-Linear Dynamic Analysis, and

b) the value of F_a used in Sentence (1) shall be 1.

4.1.8.19. Seismic Isolation

1) For the purposes of this Article and Article 4.1.8.20., the following terms shall have the meanings stated herein:

a) "seismic isolation" is an alternative seismic design concept that consists of installing an isolation system with low horizontal stiffness, thereby substantially increasing the fundamental period of the structure;

b) "isolation system" is a collection of structural elements at the level of the isolation interface that includes all individual isolator units, all structural elements that transfer force between elements of the isolation system, all connections to other structural elements, and may also include a wind-restraint system, energy-dissipation devices, and a displacement restraint system;

c) "seismically isolated structure" includes the upper portion of the structure above the isolation system, the isolation system, and the portion of the structure below the isolation system;

d) "isolator unit" is a structural element of the isolation system that permits large lateral deformations under lateral earthquake design forces and is characterized by vertical-load-carrying capability combined with increased horizontal flexibility and high vertical stiffness, energy dissipation (hysteretic or viscous), self-centering capability, and lateral restraint (sufficient elastic stiffness) under non-seismic service lateral loads;

e) "isolation interface" is the boundary between the isolated upper portion of the structure above the isolation system and the lower portion of the structure below the isolation system; and

f) "wind-restraint system" is the collection of structural elements of the isolation system that provides restraint of the seismically isolated structure for wind loads and is permitted to be either an integral part of the isolator units or a separate device.

2) Every seismically isolated structure and every portion thereof shall be analyzed and designed in accordance with

a) the loads and requirements prescribed in this Article and Article 4.1.8.20.,

b) other applicable requirements of this Subsection, and

c) appropriate engineering principles and current engineering practice.

(See Note A-4.1.8.19.(2).)

3) For the analysis and modeling of the seismically isolated structure, the following criteria shall apply:

a) a three-dimensional Non-linear Dynamic Analysis of the structure shall be performed in accordance with Article 4.1.8.12. (See Note A-4.1.8.19.(3)(a).),

b) unless verified from rational analysis, the inherent equivalent viscous damping – excluding the hysteretic damping provided by the isolation system or supplemental energy dissipation devices – used in the analysis shall not be taken as more than 2.5% of the critical damping at the significant modes of vibration,

c) all individual isolator units shall be modeled with sufficient detail to account for their non-linear force-deformation characteristics, including effects of the relevant loads, and with consideration of variations in material properties over the design life of the structure, and

d) except for elements of the isolation system, other components of the seismically isolated structure shall be modeled using elastic material properties in accordance with Sentence 4.1.8.3.(8).

4) The ground motion histories used in Sentence (3) shall be

a) appropriately selected and scaled following good engineering practice,

b) compatible with

i) a response spectrum derived from the design spectral acceleration values, S(T), defined in Sentence 4.1.8.4.(9) for ground conditions of Site Classes A, B and C, and
ii) a 5% damped response spectrum based on a site-specific evaluation for ground conditions of Site Classes D, E and F, and

c) amplitude-scaled in an appropriate manner over the period range of 0.2 T_1 to 1.5 T_1, where T_1 is the period of the isolated structure determined using the post-yield stiffness of the isolation system in the horizontal direction under consideration, or the period specified in Sentence 4.1.8.20.(1) if the post-yield stiffness of the isolation system is not well defined.

(See Note A-4.1.8.19.(4).)

4.1.8.20. Seismic Isolation Design Provisions

1) The period of the isolated structure, determined using the post-yield stiffness of the isolation system in the horizontal direction under consideration, shall be greater than three times the period of the structure above the isolation interface calculated as a fixed base.

2) The isolation system shall be configured to produce a restoring force such that the lateral force at the TDD at the centre of mass of the isolated structure above the isolation interface is at least $0.025W_b$ greater than the lateral force at 50% of the TDD at the same location, in each horizontal direction, where W_b is the portion of W above the isolation interface.

3) The values of *storey* shears, *storey* forces, member forces, and deflections used in the design of all structural framing elements and components of the isolation system shall be obtained from analysis conforming to Sentence 4.1.8.19.(3) using one of the following values, whichever produces the most critical effect:

a) mean plus I_E times the standard deviation of results of all Non-linear Dynamic Analyses, or
b) $\sqrt{I_E}$ times the mean of the results of all Non-linear Dynamic Analyses.

4) The force-deformation and damping characteristics of the isolation system used in the analysis and design of the seismically isolated structures shall be validated by testing at least two full-size specimens of each predominant type and size of isolator unit of the isolation system, which shall include

a) the individual isolator units,
b) separate supplemental damping devices, if used, and
c) separate sacrificial wind-restraint systems, if used.

5) The force-deformation characteristics and damping value of a representative sample of the isolator units installed in the *building* shall be validated by tests prior to their installation.

6) A diaphragm or horizontal structural elements shall provide continuity immediately above the isolation interface to transmit forces due to non-uniform ground motions from one part of the structure to another.

7) All structural framing elements shall be designed for the forces described in Sentence (3) with R_dR_o= 1.0, except

a) for structures with I_E < 1.5, all SFRS shall be detailed in accordance with the requirements for R_d ≥ 1.5 and the applicable referenced design standards, and
b) for structures with I_E = 1.5, all SFRS shall be detailed in accordance with the requirements for R_d ≥ 2.0 and the applicable referenced design standards.

8) The height restrictions noted in Table 4.1.8.9. need not apply to seismically isolated structures.

9) All isolator units shall be

a) designed for the forces described in Sentence (3), and
b) able to accommodate the TDD determined at the specific location of each isolator unit.

10) The isolation system, including a separate wind-restraint system if used, shall limit lateral displacement due to wind loads across the isolation interface to a value equal to that required for the least *storey* height in accordance with Sentence 4.1.3.5.(3).

4.1.8.21. Supplemental Energy Dissipation

1) For the purposes of this Article and Article 4.1.8.22., the following terms shall have the meanings stated herein:

a) "supplemental energy dissipation device" is a dedicated structural element of the supplemental energy dissipation system that dissipates energy due to relative motion of each of its ends or by alternative means, and includes all pins, bolts, gusset plates, brace extensions and other components required to connect it to the other elements of the structure; a device may be classified as either displacement-dependent or velocity-dependent, or a combination thereof, and may be configured to act in either a linear or non-linear manner, and

b) "supplemental energy dissipation system" is a collection of energy dissipation devices installed in a structure that supplement the energy dissipation of the SFRS.

2) Every structure with a supplemental energy dissipation system and every portion thereof shall be designed and constructed in accordance with

a) the loads and requirements prescribed in this Article and Article 4.1.8.22.,

b) other applicable requirements of this Subsection, and

c) appropriate engineering principles and current engineering practice.

(See Note A-4.1.8.21.(2).)

3) Where supplemental energy dissipation devices are used across the isolation interface of a seismically isolated structure, displacements, velocities, and accelerations shall be determined in accordance with Article 4.1.8.20.

4) For the analysis and modeling of structures with supplemental energy dissipation devices, the following criteria shall apply:

a) a three-dimensional Non-linear Dynamic Analysis of the structure shall be performed in accordance with Article 4.1.8.12. (See Note A-4.1.8.21.(4)(a).),

b) for SFRS with $R_d > 1.0$, the non-linear hysteretic behaviour of the SFRS shall be explicitly – with sufficient detail – accounted for in the modeling and analysis of the structure,

c) unless verified from rational analysis, the inherent equivalent viscous damping – excluding the damping provided by the supplemental energy dissipation devices – used in the analysis shall not be taken as more than 2.5% of the critical damping at the significant modes of vibration,

d) all supplemental energy dissipation devices shall be modeled with sufficient detail to account for their non-linear force deformation characteristics, including effects of the relevant loads, and with consideration of variations in their properties over the design life of the structure, and

e) except for the SFRS and elements of the supplemental energy dissipation system, other components of the structure shall be modeled using elastic material properties in accordance with Sentence 4.1.8.3.(8).

5) The ground motion histories used in Sentence (4) shall be

a) appropriately selected and scaled following good engineering practice,

b) compatible with a 5% damped response spectrum derived from the design spectral acceleration values, S(T), defined in Sentence 4.1.8.4.(9), and

c) amplitude-scaled in an appropriate manner over the period range of 0.2 T_1 to 1.5 T_1, where T_1 is the fundamental lateral period of the structure with the supplemental energy dissipation system.

(See Note A-4.1.8.21.(5).)

4.1.8.22. Supplemental Energy Dissipation Design Considerations

1) The values of *storey* shears, *storey* forces, member forces, and deflections for the design of all structural framing elements and all supplemental energy dissipation devices shall be obtained from analysis conforming to Sentence 4.1.8.21.(4) using one of the following values, whichever produces the most critical effect:

a) mean plus I_E times the standard deviation of the results of all Non-linear Dynamic Analyses, or

b) $\sqrt{I_E}$ times the mean of the results of all Non-linear Dynamic Analyses.

2) The largest inter*storey* deflection at any level of the structure as determined in accordance with Sentence (1) shall conform to the limits stated in Sentence 4.1.8.13.(3).

3) The force-deformation and force-velocity characteristics of the supplemental energy dissipation devices used in the analysis and design of structures with supplemental energy dissipation systems shall be validated by testing at least two full-size specimens of each type of supplementary energy dissipation device.

4) The force-deformation and force-velocity characteristics and damping values of a representative sample of the supplemental energy dissipation devices installed in the *building* shall be validated by tests prior to their installation.

5) Elements of the supplemental energy dissipation system, except the supplemental energy dissipation devices themselves, shall be designed to remain elastic for the design loads.

6) All structural framing elements shall be designed

a) for an SFRS with R_d =1.0, using the forces referred to in Sentence (1) with R_dR_o = 1.0, except that the SFRS shall be detailed in accordance with the requirements for $R_d \geq 1.5$ and the applicable referenced design standards, or

b) for an SFRS with $R_d > 1.0$, using the forces referred to in Sentence (1) with R_dR_o = 1.0, except that the SFRS shall be detailed in accordance with the requirements for the selected R_d and the applicable referenced design standards.

7) Supplemental energy dissipation devices and other components of the supplemental energy dissipation system shall be designed in accordance with Sentence (1) with consideration of the following:

a) low-cycle, large-displacement degradation due to seismic loads,

b) high-cycle, small-displacement degradation due to wind, thermal, or other cyclic loads,

c) forces or displacements due to gravity loads,

d) adhesion of device parts due to corrosion or abrasion, biodegradation, moisture, or chemical exposure,

e) exposure to environmental conditions, including, but not limited to, temperature, humidity, moisture, radiation (e.g., ultraviolet light), and reactive or corrosive substances (e.g., salt water),

f) devices subject to failure due to low-cycle fatigue must resist wind forces without slip, movement, or inelastic cycling,

g) the range of thermal conditions, device wear, manufacturing tolerances, and other effects that cause device properties to vary during the design life of the device, and

h) connection points of devices must provide sufficient articulation to accommodate simultaneous longitudinal, lateral, and vertical displacements of the supplemental energy dissipation system.

8) Means of access for inspection and removal for replacement of all supplemental energy dissipation devices shall be provided.

Section 4.2. Foundations

4.2.1. General

4.2.1.1. Application

1) This Section applies to *excavations* and *foundation* systems for *buildings*.

4.2.2. Subsurface Investigations, Drawings and Reviews

4.2.2.1. Subsurface Investigation

1) A *subsurface investigation*, including *groundwater conditions*, shall be carried out by or under the direction of a professional engineer having knowledge and experience in planning and executing such investigations to a degree appropriate for the *building* and its use, the ground and the surrounding site conditions. (See Note A-4.2.2.1.(1).)

4.2.2.2. Drawings

1) Drawings associated with *foundations* and *excavations* shall conform to the appropriate requirements of Section 2.2. of Division C. (See Article 2.2.4.6. of Division C.)

4.2.2.3. Field Review

1) A field review shall be carried out by the *designer* or by another suitably qualified person to ascertain that the subsurface conditions are consistent with the design and that construction is carried out in accordance with the design and good engineering practice. (See Note A-4.2.2.3.(1).)

2) The review required by Sentence (1) shall be carried out
- a) on a continuous basis
  - i) during the construction of all *deep foundation units* with all pertinent information recorded for each *foundation unit*,
  - ii) during the installation and removal of retaining structures and related backfilling operations, and
  - iii) during the placement of engineered *fills* that are to be used to support the *foundation units*, and
- b) as required, unless otherwise directed by the *Chief Building Official*,
  - i) in the construction of all *shallow foundation units*, and
  - ii) in excavating, dewatering and other related works.

4.2.2.4. Altered Subsurface Condition

1) If, during construction, the *soil*, *rock* or *groundwater* is found not to be of the type or in the condition used in design and as indicated on the drawings, the design shall be reassessed by the *designer*.

2) If, during construction, climatic or any other conditions change the properties of the *soil*, *rock* or *groundwater*, the design shall be reassessed by the *designer*.

4.2.3. Materials Used in Foundations

4.2.3.1. Wood

1) Wood used in *foundations* or in support of *soil* or *rock* shall conform with the appropriate requirements of Subsection 4.3.1.

4.2.3.2. Preservation Treatment of Wood

1) Wood exposed to *soil* or air above the lowest anticipated *groundwater* table shall be treated with preservative in conformance with CAN/CSA-O80 Series, "Wood Preservation," and the requirements of the appropriate commodity standard as follows:
- a) CAN/CSA-O80.2, "Processing and Treatment,"
- b) CAN/CSA-O80.3, "Preservative Formulations," or
- c) CSA O80.15, "Preservative Treatment of Wood for Building Foundation Systems, Basements, and Crawl Spaces by Pressure Processes."

2) Where timber has been treated as required in Sentence (1), it shall be cared for as provided in AWPA M4, "Care of Preservative-Treated Wood Products," as revised by Clause 6 of CAN/CSA-O80 Series, "Wood Preservation."

4.2.3.3. Plain and Reinforced Masonry

1) Plain or reinforced masonry used in *foundations* or in support of *soil* or *rock* shall conform with the requirements of Subsection 4.3.2.

4.2.3.4. Prevention of Deterioration of Masonry

1) Where plain or reinforced masonry in *foundations* or in structures supporting *soil* or *rock* may be subject to conditions conducive to deterioration, protection shall be provided to prevent such deterioration.

4.2.3.5. Concrete

1) Plain, reinforced or pre-stressed concrete used in *foundations* or in support of *soil* or *rock* shall conform with the requirements of Subsection 4.3.3.

4.2.3.6. Protection Against Chemical Attack

1) Where concrete in *foundations* may be subject to chemical attack, it shall be treated in conformance with the requirements in CSA A23.1, "Concrete Materials and Methods of Concrete Construction."

4.2.3.7. Steel

1) Steel used in *foundations* or in support of *soil* or *rock* shall conform with the appropriate requirements of Subsection 4.3.3. or 4.3.4., unless otherwise specified in this Section.

4.2.3.8. Steel Piles

1) Where steel *piles* are used in *deep foundations* and act as permanent load-carrying members, the steel shall conform with one of the following standards:

a) ASTM A 252, "Welded and Seamless Steel Pipe Piles,"
b) ASTM A 283/A 283M, "Low and Intermediate Tensile Strength Carbon Steel Plates,"
c) ASTM A 1008/A 1008M, "Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable,"
d) ASTM A 1011/A 1011M, "Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength," or
e) CSA G40.21, "Structural Quality Steel."

4.2.3.9. High Strength Steel Tendons

1) Where high strength steel is used for tendons in anchor systems used for the permanent support of a *foundation* or in the erection of temporary support of *soil* or *rock* adjacent to an *excavation*, it shall conform with the requirements of CSA A23.1, "Concrete Materials and Methods of Concrete Construction."

4.2.3.10. Corrosion of Steel

1) Where conditions are corrosive to steel, adequate protection of exposed steel shall be provided. (See Article 1.2.1.1. of Division A for use of other materials.)

4.2.4. Design Requirements

4.2.4.1. Design Basis

1) The design of *foundations*, *excavations* and *soil*- and *rock*-retaining structures shall be based on a *subsurface investigation* carried out in conformance with the requirements of this Section, and on any of the following, as appropriate:

a) application of generally accepted geotechnical and civil engineering principles by a professional engineer especially qualified in this field of work, as provided in this Section and other Sections of Part 4,
b) established local practice, where such practice includes successful experience both with *soils* and *rocks* of similar type and condition and with a *foundation* or *excavation* of similar type, construction method, size and depth, or
c) in situ testing of *foundation units*, such as the load testing of *piles*, anchors or footings, carried out by a person competent in this field of work.

(See Note A-4.2.4.1.(1).)

2) The *foundations* of a *building* shall be capable of resisting all the loads stipulated in Section 4.1., in accordance with limit states design in Subsection 4.1.3.

3) For the purpose of the application of the load combinations given in Table 4.1.3.2.-A, the geotechnical components of loads and the factored geotechnical resistances at ULS shall be determined by a suitably qualified and experienced professional engineer. (See Note A-4.2.4.1.(3).)
4) Geotechnical components of service loads and geotechnical reactions for SLS shall be determined by a suitably qualified and experienced professional engineer.
5) The *foundation* of a *building* shall be designed to satisfy SLS requirements within the limits that the *building* is designed to accommodate, including total settlement and differential settlement, heave, lateral movement, tilt or rotation. (See Note A-4.2.4.1.(5).)
6) Communication, interaction and coordination between the *designer* and the professional engineer responsible for the geotechnical aspects of the project shall take place to a degree commensurate with the complexity and requirements of the project.

4.2.4.2. Subsurface Investigation
1) A *subsurface investigation* shall be carried out to the depth and extent to which the *building* or *excavation* will significantly change the stress in the *soil* or *rock*, or to such a depth and extent as to provide all the necessary information for the design and construction of the *excavation* or the *foundations*.

4.2.4.3. Identification
1) The identification and classification of *soil*, *rock* and *groundwater* and descriptions of their engineering and physical properties shall be in accordance with a widely accepted system.

4.2.4.4. Depth of Foundations
1) Except as permitted in Sentence (2), the *bearing surface* of a *foundation* shall be below the level of potential damage, including damage resulting from *frost action*, and the *foundation* shall be designed to prevent damage resulting from *adfreezing* and frost jacking. (See Note A-4.2.4.4.(1).)
2) The *bearing surface* of a *foundation* need not be below the level of potential damage from frost where the *foundation*

a) is designed against *frost action*, or
b) overlies material not susceptible to *frost action*.

4.2.4.5. Sloping Ground
1) Where a *foundation* is to rest on, in or near sloping ground, this particular condition shall be provided for in the design.

4.2.4.6. Eccentric and Inclined Loads
1) Where there is eccentricity or inclination of loading in *foundation units*, this effect shall be fully investigated and provided for in the design.

4.2.4.7. Dynamic Loading
1) Where dynamic loading conditions apply, the effects shall be assessed by a special investigation of these conditions and provided for in the design.

4.2.4.8. Hydrostatic Uplift
1) Where a *foundation* or any part of a *building* is subject to hydrostatic uplift, the effects shall be provided for in the design.

4.2.4.9. Groundwater Level Change
1) Where proposed construction will result in a temporary or permanent change in the *groundwater level*, the effects of this change on adjacent *buildings* shall be fully investigated and provided for in the design.

4.2.4.10. Permafrost

1) Where conditions of permafrost are encountered or proven to exist, the design of the *foundation* shall be based upon analysis of these conditions by a person especially qualified in that field of work.

4.2.4.11. Swelling and Shrinking Soils

1) Where swelling or shrinking *soils*, in which movements resulting from moisture content changes may be sufficient to cause damage to a structure, are encountered or known to exist, such a condition shall be fully investigated and provided for in the design.

4.2.4.12. Expanding and Deteriorating Rock

1) Where *rock* that expands or deteriorates when subjected to unfavourable environmental conditions or to stress release is known to exist, this condition shall be fully investigated and provided for in the design.

4.2.4.13. Construction on Fill

1) *Buildings* may be placed on *fill* if it can be shown by subsurface investigation that

a) the *fill* is or can be made capable of safely supporting the *building*,
b) detrimental movement of the *building* or of services leading to the *building* will not occur, and
c) explosive gases can be controlled or do not exist.

4.2.4.14. Structural Design

1) The structural design of the *foundation* of a *building*, the procedures and construction practices shall conform with the appropriate Sections of this By-law unless otherwise specified in this Section.

4.2.5. Excavations

4.2.5.1. Design of Excavations

1) The design of *excavations* and of supports for the sides of excavations shall conform with Subsection 4.2.4. and with this Subsection. (See Note A-4.2.5.1.(1).)

4.2.5.2. Excavation Construction

1) Every *excavation* shall be undertaken in such a manner as to

a) prevent movement that would cause damage to adjacent *buildings* at all phases of construction, and
b) comply with the appropriate requirements of Part 8.

2) Material shall not be placed nor shall equipment be operated or placed in or adjacent to an *excavation* in a manner that may endanger the integrity of the *excavation* or its supports.

4.2.5.3. Supported Excavations

1) The sides of an *excavation* in *soil* or *rock* shall be supported by a retaining structure conforming with the requirements of Articles 4.2.5.1. and 4.2.5.2., except as permitted in Article 4.2.5.4.

4.2.5.4. Unsupported Excavations

1) The sides of an *excavation* in *soil* or *rock* may be unsupported where a design is prepared in conformance with the requirements of Articles 4.2.5.1. and 4.2.5.2.

4.2.5.5. Control of Water around Excavations

1) Surface water, all *groundwater*, *perched groundwater* and in particular *artesian groundwater* shall be kept under control at all phases of *excavation* and construction.

4.2.5.6. Loss of Ground

1) At all phases of *excavation* and construction, loss of ground due to water or any other cause shall be prevented.

4.2.5.7. Protection and Maintenance at Excavations

1) All sides of an *excavation*, supported and unsupported, shall be continuously maintained and protected from possible deterioration by construction activity or by the action of frost, rain and wind.

4.2.5.8. Backfilling

1) Where an *excavation* is backfilled, the backfill shall be placed so as to

a) provide lateral support to the *soil* adjacent to the *excavation*, and

b) prevent detrimental movements.

2) The material used as backfill or *fill* supporting a footing, *foundation* or a floor on *grade* shall be of a type that is not subject to detrimental volume change with changes in moisture content and temperature.

4.2.6. Shallow Foundations

4.2.6.1. Design of Shallow Foundations

1) The design of *shallow foundations* shall be in conformance with Subsection 4.2.4. and the requirements of this Subsection. (See Note A-4.2.6.1.(1).)

4.2.6.2. Support of Shallow Foundations

1) Where a *shallow foundation* is to be placed on *soil* or *rock*, the *soil* or *rock* shall be cleaned of loose and unsound material and shall be adequate to support the design load taking into account temperature, precipitation, construction activities and other factors that may lead to changes in the properties of *soil* or *rock*.

4.2.6.3. Incorrect Placement of Shallow Foundations

1) Where a *shallow foundation unit* has not been placed or located as indicated on the drawings,

a) the error shall be corrected, or

b) the design of the *foundation unit* shall be recalculated for the altered conditions by the *designer* and action taken as required in Article 2.2.4.7. of Division C.

4.2.6.4. Damaged Shallow Foundations

1) If a *shallow foundation unit* is damaged,

a) it shall be repaired, or

b) the design of the *foundation unit* shall be recalculated for the damaged condition by the *designer* and action taken as required in Article 2.2.4.7. of Division C.

4.2.7. Deep Foundations

4.2.7.1. General

1) A *deep foundation* shall provide support for a *building* by transferring loads by end-bearing to a competent stratum at considerable depth below the structure, or by mobilizing resistance by adhesion or friction, or both, in the *soil* or *rock* in which it is placed. (See Note A-4.2.7.1.(1).)

4.2.7.2. Design of Deep Foundations

1) *Deep foundations* shall be designed in conformance with Subsection 4.2.4. and this Subsection. (See Note A-4.2.7.2.(1).)

2) Where *deep foundation units* are load tested, as required in Clause 4.2.4.1.(1)(c), the determination of the number and type of load test and the interpretation of the results shall be carried out by a professional engineer especially qualified in this field of work. (See Note A-4.2.7.2.(2).)

3) The design of *deep foundations* shall be determined on the basis of geotechnical considerations taking into account

a) the method of installation,
b) the degree of inspection,
c) the spacing of *foundation units* and group effects,
d) other requirements in this Subsection, and
e) the appropriate structural requirements in Section 4.1. and Subsections 4.3.1., 4.3.3. and 4.3.4.

4) The portion of a *deep foundation unit* permanently in contact with *soil* or *rock* shall be structurally designed as a laterally supported compression member.

5) The portion of a *deep foundation unit* that is not permanently in contact with *soil* or *rock* shall be structurally designed as a laterally unsupported compression member.

6) The structural design of prefabricated *deep foundation units* shall allow for all stresses resulting from driving, handling and testing.

4.2.7.3. Tolerance in Alignment and Location

1) Permissible deviations from the design alignment and the location of the top of *deep foundation units* shall be determined by design analysis and shall be indicated on the drawings.

4.2.7.4. Incorrect Alignment and Location

1) Where a *deep foundation unit* has not been placed within the permissible deviations referred to in Article 4.2.7.3., the condition of the *foundation* shall be assessed by the *designer*, any necessary changes made and action taken as required in Article 2.2.4.7. of Division C.

4.2.7.5. Installation of Deep Foundations

1) *Deep foundation units* shall be installed in such a manner as not to impair
a) the strength of the *deep foundation units* and the properties of the *soil* or *rock* on or in which they are placed beyond the calculated or anticipated limits,
b) the integrity of previously installed *deep foundation units*, or
c) the integrity of neighbouring *buildings*.

4.2.7.6. Damaged Deep Foundation Units

1) Where inspection shows that a *deep foundation unit* is damaged or not consistent with design or good engineering practice,
a) such a unit shall be reassessed by the *designer*,
b) any necessary changes shall be made, and
c) action shall be taken as required in Article 2.2.4.7. of Division C.

4.2.8. Special Foundations

4.2.8.1. General

1) Where special *foundation* systems are used, such systems shall conform to Subsection 4.2.4., Sentence 4.1.1.5.(2) and Article 1.2.1.1. of Division A.

4.2.8.2. Use of Existing Foundations

1) Existing *foundations* may be used to support new or altered *buildings* provided they comply with all pertinent requirements of this Section.

Section 4.3. Design Requirements for Structural Materials

4.3.1. Wood

4.3.1.1. Design Basis for Wood

1) *Buildings* and their structural members made of wood shall conform to CSA O86, “Engineering Design in Wood.”
(See note A-4.3.1.1.)

4.3.1.2. Glued-Laminated Members
1) Glued-laminated members shall be fabricated in plants conforming to CSA O177, “Qualification Code for Manufacturers of Structural Glued-Laminated Timber.”

4.3.1.3. Termites
1) In areas known to be infested by termites, the requirements in Articles 9.3.2.9., 9.12.1.1. and 9.15.5.1. shall apply.

4.3.2. Plain and Reinforced Masonry

4.3.2.1. Design Basis for Plain and Reinforced Masonry
1) *Buildings* and their structural members made of plain and reinforced masonry shall conform to CSA S304, “Design of Masonry Structures.”

4.3.3. Plain, Reinforced and Pre-stressed Concrete

4.3.3.1. Design Basis for Plain, Reinforced and Pre-stressed Concrete
1) *Buildings* and their structural members made of plain, reinforced and pre-stressed concrete shall conform to CSA A23.3, “Design of Concrete Structures.” (See Note A-4.3.3.1.(1).)

4.3.4. Steel

4.3.4.1. Design Basis for Structural Steel
1) *Buildings* and their structural members made of structural steel shall conform to CSA S16, “Design of Steel Structures.” (See Note A-4.3.4.1.(1).)

4.3.4.2. Design Basis for Cold-Formed Steel
1) *Buildings* and their structural members made of cold-formed steel shall conform to CSA S136, “North American Specification for the Design of Cold-Formed Steel Structural Members.” (See Note A-4.3.4.2.(1).)

4.3.4.3. Steel Building Systems
1) Steel *building* systems shall be manufactured by companies certified in accordance with the requirements of CSA A660, “Certification of Manufacturers of Steel Building Systems.”

4.3.5. Aluminum

4.3.5.1. Design Basis for Aluminum
1) *Buildings* and their structural members made of aluminum shall conform to CAN/CSA-S157/S157.1, “Strength Design in Aluminum/Commentary on CSA S157-05, Strength Design in Aluminum,” using the loads stipulated in Section 4.1., in accordance with limit states design in Subsection 4.1.3.

4.3.6. Glass

4.3.6.1. Design Basis for Glass
1) Glass used in *buildings* shall be designed in conformance with
a) CAN/CGSB-12.20-M, “Structural Design of Glass for Buildings,” using an adjustment factor on the wind load, W, of not less than 0.75, or

b) ASTM E 1300, “Standard Practice for Determining Load Resistance of Glass in Buildings,” using an adjustment factor on the wind load, W, of not less than 1.0.

(See Note A-4.3.6.1.(1).)

Section 4.4. Design Requirements for Special Structures

4.4.1. Air-Supported Structures

4.4.1.1. Design Basis for Air-Supported Structures

1) The structural design of *air-supported structures* shall conform to CSA S367, “Air-, Cable-, and Frame-Supported Membrane Structures,” using the loads stipulated in Section 4.1., in accordance with limit states design in Subsection 4.1.3.

4.4.2. Parking Structures

4.4.2.1. Design Basis for Parking Structures and Repair Garages

1) Parking structures and *repair garages* shall be designed in conformance with CSA S413, “Parking Structures.” (See Note A-4.4.2.1.(1).)

Section 4.5. Objectives and Functional Statements

4.5.1. Objectives and Functional Statements

4.5.1.1. Attributions to Acceptable Solutions

1) For the purpose of compliance with this By-law as required in Clause 1.2.1.1.(1)(b) of Division A, the objectives and functional statements attributed to the acceptable solutions in this Part shall be the objectives and functional statements listed in Table 4.5.1.1. (See Note A-1.1.2.1.(1).)

Table 4.5.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 4
Forming Part of Sentence 4.5.1.1.(1)

Functional Statements and Objectives[1]	
4.1.1.3. Design Requirements	
(1)	[F20-OS2.1]
(2)	[F22-OP2.4]
	[F22-OH4]
(3)	[F20-OS2.1] Applies to structural members where temporary overloading during construction may result in impairment of that or any other member.
(4)	[F20,F80,F82-OS2.1]
(5)	[F20-OP2.1] [F22-OP2.4]
	[F20-OS2.3,OS2.4]
4.1.1.5. Design Basis	

(2)	[F20-OS2.1] [F22-OS2.4,OS2.5]
	[F20-OP2.1] [F22-OP2.4,OP2.5]
	[F22-OH4]
4.1.2.1. Loads and Effects	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(2)	[F20-OS2.1]
(3)	[F20-OS2.1]
4.1.2.2. Loads Not Listed	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.3.2. Strength and Stability	
(1)	[F20-OP2.1] [F22-OP2.4]
	[F20-OS2.1]
(2)	[F20-OS2.1] [F22-OS2.4,OS2.5] Applies to the stabilizing resistance of the *dead load*.
	[F20-OP2.1] [F22-OP2.4,OP2.5]
(3)	[F20-OS2.1] [F22-OS2.4,OS2.5] Applies to the stabilizing resistance of the *dead load*.
	[F20-OP2.1] [F22-OP2.4,OP2.5]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1] [F22-OS2.4,OS2.5]
	[F20-OP2.1] [F22-OP2.4,OP2.5]
(8)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(9)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(11)	[F20-OS2.1] [F22-OS2.4,OS2.5]

(12)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.3.3. Fatigue	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1,OP2.4] [F22-OP2.4]
	[F22-OH4]
4.1.3.4. Serviceability	
(1)	[F22-OP2.4]
	[F22-OH4]
4.1.3.5. Deflection	
(1)	(b),(c),(d) [F22-OP2.4]
	[F22-OP2.4]
	[F22-OH4]
(2)	[F22-OS2.3,OS2.4]
	[F22-OP2.4]
(3)	[F22-OP2.4]
(5)	[F22-OS2.3,OS2.4]
	[F22-OP2.3,OP2.4]
4.1.3.6. Vibration	
(1)	[F22-OP2.4]
	[F22-OH4]
(2)	[F20-OS2.1]
	[F20-OP2.1,OP2.4] [F22-OP2.4]
	[F22-OH4]
4.1.4.1. Dead Loads	
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]

	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1] [F22-OS2.4,OS2.5]
4.1.5.1. Loads Due to Use of Floors and Roofs	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.5.2. Uses Not Stipulated	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.5.3. Full and Partial Loading	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.5.4. Loads for Occupancy Served	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.5.5. Loads on Exterior Areas	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]

(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.5.7. More Than One Occupancy	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.5.8. Variation with Tributary Area	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.5.9. Concentrated Loads	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.5.10. Sway Forces in Assembly Occupancies	
(1)	[F20-OS2.1]
	[F20-OP2.1,OP2.4]
4.1.5.11. Crane-Supporting Structures and Impact of Machinery and Equipment	
(1)	[F20-OS2.1]
	[F20-OP2.1,OP2.4] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1,OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1,OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1,OP2.4]
4.1.5.12. Bleachers	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.4]

4.1.5.13. Helicopter Landing Areas	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.5.14. Loads on Guards	
(1)	[F20-OS2.1]
(2)	[F20-OS2.1]
(3)	[F20-OS2.1,OS2.4]
(4)	[F22-OS2.4]
(6)	[F20-OS2.1]
(7)	[F20-OS2.1]
4.1.5.15. Loads on Vehicle Guardrails	
(1)	[F20-OS2.1]
4.1.5.16. Loads on Walls Acting As Guards	
(1)	[F20-OS2.1]
4.1.5.17. Firewalls	
(1)	[F20-OS1.2]
	[F20-OP1.2]
	[F20-OP3.1]
(2)	[F04-OS1.2]
	[F04-OP1.2]
	[F04-OP3.1]
4.1.5.18. Loads for Building Maintenance	
(1)	[F30-OS3.1]
4.1.6.2. Specified Snow Load	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]

(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(8)	[F20-OS2.1] Applies to portion of By-law text: "The shape accumulation factor, C_a, shall be 1.0, …"
	[F20-OP2.1] [F22-OP2.4] Applies to portion of By-law text: "The shape accumulation factor, C_a, shall be 1.0,…"
	(a) to (e) [F20-OS2.1] Applies to roof shapes and configurations that call for a higher shape accumulation factor.
	(a) to (e) [F20-OP2.1] [F22-OP2.4] Applies to roof shapes and configurations that call for a higher shape accumulation factor.
(9)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.3. Full and Partial Loading	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.4. Specified Rain Load	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.5. Multi-level Roofs	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]

	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.6. Horizontal Gap between a Roof and a Higher Roof	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.7. Areas Adjacent to Roof Projections	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.8. Snow Drift at Corners	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.9. Gable Roofs	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.10. Arch Roofs, Curved Roofs and Domes	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]

(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(9)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.11. Snow Loads Due to Sliding	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.12. Valleys in Curved or Sloped Roofs	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.13. Specific Weight of Snow	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.14. Snow Removal	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.15. Ice Loading of Structures	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.7.1. Specified Wind Load	

(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.7.2. Classification of Buildings	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.7.3. Static Procedure	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]

	[F22-OH4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(8)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(10)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.7.4. Topographic Factor	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.7.5. External Pressure Coefficients	

(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(5)	[F20-OS2.1]
4.1.7.6. External Pressure Coefficients for Low Buildings	
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(8)	[F20-OS2.1]

	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(9)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.7.7. Internal Pressure Coefficient	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.7.8. Dynamic Procedure	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.7.9. Full and Partial Wind Loading	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.7.10. Interior Walls and Partitions	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.7.11. Exterior Ornamentations, Equipment and Appendages	

(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.7.12. Wind Tunnel Procedure	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.8.1. Analysis	
(2)	(a) [F20-OS2.1]
	(a) [F20-OP2.1,OP2.3] [F22-OP2.4]
	(b) [F20-OS2.1]
	(b) [F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1,OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(8)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(9)	[F20-OS2.1]

	[F20-OP2.1] [F22-OP2.4]
(10)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(11)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(12)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(13)	[F20-OS2.1]
	[F20-OP2.3] [F22-OP2.3,OP2.4]
(14)	[F20-OS2.1]
	[F20-OP2.3] [F22-OP2.3,OP2.4]
4.1.8.3. General Requirements	
(2)	[F20-OS2.1]
	[F20-OP2.1,OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(8)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.4. Site Properties	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]

	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(9)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.5. Importance Factor	
(1)	[F20-OS2.1]
	[F20-OP2.1,OP2.3] [F22-OP2.4]
4.1.8.6. Structural Configuration	
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.7. Methods of Analysis	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.8. Direction of Loading	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.9. SFRS Force Reduction Factors, System Overstrength Factors, and General Restrictions	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]

4.1.8.10. Additional System Restrictions	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	(a) [F20-OP2.3] [F22-OP2.4]
	(b) [F20-OP2.3] [F22-OP2.4]
	(c) [F20-OP2.3] [F22-OP2.4]
	(d) [F20-OP2.3] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F22-OS2.3,OS2.4]
	[F22-OP2.3,OP2.4]
(7)	[F22-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.11. Equivalent Static Force Procedure for Structures Satisfying the Conditions of Article 4.1.8.7.	
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(8)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]

(9)	(a) [F20-OS2.1]
	(a) [F20-OP2.1] [F22-OP2.4]
	(b) [F20-OS2.1]
	(b) [F20-OP2.1] [F22-OP2.4]
(10)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(11)	(a) [F20-OP2.1] [F22-OP2.4]
	(a) [F20-OS2.1]
	(b) [F20-OS2.1]
	(b) [F20-OP2.1] [F22-OP2.4]
(12)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.12. Dynamic Analysis Procedure	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	(a) [F20-OS2.1]
	(a) [F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1,OP2.3] [F22-OP2.4]
(7)	[F20-OS2.1]
	[F20-OP2.1,OP2.3] [F22-OP2.4]
(8)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(9)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(10)	[F20-OS2.1]

	[F20-OP2.1] [F22-OP2.4]
(12)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.13. Deflections and Drift Limits	
(1)	[F22-OS2.3,OS2.4]
	[F22-OP2.3,OP2.4]
(2)	[F22-OS2.3,OS2.4]
	[F22-OP2.3,OP2.4]
(3)	[F22-OS2.3,OS2.4]
	[F22-OP2.3,OP2.4]
4.1.8.14. Structural Separation	
(1)	[F22-OS2.3,OS2.4]
	[F22-OP2.3,OP2.4]
	[F22-OP4.3]
(2)	[F20-OS2.1,OS2.3,OS2.4]
	[F20-OP2.1,OP2.3,OP2.4]
	[F20-OP4.3]
(3)	[F20-OS2.1,OS2.3,OS2.4]
	[F20-OP2.1,OP2.3,OP2.4]
	[F20-OP4.3]
(4)	[F20-OS2.1,OS2.3,OS2.4]
	[F20-OP2.1,OP2.3,OP2.4]
	[F20-OP4.3]
4.1.8.15. Design Provisions	
(1)	[F20-OS2.1]
	[F20-OP2.1,OP2.3,OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1,OP2.3,OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1,OP2.3,OP2.4]

(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1,OP2.4]
(6)	[F20-OS2.1,OS2.4]
	[F20-OP2.1,OP2.4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.16. Foundation Provisions	
(1)	[F22-OS2.3,OS2.4]
	[F22-OP2.3,OP2.4]
(2)	[F20-OS2.1] Applies to portion of By-law text: "*Foundations* shall be designed to resist the lateral load capacity of the SFRS…"
	[F20-OP2.1] Applies to portion of By-law text: "*Foundations* shall be designed to resist the lateral load capacity of the SFRS…"
(5)	[F20-OS2.2,OS2.4]
	[F20-OP2.2,OP2.4]
(6)	(a) [F22-OS2.4]
	(a) [F22-OP2.4]
	(b) [F22-OS2.4]
	(b) [F22-OP2.4]
	(c) [F20-OS2.4]
	(c) [F20-OP2.4]
(7)	[F20-OS2.1]
	[F20-OP2.1,OP2.4]
(8)	(a) [F20-OS2.1]
	(a) [F20-OP2.1]
	(b) [F22-OS2.4]
	(b) [F22-OP2.4]
(9)	[F20-OS2.4]
	[F20-OP2.4]

(10)	[F20-OS2.2] [F22-OS2.4]
	[F20-OP2.2] [F22-OP2.4]
4.1.8.17. Site Stability	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.18. Elements of Structures, Non-structural Components and Equipment	
(1)	[F20,F22-OS2.4]
	[F20-OP2.3] [F22-OP2.3,OP2.4]
(4)	[F20,F22-OS2.4]
	[F20,F22-OP2.3,OP2.4]
(5)	[F20,F22-OS2.1]
	[F20,F22-OP2.1,OP2.4]
(6)	[F20,F22-OS2.4]
	[F20,F22-OP2.3,OP2.4]
(7)	[F20,F22-OS2.4] Applies to portion of By-law text: "Connections to the structure of elements and components listed in Table 4.1.8.18. shall be designed to support the component or element for gravity loads, shall conform to the requirements of Sentence 4.1.8.18.(1) …"
	[F20,F22-OP2.3,OP2.4] Applies to portion of By-law text: "Connections to the structure of elements and components listed in Table 4.1.8.18. shall be designed to support the component or element for gravity loads, shall conform to the requirements of Sentence 4.1.8.18.(1) …"
	(a) [F20,F22-OS2.4]
	(a) [F20,F22-OP2.3,OP2.4]
	(b),(c) [F20,F22-OS2.4]
	(b),(c) [F20,F22-OP2.3,OP2.4]
	(d) [F20,F22-OS2.4]
	(d) [F20,F22-OP2.3,OP2.4]
	(e) [F20,F22-OS2.4]
	(e) [F20,F22-OP2.3,OP2.4]
(9)	[F22-OS2.3,OS2.4]
	[F22-OP2.3,OP2.4]
(10)	[F22-OS2.1,OS2.3,OS2.4]
	[F22-OP2.1,OP2.3,OP2.4]

(11)	[F20-OS2.1] [F22-OS2.4]
	[F20,F22-OP2.3,OP2.4]
(12)	[F20-OS2.1] [F22-OS2.3]
	[F20-OP2.1] [F22-OP2.3]
(14)	[F22-OS2.4]
(16)	[F20,F22-OS2.4]
	[F20-OP2.3] [F22-OP2.3,OP2.4]
4.1.8.19. Seismic Isolation	
(2)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.20. Seismic Isolation Design Provisions	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(9)	[F20-OS2.1] [F22-OS2.4]

	[F20-OP2.1] [F22-OP2.4]
(10)	[F22-OS2.4]
	[F22-OP2.3,OP2.4]
4.1.8.21. Supplemental Energy Dissipation	
(2)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.22. Supplemental Energy Dissipation Design Considerations	
(1)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(7)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(8)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
4.2.2.1. Subsurface Investigation	
(1)	[F20-OS2.2,OS2.6] [F21-OS2.6]
	[F20-OP2.2] [F21-OP2.6]
	[F21-OP4.1,OP4.4]
4.2.2.3. Field Review	

(1)	[F20-OS2.2,OS2.6] [F21-OS2.6]
	[F20-OP2.2] [F21-OP2.5]
	[F21-OP4.1,OP4.4]
4.2.2.4. Altered Subsurface Condition	
(1)	[F20-OS2.2,OS2.6] [F21-OS2.6]
	[F20-OP2.2] [F21-OP2.6]
	[F21-OP4.1,OP4.4]
(2)	[F20-OS2.2,OS2.6] [F21-OS2.6]
	[F20-OP2.2] [F21-OP2.6]
	[F21-OP4.1,OP4.4]
4.2.3.2. Preservation Treatment of Wood	
(1)	[F80-OS2.3]
	[F80-OP2.3]
(2)	[F82-OS2.3]
	[F82-OP2.3]
4.2.3.4. Prevention of Deterioration of Masonry	
(1)	[F80-OS2.3]
	[F80-OP2.3]
4.2.3.6. Protection Against Chemical Attack	
(1)	[F80-OS2.3]
	[F80-OP2.3]
4.2.3.8. Steel Piles	
(1)	[F20-OS2.3]
	[F20-OP2.3]
4.2.3.9. High Strength Steel Tendons	
(1)	[F20,F80-OS2.5,OS2.6]
	[F20,F80-OP2.6,OP2.5]
	[F20,F80-OP4.1,OP4.4]
4.2.3.10. Corrosion of Steel	
(1)	[F80-OS2.3]

	[F80-OP2.3]
	[F80-OP4.1]
4.2.4.1. Design Basis	
(1)	[F20-OS2.2,OS2.6] [F21-OS2.6]
	[F20-OP2.2] [F21-OP2.5]
	[F21-OP4.1,OP4.4]
(5)	[F21-OS2.5]
	[F21-OP2.4,OP2.5]
4.2.4.2. Subsurface Investigation	
(1)	[F20-OS2.2,OS2.6] [F21-OS2.6]
	[F20-OP2.2] [F21-OP2.6]
	[F21-OP4.1,OP4.4]
4.2.4.3. Identification	
(1)	[F20-OS2.2,OS2.6] [F21-OS2.6]
	[F20-OP2.2] [F21-OP2.6]
	[F21-OP4.1,OP4.4]
4.2.4.4. Depth of Foundations	
(1)	[F21-OP2.4] Applies to portion of By-law text: "… the *bearing surface* of a *foundation* shall be below the level of potential damage, including damage resulting from *frost action* …"
	[F21-OP2.4] Applies to portion of By-law text: "… the *foundation* shall be designed to prevent damage resulting from *adfreezing* and frost jacking."
(2)	[F21-OP2.4]
4.2.4.5. Sloping Ground	
(1)	[F21-OS2.2]
	[F21-OP2.2,OP2.6,OP2.4]
4.2.4.6. Eccentric and Inclined Loads	
(1)	[F20-OS2.1,OS2.2]
	[F20-OP2.1,OP2.2,OP2.4]
4.2.4.7. Dynamic Loading	
(1)	[F20-OS2.2]
	[F20-OP2.2,OP2.6,OP2.4]

	[F20-OH4]
4.2.4.8. Hydrostatic Uplift	
(1)	[F22-OP2.1,OP2.4]
4.2.4.9. Groundwater Level Change	
(1)	[F21-OP4.1]
4.2.4.10. Permafrost	
(1)	[F20-OS2.2] [F21-OS2.5]
	[F20-OP2.2,OP2.4] [F21-OP2.6,OP2.4]
4.2.4.11. Swelling and Shrinking Soils	
(1)	[F21-OP2.6,OP2.4]
4.2.4.12. Expanding and Deteriorating Rock	
(1)	[F21-OP2.6,OP2.4]
4.2.4.13. Construction on Fill	
(1)	(a) [F20-OS2.2] [F21-OS2.5]
	(b) [F20-OP2.2,OP2.4] [F21-OP2.6,OP2.4]
	(c) [F01-OS1.1]
4.2.5.2. Excavation Construction	
(1)	[F21-OP4.1]
(2)	[F20-OS2.6]
	[F20-OP2.3]
	[F20,F21-OP4.1]
4.2.5.3. Supported Excavations	
(1)	[F20-OS2.6]
	[F21-OP4.1]
4.2.5.4. Unsupported Excavations	
(1)	[F20-OS2.6]
	[F21-OP4.1]
4.2.5.5. Control of Water around Excavations	
(1)	[F60-OS2.6]
	[F60-OP4.1,OP4.4]

4.2.5.6. Loss of Ground	
(1)	[F21-OP4.1]
4.2.5.7. Protection and Maintenance at Excavations	
(1)	[F80-OS2.6]
	[F80-OP4.1]
4.2.5.8. Backfilling	
(1)	(a) [F21-OS2.1]
	(a) [F21-OP2.1,OP2.4]
	[F21-OP4.1]
(2)	[F21-OP2.4]
4.2.6.2. Support of Shallow Foundations	
(1)	[F20-OS2.2]
	[F20-OP2.2,OP2.4] [F21-OP2.4]
4.2.6.3. Incorrect Placement of Shallow Foundations	
(1)	[F20-OS2.2]
	[F20-OP2.2,OP2.4] [F21-OP2.4]
4.2.6.4. Damaged Shallow Foundations	
(1)	[F20-OS2.1]
	[F20-OP2.1,OP2.4] [F22-OP2.4]
4.2.7.2. Design of Deep Foundations	
(3)	[F20-OS2.1,OS2.2] [F21-OS2.5]
	[F20-OP2.1,OP2.2] [F21,F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1,OP2.4] [F22-OP2.4]
(6)	[F20-OP2.1,OP2.4]
4.2.7.3. Tolerance in Alignment and Location	
(1)	[F20-OS2.1]
	[F20-OP2.1,OP2.4] [F22-OP2.4]
4.2.7.4. Incorrect Alignment and Location	
(1)	[F20-OS2.1]

	[F20-OP2.1,OP2.4] [F22-OP2.4]
4.2.7.5. Installation of Deep Foundations	
(1)	[F81-OS2.1] [F21-OS2.2,OS2.6]
	(c) [F21-OP4.1]
	(a),(b) [F81-OP2.1,OP2.4] [F21-OP2.2,OP2.4]
4.2.7.6. Damaged Deep Foundation Units	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.2.8.2. Use of Existing Foundations	
(1)	[F20-OS2.1,OS2.2]
	[F20-OP2.1,OP2.2] [F22-OP2.4]
4.3.1.1. Design Basis for Wood	
(1)	[F22,F21,F80-OH4]
	[F20-OS2.1] [F80-OS2.3]
	[F20-OP2.1] [F21,F22-OP2.4] [F80-OP2.3,OP2.4]
4.3.1.2. Glued-Laminated Members	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F21,F22-OP2.4]
	[F21,F22-OH4]
4.3.2.1. Design Basis for Plain and Reinforced Masonry	
(1)	[F21,F22,F80-OH4]
	[F20-OS2.1] [F80-OS2.3]
	[F20-OP2.1] [F22,F21-OP2.4] [F80-OP2.3,OP2.4]
4.3.3.1. Design Basis for Plain, Reinforced and Pre-stressed Concrete	
(1)	[F20-OS2.1] [F80,F81-OS2.3]
	[F20-OP2.1] [F21,F22-OP2.4] [F80,F81-OP2.3,OP2.4]
	[F21,F22,F80,F81-OH4]
4.3.4.1. Design Basis for Structural Steel	
(1)	[F20-OS2.1] [F80-OS2.3]
	[F20-OP2.1] [F20,F22-OP2.4] [F80-OP2.3,OP2.4]

	[F22,F80-OH4]
4.3.4.2. Design Basis for Cold-Formed Steel	
(1)	[F20-OS2.1] [F80-OS2.3]
	[F20-OP2.1] [F20,F22-OP2.4] [F80-OP2.3,OP2.4]
	[F22,F80-OH4]
4.3.5.1. Design Basis for Aluminum	
(1)	[F20-OS2.1] [F80-OS2.3]
	[F20-OP2.1] [F20,F22-OP2.4] [F80-OP2.3,OP2.4]
	[F22,F80-OH4]
4.3.6.1. Design Basis for Glass	
(1)	[F20-OS2.1]
	[F20-OP2.1]
4.4.1.1. Design Basis for Air-Supported Structures	
(1)	[F20-OS2.1] [F80-OS2.3]
	[F20-OP2.1] [F22-OP2.4] [F80-OP2.3]
	[F22-OH4]
4.4.2.1. Design Basis for Parking Structures and Repair Garages	
(1)	[F21,F61,F80-OS2.3]
	[F21,F61,F80-OP2.3,OP2.4]
	[F21,F61,F80-OH4]

Notes to Table 4.5.1.1.:
See Parts 2 and 3 of Division A.

Notes to Part 4
Structural Design

A-4.1.1.3.(1) Structural Integrity. The requirements of Part 4, including the CSA design standards, generally provide a satisfactory level of structural integrity. Additional considerations may, however, be required for building systems made of components of different materials, whose interconnection is not covered by existing CSA design standards, buildings outside the scope of existing CSA design standards, and buildings exposed to severe accidental loads such as vehicle impact or explosion. Further guidance can be found in the Commentary entitled Structural Integrity in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.1.3.(2) Serviceability. Information on serviceability can be found in the Commentary entitled Deflection and Vibration Criteria for Serviceability and Fatigue Limit States in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.1.5.(2) Structural Equivalents. Sentence 4.1.1.5.(2) provides for the use of design methods not specified in Part 4, including full-scale testing and model analogues. This provision is usually used to permit the acceptance of new and innovative structures or to permit the acceptance of model tests such as those used to determine structural behaviour, or snow or wind loads. Sentence 4.1.1.5.(2) specifically requires that the level of safety and performance be at least equivalent to that provided by design to Part 4 and requires that loads and designs conform to Section 4.1.

Sentence 4.1.1.5.(2) and the provision for alternative solutions stated in Clause 1.2.1.1.(1)(b) of Division A are not intended to allow structural design using design standards other than those listed in Part 4. The acceptance of structures that have been designed to other design standards would require the designer to prove to the appropriate authority that the structure provides the level of safety and performance required by Clause 1.2.1.1.(1)(b) of Division A. The equivalence of safety and performance can only be established by analyzing the structure for the loads and load factors set out in Section 4.1. and by demonstrating that the structure at least meets the requirements of the design standards listed in Sections 4.3. and 4.4.

A-4.1.2.1. Loads and Effects. Information on the definitions can be found in the Commentary entitled Limit States Design in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.2.1.(1) Temperature Changes. Information on effects due to temperature changes can be found in the Commentary entitled Effects of Deformations in Building Components in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.2.1.(3) Major Occupancies. In a building containing more than one major occupancy and classified in more than one Importance Category, the classification of each independent structural system shall be the same as for any part of the building that is dependent on that structural system and for the highest usage group according to Table 4.1.2.1.

A-Table 4.1.2.1. Importance Categories for Buildings.

Low Importance Category Buildings

Low human-occupancy farm buildings are defined in the National Farm Building Code of Canada 1995 as having an occupant load of 1 person or less per 40 m^2 of floor area. Minor storage buildings include only those storage buildings that represent a low direct or indirect hazard to human life in the event of structural failure, either because people are unlikely to be affected by structural failure, or because structural failure causing damage to materials or equipment does not present a direct threat to human life.

Buildings Containing Hazardous Materials
The following buildings contain sufficient quantities of toxic, explosive or other hazardous substances to be classified in the High Importance Category of use and occupancy:

- petrochemical facilities,
- fuel storage facilities (other than those required for post-disaster use), and
- manufacturing or storage facilities for dangerous goods.

The following types of buildings may be classified in the Normal Importance Category: buildings that are equipped with secondary containment of toxic, explosive or other hazardous substances, including but not limited to, double-wall tanks, dikes of sufficient size to contain a spill, or other means to contain a spill or a blast within the property boundary of the facility and prevent the release of harmful quantities of contaminants to the air, soil, groundwater, surface water or atmosphere, as the case may be.

A-4.1.3. Limit States Design. Information on limit states design can be found in the Commentary entitled Limit States Design in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.3.2.(2) Load Combinations.

Load Combination Equations
The load combinations in Tables 4.1.3.2.-A and 4.1.3.2.-B apply to most situations for loadbearing building structures. Guidance on special situations such as load combinations for fire resistance and building envelopes is given in the Commentary entitled Limit States Design in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

Load Cases and Crane Load Effects
The load combinations in Table 4.1.3.2.-A are to be evaluated for structures with crane load effects for the scenario where the crane loads are zero, and for structures without crane loads. The load combinations in Table 4.1.3.2.-B are to be evaluated for structures with crane loads for the scenario where the crane load effects are other than zero.

Crane Loads
Crane-supporting structures that have cranes in multiple parallel bays should be designed for the maximum vertical crane load with the cranes positioned for the most critical effect in conjunction with a lateral load with each crane in turn positioned for the most critical effect. For load combinations that include crane loads, additional guidance can be found in CISC/ICCA 2013, "Crane-Supporting Steel Structures: Design Guide."

A-4.1.3.2.(4) Effects of Lateral Earth Pressure, H, Pre-stress, P, and Imposed Deformation, T, in Design Calculations.

Effects of Lateral Earth Pressure, H, in Design Calculations
For common building structures below ground level, such as walls, columns and frames, 1.5 H is added to load combinations 2 to 4. For cantilever retaining wall structures, see the Commentary entitled Limit States Design in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

Effects of Pre-stress, P, and Imposed Deformation, T, in Design Calculations
For structures and building envelopes designed in accordance with the requirements specified in the standards listed in Section 4.3., with the exception of Clauses 8 and 18 of CSA A23.3, "Design of Concrete Structures," P and T need not be included in the load combinations of Table 4.1.3.2.-A. For structures not

within the scope of the standards listed in Section 4.3., including building envelopes, P and T must be taken into account in the design calculations. For recommended load combinations including T, see the Commentary entitled Limit States Design in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.3.2.(5) Overturning, Uplift or Sliding. Information on overturning, uplift and sliding can be found in the Commentary entitled Limit States Design in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.3.3.(1) Failure due to Fatigue. Failure due to fatigue of building structures referred to in Section 4.3. and designed for serviceability in accordance with Article 4.1.3.6. is, in general, unlikely except for girders supporting heavily used cranes, on which Article 4.1.5.11. provides guidance.

A-4.1.3.3.(2) Vibration Effects. Guidance on vibration effects can be found in the Commentary entitled Deflection and Vibration Criteria for Serviceability and Fatigue Limit States in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.3.4.(1) Loads and Load Combinations for Serviceability. The loads and load combinations for serviceability depend on the serviceability limit states and on the properties of the structural materials. Information on loads and load combinations for the serviceability limit states, other than those controlled by deflection, can be found in the Commentary entitled Deflection and Vibration Criteria for Serviceability and Fatigue Limit States in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.3.5.(1) Deflections. Serviceability criteria for deflections that cause damage to non-structural building components can be found in the standards listed in Section 4.3. Information on deflections can be found in the Commentary entitled Deflection and Vibration Criteria for Serviceability and Fatigue Limit States in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).” Information on loads and load combinations for calculating deflection can be found in the Commentary entitled Limit States Design in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.3.5.(3) Lateral Deflection of Buildings. The limitation of 1/500 drift per storey may be exceeded if it can be established that the drift as calculated will not result in damage to non-structural elements. Information on lateral deflection can be found in the Commentary entitled Wind Load and Effects in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.3.6.(1) Floor Vibration. Information on floor vibration can be found in the Commentary entitled Deflection and Vibration Criteria for Serviceability and Fatigue Limit States in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).” Information on loads and load combinations for the calculation of vibration can be found in the Commentary entitled Limit States Design in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.3.6.(2) Dynamic Analyses of Floor Vibrations. Information on a dynamic analysis of floor vibrations from rhythmic activities can be found in the Commentary entitled Deflection and Vibration Criteria for Serviceability and Fatigue Limit States in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.3.6.(3) Lateral Vibration Under Wind Load. Information on lateral vibrations and accelerations under dynamic wind loads can be found in the Commentary entitled Wind Load and Effects in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.4.1.(6) Counteracting Dead Load Due to Soil. Examples of structures that traditionally employ the dead load of soil to resist loadings are pylon signs, tower structures, retaining walls, and deadmen, which resist wind uplift and overturning in light structures.

A-4.1.5.1.(1) Loads Due to Use of Floors and Roofs. In many areas of buildings, such as equipment areas, service rooms, factories, storage areas, warehouses, museums, and office filing areas, live loads due to their intended use may exceed the minimum specified loads listed in Table 4.1.5.3. In these instances, the probable live load shall be calculated and used as the specified live load for the design of that particular area.

A-Table 4.1.5.3. Considerations for Live Loads.

Arenas, Grandstands and Stadia
The designer should give special consideration to the effects of vibration.

Attics – Limited Accessibility
Attic live loading is not required when the ceiling below the attic consists of removable panels that permit access to the ceiling space without loading the ceiling supporting members. Attic live loading is not required in any area of the attic where the least dimension of the attic space is less than 500 mm.

Corridors, Aisles and Rows of Seats
The spaces between rows of seats are typically designed for the loads of the occupancy they serve. Rows of seats typically discharge into aisles that are designed for the loads used for the rows of seats. Corridors have a minimum width of 1 100 mm and may serve as collectors for aisles; they are therefore part of the exit system and are required to be designed for a minimum live load of 4.8 kPa.

Floor Areas That Could Be Used As Viewing Areas
Some interior balconies, mezzanines, corridors, lobbies and aisles that are not intended to be used by an assembly of people as viewing areas are sometimes used as such; consequently, they are subject to loadings much higher than those for the occupancies they serve. Floor areas that may be subject to such higher loads must, therefore, be designed for a loading of 4.8 kPa.

Lecture Halls and Classrooms
For the purposes of applying the requirements of Table 4.1.5.3., lecture halls with fixed seats are similar to theatres in configuration (the seats may have a writing tablet affixed to one arm). Classrooms are typically furnished with full-sized desks having separate or integrated seats.

Minimum Roof Live Load
Articles 4.1.5.3. and 4.1.5.9. stipulate a minimum uniform roof live load of 1.0 kPa and a minimum concentrated live load of 1.3 kN. These live loads are “use and occupancy loads” intended to provide for maintenance loadings: they are not reduced as a function of area or as a function of the roof slope due to their variability in distribution and location.

Vehicle Loads
A special study should be undertaken to determine the distributed loads to be used for the design of floors and areas used by vehicles exceeding 9 000 kg gross weight and of driveways and sidewalks over areaways and basements. Where appropriate, the designer should refer to CSA S6, “Canadian Highway Bridge Design Code.”

A-4.1.5.5. Loads on Exterior Areas. In Article 4.1.5.5., “accessible” refers to the lack of a physical barrier that prevents or restricts access by vehicles or persons to the site in the context of the specific use.

A-4.1.5.8. Tributary Area. Information on tributary area can be found in the Commentary entitled Live Loads in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-Table 4.1.5.9. Loads Due to Concentrations. Special study is required to determine concentrated loads for the design of floors and areas used by vehicles exceeding 9 000 kg gross weight, and of driveways and sidewalks over areaways and basements. Where appropriate the designer should refer to CSA S6, “Canadian Highway Bridge Design Code.”

A-4.1.5.11. Crane-Supporting Structures. Guidance on crane-supporting structures can be found in CSA S16, “Design of Steel Structures.”

A-4.1.5.14. and **4.1.5.15.(1) Design of Guards.** In the design of guards, due consideration should be given to the durability of the members and their connections.

A-4.1.5.17. Loads on Firewalls. Information on loads on firewalls can be found in the Commentary entitled Structural Integrity of Firewalls in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.6.2. Coefficients for Snow Loads on Roofs. Information on coefficients for snow loads on roofs can be found in the Commentary entitled Snow Loads in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.6.2.(2) Basic Roof Snow Load Factor. Figure A-4.1.6.2.(2) shows the basic roof snow load factor, C_b, plotted against $I_cC_w^2$ ..

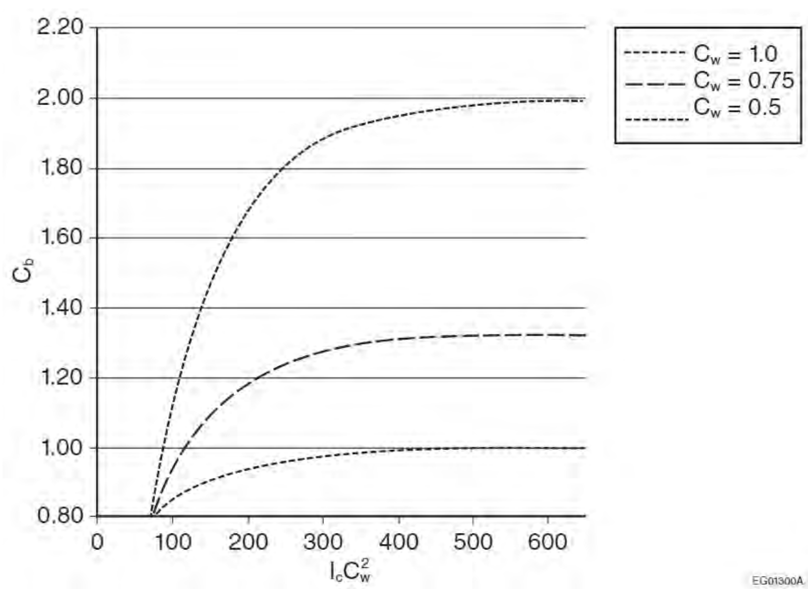


Figure A-4.1.6.2.(2)
Basic roof snow load factor, C_b

A-4.1.6.3.(2) Full and Partial Loading under Snow Loads. Information on full and partial snow loading on roofs can be found in the Commentary entitled Snow Loads in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.6.4.(1) Rain Loads. Information on rain loads can be found in the Commentary entitled Rain Loads in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.6.4.(3) Flow Control Drains. Book II (Plumbing Services) of this By-law contains requirements regarding the use of flow control roof drains. The designer must ensure that the building complies with both Book I and Book II of the Building By-law.

A-4.1.6.7.(1) Roof Projections. Elevator, air-conditioning and fan housings, small penthouses and wide chimneys are examples of roof projections.

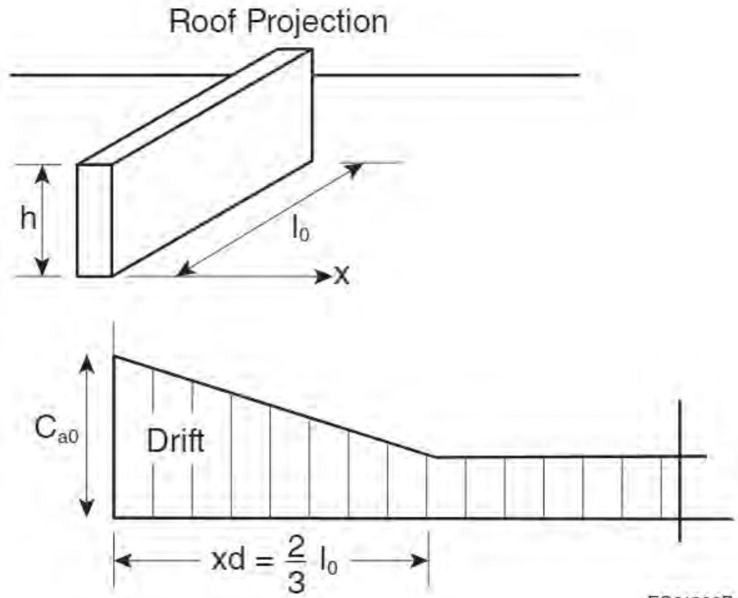
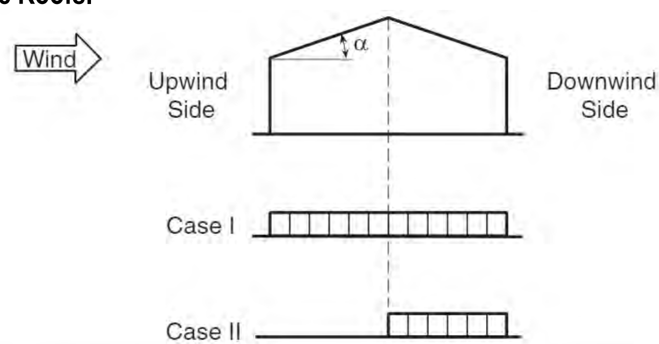


Figure A-4.1.6.7.(1)
Roof projections

A-4.1.6.7.(2) Values of C_a for Small Roof Projections. Calculating C_a in accordance with Article 4.1.6.5. rather than Sentence 4.1.6.7.(1) results in lower values for small projections.

A-4.1.6.9. Snow on Gable Roofs.



Load Case	Roof Slope, α	Factors			
		C_w	C_s	C_a on upwind side	C_a on downwind side
I	$0° \leq \alpha \leq 90°$	(2)	$f(\alpha)$(3)	1.0	1.0
II(1)	$15° < \alpha \leq 20°$ $20° < \alpha \leq 90°$	1.0 1.0	$f(\alpha)$(3)	0.0 0.0	$0.25 + \alpha/20$ 1.25

EG01306B

Figure A-4.1.6.9.
Load cases for gable roofs

Notes to Figure A-4.1.6.9.:

(1) Case II loading does not apply to gable roofs with slopes of 15° or less, to single-sloped (shed) roofs, or to flat roofs.
(2) The value of C_w for load case I is as prescribed in Sentences 4.1.6.2.(3) and (4).
(3) Varies as a function of slope, α, as defined in Sentences 4.1.6.2.(5) and (6).

A-4.1.7.1.(6) Computational Fluid Dynamics (CFD). It is not currently possible to verify the reliability and accuracy of CFD and no standards address it; as such, this method is not permitted to be used to determine specified wind loads.

A-4.1.7.2.(1) and (2) Natural Frequency. Information on calculating the natural frequency of a building can be found in the Commentary entitled Wind Load and Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.7.3.(5)(c) Procedure for Calculating Intermediate C_e. Information on calculating intermediate values of C_e between two exposures can be found in the Commentary entitled Wind Load and Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.7.3.(10) Internal Gust Effect Factor, C_{gi}. The effect of building envelope flexibility can be included in the calculation of C_{gi}. See the Commentary entitled Wind Load and Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.7.5.(2) and (3) Pressure Coefficients for Main Structural System on Rectangular Buildings.

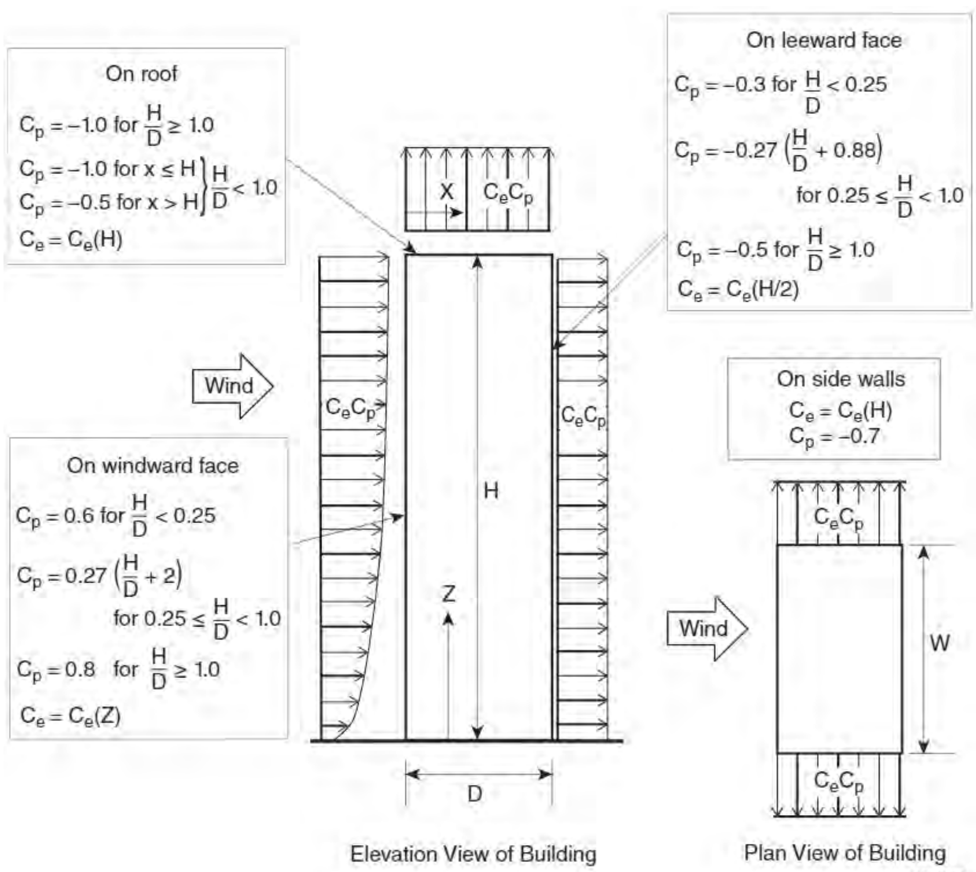


Figure A-4.1.7.5.(2) and (3)
Values of C_p for main structural system on rectangular buildings

A-4.1.7.5.(4) Pressure coefficients for roof and wall claddings and secondary structural supports of cladding on rectangular buildings.

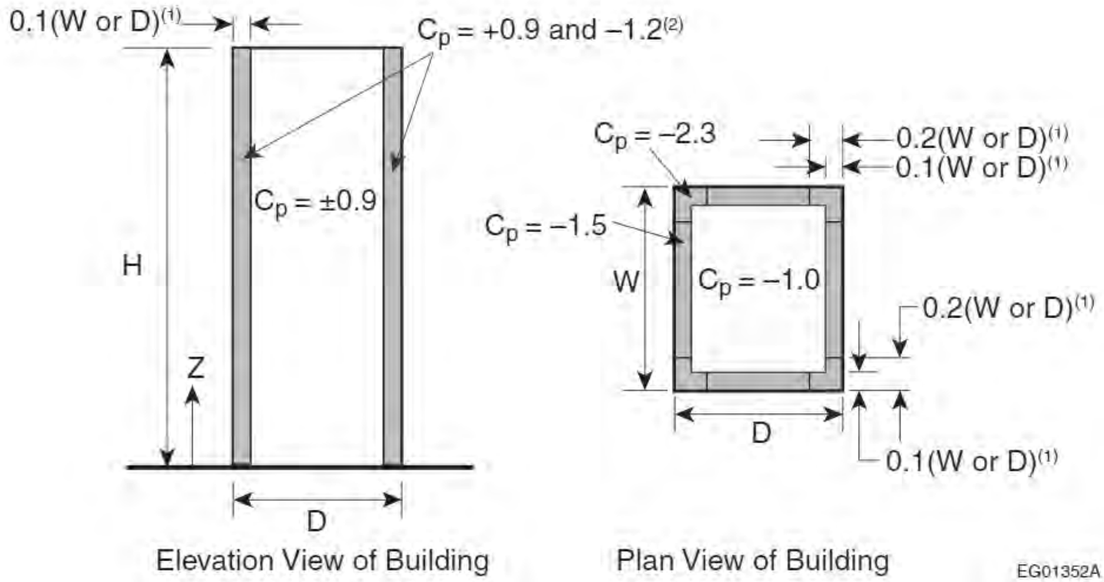


Figure A-4.1.7.5.(4)
Values of C_p for roof and wall claddings and secondary structural supports of cladding on rectangular buildings

Notes to Figure A-4.1.7.5.(4):
(1) The larger of W or D is to be used.
(2) Where vertical ribs deeper than 1 m are present on the walls, the dimensions 0.1D and 0.1W must be changed to 0.2D and 0.2W and the negative value of C_p must be changed from -1.2 to -1.4.

A-4.1.7.8.(2) and (3) Exposure Factor for Dynamic Procedure.

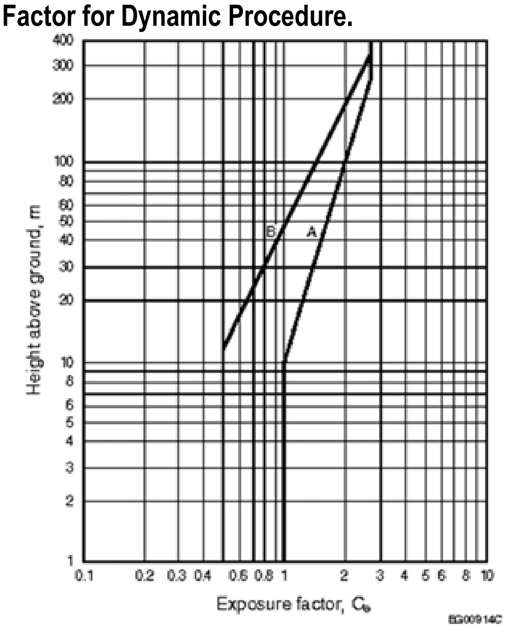


Figure A-4.1.7.8.(2) and (3)
Exposure factor, C_e, for dynamic procedure

Notes to Figure A-4.1.7.8.(2) and (3):
(1) Curve A represents C_e for open terrain, as defined in Clause 4.1.7.3.(5)(a).
(2) Curve B represents C_e for rough terrain, as defined in Clause 4.1.7.3.(5)(b).

A-4.1.7.8.(4) Peak Factor, Size Reduction Factor and Gust Energy Ratio.

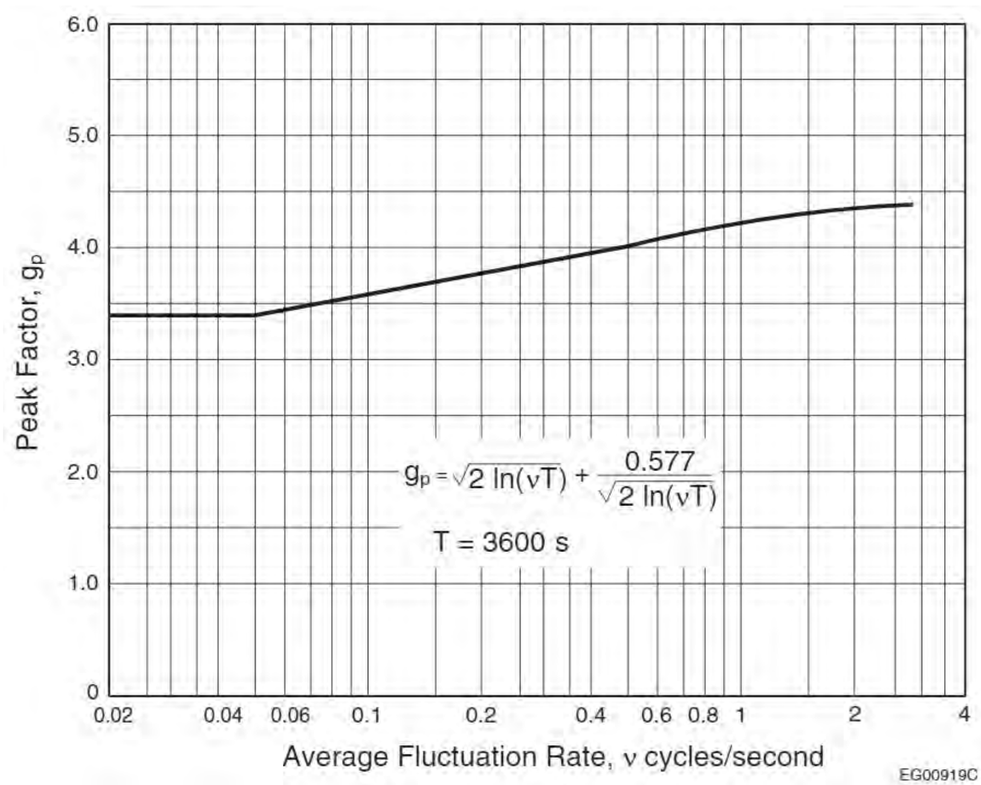


Figure A-4.1.7.8.(4)-A
Peak factor, g_p

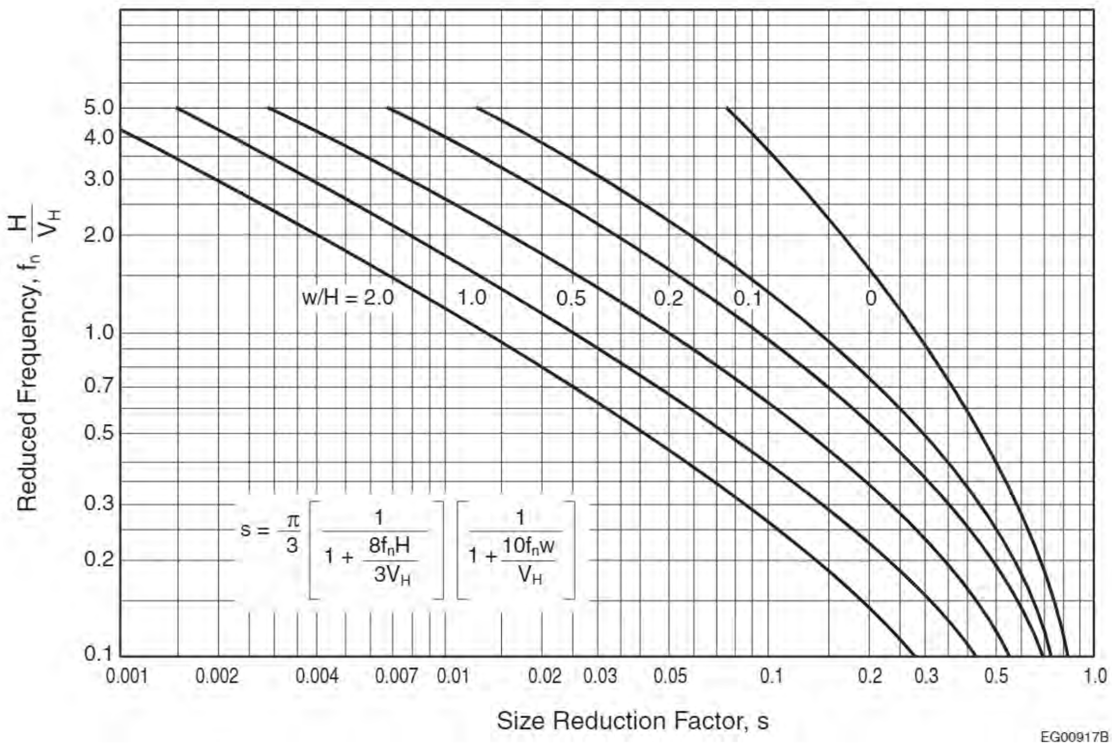


Figure A-4.1.7.8.(4)-B
Size reduction factor, s

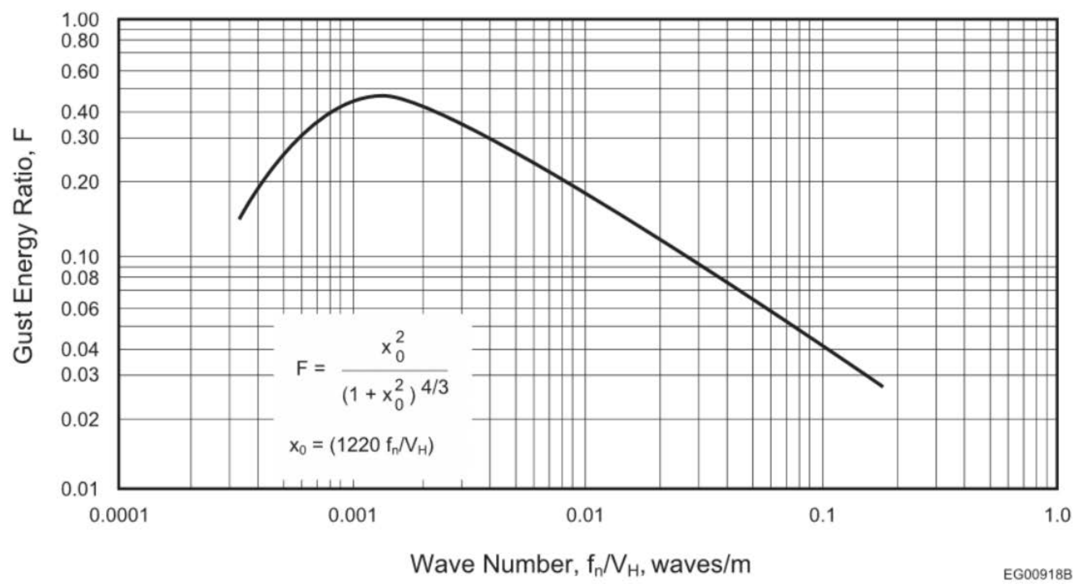


Figure A-4.1.7.8.(4)-C
Gust energy ratio, F

A-4.1.7.9.(1) Full and Partial Wind Loading. Information on full and partial loading under wind loads can be found in the Commentary entitled Wind Load and Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

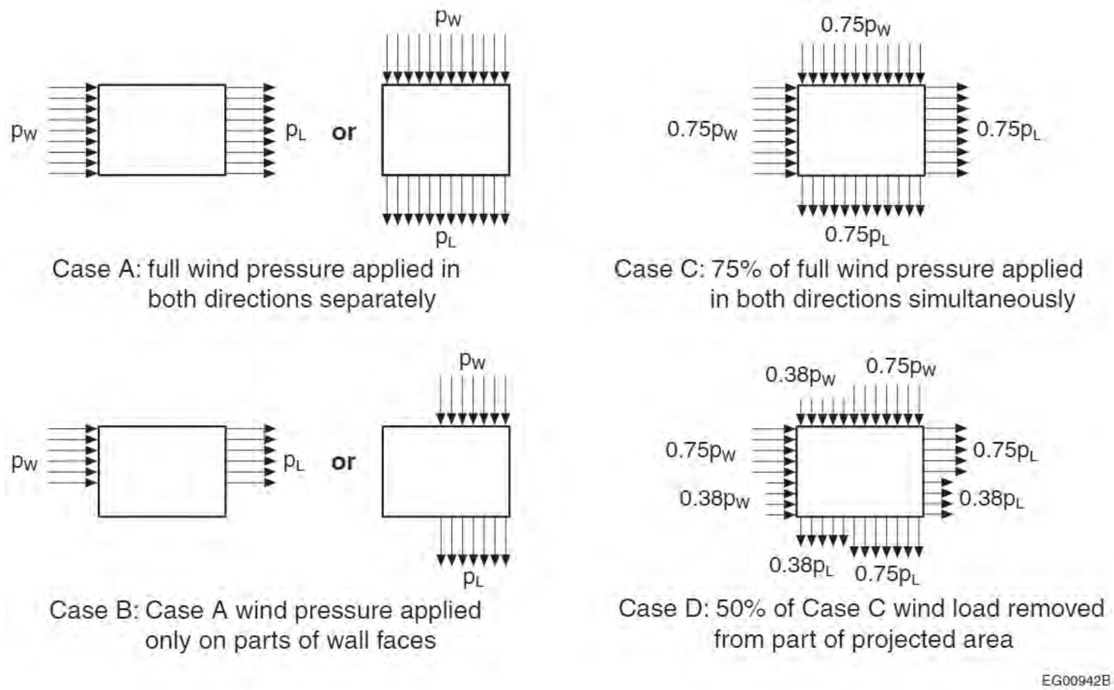


Figure A-4.1.7.9.(1)
Full and partial wind loading

A-4.1.7.11. Exterior Ornamentations, Equipment and Appendages. Appendages may increase the overall forces in the design of the building structure and need to be accounted for.

A-4.1.8.2.(1) Notation.

Definition of e_x
Information on the calculation of torsional moments can be found in the Commentary entitled Design for Seismic Effects in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

Definition of W
Information on the definition of dead load, W, can be found in the Commentary entitled Design for Seismic Effects in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.8.3.(4) General Design of the SFRS. Information on the general design requirements for the SFRS can be found in the Commentary entitled Design for Seismic Effects in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.8.3.(6) General Design of Stiff Elements. Information on the general design requirements for stiff elements can be found in the Commentary entitled Design for Seismic Effects in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.8.3.(7)(b) and (c) Stiffness Imparted to the Structure from Elements Not Part of the SFRS. Information on stiffness imparted to the structure from elements not part of the SFRS can be found in the Commentary entitled Design for Seismic Effects in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.8.3.(8) Structural Modelling. Information on structural modelling can be found in the Commentary entitled Design for Seismic Effects in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.8.4.(3) and Table 4.1.8.4.-A Site Class. Information on Site Class can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-Table 4.1.8.5. Serviceability Limit States for Earthquake. Information on serviceability limit states for earthquake can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-Table 4.1.8.6. Structural Irregularities.

Structural Irregularities
Information on structural irregularities can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

Gravity-Induced Lateral Demand – Type 9 Irregularity
Uncoupled concrete and masonry shear walls where a large fraction of the overturning resistance is provided by axial compression, rather than through yielding of the longitudinal reinforcement, are less susceptible to amplified displacements due to gravity-induced lateral demands because the axial loads have a self-centering effect on the shear walls. Walls that are stronger than the foundation and other systems such as coupled walls, braced frames, and moment frames are more susceptible to amplified displacements due to gravity-induced lateral demands. A lower limit on α is thus specified for such systems. Further information on the impacts of gravity-induced lateral demands on the seismic response of buildings can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.7.(1) Dynamic Analysis Procedures. Information on dynamic analysis procedures can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-Table 4.1.8.9. Industrial-Type Steel Structures. Guidance on the height limits, system restrictions and additional analysis and design requirements for steel SFRSs in industrial-type structures, intended essentially to support equipment, tanks or an industrial process, can be found in Annex M, Seismic Design of Industrial Steel Structures, of CSA S16, "Design of Steel Structures."

A-4.1.8.9.(4) Vertical Variations in R_dR_o. Information on vertical variations in R_dR_o can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.9.(5) R_dR_o and Equivalent Systems. Information on the R_dR_o of equivalent systems can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.10.(4) Mid-rise Timber SFRS. Information on structural irregularities in mid-rise wood construction and on how to determine the number of storeys for application in Sentence 4.1.8.10.(4) can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.10.(5) Gravity-Induced Lateral Demand – Type 9 Irregularity. Structural systems that include components such as inclined columns or horizontal floor cantilevers can induce lateral force demands on the SFRS under gravity loads. Buildings with such gravity-induced lateral demands on the SFRS are more likely to experience severe damage during strong ground shaking due to their tendency to drift only in one direction, leading to large residual displacements or instability. To determine if a building is susceptible to amplification of displacements due to gravity-induced lateral demands, the lateral resistance of the yielding mechanism to resist earthquake forces alone, Q_y, must be compared with the gravity-induced lateral demand, Q_G, at the same location. The force component selected for this comparison depends on the yielding mechanism for the SFRS. For example, for a coupled wall, the overturning moment resistance at the level of the expected plastic hinges should be compared with the overturning moment demand (at the same level) due to gravity loads alone, whereas for a steel-braced frame, the storey shear at the critical level of the yielding system should be compared with the storey shear demand (at the same level) due to the gravity loads alone. If the gravity-induced lateral demands exceed the limits prescribed in Sentence 4.1.8.10.(7), amplifications in seismic displacements due to gravity-induced lateral demands can only be identified through non-linear dynamic analyses using models that adequately represent the hysteretic behaviour of the SFRS. Further information on the impacts of gravity-induced lateral demands on the seismic response of buildings can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.10.(7) Gravity-Induced Lateral Demand – Non-Linear Dynamic Analysis. Information on non-linear dynamic analysis can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.11.(3) Determination of the Fundamental Period, T_a. Information on the determination of the fundamental period, T_a, can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.12.(1)(a) Linear Dynamic Analysis. Information on Linear Dynamic Analysis can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.12.(1)(b) Non-linear Dynamic Analysis. Information on Non-linear Dynamic Analysis can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.12.(3) Ground Motion Histories. Information on ground motion histories can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.12.(4)(a) Accidental Torsional Moments. Information on accidental torsional moments can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.13.(4) Deflections and Sway Effects. Information on deflections and sway effects can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.15.(1) Diaphragms and their Connections. Information on diaphragms and their connections can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.15.(3) Ductile Diaphragms. Information on the design of struts, collectors, chords and connections for ductile diaphragms can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.15.(4) Influence of Dynamic Diaphragm In-plane Response.

Clause 4.1.8.15.(4)(a)
In lieu of carrying out a special study as stated in Subclause 4.1.8.15.(4)(a)(iii), the anticipated total deformation demand on the vertical elements of the SFRS, including inelastic deformations, may be taken as equal to $R_oR_d(\Delta_B + \Delta_D) - R_o\Delta_D$, i.e., the difference between the total storey drift including inelastic deformation effects and diaphragm deformations, $R_oR_d(\Delta_B + \Delta_D)$, and the diaphragm deformation under R_o times the seismic load, where R_o may be replaced by the actual overstrength of the SFRS vertical elements. The design engineer must verify that the SFRS vertical elements have sufficient deformation capacity to accommodate the computed deformation demand. If the vertical elements of the SFRS do not have sufficient deformation capacity, the design forces for the vertical elements of the SFRS must be magnified by $R_d(1 + \Delta_D/\Delta_B)/(R_d + \Delta_D/\Delta_B)$. The calculation of the magnified design forces is iterative as the Δ_D/Δ_B ratio may change when using higher design forces for the vertical elements of the SFRS. Reducing the Δ_D/Δ_B ratio by increasing the stiffness of the roof diaphragm relative to that of the vertical elements of the SFRS may be considered to reduce the deformation demand on the vertical elements of the SFRS. Additional information can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

Clause 4.1.8.15.(4)(b)
The dynamic response of the diaphragm with the vertical elements of the SFRS under seismic excitation involves several modes of vibration that affect both the amplitude and distribution of in-plane shears and bending moments in the roof diaphragm. The shape of the fundamental mode of vibration resembles the deflected shape of the diaphragm/vertical SFRS elements under a distributed lateral load while higher modes involve increasing numbers of zero crossings of the deflected shapes along the length of the diaphragm, similar to the modes of a simply supported beam with distributed mass. Shears and bending moments therefore deviate from the values obtained from the equivalent static force procedure essentially due to higher mode response. Modal contributions to shears and bending moments in the diaphragms can be obtained from a Linear Dynamic Analysis. The contribution from the higher modes is generally more pronounced when the Δ_D/Δ_B ratio, the period in the first mode, or the ratio $S_a(0.2)/S_a(2.0)$ is increased. It also increases when the SFRS is designed with a higher R_d factor as inelastic deformations of the vertical elements of the SFRS attenuate the first mode response. Methods to take into account the inelastic higher mode effects on in-plane diaphragm shears and moments are discussed in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.15.(5) Discontinuities. Information on elements supporting discontinuities can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.15.(6) Vertical Variations in R_dR_o. Information on elements of the SFRS below the variation in R_dR_o can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.15.(7) Concurrent Yielding. Information on the effects of concurrent yielding of elements can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.15.(8) Design Force in Elements. Information on the design force in elements can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.16.(1) Foundation Movement. The bearing stress distribution in soil or rock that is used to determine the factored overturning resistance of the foundation influences the rotation of the foundation, which occurs due to the forces applied by the SFRS. Generally, all foundations will rotate on soil or rock. In particular, footings (a type of foundation unit) often undergo uplift at one end, and if the factored bearing stress at the other end is only over a short length, then the uplift and rotation of the footing can be significant. CSA A23.3, “Design of Concrete Structures,” contains design requirements for footings that rotate and uplift; see also the Commentary entitled Design for Seismic Effects in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)” for guidance and methods to account for foundation movement.

A-4.1.8.16.(2) Actual Lateral Load Capacity of the SFRS. The actual lateral load capacity of the SFRS includes the effects of member overstrengths similar to those used to determine the R_o factors. The applicable CSA design standards include requirements on calculating the overstrengths and capacities, which may be based on the members’ nominal or probable resistance. The actual capacities are larger than the factored loads and factored resistances and, in many cases, can be significantly larger. Note that the foundations designed to develop the capacity of the SFRS will undergo movements and Sentence 4.1.8.16.(1) still applies.

A-4.1.8.16.(4) Overturning Resistance of the Foundation. For the special case where the foundation is a footing, and where it and the attached SFRS are not constrained against rotation, it is permitted, with certain limitations, to size the footing to have a factored overturning resistance less than the overturning capacity of the supported SFRS. This approach results in a smaller footing, increased footing rotations, increased drifts in the structure, and increased soil stresses, all of which are over and above those associated with footings sized to have a factored overturning resistance equal to or greater than the overturning capacity of the SFRS. The footing itself must have a factored resistance capable of developing the required soil or rock reactions. An example of a footing and SFRS that are not constrained against rotation is an SFRS on a footing near the ground surface such that it can rotate freely and is attached to a gravity-load-resisting system (non-SFRS) that is laterally flexible and provides little lateral resistance. For this case, the SFRS is usually analyzed on its own and the resulting displacements are imposed on the non-SFRS elements in order to assess the effects on them. Cases where the footing and SFRS are attached to a system that has significant lateral stiffness require careful analysis and engineering judgement, or the footing can be capacity-designed.
Limiting the overturning moment on the foundation and the R_dR_o value provides some control on the increase in lateral displacement, drift and stress in the soil or rock. Cases that exceed these limits require special study.
For the common case where the SFRS and/or the footing are constrained in some way against rotation, the footing’s factored resistance must be equal to or greater than the capacity of the supported SFRS. An example of an SFRS constrained against freely rotating with the footing is an SFRS attached to adjacent foundation walls by below-grade diaphragms. Examples of footings constrained against free rotation are footings that use soil anchors to resist overturning, footings on piles, and raft foundations. Note that Sentence 4.1.8.16.(1) still applies.

See CSA A23.3, “Design of Concrete Structures,” and the Commentary entitled Design for Seismic Effects in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.8.16.(6)(a) Interconnection of Foundation Elements. Information on the interconnection of piles or pile caps, drilled piers, and caissons can be found in the Commentary entitled Design for Seismic Effects in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.8.16.(7) Earthquake Lateral Pressures from Backfill or Natural Ground. Information on methods of computing the seismic lateral pressures from backfill or natural ground can be found in the Commentary entitled Design for Seismic Effects in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.8.16.(8)(a) Cyclic Inelastic Behaviour of Foundation Elements. Information on the cyclic inelastic behaviour of piles or pile caps, drilled piers, and caissons can be found in the Commentary entitled Design for Seismic Effects in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

A-4.1.8.16.(9) Alternative Foundation Ties. Alternative methods of tying foundations together, such as a properly reinforced floor slab capable of resisting the required tension and compression forces, may be used. Passive soil pressure against buried pile caps may not be used to resist these forces.

A-4.1.8.16.(10) Liquefaction. Information on liquefaction can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.17.(1) Slope Stability. Information on slope instability can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.18. Elements of Structures, Non-structural Components and Equipment. Information on the requirements of Article 4.1.8.18. can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-Table 4.1.8.18. Non-structural Components and Equipment. The failure or detachment of non-structural components and equipment during an earthquake can present a major threat to life safety. The design requirements presented in Article 4.1.8.18. are intended to ensure that such components and their connections to the building will retain their integrity during strong ground shaking. Guidelines for the seismic risk reduction of such components are given in CAN/CSA-S832, "Seismic Risk Reduction of Operational and Functional Components (OFCs) of Buildings."

A-4.1.8.18.(14) Storage Racks. Free-standing steel pallet storage racks contain only materials typically loaded by forklift. They are designed to store loaded pallets, however in some cases, the stored material does not sit on a pallet. There is no occupancy within the racks. Information on racks can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.18.(15) and (16)(c) Glass Fallout and Failure. Information on glass fallout and testing for glass fallout can be found in AAMA 501.6, "Recommended Dynamic Test Method For Determining The Seismic Drift Causing Glass Fallout From A Wall System." Every surface other than inaccessible areas or areas where occupancy is prevented or access is prevented should be considered a "walking surface." Additional information can be found in ASCE/SEI 7, "Minimum Design Loads for Buildings and Other Structures," in FEMA P-750, "NEHRP Recommended Seismic Provisions for New Buildings and Other Structures," and FEMA 450-1, "NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures," and related commentaries, and in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.19.(2) Design Review. It is strongly recommended that a design review of the seismically isolated structure and its isolation system be carried out by an independent team of professional engineers and geoscientists experienced in seismic analysis methods and the theory and application of seismic isolation. The design review should include, but not be limited to, the following:

a) site-specific spectra,
b) ground motion time histories,
c) modeling and analyses,
d) testing program and results, and
e) final design of all structural framing elements and isolation system components.

A-4.1.8.19.(3)(a) Non-Linear Dynamic Analysis. Three-dimensional Non-Linear Dynamic Analysis is a complex process requiring special expertise. Guidance on Non-linear Dynamic Analysis can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.19.(4) Ground Motion Time Histories. Ground motion time histories and their horizontal and vertical components must be appropriately selected and scaled according to accepted practice. Further information on ground motion time histories can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.21.(2) Design Review. It is strongly recommended that a design review of the structure and the supplementary energy dissipation system be carried out by an independent team of professional engineers and geoscientists experienced in seismic analysis methods and the theory and application of supplementary energy dissipation. The design review should include, but not be limited to, the following:

a) ground motion time histories,
b) modeling and analyses,
c) testing program and results, and
d) final design of all structural framing elements and supplemental energy dissipation system components.

A-4.1.8.21.(4)(a) Non-linear Dynamic Analysis. Three-dimensional Non-linear Dynamic Analysis is a complex process requiring special expertise. Guidance on Non-linear Dynamic Analysis can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.1.8.21.(5) Ground Motion Time Histories. Ground motion time histories and their horizontal and vertical components must be appropriately selected and scaled according to accepted practice. Further information on ground motion time histories can be found in the Commentary entitled Design for Seismic Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.2.2.1.(1) Subsurface Investigation. Where acceptable information on subsurface conditions already exists, the investigation may not require further physical subsurface exploration or testing.

A-4.2.2.3.(1) Responsibilities of the Designer as Defined in Part 4. In certain situations, such as when the design is highly technical, it may be necessary for the "other suitably qualified person" to be someone responsible to the designer. In such cases the Chief Building Official may wish to order that the review be done by the designer.

A-4.2.4.1.(1) Innovative Designs. It is important that innovative approaches to foundation design be carried out by a person especially qualified in the specific method applied and that the design provide a level of safety and performance at least equivalent to that provided for or implicit in the design carried out by the methods referred to in Part 4. Provision must be made for monitoring the subsequent performance of such structures so that the long-term sufficiency of the design can be evaluated.

A-4.2.4.1.(3) Ultimate Limit States for Foundations. Information on ultimate limit states for foundations, including terminology and resistance factors, can be found in the Commentary entitled Foundations in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.2.4.1.(5) Design of Foundations for Differential Movements. Information on the design of foundations for differential movements can be found in the Commentary entitled Foundations in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.2.4.4.(1) Depth of Foundations. When adfreezing has occurred and subsequent freezing results in soil expansion beneath this area, the resulting uplift effect is sometimes referred to as frost jacking.

A heated building that is insulated to prevent heat loss through the foundation walls should be considered as an unheated structure unless the effect of the insulation is taken into account in determining the maximum depth of frost penetration.

A-4.2.5.1.(1) Excavations. Information on excavations can be found in the Commentary entitled Foundations in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.2.6.1.(1) Shallow Foundations. Information on shallow foundations can be found in the Commentary entitled Foundations in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.2.7.1.(1) Deep Foundation Units. A deep foundation unit can be pre-manufactured or cast-in-place; it can be driven, jacked, jetted, screwed, bored or excavated; it can be of wood, concrete or steel or a combination thereof.

A-4.2.7.2.(1) Deep Foundations. Information on deep foundations can be found in the Commentary entitled Foundations in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.2.7.2.(2) Load Testing of Piles. ASTM D 1143/D 1143M, "Deep Foundations Under Static Axial Compressive Load," defines routine load test procedures that have been extensively used.

A-4.3.1.1. Wood The design criteria for wood, CAN/CSA 086 "Engineering Design in Wood", makes assumptions that the wood products being used are in a condition as intended by their grading. This includes the limits of moisture content as specified by the grade. However, conditions such as transportation, site storage, and construction conditions can impact the original design assumptions.

Design considerations should include and be specific to shrinkage that may occur due to changes in moisture content of the wood. This is of particular concern where the building height can be up to 6 storeys, such as being built under Article 3.2.2.45. The potential building movement due to shrinkage should be indicated to other design professionals for their considerations such as cladding systems, mechanical systems, hold-down devices for structural walls and connections to non-shrinking elements including firewalls and elevator shafts.

Many wood designs now incorporate mass timber elements as part of the primary structural elements or seismic force resistance systems. Such products may include glue or mechanically laminated wood elements such as Glulam, Cross and Dowel Laminated Timbers, or other proprietary products or systems which may not exhibit the properties assumed by the by-law or its referenced standards. Where such elements are used, compliance with CAN/CSA-O86 may not be sufficient to demonstrate compliance with the objective of the By-law. In such cases, where in the opinion of the Chief Building Official the potential consequence of failure is considered to be significant, they may require that such designs be supported by the third party review of the structural design under the most credible fire impaired or unimpaired scenarios. This will include the assessment of the performance of the specified materials, fire-protective features, and expected behavior of the structure under each of these scenarios.

A-4.3.3.1.(1) Precast Concrete. CSA A23.3, "Design of Concrete Structures," requires precast concrete members to conform to CSA A23.4, "Precast Concrete – Materials and Construction."

A-4.3.4.1.(1) Welded Construction. Qualification for fabricators and erectors of welded construction is found in Clause 24.3 of CSA S16, "Design of Steel Structures."

A-4.3.4.2.(1) Cold-Formed Stainless Steel Members. There is currently no Canadian standard for the design of cold-formed stainless steel structural members. As an interim measure, design may be carried out using the limit states design provisions of ASCE/SEI 8, "Design of Cold-Formed Stainless Steel Structural Members," except that load factors, load combinations and load combination factors shall be in accordance with Subsection 4.1.3.

A-4.3.6.1.(1) Design Basis for Glass. The load factors in Tables 4.1.3.2.-A and 4.1.3.2.-B must be applied to the adjusted wind load before designing in accordance with the referenced standard. Additional information is given in the Commentary entitled Wind Load and Effects in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

A-4.4.2.1.(1) Design Basis for Parking Structures and Repair Garages. See the Commentary entitled Live Loads in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

Part 5
Environmental Separation

Section 5.1. General

5.1.1. Scope

5.1.1.1. Scope

1) This Part is concerned with

a) the control of condensation

i) in *building* components and assemblies, and

ii) on *building* materials, components and assemblies, and

b) the transfer of heat, air, moisture and sound through

i) *building* materials, components and assemblies, and

ii) interfaces between *building* materials, components and assemblies.

(See Note A-5.1.1.1.(1).)

5.1.1.2. Maritime Climate

1) This Part includes special provisions to deal with the potentially damaging effects of Vancouver's maritime climate, including the possibility of rapid decay in structural members. (See Note A-5.1.1.2.)

5.1.2. Application

5.1.2.1. Exposure to Exterior Space or the Ground and Separation of Dissimilar Environments

1) Except as provided in Sentence (2), this Part applies, as described in Subsection 1.3.3. of Division A, to

a) *building* materials, components and assemblies exposed to exterior space or the ground, including those separating interior space from exterior space or separating interior space from the ground,

b) *building* materials, components and assemblies separating environmentally dissimilar interior spaces (See Note A-5.8.), and

c) site materials, components, assemblies and grading that may affect environmental loads on *building* materials, components and assemblies exposed to exterior space or the ground.

(See Note A-5.1.2.1.(1).)

2) *Buildings* or portions of *buildings* not required to provide environmental separation, not exposed to exterior environmental loads or intended only for summer seasonal use need not conform to this Part where it can be shown, to the satisfaction of the *Chief Building Official* that the health or safety of *building* users, the intended use of the *building* and the operation of *building* services will not be adversely affected. (See Note A-5.1.2.1.(2).)

5.1.2.2. Building Envelope Professional Requirements

1) The *Building Envelope Professional* shall conduct reviews, and provide letters as required in Sentences (2) and (3), on *buildings* or portions of *buildings* with a cladding system over wood framing or light steel framing and on all residential *buildings* within the scope of Part 5 with respect to Section 5.4., 5.5. and 5.6. (See Note A-5.1.2.2.(1).)

2) The *Building Envelope Professional* shall, prior to issuance of a *building permit*, provide the *Chief Building Official* with a completed, signed and sealed commitment letter in the form attached as Schedule D-1 at the end of this part.

3) The *Building Envelope Professional* shall, prior to issuance of an *occupancy permit*, provide the *Chief Building Official* with a completed, signed and sealed completion letter in the form attached as Schedule D-2 at the end of this Part.

5.1.3. Definitions

5.1.3.1. Defined Words

1) Words that appear in italics are defined in Article 1.4.1.2. of Division A.

5.1.4. Resistance to Loads and Deterioration

5.1.4.1. Structural and Environmental Loads

(See Note A-5.1.4.1.)

1) *Building* materials, components and assemblies that separate dissimilar environments or are exposed to the exterior shall have sufficient capacity and integrity to resist or accommodate

a) all environmental loads, and effects of those loads, that may reasonably be expected having regard to

i) the intended use of the *building*, and

ii) the environment to which the materials, components and assemblies are subject, and

b) all structural loads, and effects of those loads, that may reasonably be expected.

2) Where *building* materials, components or assemblies perform more than one function, they shall satisfy the requirements of all of those functions. (See Note A-5.1.4.1.(2).)

3) Compliance with Clause (1)(a) shall be demonstrated by design complying with Subsection 5.2.1. and construction conforming to that design.

4) Compliance with Clause (1)(b) shall be demonstrated by design complying with Subsection 5.2.2., and construction conforming to that design, with regard to

a) materials, components and assemblies, and associated loads, that are identified in Part 4,

b) air pressure loads imposed on *air barrier systems*,

c) wind up-lift imposed on roofing, and

d) hydrostatic pressure imposed on the means of protection from moisture in the ground.

5) For materials, components, assemblies and loads to which Sentence (4) does not apply, compliance with Clause (1)(b) shall be demonstrated

a) by design complying with Subsection 5.2.2. for individual applicable loads and construction conforming to that design, or

b) in the case of common materials, components and assemblies, and their installation, by proven past performance over a period of several years for individual applicable loads.

(See Note A-5.1.4.1.(5).)

6) Materials, components and assemblies separating dissimilar environments and assemblies exposed to the exterior, including their connections, that are subject to structural loads as defined in Article 5.2.2.1., shall

a) transfer such loads to the *building* structure without adverse effects on the performance of other materials, components or assemblies,

b) not deflect to a degree that adversely affects the performance of other materials, components or assemblies (See Note A-5.1.4.1.(6)(b) and (c).), and

c) be designed, and constructed according to that design, to accommodate (See Note A-5.1.4.1.(6)(b) and (c).)

i) the maximum relative structural movement that may reasonably be expected, and

ii) construction tolerances that may be reasonably expected.

(See Article 4.1.3.5., Sentence 4.1.3.3.(2) and Subsection 4.1.8. for information on different types of structural movements.) (See Note A-5.1.4.1.)

5.1.4.2. Resistance to Deterioration

(See Note A-5.1.4.2.)

1) Except as provided in Sentence (2), materials used in *building* components and assemblies that separate dissimilar environments, or in assemblies exposed to the exterior, shall be

a) compatible with adjoining materials, and

b) resistant to any mechanisms of deterioration that may reasonably be expected, given

i) the nature and function of the materials, and

ii) the exposure and climatic conditions in which they will be installed.

2) Material compatibility and deterioration resistance are not required where it can be shown that incompatibility or uncontrolled deterioration will not adversely affect any of

a) the health or safety of *building* users,

b) the intended use of the *building*, or

c) the operation of *building* services.

3) Design and *construction* of *building* components and assemblies described in Article 5.1.2.1. shall be in accordance with good practice as described in CSA S478, "Guideline on Durability in Buildings".

5.1.5. Other Requirements

5.1.5.1. Requirements in Other Parts of the By-law

1) Energy utilization, structural and fire safety requirements of other Parts of this By-law shall apply.

Section 5.2. Loads and Procedures

5.2.1. Environmental Loads and Design Procedures

5.2.1.1. Exterior Environmental Loads

1) Above ground climatic loads shall be determined according to Subsection 1.1.3.

2) Except as provided in Sentence (3), below ground exterior environmental loads not described in Subsection 1.1.3. shall be determined from existing geological and hydrological data or from site tests.

3) Where local design and construction practice has shown *soil* temperature analysis to be unnecessary, *soil* temperatures need not be determined. (See Note A-5.2.1.1.(3).)

5.2.1.2. Interior Environmental Loads

1) Interior environmental loads shall be determined in accordance with good practice as described in Sentence 6.2.1.1.(1) based on the intended use of the space. (See Note A-5.2.1.2.(1).)

5.2.1.3. Environmental Load and Transfer Calculations

1) Calculations related to the transfer of heat, air and moisture and the transmission of sound shall conform to good practice such as that described in the ASHRAE Handbooks.

2) For the purposes of any analysis conducted to indicate conformance to the thermal resistance levels required in Article 5.3.1.2., *soil* temperatures shall be determined based on annual average *soil* temperature, seasonal amplitude of variation and attenuation of variation with depth.

3) Wind load calculations shall conform to Subsection 4.1.7.

5.2.2. Structural Loads and Design Procedures

5.2.2.1. Determination of Structural Loads and Effects

1) Where materials, components or assemblies that separate dissimilar environments or are exposed to the exterior, or their connections, are required to be designed to withstand structural loads, these loads shall be determined in accordance with Part 4. (See also Subsection 2.2.5. of Division C.)

2) Except as provided in Article 4.1.8.18., the structural loads referred to in Sentence (1) and their related effects shall include

a) *dead loads* transferred from structural elements,

b) wind, snow, rain, hydrostatic and earth pressures,

c) earthquake effects for *post-disaster buildings*, depending on their intended function (See Note A-5.2.2.1.(2)(c).),

d) *live loads* due to use and *occupancy*, and

e) loads due to thermal or moisture-related expansion and contraction, deflection, deformation, creep, shrinkage, settlement, and differential movement.

3) Where materials, components or assemblies that separate dissimilar environments or are exposed to the exterior, or their connections, can be expected to be subject to loads or other effects not described in this Subsection or in Part 4, such loads or effects shall be taken into account in the design based on the most current and applicable information available.

5.2.2.2. Determination of Wind Load

(See Note A-5.2.2.2.)

1) This Article applies to the determination of wind load to be used in the design of materials, components and assemblies, including their connections, that separate dissimilar environments or are exposed to the exterior, where these are

a) subject to wind load, and

b) required to be designed to resist wind load.

2) Except as provided in Sentence (3), the wind load referred to in Sentence (1) shall be 100% of the specified wind load determined in accordance with Article 4.1.7.1.

3) Where it can be shown by test or analysis that a material, component, assembly or connection referred to in Sentence (1) will be subject to less than 100% of the specified wind load, the wind load referred to in Sentence (1) shall be not less than the load determined by test or analysis.

4) Except as provided in Sentence (5), the wind uplift resistance of membrane roofing assemblies shall be determined in accordance with the requirements of CAN/CSA-A123.21, "Dynamic Wind Uplift Resistance of Membrane-Roofing Systems." (See Note A-5.2.2.2.(4).)

5) Membrane roofing assemblies with proven past performance for the anticipated wind loads need not comply with Sentence (4). (See Note A-5.1.4.1.(5).)

5.2.2.3. Design Procedures

1) Structural design shall be carried out in accordance with Subsection 4.1.3. and other applicable requirements in Part 4.

Section 5.3. Heat Transfer

(See Note A-5.3.)

5.3.1. Thermal Resistance of Assemblies

5.3.1.1. Required Resistance to Heat Transfer

(See Note A-5.3.1.1.)

1) Where a *building* component or assembly will be subjected to an intended temperature differential, the component or assembly shall include materials to resist heat transfer or a means to dissipate transferred heat in accordance with the remainder of this Subsection, and Part 10 of Division B.

2) Deleted.

5.3.1.2. Properties to Resist Heat Transfer or Dissipate Heat

(See Note A-5.3.1.2.)

1) Taking into account the conditions on either side of the environmental separator, materials and components installed to provide the required resistance to heat transfer or the means implemented to dissipate heat shall provide sufficient resistance or dissipation,

a) to minimize surface condensation on the warm side of the component or assembly,

b) in conjunction with other materials and components in the assembly, to minimize condensation within the component or assembly,

c) in conjunction with systems installed for space conditioning, to meet the interior design thermal conditions for the intended *occupancy*, and

d) to minimize ice damming on sloped roofs.

(See Note A-5.3.1.2.(1).)

5.3.1.3. Location and Installation of Materials Providing Thermal Resistance

1) Where a material required by Article 5.3.1.1. is intersected by a *building* assembly, penetrated by a high conductance component or interrupted by expansion, control or construction joints, and where condensation is likely to occur at these intersections, penetrations or interruptions, sufficient thermal resistance shall be provided so as to minimize condensation at these locations.

2) Materials providing required thermal resistance shall have sufficient inherent resistance to airflow or be positioned in the assembly so as to prevent convective airflow through and around the material. (See Note A-5.3.1.3.(2).)

Section 5.4. Air Leakage

5.4.1. Air Barrier Systems

5.4.1.1. Required Resistance to Air Leakage

(See Note A-5.4.1.1.)

1) Where a *building* component or assembly separates interior *conditioned space* from exterior space, interior space from the ground, or environmentally dissimilar interior spaces, the properties and position of the materials and components in those components or assemblies shall be such that they control air leakage or permit venting to the exterior so as to

a) provide acceptable conditions for the *building* occupants,

b) maintain appropriate conditions for the intended use of the *building*,

c) minimize the accumulation of condensation in and the penetration of precipitation into the *building* component or assembly,

d) control heat transfer to roofs where ice damming can occur,

e) minimize the ingress of airborne radon from the ground with an aim to controlling the indoor radon concentration to an acceptable level, and

f) not compromise the operation of *building* services.

2) An *air barrier system* shall be installed to provide the principal resistance to air leakage.

3) Deleted.

5.4.1.2. Air Barrier System Properties

1) Materials intended to provide the principal resistance to air leakage shall

a) have an air leakage characteristic not greater than 0.02 $L/(s \cdot m^2)$ measured at an air pressure difference of 75 Pa, when tested in accordance to ASTM E 2178, “Air Permeance of Building Materials,” or

b) conform to CAN/ULC-S741, “Air Barrier Materials – Specification.”

(See Note A-5.4.1.2.(1).)

2) Deleted.

3) The *air barrier system* shall be continuous

a) across construction, control and expansion joints,
b) across junctions between different *building* assemblies, and
c) around penetrations through the *building* assembly.

4) The structural design of *air barrier systems* installed in assemblies subject to air pressure loads shall comply with Article 5.1.4.1. and Subsection 5.2.2.

Section 5.5. Vapour Diffusion

5.5.1. Vapour Barriers

5.5.1.1. Required Resistance to Vapour Diffusion

(See Note A-5.5.1.1.)

1) Where a *building* component or assembly is subjected to differentials in temperature and water vapour pressure, the properties and position of the materials and components in those components or assemblies shall be such that they control vapour diffusion or permit venting to the exterior so as to minimize the accumulation of condensation in the *building* component or assembly.

2) A *vapour barrier* shall be installed to provide the principal resistance to water vapour diffusion.

3) Deleted.

5.5.1.2. Vapour Barrier Properties and Installation

(See Note A-5.3.1.2.)

1) The *vapour barrier* shall have sufficiently low permeance and shall be positioned in the *building* component or assembly so as to

a) minimize moisture transfer by diffusion, to surfaces within the assembly that would be cold enough to cause condensation at the design temperature and humidity conditions, or
b) reduce moisture transfer by diffusion, to surfaces within the assembly that would be cold enough to cause condensation at the design temperature and humidity conditions, to a rate that will not allow sufficient accumulation of moisture to cause deterioration or otherwise adversely affect any of
   i) the health or safety of *building* users,
   ii) the intended use of the *building*, or
   iii) the operation of *building* services.

(See Note A-5.5.1.2.(1).)

2) Coatings applied to gypsum board to provide required resistance to vapour diffusion shall conform to the requirements of Sentence (1) when tested in accordance with CAN/CGSB-1.501-M, “Method for Permeance of Coated Wallboard.”

3) Coatings applied to materials other than gypsum board to provide required resistance to vapour diffusion shall conform to the requirements of Sentence (1) when tested in accordance with ASTM E 96/E 96M, “Water Vapor Transmission of Materials,” by the desiccant method (dry cup).

Section 5.6. Precipitation

5.6.1. Protection from Precipitation

5.6.1.1. Required Protection from Precipitation

(See Note A-5.6.1.1.)

1) Where a *building* component or assembly is exposed to precipitation, the component or assembly shall

a) minimize ingress of precipitation into the component or assembly, and
b) prevent ingress of precipitation into interior space.

2) Deleted.

5.6.1.2. Installation of Protective Materials

(See Note A-5.6.1.2.)

1) Where protective materials are applied to assemblies to provide the required protection from precipitation, they shall be installed so as to shed precipitation or otherwise minimize its entry into the assembly and prevent its penetration through the assembly. (See Note A-5.6.1.2.(1).) (See also Clause 5.3.1.2.(1)(d).)

2) Where protective materials applied to assemblies to provide the required protection from precipitation are part of a vegetated roofing system, they shall be resistant to root and rhizome penetration when tested in accordance with ANSI/GRHC/SPRI VR-1, "Investigating Resistance to Root Penetration on Vegetative Roofs." (See Note A-5.6.1.2.(2).)

3) Flashings, drips, or overhangs shall be incorporated to deflect accumulated water from the *building* face where there are changes in planes of walls and roofs, changes in cladding material, or window or door heads or sills.
(See Note A-5.6.1.2.(3).)

5.6.2. Drainage, Accumulation and Disposal

5.6.2.1. Drainage

(See Note A-5.6.2.1.)

1) Materials, components, assemblies, joints in materials, junctions between components and junctions between assemblies exposed to precipitation shall be

a) designed to shed precipitation, and
b) drained to direct precipitation to the exterior.

2) Deleted.

5.6.2.2. Accumulation and Disposal

1) Where water, snow or ice can accumulate on a *building*, provision shall be made to minimize the likelihood of hazardous conditions arising from such accumulation.

2) Where precipitation can accumulate on sloped or horizontal assemblies, provision shall be made for drainage conforming with Article 2.4.10.4. of Division B of Book II (Plumbing Systems) of this By-law.

3) Where downspouts are provided and are not connected to a sewer, provisions shall be made to

a) divert the water from the *building*, and
b) prevent *soil* erosion.

4) Junctions between vertical assemblies, and sloped or horizontal assemblies, shall be designed and constructed to minimize the flow of water from the sloped or horizontal assembly onto the vertical assembly.

5) Where a roof or balcony is entirely enclosed by parapet walls, there shall be a sufficient number of overflow outlets installed in the parapet walls in order to properly drain the roof or balcony in the event that any rainwater conductors become obstructed. (See Note A-5.6.2.2.(5).)

Section 5.7. Surface and Ground Water

(See Note A-5.7.)

5.7.1. Site Factors

5.7.1.1. Application

1) This Subsection applies to the location of *buildings*, the grading of *building* sites, the directing of water away from *building* assemblies, and the provision of means for drainage.

5.7.1.2. Required Protection

1) The *building* shall be located, the *building* site shall be graded, or water shall be directed away from *building* assemblies so as to prevent or accommodate the accumulation of surface water against the *building* or adjacent *buildings*.
2) Drainage shall be provided to direct water away from assemblies separating interior space from the ground, except

a) where the assembly is designed in accordance with Subsection 5.7.2. to withstand continuous hydrostatic pressure.
b) **Deleted**.

(See Note A-5.7.1.2.(2).)

5.7.2. Protection against Hydrostatic Pressure

5.7.2.1. Application

1) This Subsection applies to waterproofing materials, components, assemblies and systems applied to *building* assemblies that separate dissimilar environments and are subjected to hydrostatic pressure.

5.7.2.2. Design of Building Elements Under Hydrostatic Loads

1) Waterproofing materials, components, assemblies and systems described in Article 5.7.2.1. shall be designed in accordance with Subsection 5.1.4.
2) Hydrostatic design loads shall be determined in accordance with Subsection 5.2.2.

5.7.2.3. Required Protection

1) Waterproofing materials, components, assemblies and systems described in Article 5.7.2.1. shall comply with Article 5.7.3.2.

5.7.3. Protection against Ground Water

5.7.3.1. Application

1) This Subsection applies to the protection of *building* assemblies that separate interior space from the ground.

5.7.3.2. Required Protection

1) Except as provided in Article 5.7.3.4., *building* assemblies described in Article 5.7.3.1. shall be protected by waterproofing in accordance with Article 5.7.3.3. so as to prevent the ingress of water into the *building* or the accumulation of water against the *building*.
2) Deleted.

5.7.3.3. Waterproofing

1) Waterproofing materials, components, assemblies, or systems installed to provide the required protection shall form a continuous and impervious barrier to the ingress of water and be capable of accommodating

a) imperfections, construction joints, control joints and expansion joints, (See Note A-5.7.3.3.(1)(a).),
b) junctions between different *building* assemblies, and
c) elements penetrating *building* assemblies.

5.7.3.4. Where Dampproofing is Permitted

1) Vertical *building* assemblies that separate interior space from the ground are permitted to be dampproofed where

a) such assemblies are not subjected to hydrostatic pressure,
b) the substrate is cast-in-place concrete, and
c) a drainage layer is installed between the *building* assembly and the *soil*.

(See Note A-5.7.3.4.(1).)

2) Joints, junctions and penetrations shall be designed and constructed to maintain the continuity of the dampproofing.

Section 5.8. Sound Transmission

(See Note A-5.8.)

5.8.1. Protection from Airborne Noise

5.8.1.1. Required Protection

1) Except as provided in Sentence (2), a *dwelling unit* shall be separated from every other space in a *building* in which noise may be generated by

a) a separating assembly and adjoining constructions, which, together, provide an *apparent sound transmission class (ASTC)* rating not less than 47, or

b) a separating assembly that provides a *sound transmission class (STC)* rating of not less than 50 and adjoining constructions that conform to Article 9.11.1.4.

2) Assemblies and adjoining constructions separating a *dwelling unit* from an elevator shaft or a refuse chute shall have an *STC* rating not less than 55.

5.8.1.2. Determination of Sound Transmission Ratings

(See Note A-5.8.1.2.)

1) The *STC* ratings of separating assemblies shall be determined in accordance with ASTM E 413, "Classification for Rating Sound Insulation," using the results from measurements carried out in accordance with ASTM E 90, "Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements."

2) The *ASTC* ratings of separating assemblies and adjoining constructions shall be

a) determined in accordance with ASTM E 413, "Classification for Rating Sound Insulation," using the results from measurements carried out in accordance with ASTM E 336, "Measurement of Airborne Sound Attenuation between Rooms in Buildings," or

b) calculated in accordance with

i) the detailed method described in Article 5.8.1.4., or

ii) the simplified method described in Article 5.8.1.5.

5.8.1.3. Compliance with Required Ratings

1) Compliance with the required *STC* ratings shall be demonstrated through

a) measurements carried out in accordance with Sentence 5.8.1.2.(1), or

b) the construction of separating assemblies conforming to those presented in Table 9.10.3.1.-A or 9.10.3.1.-B, as applicable.

2) Compliance with the required *ASTC* ratings shall be demonstrated through

a) measurements or calculations carried out in accordance with Sentence 5.8.1.2.(2), or

b) the construction of separating assemblies conforming to those presented in Table 9.10.3.1.-A or 9.10.3.1.-B, as applicable, that have an *STC* rating of not less than 50 in conjunction with flanking assemblies constructed in accordance with Article 9.11.1.4.

5.8.1.4. Detailed Method for Calculating ASTC

(See Note A-5.8.1.4.)

1) The sound transmission loss measured in accordance with ASTM E 90, "Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements," shall be used in lieu of the sound reduction index required in ISO 15712-1, "Building Acoustics – Estimation of Acoustic Performance of Buildings From the Performance of Elements – Part 1: Airborne Sound Insulation Between Rooms."

2) The vibration reduction index for the junctions between separating assemblies shall be
a) determined using the equations presented in Annex E of ISO 15712-1, "Building Acoustics – Estimation of Acoustic Performance of Buildings From the Performance of Elements – Part 1: Airborne Sound Insulation Between Rooms," or
b) measured in accordance with Parts 1 to 4 of ISO 10848, "Acoustics – Laboratory Measurement of the Flanking Transmission of Airborne and Impact Sound Between Adjoining Rooms."

3) The normalized flanking level difference shall be measured in accordance with Parts 1 to 4 of ISO 10848, "Acoustics – Laboratory Measurement of the Flanking Transmission of Airborne and Impact Sound Between Adjoining Rooms."

4) The direct sound reduction index for the separating assembly in situ shall be determined using Clause (a) or (b), depending on the type of construction:
a) for a lightweight separating wall or floor assembly with wood or steel framing, the index shall be taken as equal to the sound transmission loss, without correction;
b) for a heavyweight separating wall or floor assembly of concrete or masonry, the index shall be determined in accordance with the detailed method for structure-borne transmission presented in ISO 15712-1, "Building Acoustics – Estimation of Acoustic Performance of Buildings From the Performance of Elements – Part 1: Airborne Sound Insulation Between Rooms."

5) The flanking sound reduction index for each flanking path at each edge of the separating assembly shall be determined using Clause (a), (b) or (c), depending on the type of construction:
a) for a lightweight separating wall or floor assembly with wood or steel framing and connected lightweight flanking assemblies with wood or steel framing, the index shall be taken as equal to the normalized flanking level difference re-normalized for the *ASTC* field situation in accordance with Annex F of ISO 15712-1, "Building Acoustics – Estimation of Acoustic Performance of Buildings From the Performance of Elements – Part 1: Airborne Sound Insulation Between Rooms";
b) for a heavyweight separating wall or floor assembly of concrete or masonry and connected flanking assemblies of concrete or masonry, the index shall be determined in accordance with the detailed method for structure-borne transmission presented in ISO 15712-1, "Building Acoustics – Estimation of Acoustic Performance of Buildings From the Performance of Elements – Part 1: Airborne Sound Insulation Between Rooms";
c) for a mixture of lightweight framed assemblies and heavyweight concrete or masonry assemblies, the index shall be determined in accordance with Clause (a) or (b).

6) Once the pertinent indices and measurements referred to in Sentences (1) to (5) have been determined based on the type of construction, the apparent sound reduction index shall then be determined in accordance with ISO 15712-1, "Building Acoustics – Estimation of Acoustic Performance of Buildings From the Performance of Elements – Part 1: Airborne Sound Insulation Between Rooms."

7) The *ASTC* shall be calculated in accordance with ASTM E 413, "Classification for Rating Sound Insulation," using the apparent sound reduction index determined in Sentence (6), which shall be treated as equivalent to the values of apparent sound transmission loss measured in accordance with ASTM E 336, "Measurement of Airborne Sound Attenuation between Rooms in Buildings."

5.8.1.5. Simplified Method for Calculating ASTC

(See Note A-5.8.1.4.)

1) The *STC* rating shall be used in lieu of the weighted sound reduction index required in ISO 15712-1, "Building Acoustics – Estimation of Acoustic Performance of Buildings From the Performance of Elements – Part 1: Airborne Sound Insulation Between Rooms."

2) The vibration reduction index for the junctions between separating assemblies shall be
a) determined using the equations presented in Annex E of ISO 15712-1, "Building Acoustics – Estimation of Acoustic Performance of Buildings From the Performance of Elements – Part 1: Airborne Sound Insulation Between Rooms," or
b) measured in accordance with Parts 1 to 4 of ISO 10848, "Acoustics – Laboratory Measurement of the Flanking Transmission of b) Airborne and Impact Sound Between Adjoining Rooms."

3) The weighted normalized flanking level difference shall be determined in accordance with ASTM E 413, “Classification for Rating Sound Insulation,” using the results from measurements carried out in accordance with Parts 1 to 4 of ISO 10848, “Acoustics – Laboratory Measurement of the Flanking Transmission of Airborne and Impact Sound Between Adjoining Rooms.”
4) The direct weighted sound reduction index for the separating assembly shall be taken as equal to the *STC*, without correction.
5) The weighted flanking sound reduction index for each flanking path at each edge of the separating assembly shall be determined using Clause (a) or (b), depending on the type of construction:

a) for a lightweight separating wall or floor assembly with wood or steel framing and connected lightweight flanking assemblies with wood or steel framing, the index shall be taken as equal to the weighted normalized flanking level difference re-normalized for the ASTC field situation in accordance with Annex F of ISO 15712-1, “Building Acoustics – Estimation of Acoustic Performance of Buildings From the Performance of Elements – Part 1: Airborne Sound Insulation Between Rooms”;

b) for a heavyweight separating wall or floor assembly of concrete or masonry and connected flanking assemblies of concrete or masonry, the index shall be determined in accordance with the simplified method for structure-borne transmission presented in ISO 15712-1, “Building Acoustics – Estimation of Acoustic Performance of Buildings From the Performance of Elements – Part 1: Airborne Sound Insulation Between Rooms.”

6) Once the pertinent indices and measurements referred to in Sentences (1) to (5) have been determined based on the type of construction, the *ASTC* shall then be calculated in accordance with ISO 15712-1, “Building Acoustics – Estimation of Acoustic Performance of Buildings From the Performance of Elements – Part 1: Airborne Sound Insulation Between Rooms.”

Section 5.9. Standards

5.9.1. Applicable Standards

5.9.1.1. Compliance with Applicable Standards

1) Except as provided in Sentence (2) and elsewhere in this Part, materials and components, and their installation, shall conform to the requirements of the applicable standards in Table 5.9.1.1. where those materials or components are

a) incorporated into environmental separators or assemblies exposed to the exterior, and

b) installed to fulfill the requirements of this Part.

(See Note A-5.9.1.1.(1).)

2) The requirements for *flame-spread ratings* contained in thermal insulation standards shall be applied only as required in Part 3.

Table 5.9.1.1.
Standards Applicable to Environmental Separators and Assemblies Exposed to the Exterior
Forming Part of Sentence 5.9.1.1.(1)

Issuing Agency	Document Number	Title of Document
ASME	B18.6.1	“Wood Screws (Inch Series)”
ASTM	A 123/A 123M	“Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products”
ASTM	A 153/A 153M	“Zinc Coating (Hot-Dip) on Iron and Steel Hardware”

ASTM	A 653/A 653M	"Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process"
ASTM	C 4	"Clay Drain Tile and Perforated Clay Drain Tile"
ASTM	C 73	"Calcium Silicate Brick (Sand-Lime Brick)"
ASTM	C 126	"Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units"
ASTM	C 212	"Structural Clay Facing Tile"
ASTM	C 412M	"Concrete Drain Tile (Metric)"
ASTM	C 444M	"Perforated Concrete Pipe (Metric),"
ASTM	C 553	"Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications"
ASTM	C 612	"Mineral Fiber Block and Board Thermal Insulation"
ASTM	C 700	"Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated"
ASTM	C 726	"Mineral Wool Roof Insulation Board"
ASTM	C 834(1)	"Latex Sealants"
ASTM	C 840	"Application and Finishing of Gypsum Board"
ASTM	C 920(1)	"Elastomeric Joint Sealants"
ASTM	C 991	"Flexible Fibrous Glass Insulation for Metal Buildings"
ASTM	C 1002	"Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs"
ASTM	C 1177/C 1177M	"Glass Mat Gypsum Substrate for Use as Sheathing"
ASTM	C 1178/C 1178M	"Coated Glass Mat Water-Resistant Gypsum Backing Panel"
ASTM	C 1184(1)	"Structural Silicone Sealants"
ASTM	C 1311(1)	"Solvent Release Sealants"
ASTM	C 1330(1)	"Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants"
ASTM	C 1396/C 1396M(2)	"Gypsum Board"
ASTM	C 1658/C 1658M(3)	"Glass Mat Gypsum Panels"
ASTM	D 1227	"Emulsified Asphalt Used as a Protective Coating for Roofing"
ASTM	D 2178/D 2178M	"Asphalt Glass Felt Used in Roofing and Waterproofing"
ASTM	D 3019(4)	"Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, Asbestos-Fibered, and Non-Asbestos-Fibered"
ASTM	D 4479/D 4479M	"Asphalt Roof Coatings – Asbestos-Free"

ASTM	D 4637/D 4637M	"EPDM Sheet Used In Single-Ply Roof Membrane"
ASTM	D 4811/D 4811M	"Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing"
ASTM	D 6878/D 6878M	"Thermoplastic Polyolefin Based Sheet Roofing"
ASTM	E 2190	"Insulating Glass Unit Performance and Evaluation"
BNQ	BNQ 3624-115	"Polyethylene (PE) Pipe and Fittings – Flexible Pipes for Drainage – Characteristics and Test Methods"
CGSB	CAN/CGSB-11.3-M	"Hardboard"
CGSB	CAN/CGSB-11.5-M	"Hardboard, Precoated, Factory Finished, for Exterior Cladding"
CGSB	CAN/CGSB-12.1-M	"Tempered or Laminated Safety Glass"
CGSB	CAN/CGSB-12.2-M	"Flat, Clear Sheet Glass"
CGSB	CAN/CGSB-12.3-M	"Flat, Clear Float Glass"
CGSB	CAN/CGSB-12.4-M	"Heat Absorbing Glass"
CGSB	CAN/CGSB-12.8	"Insulating Glass Units"
CGSB	CAN/CGSB-12.10-M	"Glass, Light and Heat Reflecting"
CGSB	CAN/CGSB-12.11-M	"Wired Safety Glass"
CGSB	37-GP-9Ma	"Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing"
CGSB	CAN/CGSB-37.50-M	"Hot-Applied, Rubberized Asphalt for Roofing and Waterproofing"
CGSB	CAN/CGSB-37.54	"Polyvinyl Chloride Roofing and Waterproofing Membrane"
CGSB	37-GP-56M	"Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing"
CGSB	CAN/CGSB-37.58-M	"Membrane, Elastomeric, Cold-Applied Liquid, for Non-Exposed Use in Roofing and Waterproofing"
CGSB	CAN/CGSB-41.24	"Rigid Vinyl Siding, Soffits and Fascia"
CGSB	CAN/CGSB-51.32-M	"Sheathing, Membrane, Breather Type"
CGSB	CAN/CGSB-51.33-M	"Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction"

CGSB	CAN/CGSB-51.34-M	"Vapour Barrier, Polyethylene Sheet for Use in Building Construction"
CGSB	CAN/CGSB-93.1-M	"Sheet, Aluminum Alloy, Prefinished, Residential"
CGSB	CAN/CGSB-93.2-M	"Prefinished Aluminum Siding, Soffits, and Fascia, for Residential Use"
CGSB	CAN/CGSB-93.3-M	"Prefinished Galvanized and Aluminum-Zinc Alloy Steel Sheet for Residential Use"
CGSB	CAN/CGSB-93.4	"Galvanized Steel and Aluminum-Zinc Alloy Coated Steel Siding, Soffits and Fascia, Prefinished, Residential"
CSA	A23.1	"Concrete Materials and Methods of Concrete Construction"
CSA	CAN/CSA-A82	"Fired Masonry Brick Made from Clay or Shale"
CSA	CAN3-A93-M	"Natural Airflow Ventilators for Buildings"
CSA	A123.1/A123.5	"Asphalt Shingles Made From Organic Felt and Surfaced with Mineral Granules/Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules"
CSA	CAN/CSA-A123.2	"Asphalt-Coated Roofing Sheets"
CSA	A123.3	"Asphalt Saturated Organic Roofing Felt"
CSA	CAN/CSA-A123.4	"Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems"
CSA	A123.17	"Asphalt Glass Felt Used in Roofing and Waterproofing"
CSA	CAN3-A123.51-M	"Asphalt Shingle Application on Roof Slopes 1:3 and Steeper"
CSA	CAN3-A123.52-M	"Asphalt Shingle Application on Roof Slopes 1:6 to Less Than 1:3"
CSA	A165.1	"Concrete Block Masonry Units"
CSA	A165.2	"Concrete Brick Masonry Units"
CSA	A165.3	"Prefaced Concrete Masonry Units"
CSA	A179	"Mortar and Grout for Unit Masonry"
CSA	CAN/CSA-A220	"Concrete Roof Tiles"
CSA	A371	"Masonry Construction for Buildings"
CSA	A3001	"Cementitious Materials for Use in Concrete"
CSA	CAN/CSA-B182.1	"Plastic Drain and Sewer Pipe and Pipe Fittings"
CSA	G40.21	"Structural Quality Steel"
CSA	G401	"Corrugated Steel Pipe Products"
CSA	CAN/CSA-O80 Series	"Wood Preservation"

CSA	O118.1	“Western Red Cedar Shakes and Shingles”
CSA	O118.2	“Eastern White Cedar Shingles”
CSA	O121	“Douglas Fir Plywood”
CSA	O141	“Softwood Lumber”
CSA	O151	“Canadian Softwood Plywood”
CSA	O153	“Poplar Plywood”
CSA	O325	“Construction Sheathing”
CSA	O437.0	“OSB and Waferboard”
HPVA	ANSI/HPVA HP-1	“Hardwood and Decorative Plywood”
ULC	CAN/ULC-S701	“Thermal Insulation, Polystyrene, Boards and Pipe Covering”
ULC	CAN/ULC-S702	“Mineral Fibre Thermal Insulation for Buildings”
ULC	CAN/ULC-S703	“Cellulose Fibre Insulation for Buildings”
ULC	CAN/ULC-S704	“Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced”
ULC	CAN/ULC-S705.1	“Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Material – Specification”
ULC	CAN/ULC-S705.2	“Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Application”
ULC	CAN/ULC-S706	“Wood Fibre Insulating Boards for Buildings”
ULC	CAN/ULC-S710.1	“Thermal Insulation – Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification”
ULC	CAN/ULC-S711.1	“Thermal Insulation – Bead-Applied Two Component Polyurethane Air Sealant Foam, Part 1: Material Specification”

Notes to Table 5.9.1.1.:
(1) See Note A-Table 5.9.1.1.
(2) The *flame-spread rating* of gypsum board shall be determined in accordance with CAN/ULC-S102 in lieu of ASTM E 84 as indicated in ASTM C 1396/C 1396M.
(3) The *flame-spread rating* of glass mat gypsum panels shall be determined in accordance with CAN/ULC-S102 in lieu of ASTM E 84 as indicated in ASTM C 1658/C 1658M.
(4) For the purpose of compliance with Part 5, ASTM D 3019 shall only apply to the non-fibered and non-asbestos-fibered types of asphalt roll roofing.

5.9.2. Windows, Doors, Skylights, and Other Glazed Products

5.9.2.1. General

1) This Subsection applies to windows, doors, skylights, and other glazed products and their components, that separate
- a) interior space from exterior space, or
- b) environmentally dissimilar interior spaces.

2) For the purpose of this Subsection, the term “skylight” refers to unit skylights, roof windows and tubular daylighting devices.

3) Windows, doors, skylights, other glazed products and their components that are required to have a *fire-protection rating* need not conform to this subsection. (See Note A-5.9.2.1.(3).)

5.9.2.2. Design and Construction

(See Note A-5.9.2.2.)

1) Windows, doors, skylights, and their components shall be designed and constructed in accordance with

a) Subsection 5.1.4., Section 5.3., Section 5.4. and Section 5.6., or

b) the following standards

i) AAMA/WDMA/CSA 101/I.S.2/A440, "NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights," and

ii) except as permitted by Sentence (3), CSA A440S1, "Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights."

(See Note A-5.9.2.2.(1).)

2) Other glazed products and their components shall be designed and constructed in accordance with Subsection 5.1.4., Section 5.3., Section 5.4. and Section 5.6. (See Note A-5.9.2.2.(2).)

3) For the purposes of conformance with Subclause (1)(b)(ii), loads and procedures from Section 5.2 may be used instead of the loads and procedures set out in the standard. (See Note 5.9.2.2.(3).)

5.9.2.3. Reserved.

5.9.2.4. Heat Transfer

1) Windows, doors and skylights shall meet the heat transfer performance requirements stated in Section 5.3.

(See Note A-5.3.1.2.)

2) Except as provided in Sentence (3), all metal-framed glazed assemblies separating interior *conditioned space* from interior unconditioned space or exterior space shall incorporate a thermal break to minimize condensation.

3) Metal-framed glazed assemblies need not comply with Sentence (2) where these assemblies are

a) storm windows or doors, or

b) windows or doors that are required to have a *fire-protection rating*.

(See Note A-5.9.2.4.(3).)

5.9.3. Reserved.

5.9.4. Exterior Insulation Finish Systems

5.9.4.1. Structural Loads, Heat Transfer, Air Leakage, Vapour Diffusion and Water Penetration

1) Exterior insulation finish systems and their components shall comply with

a) Subsection 5.1.4. and Sections 5.3. to 5.6., and

b) CAN/ULC-S716.1, "Exterior Insulation and Finish Systems (EIFS) – Materials and Systems," where covered in the scope of that standard.

(See Note A-5.9.4.1.(1).)

Section 5.10. Objectives and Functional Statements

5.10.1. Objectives and Functional Statements

5.10.1.1. Attributions to Acceptable Solutions

1) For the purpose of compliance with this By-law as required in Clause 1.2.1.1.(1)(b) of Division A, the objectives and functional statements attributed to the acceptable solutions in this Part shall be the objectives and functional statements listed in Table 5.10.1.1. (See Note A-1.1.2.1.(1).)

Table 5.10.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 5
Forming Part of Sentence 5.10.1.1.(1)

Functional Statements and Objectives(1)	
5.1.4.1. Structural and Environmental Loads	
(1)	(a) [F55,F61,F63-OH1.1,OH1.2,OH1.3]
	[F20-OS3.1] Applies to snow fences and sloped glazing.
	[F61-OH4]
	(a) [F60,F61,F63-OS2.2,OS2.3]
	(a) [F20,F51,F55-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
	(b) [F20-OS2.1] [F21,F22-OS2.3,OS2.4]
	(b) [F20,F21,F22-OH1.1,OH1.2,OH1.3]
	(b) [F20-OH4]
(4)	[F20-OS2.1] [F21,F22-OS2.3,OS2.4]
	[F20,F21,F22-OH1.1,OH1.2,OH1.3]
(5)	(a) [F20-OS2.1] [F21,F22-OS2.3,OS2.4]
	(a) [F20,F21,F22-OH1.1,OH1.2,OH1.3]
	(b) [F20-OS2.1] [F21,F22-OS2.3,OS2.4]
	(b) [F20,F21,F22-OH1.1,OH1.2,OH1.3]
(6)	[F20,F21,F22-OH1.1,OH1.2,OH1.3]
	(a) [F20-OS2.1,OS2.3] (b) and (c) [F21,F22-OS2.3]
	(b) and (c) [F22-OH4]
5.1.4.2. Resistance to Deterioration	
(1)	[F80,F81-OH1.1,OH1.2,OH1.3]
	[F80,F81-OS3.1] Applies to floor assemblies.
	[F80,F81-OH4] Applies to floor assemblies.
	[F80,F81-OS2.3]

	[F80,F81-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
5.2.1.1. Exterior Environmental Loads	
(2)	[F40,F20-OH1.1] [F20-OH1.2,OH1.3]
	[F20-OS2.1]
5.2.1.2. Interior Environmental Loads	
(1)	[F51,F55,F61,F63-OH1.1,OH1.2]
	[F55,F61,F63-OS2.3]
	[F51,F61,F63,F55-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
5.2.1.3. Environmental Load and Transfer Calculations	
(1)	[F56-OH3.1] Applies to sound transmission calculations.
	[F61,F51,F63,F55-OH1.1,OH1.2] [F51,F61-OH1.3] Applies to heat, air and moisture transfer calculations.
	[F61,F51,F63-OS2.3] Applies to heat, air and moisture transfer calculations.
(3)	[F61,F63,F55-OH1.1,OH1.2] [F61,F55-OH1.3]
	[F20-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
	[F20-OS2.1]
5.2.2.1. Determination of Structural Loads and Effects	
(1)	[F20-OS2.1] [F21,F22-OS2.3,OS2.4]
	[F20,F21,F22-OH1.1,OH1.2,OH1.3]
	[F20,F21,F22-OH4]
(3)	[F20-OS2.1] [F21,F22-OS2.3,OS2.4]
	[F20,F21,F22-OH1.1,OH1.2,OH1.3]
	[F20,F21,F22-OH4]
5.2.2.2. Determination of Wind Load	
(2)	[F20-OS2.1] [F22-OS2.3,OS2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OH4]
(3)	[F20-OS2.1] [F22-OS2.3,OS2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OH4]
(4)	[F20,F55,F61-OH1.1,OH1.2,OH1.3]

	[F20,F55,F61-OS2.1,OS2.3]
5.2.2.3. Design Procedures	
(1)	[F20-OS2.1] [F22-OS2.3,OS2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OH4]
5.3.1.1. Required Resistance to Heat Transfer	
(1)	[F63-OH1.1] [F51,F63-OH1.2]
	[F63-OS2.3]
	[F51,F63-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
5.3.1.2. Properties to Resist Heat Transfer or Dissipate Heat	
(1)	(a),(b) [F51,F63-OH1.1] (c) [F51-OH1.2]
	(b) and (d) [F51,F63-OS2.3]
	(b) [F51,F63-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
	(d) [F30-OS3.1]
5.3.1.3. Location and Installation of Materials Providing Thermal Resistance	
(1)	[F51,F63-OH1.1]
	[F63-OS2.3]
(2)	[F51,F63-OH1.1,OH1.2]
	[F63-OS2.3]
	[F51,F63-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
5.4.1.1. Required Resistance to Air Leakage	
(1)	(a),(b),(f) [F51,F52,F54,F55-OH1.2] (a),(b),(c),(e) [F40,F55-OH1.1] (c) [F55,F61,F63-OH1.3]
	(c) and (d) [F61,F62,F63,F55-OS2.3]
	(d) [F55,F62-OS3.1]
	(f) [F55,F62-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
(2)	[F40-OH1.1] [F52,F54-OH1.2] [F51,F55,F61,F63-OH1.1,OH1.2,OH1.3]
	[F61,F63-OS2.3]

	[F51,F55-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
5.4.1.2. Air Barrier System Properties	
(1)	[F55-OH1.1,OH1.2,OH1.3]
	[F55-OS2.3]
	[F55-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
(3)	[F61,F51,F63,F55-OH1.1,OH1.2] [F55,F61-OH1.3]
	[F61,F63-OS2.3]
	[F61,F51,F63-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
5.5.1.1. Required Resistance to Vapour Diffusion	
(1)	[F63-OH1.1,OH1.2]
	[F63-OS2.3]
(2)	[F63-OH1.1,OH1.2]
	[F63-OS2.3]
5.5.1.2. Vapour Barrier Properties and Installation	
(1)	[F63-OH1.1,OH1.2]
	[F63-OS2.3]
(2)	[F63-OH1.1,OH1.2]
	[F63-OS2.3]
(3)	[F63-OH1.1,OH1.2]
	[F63-OS2.3]
5.6.1.1. Required Protection from Precipitation	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
5.6.1.2. Installation of Protective Materials	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
5.6.2.1. Sealing and Drainage	
(1)	[F61,F62-OH1.1,OH1.2,OH1.3]

	[F61,F62-OS2.3]
5.6.2.2. Accumulation and Disposal	
(1)	[F30-OS3.1]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(3)	[F61-OH1.1,OH1.2,OH1.3]
	[F60-OS2.3] [F21-OS2.2]
	(b) [F21-OP2.6]
(4)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
5.7.1.2. Required Protection	
(1)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.3]
(2)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.2,OS2.3]
5.7.3.2. Required Protection	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
5.7.3.3. Waterproofing	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
5.7.3.4. Where Dampproofing is Permitted	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
5.8.1.1. Required Protection	
(1)	[F56-OH3.1]
(2)	[F56-OH3.1]
5.8.1.2. Determination of Sound Transmission Ratings	

(1)	[F56-OH3.1]
(2)	[F56-OH3.1]
5.8.1.4. Detailed Method for Calculating ASTC	
(1)	[F56-OH3.1]
(2)	[F56-OH3.1]
(3)	[F56-OH3.1]
(4)	[F56-OH3.1]
(5)	[F56-OH3.1]
(6)	[F56-OH3.1]
(7)	[F56-OH3.1]
5.8.1.5. Simplified Method for Calculating ASTC	
(1)	[F56-OH3.1]
(2)	[F56-OH3.1]
(3)	[F56-OH3.1]
(4)	[F56-OH3.1]
(5)	[F56-OH3.1]
(6)	[F56-OH3.1]
5.9.1.1. Compliance with Applicable Standards	
(1)	[F20,F22,F51,F54,F55,F61,F63,F80-OH1.1,OH1.2] [F41,F55-OH1.1] [F55,F61,F80-OH1.3]
	[F20,F80-OS2.1] [F20,F22,F51,F61,F63,F80-OS2.3] [F51-OS2.5]
	[F80,F61,F63-OS3.1]
	[F80,F61,F63-OH4] Applies to floor assemblies.
	(a) [F61,F63-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
	[F20,F80-OP2.1,OP2.3] [F22,F80-OP2.4]
	[F42-OH2.5]
5.9.2.2. Applicable Standards	
(1)	[F20,F55,F61,F63-OH1.1,OH1.3] [F20,F55,F61,F63,F81-OH1.2]
	[F20,F55,F61-OS2.3]
	[F20,F55,F61-OP2.3]
5.9.2.4. Heat Transfer	

(2)	[F63-OH1.1,OH1.2]
	[F63-OS2.3]
5.9.3.3. Heat Transfer	
(2)	[F63-OH1.1,OH1.2]
	[F63-OS2.3]
5.9.3.4. Air Leakage	
(2)	[F55,F63-OH1.1,OH1.2,OH1.3]
	[F55,F63-OS2.3]
	[F55-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
5.9.3.5. Water Penetration	
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
5.9.4.1. Structural Loads, Heat Transfer, Air Leakage, Vapour Diffusion and Water Penetration	
(1)	(b) [F61,F62-OH1.1,OH1.2,OH1.3]
	(b) [F61,F62-OS2.3]

Notes to Table 5.10.1.1.:
(1) See Parts 2 and 3 of Division A.

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE D

Building Permit No._____________

Forming Part of Sentence 2.2.7.3.(1), Div. C of the Building By-law

COMMITMENT FOR BUILDING ENVELOPE PROFESSIONAL REVIEW

Notes:

i) This letter must be submitted before issuance of a building permit.
ii) This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C.
iii) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

RE: ____

Address of Project (Print)

The undersigned *Building Envelope Professional* has been retained with respect to the above referenced *project*, and gives a commitment of responsibility for *Building Envelope Professional* design review and enhanced *field review* for components and assemblies as required **in Article 5.1.2.2. in Part 5 of Division B**, of the Building By-law, and as the *Building Envelope Professional* in their professional discretion considers to be necessary, for the *project* designed by,

____

Name of *registered professional* signing for 'Architectural' items of Schedule B letters (Print)

who is providing the *Chief Building Official* with Schedule B 'ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW' letter covering 'Architectural' items. The undersigned will sign and provide copies of all reports to the *registered professional* responsible for 'Architectural' items, and copies of these reports shall also be available on site, for review by the City of Vancouver District Building Inspector. The undersigned undertakes to notify the *Chief Building Official* in writing as soon as practical if their contract is terminated at any time.

____

Name (Print)

____

Address of (Print)

____

City Postal Code

____

Telephone (Print) Email

(If the *Building Envelope Professional* is a member of a firm, complete the following.)

I am a member of the firm, ____________________________ and I sign this letter on behalf of the firm.

(Print Name of Firm)

NOTE: The above letter must be signed by a *Building Envelope Professional*. The Building By-Law defines a *Building Envelope Professional* to mean a person who is a member of the Architectural Institute of British Columbia or the Association of Professional Engineers and Geoscientists of British Columbia.

____

CRP's Initials

1 of 1

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE C-D

Forming Part of Section 5.1, Division B of the Building By-law

Building Permit No.______________

COMPLETION OF BUILDING ENVELOPE PROFESSIONAL REVIEW

Notes:

i) This letter must be submitted after the completion of the project at final inspection.

ii) This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C.

iii) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

RE: ____

Address of Project (Print)

The undersigned *Building Envelope Professional* has been retained with respect to the above referenced *project*, and gives a commitment of responsibility for *Building Envelope Professional* design review and enhanced *field review* for components and assemblies as required **in Article 5.1.2.2. in Part 5 of Division B**, of the Building By-law, and as the *Building Envelope Professional* in their professional discretion considers to be necessary, for the *project* designed by,

____

Name of *registered professional* signing for 'Architectural' items of Schedule B letters (Print)

who is providing the *Chief Building Official* with Schedule B 'ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW' letter covering 'Architectural' items. The undersigned will sign and provide copies of all reports to the *registered professional* responsible for 'Architectural' items, and copies of these reports shall also be available on site, for review by the City of Vancouver District Building Inspector. The undersigned undertakes to notify the *Chief Building Official* in writing as soon as practical if their contract is terminated at any time.

____

Name (Print)

____

Address of (Print)

____

City Postal Code

____

Telephone (Print) Email

(If the *Building Envelope Professional* is a member of a firm, complete the following.)

I am a member of the firm, ______________________________ and I sign this letter on behalf of the firm.

(Print Name of Firm)

NOTE: The above letter must be signed by a *Building Envelope Professional*. The Building By-Law defines a *Building Envelope Professional* to mean a person who is a member of the Architectural Institute of British Columbia or the Association of Professional Engineers and Geoscientists of British Columbia.

____

CRP's Initials

1 of 1

Notes to Part 5
Environmental Separation

A-5 Environmental Separation. The requirements provided in Part 5 pertain to the separation of environmentally dissimilar spaces. Most obvious is the need to separate indoor conditioned spaces from unconditioned spaces, the outdoors or the ground. There are also cases where separation is needed between interior spaces which are intended to provide different environments. (See also Notes A-5.1.1.1.(1) and A-5.1.2.1.(1).)

A-5.1.1.1.(1) Scope. Part 5 provides explicit requirements related to the transfer of heat, air, moisture and sound in various forms. Control of the ingress of radon and other soil gases is addressed by the requirements related to air leakage.

A-5.1.1.2. Maritime Climate. The effects of Vancouver's maritime climate are well documented. The City's prolonged stretches of near continuous rainfall, combined with driving winds produce extended periods of wetting of building exteriors. This extended wetting combined with very mild year round temperatures means that there are limited periods in which the drying of an envelope assembly might occur. These factors create an environment where the possibility of moisture induced deterioration of materials is very high. The choice of appropriate materials and assemblies for building envelopes is therefore extremely important in Vancouver.

Consistent application of basic water management principles; deflection, drainage, drying and durability of materials throughout the design and construction process is critical for a successful building envelope assembly in Vancouver's climate. Although excess moisture in an envelope assembly can come from construction sources, exterior sources such as rainwater, or interior humidity sources, it has been shown that most performance problems in Vancouver have resulted from a failure to control exterior sources. In Vancouver, the first consideration in envelope design should be the deflection of incident rain with elements such as roof overhangs and the use of flashings with drip edges to direct water away from a building face. The ability to effectively drain water, which does penetrate through the cladding, should be the next consideration for successful envelope assemblies. Since many materials used in the construction of building envelope assemblies are susceptible to deterioration or decay if they remain wet, the ability of the assembly to allow for drying should be considered in the design. However, as the potential for drying in this climate is relatively limited, it should not be relied upon as the primary mechanism, and it should be ensured that materials placed in an exterior envelope assembly do not contain excess moisture before the assembly is enclosed. Lastly, where the probability exists that materials may be exposed to moisture sources, it is critical to choose materials which are durable enough to withstand the moisture until it is dissipated.

Selection and specification of performance criteria for components such as windows should ensure that the components are also capable of meeting the overall envelope performance requirements. In addition, the integration of components into the overall envelope assembly should be carefully considered in the drafting of design documents and throughout the construction process, particularly at the interfaces between components such as windows and the adjacent wall system. All envelope details should be clearly shown in the construction documents, using a progressive series of three dimensional details where correct layering and overlapping of materials needs to be clarified. For critical building envelope assembly details or new and unique assemblies, full-scale mock-ups and testing on site are extremely valuable in confirming the performance of an assembly and in establishing construction standards for the balance of the envelope construction.

The requirements in Part 5 outline a performance standard for the building envelopes, but good design practice should go beyond the requirements in these regulations. Issues such as the quality of detailing, the compatibility of materials used in assemblies, and a design that allows for the simplicity of on-going maintenance are concerns that a professional designer should take into account in the design of a successful building envelope assembly.

Guidance with respect to building science principles and envelope assembly performance for maritime climates is available from a variety of sources. The Canadian Building Digest series and many other publications from the National Research Council (NRC) and in particular from the Institute for Research in Construction (IRC) are valuable resources. Canada Mortgage and Housing Corporation (CMHC) has also published a wide variety of documents which are useful in understanding building science principles and the application of these principles to residential design and construction. Locally, courses in building envelope basics, offered as the educational component towards a Building Envelope Professional accreditation, are administered by the Architectural Institute of BC. Regular seminars on building envelope issues are also offered on an industry wide basis by the BC Building Envelope Council.

A-5.1.2.1.(1) Application. Subsection 1.3.3. of Division A specifies that Part 5 applies to all buildings except those within the scope of Part 9 or the scope of the National Farm Building Code of Canada. Because of their intended use, many buildings need only provide a limited degree of separation from the outdoor environment, the ground, or between interior spaces. The provisions in Part 5 are written to allow exemptions for these buildings.
Part 5 applies to building elements that separate dissimilar environments and to site conditions that may affect environmental loading on the building envelope.

The provisions address

- the design and construction, or selection, of building components, such as windows and doors,
- the design and construction of building assemblies, such as walls, floors and roofs,
- the design and construction of the interfaces between the above-mentioned elements, and
- the design or selection, and installation, of site materials, components and assemblies, such as backfill and drainage, and grading.

Part 5 applies not only to building elements that separate indoor space from outdoor space, but also to those elements that separate indoor space from the ground and that separate adjacent indoor spaces having significantly different environments.

Indoor spaces that require separation include interior conditioned spaces adjacent to indoor unconditioned spaces, and adjacent interior conditioned spaces that are intended to provide different environments. An extreme example of the last would be a wall that separates an indoor ice rink from a swimming pool.

Some building elements are exposed to exterior environmental loads but do not separate dissimilar environments. Solid guards on exterior walkways are one example. Such constructions are subject to the application of Part 5.

A-5.1.2.1.(2) Exemptions. This sentence is intended to allow for the exemption of the application of Part 5 to buildings or parts of buildings where it can be shown that due to the intended use of a building, the full provisions of Part 5 are not necessary. As an example, buildings such as open parking garages, stadia, and certain park buildings intended for summer use would only require a limited degree of separation from the exterior environment. Any proposed exemptions should be discussed with the City of Vancouver prior to implementation.

A-5.1.2.2.(1) Building Envelope Professional Reviews Scope of Application and Letters of Commitment and Completion. The specific areas of focus for which a Building Envelope Professional is required to perform reviews are Sections 5.4., 5.5. and 5.6. The duties are described as Building Envelope Professional design review and enhanced field review. The design review is required to be completed by a Building Envelope Professional. This review is intended to ascertain that the design for which they will be giving a commitment of responsibility for review in the field substantially complies with Part 5 with respect to Sections 5.4., 5.5. and 5.6.

The term enhanced field review is used to differentiate the level of review for which a Building Envelope Professional is responsible, from that which a registered professional signing for architectural items in Schedules B-1 and B-2 would be responsible. The requirements in Part 5 outline a minimum performance standard, but these requirements cannot address the specific detail concerns which experience has shown are the primary source of problems which have resulted in the deterioration of building envelopes. Building Envelope Professional enhanced field review is intended to address this concern. It requires that the professional performs field reviews at a sufficient frequency and reviews a substantial number of the details, which could be potential problem sources, in order to ascertain that the performance requirements of Part 5 are satisfied. While a professional may not be able to see all of the details, the level of duty intended for this enhanced field review is to review as many details as possible rather than just a representative sampling.

An additional duty of the Building Envelope Professional involves the review of moisture content present in envelope assemblies prior to enclosure. Exterior walls, in buildings of structural light framing systems, should not be enclosed when there is sufficient moisture present to initiate deterioration. While wood may have been delivered to a construction site kiln dried, exposure to rain during construction may raise the moisture content to an unacceptable level (above 19 per cent). Water may also have collected in elements of wall assemblies, such as steel stud tracks, and may lead to deterioration if not dried out prior to the wall assembly being enclosed.

The Building Envelope Professional is required to assure that all wood framing, structural members, and sheathing do not exceed 19% moisture content, and all other materials are dry, prior to the wall assembly being enclosed.

The Articles in Section 5.4 do not define the air tightness limits of a completed assembly, but only that of the components in an assembly. Therefore, it is a critical responsibility of the Building Envelope Professional to conduct sufficient design and field review work in order to be able to ascertain that the continuity of the air barrier system meets the performance requirements of this Part.

The Building Envelope Professional is required to perform sufficient design and field review work to ascertain that the installed vapour barrier system meets the performance requirements of Part 5. The Building Envelope Professional is required to confirm adequate completeness of the system in order to ensure that vapour diffusion is retarded at an appropriate wall location and that all inappropriate barriers to diffusion are eliminated.

Preventing inappropriate barriers to diffusion requires careful attention to detail. While it is often unintended, envelope assemblies may end up with more than one functional vapour barrier. As it can never be ensured that an exterior envelope assembly will always be free of moisture, the drying mechanism must not be blocked, or the trapped moisture may lead to deterioration of moisture sensitive materials. Drying potential in the system requires that vapour, driven by a vapour pressure differential (i.e. from high interior vapour pressure to low exterior vapour pressure) be allowed to pass to a location in the assembly which is open to exterior air (such as a cavity) where drying may occur. Plywood sheathing for instance has sufficiently low permeance that care must be taken in the design of an assembly to ensure that vapour is allowed to pass the sheathing if it is not intended to act as a vapour barrier. Caution may also be needed with the over use of impermeable sheet membrane materials at details such as windows. If the application is too extensive, the potential for moisture diffusion out of the assembly may be locally impeded, with a resultant increase in the likelihood of deterioration.

The Building Envelope Professional is required to perform sufficient design and field review work to ascertain that the installed exterior cladding system meets the performance requirements of Part 5. The Building Envelope Professional is required to confirm that the cladding system will provide continuous precipitation protection, the drainage paths are complete and the flashings as installed over the complete exterior envelope will function properly.

A-5.1.4.1. Application of Structural Design to Other Building Elements. Part 4, as currently written, applies primarily to buildings as a whole and to structural members. Requirements defining structural loads and design to accommodate or resist those loads, however, apply not only to buildings as a whole and components that are traditionally recognized as structural members, but also apply to other elements of the building that are subject to structural loading. This is addressed to some extent in Part 4 by the requirements that pertain, for example, to wind loads on cladding. A range of structural loads and effects, as defined in Subsection 4.1.2., may be imposed on non-loadbearing elements such as backing walls, roofing, interior partitions and their connections. These must generally be addressed using the same load determination and structural design procedures as used for structural members.

Responsibility for the structural design of buildings as a whole and their structural members is commonly assigned to the engineer of record. The application of Part 4 reflects this, and as such, “non-structural” elements are not explicitly identified in the Part 4 provisions. Rather the application of Part 4 to these elements is specified in cross-references from other Parts of the By-law, e.g. Part 5, which recognizes the fact that the structural design of these elements is often carried out by engineers other than the engineer of record.

Part 4 does not generally apply to the structural design of building services, such as heating, ventilating, air-conditioning, plumbing, electrical, electronic or fire safety systems, though these may be subject to structural loads. It does, however, apply to the design of the connections of building services to address earthquake loads (See Article 4.1.8.18.).

A-5.1.4.1.(2) Materials, Components and Assemblies with Multiple Functions. Where materials, components or assemblies are used to fulfill multiple functions, the designer may have to take into account their function with regard to structural loads, heat transfer, air leakage, vapour diffusion, and protection from precipitation, surface and ground water, and sound transmission. Materials should be selected taking into account the environmental loads to which they will be subjected, their physical and chemical characteristics, and their installation. Design and construction details should satisfy all intended functions and ensure continuity within and between assemblies, without adversely impacting adjacent materials, components or assemblies. The designer should also anticipate unintended consequences when materials that may fulfill multiple functions are used. For example, building membranes consisting of modified bitumen compounds, which are commonly used to control both water ingress and air leakage, also typically have low vapour transmission characteristics. Similarly, extruded polystyrene boards, which are used as thermal insulation, may also act as a component of an air barrier assembly, thus requiring wind loads to be considered.

An increasing number of manufactured systems are being used to serve more than one (and sometimes all) of the functions of an environmental separator: examples include pre-engineered building systems, exterior insulation finish systems, insulated metal panel systems, windows, other fenestration assemblies, and insulated precast concrete wall panels. These systems consist of combinations of pre-manufactured and/or site-built components, which are supposed to be assembled in a prescribed manner.

Ensuring compliance with one Section of Part 5 may impact compliance with other Sections of Part 5: for example, air barriers that are integral to some systems may also act as vapour barriers and impact condensation control. By extension, ensuring compliance with the requirements of Part 5 may impact compliance with other Parts of the By-law: for example, increasing the thickness of the insulation to improve an assembly’s thermal performance may impact its compliance with Part 3 with regard to fire resistance.

Compliance with a standard listed in Section 5.9. does not ensure that a system is appropriate for the intended application. The designer should consider all relevant criteria, beyond the standard tests, when selecting an appropriate product for a project.

A-5.1.4.1.(5) Past Performance as Basis for Compliance with Respect to Structural Loads. As discussed in Note A-5.1.4.1., a range of structural loads and effects can be imposed on materials, components and assemblies in environmental separators and assemblies exposed to the exterior. In many instances, compliance with Sentence 5.1.4.1.(1) for structural loads must be determined based on the loads and calculation methods described in Part 4 as specified in Sentence 5.1.4.1.(3) and the referenced Subsection 5.2.2., e.g. for cladding. In practice, compliance for some materials, components or assemblies of environmental separators and assemblies exposed to the exterior is determined by relying on provisions governing the use of alternative solutions (such as Clause 1.2.1.1.(1)(b) of Division A).

For some very common building elements and installations, however, there is a very large body of evidence of proven performance over a long period of time. In these cases, imposing the degree of analysis, or documentation of performance, required by Part 4 or Section 2.3. of Division C would be unnecessary and onerous. Clause 5.1.4.1.(5)(b) is intended to address these particular cases. Because the constructions are so widely accepted throughout the industry and the body of evidence is so substantial (though not necessarily documented in an organized fashion), there should be no question that detailed analysis or documentation is unnecessary.

Whether compliance of a particular material, component or assembly may be determined based on past performance depends not only on the type of material, component or assembly, but also on its intended function, the particular loads to which it will be subject and the magnitude of those loads. Because the possible combinations and permutations are infinite, only guidelines can be provided as to when past performance is a reasonable basis for determining compliance.

In determining compliance based on past performance, the period of past performance considered should be a substantial number of years. For example, 30 years is often used to do life-cycle cost analysis of the viability of investments in building improvements. This period is more than long enough for most deficiencies to show up. There should be no question as to the structural adequacy of a material, component or assembly that has been successfully used in a given application for such a period.

The determination of compliance may be based on past performance only where the function of the material, component or assembly is identical to that of the materials, components or assemblies used as a reference, and where the expected loads do not exceed those imposed on the reference materials, components or assemblies. For example, the acceptance of gypsum board, and its fastening, to serve as part of the backing wall supporting cladding cannot be based on the performance of gypsum board that has served only as an interior finish.

The determination of compliance may be based on past performance only where the properties of the material, component or assembly are identical or superior to those of the materials, components or assemblies used as a reference. For example, where a component of a certain gauge of a particular metal has provided acceptable performance, the same component made of the same metal or a stronger one would be acceptable.

Compliance with respect to various loads may be determined individually. A particular material may have to be designed to Part 4 to establish acceptable resistance to wind or earthquake loads, for example, but past performance may be adequate to determine that the material and normal fastening will support the material's dead load and will resist loads imposed by thermal and moisture-related expansion and contraction.

Past performance is a reasonable basis for determining compliance for lighter materials, components or assemblies not subject to wind load; for example, semi-rigid thermal insulation installed in wall assemblies where other materials, components or assemblies are installed to resist air pressure loads.

Past performance is an appropriate basis for determining compliance for some smaller elements that will be subject to wind loads but are continually supported or fastened behind elements that are designed for wind loads, for example, standard flashing over wall penetrations.

It should be noted that this particular approach to demonstrating compliance pertains only to the resistance or accommodation of structural loads described in Part 4. The resistance or accommodation of environmental loads, resistance to deterioration, and material compatibility must still be addressed in accordance with Part 5.

A-5.1.4.1.(6)(b) and (c) Accommodating Movement. It is well understood that the deflection of the backing assembly in a wall can have significant effects on the performance of the cladding. For example, CSA S304, "Design of Masonry Structures," specifies the maximum deflection criteria for backing assemblies to masonry veneer. Clauses 5.1.4.1.(6)(b) and (c) are written in very general terms in recognition of the fact that not only can the deflection of cladding affect the performance of the backing assembly, but that the excessive deflection of any element has the potential to adversely affect the performance of any adjacent element. Similarly, inter-storey drift has the potential to adversely affect the performance of components and assemblies of environmental separators. CSA O86, "Engineering Design in Wood," specifies a method for calculating building movement due to changes in moisture content. The effects of movement should be avoided or accommodated.

A-5.1.4.2. Deterioration. Environmental loads that must be considered include but are not limited to: sound, light and other types of radiation, temperature, moisture, air pressure, acids and alkalis.

Mechanisms of deterioration include:

- structural (impact, air pressure)
- hygrothermal (freeze-thaw, differential movement due to thermal expansion and contraction, ice lensing)
- electrochemical (oxidation, electrolytic action, galvanic action, solar deterioration)
- biochemical (biological attack, intrusion by insects and rodents).

Information on the effects of deformations in building elements can be found in the Commentary entitled Effects of Deformations in Building Components in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

Resistance to deterioration may be determined based on field performance, accelerated testing or compliance with guidelines provided by evaluation agencies recognized by the authority having jurisdiction. Guidance can be found in CSA S478, "Guideline on Durability in Buildings."

Building components should be designed with some understanding of the length of time over which they will effectively perform their intended function. Actual service life will depend on the materials used and the environment to which they are exposed. The design should take into consideration these factors, the particular function of the component and the implications of premature failure, the ease of access for maintenance, repair or replacement, and the cost of repair or replacement.

Many buildings are designed such that access for maintenance, repair or replacement is not possible without damaging – or seriously risking damaging – other building elements. This can become a considerable deterrent to proper maintenance thus compromising the performance of the subject materials, components and assemblies, or other elements of the building. In cases where it is known or expected that maintenance, repair or replacement is likely to be required for certain elements before such time as the building undergoes a major retrofit, special consideration should be given to providing easy access to those elements. Anchorage points for maintenance personnel should be considered during the design of multi-storey buildings, including those of wood-frame construction, as adding them post-construction can be difficult.

Where the use of a building or space, or the services for a building or space, are changed significantly, an assessment of the impact of the changes on the environmental separators should be conducted to preclude premature failures that could create hazardous conditions.

A-5.2.1.1.(3) Soil Temperatures. In theory, soil temperatures are needed to determine the conformance of a design to the requirements related to heat transfer and vapour diffusion. In practice, standard construction in a particular area may have proven to perform quite adequately and detailed calculations of soil temperature are unnecessary. (See also Sentence 5.2.1.3.(2).)

A-5.2.1.2.(1) Interior Environmental Loads. The interior environmental conditions required depend on the intended use of the spaces in the building as defined in the building program. Spaces in different types of buildings and different spaces within a single building may impose different loads on the separators between interior and exterior spaces and between adjacent interior spaces. The separators must be designed to withstand the expected loads.

A-5.2.2.1.(2)(c) Determination of Structural Loads and Effects. As regards materials, components and assemblies and their interfaces that are installed in buildings to which Part 5 applies, the effects of earthquake loads on their ability to resist or accommodate environmental loads are generally only taken into account in the design of post-disaster buildings. For all other buildings, damage to building components during seismic events is anticipated and these buildings are not intended to be functional after the event. However, for post-disaster buildings, seismic effects must be taken into account in the design for environmental separation, as these buildings are required to have an adequate degree of functionality after the design event to meet their intended function (See Article 4.1.8.13. for deflections and drift limits for post-disaster buildings).
However, it is important to note that earthquake effects must be taken into account in the seismic design of all building materials, components and assemblies and their interfaces covered by Article 4.1.8.18. to address life safety and the structural protection of buildings.

A-5.2.2.2. Resistance to Wind and Other Air Pressure Loads. The wind load provisions apply to roofing and other materials subject to wind-uplift loads.

Note that, although Article 5.2.2.2. is specifically concerned with wind loads and directly references only one Article from Part 4, Sentence 5.2.2.1.(1) references all of Part 4 and would invoke Article 4.1.7.10. for example, which is concerned with air pressure loads on interior walls and partitions.

A-5.2.2.2.(4) Membrane Roofing Systems. Wind loads for membrane roofing systems must be calculated in accordance with Part 4. The tested uplift resistance and factored load should satisfy the requirements of the Commentary entitled Limit States Design in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

The test method described in CAN/CSA-A123.21, “Dynamic Wind Uplift Resistance of Membrane-Roofing Systems,” applies only to membrane roofing systems whose components’ resistance to wind uplift is achieved by fasteners or adhesives. It does not apply to roofing systems that use ballasts, such as gravel or pavers, to secure the membrane against wind uplift.
In the case of membrane roofing systems in which the waterproof membrane is attached to the structural deck using mechanical fasteners, the wind-induced forces and the roofing system’s response are time- and space-dependent and, thus, dynamic in nature. Further information on the design and evaluation of such systems can be found in “A Guide for the Wind Design of Mechanically Attached Flexible Membrane Roofs,” published by NRC.

The wind uplift resistance obtained from the test method in CAN/CSA-A123.21 is limited to configurations with specific fastener or adhesive patterns. To extrapolate the test data to non-tested configurations, refer to ANSI/SPRI WD-1, “Wind Design Standard Practice for Roofing Assemblies,” for a rational calculation procedure. However, in using this extrapolation procedure, wind loads should be calculated in accordance with the BCBC. NRC’s guide for wind design referenced above provides further guidance and examples of wind load calculations.

A-5.3. Heat Transfer. In addressing issues related to health and safety, Section 5.3. calls up levels of thermal resistance needed to minimize condensation on or within environmental separators, and to ensure thermal conditions appropriate for the building use. Energy regulations, where they exist, specify levels of thermal resistance required for energy efficiency or call up energy performance levels, which relate to levels of thermal resistance. Where Part 5 calls for levels of thermal resistance higher than those required by the energy regulations, the requirements of Part 5 take precedence.

A-5.3.1.1. Required Resistance to Heat Transfer. The control of heat flow is required wherever there is an intended temperature difference across the building assembly. The use of the term "intended" is important since, whenever interior space is separated from exterior space, temperature differences will occur.

The interior of an unheated warehouse, for example, will often be at a different temperature from the exterior due to solar radiation, radiation from the building to the night sky and the time lag in temperature change due to the thermal mass of the building and its contents. If this temperature difference is not "intended," no special consideration need be given to the control of heat flow. If the warehouse is heated or cooled, thus making the temperature difference "intended," some consideration would have to be given to the control of heat flow.

It should be noted, however, that in many cases, such as with adjacent interior spaces, there will be an intended temperature difference but the difference will not be great. In these cases, the provisions to control heat flow may be little or no more than would be provided by any standard interior separator. That is, materials typically used in the construction of partitions may provide the separation needed to meet the requirements of Section 5.3. without adding what are generally considered to be "insulating" materials.

A-5.3.1.2. Material and Component Properties and Condensation. Total prevention of condensation is generally unnecessary and its achievement is rarely a certainty at design conditions. Part 5, therefore, requires that condensation be minimized. The occurrence of condensation should be sufficiently rare, or the quantities accumulated should be sufficiently small and dry rapidly enough, to avoid material deterioration and the growth of mould and fungi.

The Harmonized North American Fenestration Standard, AAMA/WDMA/CSA 101/I.S.2/A440, "NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights," identifies procedures to determine the condensation resistance and thermal transmittance of windows, doors and skylights though testing for condensation resistance is presented as optional in the standard. As such, a fenestration product that meets the standard's requirements on air leakage, water penetration, uniform load and other performance requirements may not meet the condensation resistance performance level needed for a given application. Only the physical test procedure presented in CSA A440.2, "Fenestration Energy Performance," can be used to establish the temperature index (I) value, which denotes condensation resistance performance evaluation criteria. It is recommended that designers specify I values for a given application to minimize the potential for condensation. Further guidance on the selection of the correct I value is provided in CSA A440.3, "User Guide to CSA A440.2-14, Fenestration Energy Performance."

The scope of AAMA/WDMA/CSA 101/I.S.2/A440, which is referenced in Subsection 5.9.2., includes skylights and tubular daylighting devices (TDD). Where skylights and TDDs pass through unconditioned space, their wells and shafts may become the environmental separator and would therefore have to comply with the requirements of Part 5.

A-5.3.1.2.(1) Use of Thermal Insulation or Mechanical Systems for Environmental Control. The level of thermal resistance required to avoid condensation on the warm side of an assembly or within an assembly (at the vapour barrier), and to permit the maintenance of indoor conditions appropriate for the occupancy depends on

- the occupancy
- the exterior design air temperature
- the interior design air temperature and relative humidity
- the capacity of the heating system, and
- the means of delivering heat.

To control condensation on the interior surface of an exterior wall, for example, the interior surface must not fall below the dew point of the interior air. If, for instance, the interior air is 20°C and 35% RH, the dew point will be 4°C. If the interior air is 20°C and 55% RH, the dew point will be 11°C.

Where the exterior design temperature is mild, such as in south coastal British Columbia, the interior RH during the heating season may well be around 55%. With an exterior temperature of −7°C, the materials in the environmental separator would have to provide a mere RSI 0.082 to avoid condensation on the interior surface. Depending on the specific properties of the material, this RSI might be provided by 10-mm plywood. Therefore, materials generally recognized as thermal insulation would not be required only to limit condensation on the warmer side of the building envelope.

In other areas of the Province, however, exterior design temperatures are much lower. In these cases, maintaining temperatures inboard of the vapour barrier above the dew point will require insulation or increased heat delivery to the environmental separator. Direct delivery of heat over the entire surface of the environmental separator is generally impractical. Indirect heat delivery may not be possible without raising the interior air temperatures above the comfort level. In any case, increased heat delivery would often entail excessive energy costs.

In addition to controlling condensation, interior surface temperatures must be warm enough to avoid occupant discomfort due to excessive heat loss by radiation. Depending on the occupancy of the subject spaces, this may require the installation of insulation even where it is not needed to control condensation.

A-5.3.1.3.(2) Position of Materials Providing Thermal Resistance. For a material providing thermal resistance to be effective, it must not be short-circuited by convective airflow through or around the material. The material must therefore be either

- the component of the air barrier system providing principal resistance to air leakage, or
- installed in full and continuous contact with a continuous low air permeance component.

A-5.4.1.1. Resistance to Air Leakage. An air barrier system in above-grade building components and assemblies separating conditioned space from the exterior will reduce the likelihood of condensation due to air leakage, discomfort from drafts, the infiltration of dust and other pollutants, and interference in the performance of building services, such as HVAC and plumbing. These problems can all lead to serious health or safety hazards.

Currently, the most obvious and significant problems are due to moisture-related material deterioration, such as rot and corrosion, which can lead to the failure of component connections. The infiltration of dust and other pollutants can lead to a wide range of health problems. Where the separator is subject to high moisture levels, the pollutants may include fungus spores. Interference with the performance of building services can lead to unhealthy conditions and potentially hazardous conditions during the heating season in many regions of the province.

There are few buildings intended for human occupancy where the interior space is conditioned but where an air barrier system is not required. Some industrial buildings, for example, may be exempt. This would depend, however, on the particular levels of interior conditioning provided, ventilation levels, protection provided for the workers, and the tolerance of the building's construction to the accumulation of condensation and potential precipitation ingress.

Some industrial buildings are provided with only limited conditioning, for example radiant heating, and ventilation levels are sufficient to reduce relative humidity to a level at which condensation will not accumulate to a degree that is problematic. Conversely, some industrial buildings, due to the processes they contain, operate at very high temperatures and high ventilation levels. In these cases, the building envelope will be maintained at temperatures that will avoid condensation. In both examples above, either the ventilation rates or protective gear required in the work environment would protect the occupants from unacceptable levels of pollutants.

Where adjacent interior environments are sufficiently different, controlling airflow between those spaces is necessary to maintain conditions. Referring again to the industrial building examples above, assemblies separating office space from the work floor would likely require an air barrier system.

The word “minimize” is used in Clause 5.4.1.1.(1)(c) because not all moisture accumulation in an assembly need be of concern. Incidental condensation is normal but should be sufficiently rare and in sufficiently limited quantities and should dry rapidly enough to avoid material deterioration and the growth of mould or fungi.

An air barrier system is required in components and assemblies in contact with the ground to control the ingress of radon, and may be required to control the ingress of other soil gases such as methane.

In addition to an air barrier system, other measures may be required to reduce the radon concentration to a level below the guideline specified by Health Canada. Further information on protection from radon ingress can be found in:

- “Radon: A Guide for Canadian Homeowners” (CMHC/HC),
- “Guide for Radon Measurements in Public Buildings (Schools, Hospitals, Care Facilities, Detention Centres)” (HC), and
- EPA 625/R-92/016, “Radon Prevention in the Design and Construction of Schools and Other Large Buildings.”

A-5.4.1.2.(1) Air Leakage through the Air Barrier System.
The current requirements specify only a maximum air leakage rate for the material in the air barrier system that provides the principal resistance to air leakage.

Research and in-situ testing of installed air barrier systems have shown that the bulk of air leakage occurs through joints (between air barrier materials) and junctions (between air barrier components).

Ideally, a maximum air leakage rate for the complete air barrier system would be specified. The maximum acceptable rate will ultimately depend on warm and cold side temperatures and humidity conditions, and on the susceptibility of the environmental separator to moisture-related deterioration. Recommended maximum leakage rates for the air barrier system in an exterior envelope in most locations in Canada are shown in Table A-5.4.1.2.(1) and (2). These values are for air barrier systems in opaque, insulated portions of the building envelope. They are not for whole buildings, as windows, doors and other openings are not included. The Table is provided for guidance when testing air barrier systems as portions of an envelope.

Table A-5.4.1.2.(1)
Recommended Maximum Air Leakage Rates
Forming Part of Note A-5.4.1.2.(1) and (2)

Warm Side Relative Humidity at 21°C	Recommended Maximum System Air Leakage Rate, L/(s·m^2) at 75 Pa
< 27%	0.15
27% to 55%	0.10
> 55%	0.05

Determining the leakage rate of a particular assembly, however, is problematic. There is little information available on the airtightness of the many air barrier systems used in building construction, and testing requires specialized equipment and expertise. Depending on the type of test,

- testing may not represent the performance of the complete installed system,
- the location of deficiencies may be difficult to identify, and
- rectification of deficiencies may not be feasible.

Despite the difficulties, when using a system whose performance is not known, it is recommended that tests be conducted. Testing options include:

- laboratory tests of small sections of the air barrier system, including the joints and intersections of different assemblies
- laboratory tests of large wall sections
- in-situ tests of characteristic envelope areas.

A-5.5.1.1. Required Resistance to Vapour Diffusion. Resistance to vapour diffusion is required to reduce the likelihood of condensation within building assemblies, and the consequent potential for material deterioration and fungal growth. Deterioration such as rot and corrosion can lead to the failure of building components and connections, and interfere with the performance of building services. Some fungi can have very serious effects on health.

In Canada, relatively few buildings that are subject to temperature and vapour pressure differences would be constructed or operated in such a manner that the control of vapour diffusion would not need to be addressed in their design. Assemblies enclosing certain industrial spaces, as described in Note A-5.4.1.1. for example, may be exempt.

For residential spaces, and most other spaces that are conditioned for human occupancy, a means of vapour diffusion control is generally agreed to be necessary, even in the milder climates of the province. The questions in those cases pertain to the degree of control needed.

The word “minimize” is used in Sentence 5.5.1.1.(1) because not all moisture accumulation in an assembly need be of concern. Incidental condensation is normal but should be sufficiently rare and in sufficiently limited quantities, and should dry rapidly enough, to avoid material deterioration and the growth of mould or fungi. Here are some references regarding the effects of fungi on health:

- “Fungal Contamination in Public Buildings: Health Effects and Investigation Methods,” Health Canada
- “Guidelines on Assessment and Remediation of Fungi in Indoor Environments,” New York City Department of Health and Mental Hygiene (NYCDH)

A-5.5.1.2.(1) Vapour Barrier Materials and Installation. In the summer, many buildings are subject to conditions where the interior temperature is lower than the exterior temperature. Vapour transfer during these periods is from the exterior to the interior. In general, in Canada, the duration of these periods is sufficiently short, the driving forces are sufficiently low, and assemblies are constructed such that any accumulated moisture will dissipate before deterioration will occur.
Buildings such as freezer plants, however, may operate for much of the year at temperatures that are below the ambient exterior temperature. In these cases, the “warm” side of the assembly would be the exterior and a detailed analysis on an annual basis is required.
Steady state heat transfer and vapour diffusion calculations may be used to determine acceptable permeance levels for the vapour barrier and to identify appropriate positions for the vapour barrier within the building assembly.

A-5.6.1.1. Required Protection from Precipitation. Windows, cast-in-place concrete walls, and metal and glass curtain wall systems are examples of components and assemblies that, when properly designed and constructed, are expected to prevent the ingress of precipitation into a building. Assemblies such as roofs and veneer walls consist of materials specifically intended to screen precipitation.

Components and assemblies separating interior conditioned space from the exterior are generally required to provide protection from the ingress of precipitation. Components and assemblies separating interior unconditioned space from the exterior may or may not be required to provide protection from the ingress of precipitation. Buildings such as stadia, parking garages and some seasonally occupied buildings, for example, may not require complete protection from the ingress of precipitation. The degree of protection will depend to a large extent on the materials selected for the building elements that will be exposed to precipitation.

The word “minimize” is used in Sentence 5.6.1.1.(1) because not all moisture ingress or accumulation in an assembly need be of concern. The penetration of wind-driven rain past the cladding may not affect the long-term performance of the assembly, provided the moisture dries out or is drained away before it initiates any deterioration of building materials. When the design service life of a material or component is longer than the design service life of the overall assembly, taking into account the expected exposure to moisture, initiating deterioration of the material should not be of concern. That is to say, provided the material or component continues to provide the necessary level of performance for its intended service life and does not adversely affect the service life of the assembly of which it is a part, the deterioration of the material or component is not an issue.

A-5.6.1.2. Protective Material

Draining Moisture with Protective Materials

The City of Vancouver’s past experience has shown that it is virtually impossible to make face sealed walls work in the Vancouver climate, in anything beyond a very low exposure condition. The intent of Section 5.6. is to illustrate to the designer that a rainscreen design is the minimum acceptable option for vertical exterior envelope assemblies in Part 5 buildings. Where there is a slope in any element of the envelope, it should be considered a roof and treated accordingly.

Where the system is a mass wall construction type, and does not include a cladding, all joints between panels (and junctions to other elements such as windows) are required to be two-stage or rainscreen joints with an appropriate means to drain any accumulated moisture to the exterior.

Exterior Cladding over Structural Light Framing

Exterior cladding shall be installed over a cavity with all the necessary through wall flashings designed to drain accumulated moisture to the exterior, where the wall system incorporates exterior cladding over structural light wood or steel framing systems,. This cavity, a water shedding plane on the interior side of the cavity and a complete air barrier system to achieve pressure moderation, constitute the primary elements of a required rainscreen design. Compartmentalization of the cavity, in particular at corners, is required to achieve effective pressure moderation. Where the cladding material is stiffer than the supporting light frame structure, such as in a stucco application, the compartmentalization should include though wall flashing at each floor. The design of the cavity should minimize the potential for water to bridge across this gap and maximize the free air space.

While there is agreement on the need for a cavity, current research is not conclusive on the optimal width of a cavity to maximize drying potential, however a conservative approach would suggest that the widest allowable cavity would be prudent in this environment, where drying is an issue. As other Sections of this By-law limit a cavity in a wall to 25 mm before requiring fire stopping, a 19 mm (3/4”) cavity is the minimum width recommended which will satisfy this requirement, while still maximizing the drying potential for an assembly with insulation in the stud space. [See Clause 3.1.11.2.(2)(d)]

Where the envelope system employs a full membrane application on the outside of the sheathing and where all of the insulation is installed outboard, then the width of the cavity may be reduced, since the drying potential is not as critical in this configuration. Research has shown that a 10 mm gap is sufficient to prevent liquid water from bridging across a cavity. Therefore, a cavity width of 12 mm (1/2”) is the minimum recommended for this configuration, provided that the application of the cladding and the insulation is constructed so that the Building Envelope Professional can assure that this 12 mm (1/2”) gap can be maintained.

Exterior columns, beams, walkways, guardrails, or other elements, which do not form a direct continuation of the building enclosure, may not be required to be constructed as rainscreen assemblies. For this approach to be acceptable, these elements must be totally constructed with pressure treated lumber and sheathing (field treated at cuts and boltholes) or other durable materials, with corrosion resistant fasteners and be provided with proper ventilation.

Exterior Insulation Finish Systems
Subject to specific limitations, the required cavities in Exterior Insulation Finish Systems may be reduced in dimension provided they form part of a pressure moderated rainscreen system. This approach would not be acceptable where the application is over wood framing.

A-5.6.1.2.(1) Ice Damming. Water leakage through sloped roofs is often due to the formation of ice dams at the eaves, which can be limited by controlling the transfer of heat to the roof through a combination of insulation and venting to dissipate heat. See Clause 5.3.1.2.(1)(d).

A-5.6.1.2.(2) Vegetated Roofing Systems. The integrity of some assemblies installed to provide the required protection from the ingress of precipitation in vegetated roofing systems can be compromised due to an inadequate resistance to the penetration of plant roots and rhizomes. Additional information on vegetated roofing systems and the performance of protective materials can be found in the German Landscape Research, Development and Construction Society's (FLL) "Guidelines for the Planning, Construction and Maintenance of Green Roofing" and in the National Roofing Contractors Association's "Vegetative Roof Systems Manual."

A-5.6.1.2.(3) Flashings, Drips or Overhangs As the first principle for water management in a building envelope is deflection, the appropriate use of flashings, drips or overhangs is a critical part of any precipitation protection system. The 1996 CMHC survey of envelope failures in B.C. found a striking inverse relationship between the length of overhang, and the percentage of walls which experienced water induced problems. Roof overhangs perform a more complex function than that as a simple 'umbrella' shielding the wall below. Studies have shown that a large proportion of the precipitation incident on any building face will be deposited on an overhang at the top of a wall due to wind movement and water deposition patterns. If the overhang includes a means to shed this water, a large portion of the precipitation can be deflected without it ever touching the rest of the building face. Proper detailing and lapping of flashings with other materials is also critical to prevent the ingress of precipitation where there are changes in planes of walls and roofs, changes in cladding material, or window or door heads and sills.

Information on the installation of flashing to drain water to the exterior of roof or wall assemblies may be found in a number of publications including, but not limited to:
- "Roofing Practices Manual," Roofing Contractors Association of British Columbia
- "Best Practice Guide: Flashings," Canada Mortgage and Housing Corporation
- "Technical Notes," Masonry Institute of British Columbia
- "Architectural Sheet Metal Manual," Sheet Metal and Air-Conditioning Contractors National Association, Inc.

A-5.6.2.1. Sealing and Drainage. Providing a surface-sealed, durable, watertight cover on the outside of a building is difficult. Where there is a likelihood of some penetration by precipitation into a component or assembly, drainage is generally required to direct the moisture to the exterior.
The degree of protection against precipitation ingress needed in any particular case and the approach taken to provide that protection will depend on
- the exterior loads imposed on the assembly
- the materials selected for the backing assembly,
- the use of the enclosed space, and
- the level of maintenance that will be acceptable to the owners.

Where exterior loads are greater, it may be prudent to select a precipitation protection system whose small failures will not be as likely to have an immediate impact on the building or its occupants. For example, drained and vented wall and vented roof assemblies are typical for low-rise residential buildings. More robust drained and vented wall assemblies are recommended for mid- and high-rise buildings where the cost of maintenance and repair could be high.
Where materials with a greater resistance to moisture are used in the assembly, a less rugged precipitation protection system or a less rigorous maintenance schedule may be acceptable. This might be the case, for example, where the wall or backing wall is concrete or masonry.

For spaces that are not intended for ongoing human occupancy, some rainwater leakage may not be of particular concern. This may be the case for certain warehouse spaces for example, depending on how the spaces are used and conditioned.
Information on the installation of flashing to drain water to the exterior of roof and wall assemblies may be found in a number of publications including, but not limited to:

- “Architectural Sheet Metal Manual,” Sheet Metal and Air-Conditioning Contractors National Association, Inc.
- “High-Rise Residential Construction Guide,” Tarion Warranty Corporation (formerly Ontario New Home Warranty Program)
- Technical Notes, National Concrete Masonry Association
- Roofing Specifications, Canadian Roofing Contractors’ Association
- “The NRCA Roofing Manual: Membrane Roof Systems” and “The NRCA Waterproofing Manual,” National Roofing Contractors Association
- Technical Notes on Brick Construction, Brick Industry Association

Environmental separators installed in buildings of wood construction that exceed 4 storeys can be subjected to increased loading due to the height of the building. As such, certain design considerations may require different approaches from the common ones used by industry for buildings of 4 storeys or less. These considerations include, but are not limited to, the following:

- air barrier assemblies,
- fenestration selection,
- protection from precipitation,
- differential movement due to wood shrinkage,
- roofing selection and design, and
- risk of deterioration due to longer exposure of materials to the elements during construction.

Information on environmental separators and the loading to which they are subjected when installed in buildings of wood construction, as well as recommendations on dealing with differential movement, can be found in the following publications, among others:

- “Moisture and Wood-Frame Buildings,” Canadian Wood Council
- “Guide for Designing Energy-Efficient Building Enclosures for Wood-Frame Multi-Unit Residential Buildings in Marine to Cold Climate Zones in North America,” FPInnovations and RDH Building Engineering Ltd.

A-5.6.2.2.(5) Overflow Outlets Where a roof or balcony is entirely enclosed by parapet walls there is a likelihood of drains becoming obstructed with materials such as leaves falling during heavy autumn rains. It is recommended that a secondary means of drainage such as scuppers be provided. Overflow outlets should be installed in the parapet walls in sufficient number and at an appropriate height to drain the roof or balcony, to avoid water backing up into moisture sensitive assemblies, and to prevent structural collapse from ponding.

A-5.7. Protection from Interior Sources of Water. Protection similar to that prescribed in Section 5.7. may be required where interior assemblies are in contact with water (such as site-built showers, steam rooms, swimming pool areas) and where adjacent interior spaces need to be protected from the transfer of water through these assemblies.

A-5.7.1.2.(2) Drainage. Water should be directed away from the building and, ultimately, to a municipal drainage system, drainage ditch, swale, or other acceptable water management means. This can be accomplished by setting the building grade higher than the surrounding grades, by sloping the grade away from the building, by installing a surface water drainage system, or by a combination of these approaches. The chosen approach should follow generally accepted guidelines, such as the Rational Method of Stormwater Design by David B. Thompson, or other design methods acceptable to the Chief Building Official.

A-5.7.3.3.(1)(a) Imperfections. Examples of imperfections include shrinkage cracks, air holes, honeycombing, form-tie cone holes, and form joint ridges.

A-5.7.3.4.(1) Dampproofing. Dampproofing refers to the application of a material or materials to an environmental separation assembly to protect it and the interior space against the transfer of moisture due to the mechanisms of water vapour transmission, capillary action and pressure differences other than hydrostatic pressure.
A dampproofed assembly should be designed such that it can provide short-term resistance to the ingress of water due to occasional hydrostatic pressure from ground water.

A-5.8. Required Protection from Noise. Section 5.8. applies to the separation of dwelling units from other dwelling units and from spaces where noise may be generated with regard to sound transmission irrespective of Clause 5.1.2.1.(1)(b), which deals with the separation of dissimilar environments. It is understood that, at any time, there is the potential for sound levels to be quite different in adjoining dwelling units.

A-5.8.1.2. Using ASTC in lieu of STC. A designer may choose to use an ASTC rating of equal or higher numerical value than the required STC to show compliance where STC ratings are required.
An ASTC measurement or calculation will always yield a value equal to or lower than the STC for the same configuration, as the ASTC includes flanking transmission.

A-5.8.1.4. Methods of Calculating ASTC. The technical concepts, terminology, and calculation procedures relating to the detailed and simplified ASTC calculation methods are discussed in detail, with numerous worked examples, in the NRC publication entitled “Guide to Calculating Airborne Sound Transmission in Buildings.” This Guide includes references to readily-available sources of pertinent data.

For many common constructions, the calculations required by Article 5.8.1.4. can be performed using software tools, such as soundPATHS, which is available on NRC’s Web site.
The simplified calculation method may not always identify the prominent flanking paths. Furthermore, it corresponds more closely with the results of the detailed calculation method where the separating assembly and the flanking constructions are both constructed according to the same method, i.e. either both are lightweight construction (steel or wood framing) or both are heavyweight construction (masonry or concrete).

A-5.9.1.1.(1) Selection of Materials and Components and Compliance with Referenced Standards. It is important to note that Sentence 5.9.1.1.(1) is stated in such a way that the selection of materials and components is not limited to those traditionally recognized as serving particular functions or those for which a standard is identified in Table 5.9.1.1. This approach permits more flexibility than is provided by similar requirements in Part 9. As long as the selected material meets the performance requirements stated elsewhere in Part 5, the material may be used to serve the required function.
However, where the selected material or component, or its installation, falls within the scope of any of the standards listed in Table 5.9.1.1., the material, component or installation must comply with that standard. For example, if some resistance to heat transfer is required between two interior spaces and standard partition construction will provide the necessary resistance, the installation of one of the “thermal insulation” materials identified in the standard list is not

required. If, on the other hand, one decides to install glass fibre insulation, the material must conform to CAN/ULC-S702, “Mineral Fibre Thermal Insulation for Buildings.”

A-Table 5.9.1.1. Selection and Installation of Sealants. Analysis of many sealant joint failures indicates that the majority of failures can be attributed to improper joint preparation and deficient installation of the sealant and various joint components. The following ASTM guidelines describe several aspects that should be considered when applying sealants in unprotected environments to achieve a durable application:

- ASTM C 1193, “Use of Joint Sealants,”
- ASTM C 1299, “Selection of Liquid-Applied Sealants,” and
- ASTM C 1472, “Calculating Movement and Other Effects When Establishing Sealant Joint Width.”

The sealant manufacturer’s literature should always be consulted for recommended procedures and materials.

A-5.9.2.1.(3) Airtightness and Watertightness of Windows, Doors, Skylights, Other Glazed Products and their Components Required to have a Fire-Protection Rating. The airtightness and watertightness requirements are waived for these products when used in such an application, in recognition of the fact that the availability of assemblies that meet both the requirements of the applicable standards and the requirements for fire resistance may be limited. However, control of air and water leakage should not be ignored: measures should be taken to attempt to comply with applicable requirements.

A-5.9.2.2. Design and Construction of Windows, Doors and Skylights.

Design Values

CSA A440S1, “Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights,” requires that the individual performance levels achieved by the product for structural resistance, water penetration resistance and air leakage resistance be reported on the product’s performance label.

Storm Doors and Windows

Where storm doors and storm windows are not incorporated in a rated window or door assembly, they should be designed and constructed to comply with the applicable requirements of Part 5 regarding such properties as appropriate air leakage and structural loads.

Forced Entry Test

Even though the performance label on rated windows, doors and skylights does not explicitly indicate that the product has passed the forced entry resistance test, products are required to pass this test in order to be rated.

Installation and Field Testing of Windows, Doors and Skylights

The installation details of windows, doors, skylights and their components must be appropriately designed and implemented for the building envelope assembly to perform acceptably overall. The proper design of the installation details provides the information necessary to integrate the structure and air, vapour and moisture barrier functions of windows, doors and skylights into the overall design of the building envelope assembly. Construction should be carried out in accordance with these details to achieve an appropriate level of long-term performance. Further guidance on installation detailing can be found in CAN/CSA-A440.4, “Window, Door, and Skylight Installation.”

It is recommended that the performance of installed windows, doors and skylights be field tested early in the envelope construction phase so that any discontinuities can be readily identified and corrected before construction of the building envelope assembly is completed. Additional field testing during subsequent construction phases to monitor installation consistency is also recommended. Field test procedures should be carried out in accordance with test standards such as ASTM E 783, “Field Measurement of Air Leakage

Through Installed Exterior Windows and Doors," and ASTM E 1105, "Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference." Further guidance can be found in Annex D of CAN/CSA-A440.4, "Window, Door, and Skylight Installation," however, the performance requirements developed in AAMA/WDMA/CSA 101/I.S.2/A440, "NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights," should be used rather than the industry performance data values listed in CAN/CSA-A440.4.

A-5.9.2.2.(1) Two Compliance Paths. It is intended that any fenestration product that conforms to this Part may choose to comply with either Clause (a) or Clause (b) of Sentence 5.9.2.2.(1). Even if a product is in scope of the standards referenced via Clause (b) (NAFS and the Canadian Supplement to NAFS), the compliance path in Clause (a) may be used. However, it is not intended that the compliance path in Clause (b) be used where fenestration products are not within the scope of the referenced standards.

A-5.9.2.2.(2) Other Glazed Products. Glazed products such as curtain walls or sloped glazing that are not typically considered windows but are installed as part of a separation described in Sentence 5.9.2.1.(1) are not within the scope of the referenced standards and therefore must conform to Subsection 5.1.4. and Sections 5.3., 5.4. and 5.6. The following are considered to be "other glazed products":

Curtain Wall
A curtain wall is considered to be a continuous wall cladding assembly (which may include fenestration and opaque portions) that is hung away from the edge of the primary floor structure. Curtain wall assemblies do not generally support vertical loads other than their own weight. Anchorage is typically provided by anchors that connect back to the floor structure. Curtain wall assemblies can be either "stick built," meaning each main unit is assembled on-site, or a "unitized" system, meaning factory-assembled main units are installed and connected together on-site.

Window Wall
A window wall is considered to be a wall cladding assembly (which may include fenestration and opaque portions) that spans from the top of a primary floor structure to the underside of the next higher primary floor structure. Window wall assemblies do not generally support vertical loads other than their own weight. Primary provision for anchorage occurs at head and sill connections with the adjoining floor structure. Window wall assemblies may include separate or integral floor edge covers.

Storefront
A storefront is considered to be a non-residential assembly (which may include fenestration and opaque portions) consisting of one or more elements that could include doors, windows and curtain wall framing. Storefronts do not generally support vertical loads other than their own weight. Storefront profiles are typically narrow, rectilinear framing members that hold a combination of pocket glazing and applied glazing stops to securely retain the infills. Vertical framing members typically span the height of one floor or are retained within a structural punched opening.

Storefront assemblies are designed/selected to take into account the anticipated service and exposure conditions, which may be different than those for other portions of the building.

Glazed Architectural Structures
Glazed architectural structures are considered glazing assemblies that are supported in a non-traditional manner, such as corner-clamped, point-supported, linear-supported and edge-clamped glazing. Structural support systems can include, but are not limited to, tension cables, tension rods, steel and glass. Glazed architectural structures do not generally support vertical loads other than their own weight. These assemblies are designed/selected to take into account the anticipated service and exposure conditions, which may be different than those for other portions of the building.

Skylights that are not covered by AAMA/WDMA/CSA 101/I.S.2/A440, “NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights,” are considered glazed architectural structures.

Testing of Other Glazed Products
Although other glazed products are generally not within the scope of the standards referenced in Clause 5.9.2.2.(1)(b), they can be tested using other standards such as:

- AAMA 501, “Test for Exterior Walls,”
- AAMA 501.1, “Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure,”
- AAMA 501.2, “Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems,”
- AAMA 501.4, “Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts,”
- AAMA 501.5, “Thermal Cycling of Exterior Walls,” and
- AAMA 501.6, “Recommended Dynamic Test Method For Determining The Seismic Drift Causing Glass Fallout From A Wall System.”
- ASTM E 283, “Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.”
- ASTM E 330/E 330M, “Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.”
- ASTM E 331, “Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.”
- ASTM E 547, “Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference.”
- ASTM E 783, “Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.”
- ASTM E 1105, “Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.”

Water Penetration
Notwithstanding that other glazed products are not covered under the testing scope of CSA A440S1, “Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights,” they may be tested at the driving rain wind pressure calculated in accordance with the procedure described therein.

Resistance to Condensation
Notwithstanding that other glazed products are not fully covered under the testing scope of CSA A440.2, “Fenestration Energy Performance,” the test method described therein can be used to evaluate their resistance to condensation, with technical modifications to accommodate differences in the size and configuration of the specimen. It is also common practice to use one cold cycle of AAMA 501.5, “Thermal Cycling of Exterior Walls,” to assess the potential for condensation. Both methods can be used for mock-ups in laboratory performance evaluations, however, only the test method in CSA A440.2 should be used if a Temperature Index is required. In most cases, the project specification documents establish the hygrothermal conditions (i.e., exterior temperature, interior temperature, interior relative humidity) for which the potential for condensation should be minimized. Under these conditions, the aforementioned test methods can be used to aid in the selection of the appropriate system performance to minimize the potential for interior surface condensation. In all cases, care should be taken in the construction and configuration of the specimen, as these parameters may have an impact on its thermal performance and resistance to condensation. These parameters may include, without limitation, interior wall construction and finishes, heating systems, ventilation systems, etc., to simulate the actual in-service conditions as closely as practicable.

Air Leakage Rate and Test Pressure
Air leakage rates and/or higher differential test pressure can be selected for specific applications of other glazed products where tight control of airflow is required to prevent interstitial condensation (e.g., in concealed spaces), improve thermal comfort (e.g., in hospitals, seniors' residences), or prevent the migration of airborne contaminants (e.g., in food and drug research, manufacturing applications, biological laboratories). It is typical of other glazed products to be used as the sole building envelope component; where this is the case, a correspondingly higher degree of airtightness may be required.

In addition, higher test pressure differentials can be used to evaluate assemblies with low air leakage, such as non-operable or fixed fenestration systems whose air leakage rates are not easily measurable at the lower standard pressure differentials.

A-5.9.2.2.(3) Loads and Procedures. For windows within the scope of the "Canadian Supplement" referred to in Sentence 5.9.2.2.(1), structural and wind loads are included and may be calculated in accordance with that standard. As an alternative, structural and wind loads from Section 5.2. may be used to select fenestration products that are appropriate for the point of installation. Values derived from the referenced standard, which uses a simplified calculation method, are typically higher than those derived from calculations done in conformance with Section 5.2.

A-5.9.2.4.(3) Heat Transfer through Fire-Rated Glazed Assemblies. Thermal bridging through fire-rated glazed assemblies should not be ignored; measures should be taken to minimize condensation consistent with the intent of Sentence 5.9.2.4.(2).

A-5.9.4.1.(1) Exterior Insulation Finish Systems (EIFS). The reference to CAN/ULC-S716.1, "Exterior Insulation and Finish Systems (EIFS) – Materials and Systems," in Clause 5.9.4.1.(1)(b) does not preclude the use of other component materials that may also meet the intent of the By-law. For example, using mineral-fibre insulation in lieu of other rigid insulation types, mechanical fastening methods for the insulation component in lieu of adhesive, or a type of water-resistive barrier other than a liquid-applied water-resistive barrier could be acceptable.

The following two companion standards facilitate the application of and conformance with CAN/ULC-S716.1:

- CAN/ULC-S716.2, "Exterior Insulation and Finish Systems (EIFS) – Installation of EIFS Components and Water Resistive Barrier," and
- CAN/ULC-S716.3, "Exterior Insulation and Finish System (EIFS) – Design Application."

Additional information on EIFS design and installation can be found in the EIFS Council of Canada's "EIFS Practice Manual" and the manufacturer's literature.

EIFS Selection
CAN/ULC-S716.1 provides minimum performance criteria for EIFS materials and systems that are tested under specific laboratory test protocols identified in the standard. However, compliance with this standard does not ensure that a system is appropriate for all projects. When selecting an EIFS product, designers should consider all relevant criteria – not only those covered by the tests in CAN/ULC-S716.1 – including, but not limited to,

- building exposure
- local climate characteristics (wind, precipitation, temperature variations, solar exposure)
- intended building use
- intended resistance to damage and deterioration
- construction tolerances
- constructability

Design and Construction of EIFS Drainage Cavity

The drainage capacity and thermal performance of the EIFS assembly can be affected by the dimensions and configuration of the EIFS drainage cavity.

EIFS are installed over other building materials such as sheathing and primary structural components, which have various construction installation tolerances. Designers should take into consideration the cumulative effects of construction tolerances and sequencing when specifying the drainage method and the cavity dimensions and configuration in order to ensure adequate drainage.

Designers should also take into account the impact of air movement, which varies depending on cavity size and the extent of venting, on the EIFS' thermal performance when reviewing the overall thermal performance of the building envelope. ASTM C 1363, "Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus," presents one method for assessing the thermal performance of assemblies.

Where an Exterior Insulation Finish System (EIFS) is used, design review and enhanced field review is required to be conducted by a Building Envelope Professional who has specialized training and experience with EIFS. The professional is required to review the project specific design, and confirm that the whole system including the required thermal expansion/contraction joints, joints around doors or windows, or any other penetrations of the finish will allow for drainage back to the exterior, without reliance on surface sealing. The professional is also responsible for reviewing the pressure moderating system including compartmentalization, vent location, sizing, and confirming the required stiffness of the substrate, using calculations based on the manufacturer's data or by testing demonstrating that sufficient pressure equalization has been achieved as defined by the Institute for Research in Construction, Construction Technology Update No. 17; "Pressure Equalization in Rainscreen Wall Systems," July 1998.

The quality provisions of the CCMC Technical Guide for "Exterior Insulation and Finish Systems (EIFS) Class PB Masterformat Section 07240", Section 7.0 "Quality Assurance Program" must be adhered to. Buildings are required to be designed incorporating devices such as davit bases or other design elements, so that any required maintenance could be provided without causing undue damage to the EIFS.

Part 6
Heating, Ventilating and Air-conditioning

Section 6.1. General

6.1.1. Application

6.1.1.1. Scope

1) The scope of this Part shall be as described in Subsection1.3.3.of DivisionA.

6.1.1.2. Application

1) This Part applies to systems and equipment for heating, ventilating and air-conditioning services.

6.1.2. Reserved

6.1.3. Plans and Specifications

6.1.3.1. Required Plans and Specifications

1) Plans, specifications and other information for heating, ventilating and air-conditioning systems shall conform to Subsection2.2.6.of DivisionC.

Section 6.2. Planning

(See Part 10)

6.2.1. General

6.2.1.1. Good Engineering Practice

(See NoteA-6.2.1.1.)

1) Heating, ventilating and air-conditioning systems, including mechanical refrigeration equipment, shall be designed, constructed and installed in conformance with good engineering practice such as that described in, but not limited to,

a) the ASHRAE Handbooks and Standards,
b) the HRAI Digest,
c) the Hydronics Institute Manuals,
d) the NFPA Standards,
e) the SMACNA Manuals,
f) the Industrial Ventilation Manual published by the ACGIH,
g) CSA B214, "Installation Code for Hydronic Heating Systems,"
h) CAN/CSA-Z317.2, "Special Requirements for Heating, Ventilation, and Air-Conditioning (HVAC) Systems in Health Care Facilities," and
i) EPA 625/R-92/016, "Radon Prevention in the Design and Construction of Schools and Other Large Buildings."

6.2.1.2. Outdoor Design Conditions

1) The outdoor conditions to be used in designing heating, ventilating and air-conditioning systems shall be determined in conformance with Subsection1.1.3.

2) Reserved.

3) Reserved.

6.2.1.3. Expansion, Contraction and System Pressure

1) Heating and cooling systems shall be designed to allow for expansion and contraction of the heat transfer fluid and to maintain the system pressure within the rated working pressure limits of all components of the system.

6.2.1.4. Structural Movement

(See NoteA-6.2.1.4.)

1) Mechanical systems and equipment shall be designed and installed to accommodate the maximum relative structural movement provided for in the construction of the *building*.

6.2.1.5. Installation Standards

1) Except as provided in Articles6.9.4.2. and 6.3.1.5., the installation of heating and air-conditioning equipment, including mechanical refrigeration equipment, and including provisions for mounting, clearances and air supply, shall conform to

- a) **Reserved**,
- b) the Safety Standards Act and the following of its regulations:
  - i) the Gas Safety Regulation,
  - ii) the Electrical Safety Regulation, and
  - iii) the Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation,
- c) CSA B139, “Installation Code for Oil-Burning Equipment,” and
- d) CSA B365, “Installation Code for Solid-Fuel-Burning Appliances and Equipment.”
- e) **Reserved**,
- f) **Reserved**.

2) For the purposes of Clause (1)(c), a solid-fuel burning boiler accepted for use under section 10 of the Safety Standards Act satisfies section 3.1 of CAN/CSA-B365, “Installation Code for Solid-Fuel-Burning Appliances and Equipment.”

6.2.1.6. Installation – General

1) Equipment requiring periodic maintenance and forming part of a heating, ventilating or air-conditioning system shall be installed with provision for access for inspection, maintenance, repair and cleaning. (SeeNoteA-6.2.1.6.(1).)

2) Mechanical equipment shall be provided with guards so as to prevent injury.

3) Heating, ventilating or air-conditioning systems shall be protected from freezing if they may be adversely affected by freezing temperatures.

6.2.1.7. Asbestos

1) Asbestos shall not be used in HVAC systems and equipment.

6.2.2. Incinerators

6.2.2.1. Applicable Standard

1) The design, construction, installation and *alteration* of every indoor incinerator shall conform to NFPA82, “Incinerators and Waste and Linen Handling Systems and Equipment.”

6.2.3. Solid Fuel Storage

6.2.3.1. Solid Fuel Storage Bins

1) A storage bin for solid fuel shall not be located above a sewer opening or drain opening.

2) Storage bins for solid fuel shall be designed and constructed so that the air temperature in the bin or the surface temperature of any part of the floor or walls is below 50°C.

Section 6.3. Ventilation Systems

6.3.1. Ventilation

6.3.1.1. Required Ventilation

1) Except as provided in Sentence(3), all *buildings* shall be ventilated in accordance with this Part.
2) Except in *storage garages* covered by Article6.3.1.4., the rates at which outdoor air is supplied in *buildings* by ventilation systems shall be not less than the rates required by ANSI/ASHRAE 62, "Ventilation for Acceptable Indoor Air Quality" (except Addendum n).
3) Self-contained heating-season mechanical ventilation systems serving only one *dwelling unit* shall complywith

a) this Part, or
b) Subsection9.32.3.

4) For *suites* in *buildings* conforming to Subsection 10.2.2.5., the outdoor air required by Sentence (2) shall be supplied directly to each suite by mechanical ventilation through ducting.
(See Note A-6.3.1.1.(4).)

6.3.1.2. Crawl Spaces and Attic or Roof Spaces

1) Unconditioned and unoccupied crawl spaces and unconditioned and unoccupied *attic or roof spaces* shall be ventilated by natural or mechanical means as required by Part5. (See NoteA-6.3.1.2.(1).)

6.3.1.3. Natural Ventilation

1) Except as permitted by Sentence(2) and except as required by Sentence 6.3.1.1.(4), the ventilation required by Article6.3.1.1. shall be provided by mechanical ventilation, except that it can be provided by natural ventilation or a combination of natural and mechanical ventilation in

a) *buildings* of other than *residential occupancy* having an *occupant load* of not more than one person per 40m^2 during normal use,
b) *buildings* of *industrial occupancy* where the nature of the processes contained therein permits or requires the use of large openings in the *building* envelope even during the winter, and
c) seasonal *buildings* not intended to be occupied during the winter.

2) Where climatic conditions permit, *buildings* containing *occupancies* other than *residential occupancies* may be ventilated by natural ventilation methods in lieu of mechanical ventilation where engineering data demonstrates that such a method will provide the required ventilation for the type of *occupancy*.

6.3.1.4. Ventilation of Storage Garages

1) Except as provided in Sentences(4) and(6), an enclosed *storage garage* for five or more motor vehicles shall have a mechanical ventilation system designed to

a) limit the concentration of carbon monoxide to not more than 100parts per million parts of air,
b) limit the concentration of nitrogen dioxide to not more than 3parts per million parts of air, where the majority of the vehicles stored are powered by diesel-fuelled engines, or
c) provide, during operating hours, a continuous supply of outdoor air at a rate of not less than 3.9L/s for each square metre of floor area (See Article3.3.1.20.).

(See also Sentence3.3.5.4.(4).) (See NoteA-6.3.1.4.(1).)
2) Mechanical ventilation systems provided in accordance with Clause(1)(a) shall be controlled by carbon monoxide monitoring devices, and systems provided in accordance with Clause(1)(b) shall be controlled by nitrogen dioxide or other acceptable monitoring devices. (See NoteA-6.3.1.4.(2).)
3) Mechanical ventilation systems provided in accordance with Sentence(1) shall be designed such that the pressure in the *storage garage* is less than the pressure in adjoining *buildings* of other *occupancy*, or in adjacent portions of the same *building* having a different *occupancy*.

4) In *storage garages* subject to the requirements of Sentences(1) and(2), where motor vehicles are parked by mechanical means, the ventilation requirements may be reduced by one half.
5) Except as provided in Sentence(6), ticket and attendant booths of *storage garages* shall be pressurized with a supply of uncontaminated air.
6) The requirements of Sentences(1) to(5) shall not apply to *open-air storeys* in a *storage garage*.

6.3.1.5. Heat Recovery Ventilators

1) Heat recovery ventilators with rated capacities of not less than 25L/s and not more than 200L/s shall be installed in accordance with Subsection9.32.3.

6.3.1.6. Indoor Air Contaminants

(See NoteA-6.3.1.6.)
1) Air contaminants of concern that are released within *buildings* shall
- a) be removed insofar as is possible at their points of origin, and
- b) not be permitted to accumulate in concentrations greater than those permitted by applicable by-laws or regulatory enactments or, in the absence of such requirements, by good engineering practice such as that described in the publications listed in Sentence6.2.1.1.(1), measured using the methodology describedtherein.

2) Systems serving spaces that contain sources of contamination and systems serving other occupied parts of the *building* but located in or running through spaces that contain sources of contamination shall be designed in such a manner as to prevent the spread of such contamination to other occupied parts of the *building*.
3) Heating, ventilating and air-conditioning systems shall be designed to minimize the growth and spread of bio-contaminants.

6.3.1.7. Commercial Cooking Equipment

1) Except as provided in Sentences (2) and (3), Article 3.6.3.1. and Article3.6.3.5., systems for the ventilation of commercial cooking equipment shall be designed, constructed and installed to conform to NFPA96, “Ventilation Control and Fire Protection of Commercial Cooking Operations.”
2) The exhaust from a commercial cooking unit shall discharge through an ecology unit or *acceptable* equipment complying with Sentence (4), where the exterior wall termination of the exhaust is within 3 m of a *lane*, property line or street property line. (See Note A-6.31.7.(2).)
3) The exhaust from a commercial cooking unit which is discharged from an exterior wall termination shall not
- a) be discharged in a location or manner which causes a concentrated stream of air to fall directly onto pedestrians,
- b) be discharged in a location or manner which causes exhaust to accumulate in an area with outdoor seating, and
- c) generate a sound pressure level which exceeds noise levels permitted by the Noise Control By-law.

(See Note A-6.3.1.7.(3).)
4) Equipment provided in compliance with Sentence (3) shall
- a) remove 99.97% of the grease entering the equipment,
- b) be of continuously welded 1.5 mm thick carbon steel or 1.1 mm stainless steel,
- c) prevent the leakage of flame, smoke, or grease from the equipment at normal or abnormal temperatures,
- d) limit the temperature rise of adjacent combustible materials to no more than 97°C above room temperature, and
- e) limit the temperature of exhaust air at the exhaust outlet to no more than 138°C.

(See Note A-6.3.1.7.(4).)

6.3.2. Air Duct Systems

6.3.2.1. Application

1) This Subsection applies to the design, construction and installation of air duct distribution systems serving heating, ventilating and air-conditioning systems other than those in *dwelling units* covered by Part9.

6.3.2.2. Drain Pans

1) Dehumidifying cooling coil assemblies and condensate-producing heat exchangers shall be equipped with drain pans beneath them that are

a) designed in accordance with Section 5.11, Drain Pans, of ANSI/ASHRAE 62.1, "Ventilation for Acceptable Indoor Air Quality,"

b) provided with an outlet that is piped to the outside of the airstream in a location where condensate can be eliminated, and

c) installed so that water drains freely from the pan.

6.3.2.3. Materials in Air Duct Systems

1) All ducts, duct connectors, associated fittings and *plenums* used in air duct systems shall be constructed of materials as described in Article3.6.5.1.

2) Ducts that are used in a location where they may be subjected to excessive moisture shall have no appreciable loss of strength when wet and shall be resistant to moisture-induced corrosion.

3) All ductwork and fittings shall be constructed and installed as recommended in SMACNA Manuals and ASHRAE Standards.

4) All duct materials shall be suitable for exposure to the temperature and humidity of the air being carried and shall be resistant to corrosion caused by contaminants in the air being conveyed in the duct.

6.3.2.4. Connections in Air Duct Systems

1) Air duct systems shall have tight-fitting connections throughout.

6.3.2.5. Duct Coverings and Linings

(See NoteA-6.3.2.5.)

1) Coverings, linings and associated adhesives and insulation used in air ducts, *plenums* and other parts of air duct systems shall comply with Article3.6.5.4.

2) Duct linings shall be installed so that they will not interfere with the operation of volume or balancing dampers or of *fire dampers*, *fire stop flaps* and other *closures*.

6.3.2.6. Clearance of Ducts and Plenums

1) The clearance of ducts and *plenums* from *combustible* materials shall comply with Article3.6.5.6.

6.3.2.7. Interconnection of Systems

1) In a *care* or *residential occupancy*, air from one *suite* shall not be circulated to any other *suite* or to a *public corridor*.

2) Except as permitted by Sentences(3) and6.3.2.10.(6), air duct systems serving *storage garages* shall not be directly interconnected with other parts of the *building*.

3) *Exhaust ducts* referred to in Sentence6.3.2.10.(10) are permitted to exhaust through an enclosed *storage garage* prior to exhausting to the outdoors, provided

a) the *storage garage*'s exhaust system runs continuously,

b) the capacity of the *storage garage*'s exhaust system is equal to or exceeds the volume of the exhaust entering the garage, and

c) a leakage rate 1 smoke/*fire damper* rated in accordance with CAN/ULC-S112.1, "Leakage Rated Dampers for Use in Smoke Control Systems," is provided near the duct outlet location in the *storage garage* to prevent air from the *storage garage* from entering the exhaust ductwork system in the event the *building's* exhaust fan is shut down.

6.3.2.8. Makeup Air
(See NoteA-6.2.1.1.)
1) In ventilating systems that exhaust air to the outdoors, provision shall be made for the admission of a supply of makeup air in sufficient quantity so that the operation of the exhaust system and other exhaust equipment or combustion equipment is not adversely affected.
2) Makeup air facilities required by Sentence(1) shall be interlocked with the exhaust devices they serve so that both operate together.
3) Where makeup air facilities are intended to introduce air directly from the outdoors to occupied parts of the *building* in winter, they shall incorporate means of tempering that air to maintain the indoor design temperature.

6.3.2.9. Supply, Return, Intake and Exhaust Air Openings
1) Supply, return and exhaust air openings located less than 2m above the floor in rooms or spaces in *buildings* shall be protected by grilles having openings of a size that will not allow the passage of a 15mm diameter sphere.
2) Outdoor air intakes shall be located so that
a) the quality of the air entering the *building* complies with Sentences6.2.1.2.(2) and(3), and
b) they are separated a minimum distance from sources of contaminants in accordance with Table6.3.2.9.

Table 6.3.2.9.
Minimum Distances of Air Intakes from Sources of Contaminants
Forming Part ofSentence6.3.2.9.(2)

Source of Contaminants	Minimum Distance of Outdoor Air Intake, m
Garage entry of a garage for 5 or more motor vehicles, automobile loading area and drive-in queue	4.5
Truck loading area or dock, and bus parking	7.6
Driveway, street, and parking space	1.5
Thoroughfare, arterial road, freeway, and highway	7.6
Garbage storage/pick-up area and dumpsters	4.5
Discharge from evaporative cooling tower, evaporative fluid cooler and evaporative condenser	7.6
Sanitary vent	3.5
Kitchen cooking exhaust	3.0
Vent for combustion products	3.0

3) Outdoor air intakes shall be installed not less than 0.3m above roofs, landscape grades or other surfaces, taking into account anticipated snow accumulation levels.
4) Exterior openings for outdoor air intakes and exhaust outlets shall be shielded from the entry of snow and rain and shall be fitted with corrosion-resistant screens of mesh having openings not larger than 15mm,

except where experience has shown that climatic conditions require larger openings to prevent the screen openings from icing over.
5) Screens required in Sentence(4) shall be accessible for maintenance.
6) *Combustible* grilles, diffusers and other devices covering supply, return, intake and exhaust openings shall comply with Article3.6.5.7.

6.3.2.10.Exhaust Ducts and Outlets

1) Except as provided in Sentence(2), exhaust ducts of non-mechanical ventilating systems serving separate rooms or spaces shall not be combined.
2) *Exhaust ducts* of non-mechanical ventilating systems serving similar *occupancies* may be combined immediately below the point of final delivery to the outdoors, such as at the base of a roof ventilator.
3) *Exhaust ducts* of ventilating systems shall have provision for the removal of condensation where this may be aproblem.
4) Exhaust outlets shall be designed to prevent backdraft under wind conditions.
5) Except as permitted in Sentence(6), exhaust systems shall discharge directly to the outdoors. (See NoteA-6.3.2.10.(5) and (6).)
6) Exhaust systems are permitted to exhaust into a *storage garage*, provided
- a) they serve rooms that are accessible only from that *storage garage*,
- b) the exhaust contains no contaminants that would adversely affect the air quality in the *storage garage* (SeeNoteA-6.3.2.10.(6)(b).), and
- c) they are designed in accordance with Sentence6.3.2.7.(3).

(See NoteA-6.3.2.10.(5) and (6).)
7) *Exhaust ducts* connected to laundry-drying equipment shall be
- a) independent of other *exhaust ducts*,
- b) accessible for inspection and cleaning, and
- c) constructed of a smooth corrosion-resistant material.

(See NoteA-6.3.2.10.(7) and (8).)
8) Where collective venting of multiple installations of laundry-drying equipment is used, the ventilation systemshall
- a) be connected to a common *exhaust duct* that is vented by one central exhaust fan and incorporates one central lint trap,
- b) include an interlock to activate the central exhaust fan when laundry-drying equipment is in use, and
- c) be provided with make-up air.

(See NoteA-6.3.2.10.(7) and (8).)
9) *Exhaust ducts* or vents connected to laundry-drying equipment shall discharge directly to the outdoors.
10) Except as provided in Sentence(12) and except for self-contained systems serving individual *dwelling units*, *exhaust ducts* serving rooms containing water closets, urinals, basins, showers or slop sinks shall be independent of other *exhaust ducts*.
11) Except as provided in Sentence(12) and except for self-contained systems serving individual *dwelling units*, *exhaust ducts* serving rooms containing residential cooking equipment shall be independent of other *exhaust ducts*.
12) Two or more exhaust systems described in Sentences(10) and(11) may be interconnected or connected with *exhaust ducts* serving other areas of the *building*, provided
- a) the connections are made at the inlet of an exhaust fan, and all interconnected systems are equipped with suitable back pressure devices to prevent the passage of odours from one system to another when the fan is not in operation, or
- b) the *exhaust ducts* discharge to a shaft that is served by an exhaust fan having a capacity that is equal to or greater than the combined capacity of the exhaust fans discharging to the *plenum* multiplied by the operation diversity factor, provided that the exhaust fan serving the shaft operates continuously (See NoteA-6.3.2.10.(12)(b).).

13) Where *exhaust ducts* containing air from *conditioned spaces* pass through or are adjacent to unconditioned spaces, the ducts shall be constructed to prevent condensation from forming on the inside or outside of the ducts.

6.3.2.11. Return-Air System

1) Return-air systems shall comply with Article3.6.5.8.
2) Where a ceiling space is used as a return-air *plenum*, the requirements of Article3.6.4.3. shall apply.
3) A *public corridor* or *exit* shall not be used as a return-air *plenum*.

6.3.2.12. Underground Ducts

1) Underground ducts shall
a) be constructed and installed to provide interior drainage from and access to all low points,
b) not be connected directly to a sewer, and
c) be installed and constructed of materials recommended by ASHRAE and SMACNA Standards and HRAI Manuals.

2) A clean-out or pump-out connection shall be provided in an underground duct system at every low point of the duct system.

6.3.2.13. Filters

1) Air filters for air duct systems shall conform to the requirements for Class2 air filter units as described in CAN/ULC-S111, “Fire Tests for Air Filter Units.”
2) When electrostatic-type filters are used, they shall be installed so as to ensure that the electric circuit is automatically de-energized when filter access doors are opened or, in *dwelling units*, when the *furnace* circulation fan is not operating.

6.3.2.14. Reserved

6.3.2.15. Evaporative Cooling Towers, Evaporative Fluid Coolers and EvaporativeCondensers

1) Discharge from evaporative cooling towers to ventilation air intakes shall comply with
a) Sentence6.3.2.9.(2), and
b) CAN/CSA-Z317.2, “Special Requirements for Heating, Ventilation, and Air-Conditioning (HVAC) Systems in Health Care Facilities.”

2) The distance between the air intakes of evaporative cooling towers, evaporative fluid coolers and evaporative condensers in relation to kitchen exhaust outlets, vegetation or other sources of organic matter shall be not less than4.6m.
3) Deleted.
4) Water treatment equipment for biological growth control shall be provided in accordance with Sub-Section7.6.2. of ASHRAE Guideline12, “Minimizing the Risk of Legionellosis Associated with Building WaterSystems.”
5) Deleted.
6) Evaporative cooling towers, evaporative fluid coolers and evaporative condensers shall be provided with access ports, service platforms, fixed ladders and restraint connections to allow visual inspection, maintenance and testing.

6.3.2.16. Evaporative Air Coolers, Misters, Atomizers, Air Washers and Humidifiers

1) The filter and water evaporation medium of every air washer and evaporative air cooler enclosed within a *building* shall be made of *noncombustible* material.
2) Sumps for air washers and evaporative air coolers shall be constructed and installed so that they can be flushed and drained.

3) Evaporative air coolers, misters, atomizers, air washers and humidifiers shall be designed in accordance with Sections8 and 9 of ASHRAE Guideline 12, "Minimizing the Risk of Legionellosis Associated with Building WaterSystems."

6.3.2.17. Fans and Associated Air-Handling Equipment

1) Fans for heating, ventilating and air-conditioning systems shall be located and installed so that their operation

a) does not adversely affect the draft required for proper operation of fuel-fired *appliances*, and

b) does not allow the air in the duct system to be contaminated by air or gases from the *boiler* room or *furnace*room.

2) Fans and associated air-handling equipment, such as air washers, filters and heating and cooling units, when installed on the roof or elsewhere outside the *building*, shall be of a type designed for outdoor use.

6.3.2.18. Vibration Isolation Connectors

1) Vibration isolation connectors in air duct systems shall comply with Article3.6.5.2.

6.3.2.19. Tape

1) Tape used for sealing joints in air ducts, *plenums* and other parts of air duct systems shall comply with Article3.6.5.3.

6.3.3. Chimneys and Venting Equipment

6.3.3.1. Requirement for Venting

1) Except as provided in Articles6.3.3.2. and6.3.3.3., the products of combustion from oil-, gas- and solid-fuel-burning *appliances* shall be vented in conformance with the requirements in the applicable *appliance* installation standard listed in Article6.2.1.5.

2) Except as provided in Article6.2.1.5., vented products of combustion, other than those referred to in Sentence(1), shall be discharged away from the *building*, so as not to re-enter it, to a distance not less than

a) 2.15m above sidewalks and driveways,

b) 3m from outdoor air intakes,

c) 3m horizontally or vertically from doors and operable windows, and

d) 3m horizontally or vertically from occupiable outdoor spaces, excluding maintenance spaces.

(See NoteA-6.3.3.1.(2).)

6.3.3.2. Masonry or Concrete Chimneys

1) Rectangular *masonry or concrete chimneys* not more than 12m in height shall conform to Part9 if they serve

a) appliances with a combined total rated heat output of 120kW or less, or

b) fireplaces.

2) *Masonry or concrete chimneys* other than those described in Sentence(1) shall be designed and installed in conformance with the appropriate requirements in NFPA211, "Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances."

6.3.3.3. Metal Smoke Stacks

1) Single wall metal smoke stacks shall be designed and installed in conformance with NFPA211, "Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances."

6.3.3.4. Access Ladders

1) Access ladders for *chimneys*, when provided, shall consist of steel or bronze rungs, built into the walls of the *chimneys*.

2) Rungs for external ladders shall begin at not less than 2.5m from ground level.

6.3.4. Ventilation for Laboratories

6.3.4.1. Application

1) This Subsection applies to laboratories where *dangerous goods*, including *flammable liquids* and *combustible liquids*, are used in normal laboratory operations in quantities or in a manner that creates a fire or explosion hazard.

6.3.4.2. General Ventilation

1) A laboratory shall be provided with continuous mechanical ventilation designed to ensure that *dangerous goods* vapours and particles

a) do not accumulate in the laboratory,
b) are prevented from migrating to other parts of the *building*,
c) do not accumulate in the ventilation system,
d) are exhausted to the outdoors, and
e) are not returned to the *building*.

2) A ventilation system required by this Subsection shall be provided with monitoring devices to

a) indicate that the ventilation system is in operation, and
b) sound an alarm if the ventilation system is malfunctioning.

3) A ventilation system required by this Subsection shall be maintained in conformance with Article5.5.4.1. of DivisionB of the Fire By-law.

6.3.4.3. Enclosure Exhaust Ventilation

1) The ventilation system for a power-ventilated enclosure required by Sentence5.5.4.2.(1) of DivisionB of the Fire By-law shall

a) conform to NFPA91, “Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids,”
b) provide continuous exhaust ventilation at an air velocity sufficient to prevent the accumulation of *combustible* or reactive deposits in the power-ventilated enclosure and its *exhaust duct* system,
c) confine *dangerous goods* vapours and particles to the area where they are generated and exhaust them to the outdoors,
d) not return the exhausted air to the *building*, and
e) be provided with well identified control switches that are
  i) located outside of the power-ventilated enclosure, and
  ii) readily accessible in case of an emergency.

6.3.4.4. Enclosure Construction

1) The power-ventilated enclosure required by Sentence 5.5.4.2.(1) of DivisionB of the Fire By-law and its *exhaust duct* system shall

a) except as provided in Sentences(2) and(3), be constructed of *noncombustible* materials compatible with and chemically resistant to the *dangerous goods* vapours and particles being exhausted, and
b) be provided with access doors to permit inspection and maintenance of the fan assembly and *exhaust ducts*.

2) *Combustible* materials are permitted in systems described in Clause(1)(a) if

a) such materials are required by the corrosive or reactive properties of the *dangerous goods* being used, and
b) their *flame-spread rating* is not more than 25.

3) The *flame-spread rating* required by Sentence(2) is permitted to be greater than 25 if an automatic fire suppression system is provided inside the power-ventilated enclosure and its *exhaust duct* system.

Section 6.4. Heating Systems

6.4.1. Heating Appliances, General

6.4.1.1. Location of Appliances

1) Except for *appliances* installed in *dwelling units*, fuel-fired heating *appliances* shall be located, enclosed or separated from the remainder of the *building* in conformance with Section3.6. (Seealso Subsection9.10.10.)

6.4.1.2. Appliances Installed Outside the Building

1) Fuel-fired *appliances* installed outside a *building* shall be designed and constructed for outdoor use.

6.4.2. Unit Heaters

6.4.2.1. Clearances

1) Every *unit heater* using either steam or hot water as the heating medium shall be installed such that the clearances between the *appliance* and adjacent *combustible* material conform to Table6.7.1.2.

6.4.3. Radiators and Convectors

6.4.3.1. Lining or Backing

1) A *noncombustible* lining or backing shall be provided for every steam or hot water radiator and convector

a) located in a recess or concealed space, or

b) attached to the face of a wall of *combustible construction*.

2) Every steam or hot water radiator and convector shall be installed so as to conform to the clearance requirements of Table6.7.1.2.

Section 6.5. Thermal Insulation Systems

6.5.1. Insulation

6.5.1.1. Insulation and Coverings

(See NoteA-6.3.2.5.)

1) Insulation and coverings on pipes shall comply with Article3.6.5.5.

2) Insulation and coverings on pipes shall be composed of material that will withstand deterioration from softening, melting, mildew and mould at the operating temperature of the system.

3) Exposed piping or equipment subject to human contact shall be insulated so that the temperature of the exposed surface does not exceed 70°C. (See NoteA-6.5.1.1.(3).)

Section 6.6.Refrigeration and Cooling Systems

6.6.1. Refrigerating Systems and Equipment for Air-conditioning

6.6.1.1. Cooling Units

1) Where a cooling unit is combined with a fuel-fired *furnace* in the same duct system, the cooling unit shall be installed

a) in parallel with the heating *furnace*,

b) upstream of the *furnace* provided the *furnace* is designed for such application, or

c) downstream of the *furnace* provided the cooling unit is designed to prevent excessive temperature or pressure in the refrigeration system.

Section 6.7. Piping Systems

6.7.1. Piping for Heating and Cooling Systems

6.7.1.1. Piping Materials and Installation

1) Piping shall be made from materials designed to withstand the effects of temperatures and pressures that may occur in the system. (See Articles3.1.5.19.,3.1.9.1.,9.10.9.6. and9.10.9.7. for fire safety requirements.)
2) Every pipe used in a heating or air-conditioning system shall be installed to allow for expansion and contraction due to temperature changes.
3) Supports and anchors for piping in a heating or air-conditioning system shall be designed and installed to ensure that undue stress is not placed on the supporting structure.

6.7.1.2. Clearances

1) Clearances between *combustible* material and bare pipes carrying steam or hot water shall conform to Table6.7.1.2.

Table 6.7.1.2.
Clearance Between Steam or Hot Water Pipes and Combustible Material
Forming Part ofArticles6.4.2.1. and6.7.1.2., and Sentence6.4.3.1.(2)

Steam or Water Temperature, °C	Minimum Clearance, mm
Up to 95	No clearance
Above 95 to 120	15
Above 120	25

6.7.1.3. Surface Temperature

1) The exposed surface temperature of a steam or hot water radiator shall not exceed 70°C unless precautions are taken to prevent human contact. (See NoteA-6.5.1.1.(3).)

6.7.1.4. Protection

1) Where a pipe carrying steam or hot water at a temperature above 120°C passes through a *combustible* floor, ceiling or wall, the construction shall be protected by a sleeve of metal or other *noncombustible* material not less than 50mm larger in diameter than the pipe.

6.7.1.5. Piping in Shafts

1) Where piping for heating or air-conditioning systems is enclosed in a shaft, the requirements of Article3.6.3.1. for shafts shall apply.

6.7.2. Storage Bins

6.7.2.1. Storage Bins

1) Service pipes passing through a storage bin for solid fuel shall be protected or so located as to avoid damage to the pipes.
2) Except for fuel-thawing pipes, every pipe designed to operate at a temperature of 50°C or above shall be located where solid fuel cannot be stored in contact with it.

Section 6.8. Equipment Access

6.8.1. Openings

6.8.1.1. Access Openings

1) Any covering of an access opening through which a person could enter shall be openable from the inside without the use of keys where there is a possibility of the opening being accidentally closed while the system or equipment is being serviced.

6.8.1.2. Openings in Air Duct Systems

1) Air duct systems shall have no openings other than those required for the proper operation and maintenance of the system.
2) Access openings shall be provided in duct systems to allow the removal of material that may accumulate in *plenums* and ducts.

6.8.1.3. Odour Removal Equipment

1) When odour removal equipment of the adsorption type is used, it shall be
- a) installed to allow access so that adsorption material can be reactivated or renewed, and
- b) protected from dust accumulation by air filters installed on the inlet side.

2) Facilities for flushing and drainage shall be provided where filters are designed to be washed in place.

Section 6.9. Fire Safety Systems

6.9.1. General

6.9.1.1. Fire Safety Requirements

1) The fire safety characteristics of heating, ventilating and air-conditioning systems shall comply with Subsection3.6.5.
2) Characteristics referred to in Sentence(1) include but are not limited to
- a) use of *combustible* materials in duct systems,
- b) *flame-spread ratings* and smoke-developed ratings of duct and pipe materials and coverings,
- c) installation of equipment relative to property lines, and
- d) requirements for *fire dampers* and *fire stop flaps*.

6.9.1.2. Hazardous Gases, Dusts or Liquids

1) Except as provided in Subsection6.3.4., systems serving spaces that contain hazardous gases, dusts or liquids shall be designed, constructed and installed to conform to the requirements of the Fire By-law and all applicable by-laws or regulatory enactments or, in the absence of such requirements, to good engineering practice such as that described in the publications of the National Fire Protection Association. (SeeNoteA-6.9.1.2.(1).)
2) When indoor piping for ClassI *flammable liquids* is installed in a trench, the trench shall be
- a) provided with positive ventilation to the outdoors, or
- b) designed to prevent the accumulation of flammable vapours.

6.9.1.3. Commercial Cooking Equipment

1) Fire protection systems for commercial cooking equipment referred to in Sentence6.3.1.7.(1) using vegetable oil or animal fat shall conform to
- a) ANSI/UL 300, “Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment,” or
- b) ULC/ORD-C1254.6, “Fire Testing of Restaurant Cooking Area Fire Extinguishing System Units.”

6.9.2. Dampers and Ductwork

6.9.2.1. Fire Dampers

1) *Fire dampers* shall conform to Article3.1.8.10.

6.9.2.2. Smoke Detectors

1) Air handling systems shall incorporate *smoke detectors* where and as required by Article3.2.4.12.

6.9.2.3. Exhaust Ducts and Outlets

1) Where an *exhaust duct* system is used for smoke removal in a high *building*, the requirements of Article3.2.6.6. shall apply.

2) Where *exhaust duct* systems from more than one *fire compartment* are connected to an *exhaust duct* in a vertical service space, the requirements of Article3.6.3.4. shall apply.

6.9.2.4. Ducts in Exits

1) Where ducts penetrate *fire separations* separating *exits* from the remainder of the *building*, they shall be in accordance with Article3.4.4.4.

6.9.3. Carbon Monoxide Alarms

6.9.3.1. Carbon Monoxide Alarms

1) This Article applies to every *building* that contains a *residential occupancy*, a *care occupancy* with individual *suites*, or a *care occupancy* containing sleeping rooms not within a *suite*, and that also contains

a) a fuel-burning *appliance*, or

b) a *storage garage*.

2) Carbon monoxide (CO) alarms required by this Article shall

a) conform to CAN/CSA-6.19, "Residential Carbon Monoxide Alarming Devices,"

b) be equipped with an integral alarm that satisfies the audibility requirements of CAN/CSA-6.19, "Residential Carbon Monoxide Alarming Devices,"

c) have no disconnect switch between the overcurrent device and the CO alarm, where the CO alarm is powered by the electrical system serving the *suite* (See NoteA-6.9.3.1.(2)(c).), and

d) be mechanically fixed at a height above the floor as recommended by the manufacturer.

3) Where a fuel-burning *appliance* is installed in a *suite* of *residential occupancy* or in a *suite* of *care occupancy*, a COalarm shall be installed

a) inside each bedroom, or

b) outside each bedroom, within 5m of each bedroom door, measured following corridors and doorways.

4) Where a fuel-burning *appliance* is installed in a *service room* that is not in a *suite* of *residential occupancy* nor in a *suite* of *care occupancy*, a CO alarm shall be installed

a) either inside each bedroom, or if outside, within 5m of each bedroom door, measured following corridors and doorways, in every *suite* of *residential occupancy* or *suite* of *care occupancy* that shares a wall or floor/ceiling assembly with the *service room*, and

b) in the *service room*.

5) For each *suite* of *residential occupancy* or *suite* of *care occupancy* that shares a wall or floor/ceiling assembly with a *storage garage* or that is adjacent to an attic or crawl space to which the *storage garage* is also adjacent, a CO alarm shall be installed

a) inside each bedroom, or

b) outside each bedroom, within 5m of each bedroom door, measured following corridors and doorways.

6.9.4. Ash Storage

6.9.4.1. Ash Storage Bins

1) Every ash storage bin shall be constructed of *noncombustible* material.

2) Every opening in an ash storage bin shall be protected by a tight-fitting metal door with metal frame securely fastened to the bin.

6.9.4.2. Fireplaces

1) Fireplaces shall conform to the requirements of Section9.22.

Section 6.10. Objectives and Functional Statements

6.10.1. Objectives and Functional Statements

6.10.1.1. Attributions to Acceptable Solutions

1) For the purpose of compliance with this By-law as required in Clause1.2.1.1.(1)(b)of DivisionA, the objectives and functional statements attributed to the acceptable solutions in this Part shall be the objectives and functional statements listed in Table6.10.1.1. (See NoteA-1.1.2.1.(1).)

Table 6.10.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 6
Forming Part ofSentence6.10.1.1.(1)

Functional Statements and Objectives(1)	
6.2.1.1. Good Engineering Practice	
(1)	(a) to (e) [F31,F51-OP1.1]
	(a) to (c) and (e) to (i) [F40,F50,F51,F52,F54,F63-OH1.1]
	(a),(b),(c),(e),(f),(g),(h) [F50,F51,F52,F54,F63-OH1.2,OH1.3]
	[F31,F50,F51,F52,F54,F63-OS3.2,OS3.4]
	(d) [F01-OS1.1]
6.2.1.2. Outdoor Design Conditions	
(2)	[F40,F44,F50-OH1.1]
	[F44-OS3.4]
(3)	[F40,F44,F50-OH1.1]
	[F44-OS3.4]
6.2.1.3. Expansion, Contraction and System Pressure	
(1)	[F20-OS3.2]
6.2.1.4. Structural Movement	
(1)	[F23-OS3.1]
	[F51,F63,F50-OH1.1,OH1.2,OH1.3]

6.2.1.5. Installation Standards	
(1)	[F43-OS1.1]
	[F43-OS3.4]
	[F43-OP1.1]
6.2.1.6. Installation – General	
(1)	[F82-OS1.1]
	[F82-OS3.4]
	[F82-OP1.1]
(2)	[F31-OS3.1]
(3)	[F81-OS3.2,OS3.3,OS3.4]
	[F81-OS1.1]
6.2.1.7. Asbestos	
(1)	[F43-OH1.1]
6.2.2.1. Applicable Standard	
(1)	[F81-OS1.1]
6.2.3.1. Solid Fuel Storage Bins	
(1)	[F30-OH2.1]
(2)	[F01-OS1.1]
	[F01-OP1.1]
6.3.1.1. Required Ventilation	
(1)	[F50,F31,F63,F51,F54,F52-OS1.1]
	[F50,F31,F63,F51,F54,F52-OP1.1]
(2)	[F50-OH1.1]
(4)	[F50-OH1.1]
6.3.1.2. Crawl Spaces and Attic or Roof Spaces	
(1)	[F61,F63,F41-OH1.1,OH1.3]
6.3.1.3. Natural Ventilation	
(1)	[F50-OH1.1]
(2)	[F50-OH1.1]
6.3.1.4. Ventilation of Storage Garages	

(1)	[F50,F44-OS3.4]
(2)	[F44-OS3.4]
(3)	[F44-OS3.4]
(4)	[F50,F44-OS3.4]
(5)	[F50,F44-OH1.1]
	[F50,F44-OS3.4]
6.3.1.6. Indoor Air Contaminants	
(1)	[F44-OS3.4]
	[F44-OH1.1]
(2)	[F44-OH1.1]
(3)	[F52-OH1.1]
6.3.1.7. Commercial Cooking Equipment	
(1)	[F01,F44-OS1.1]
	[F01,F44-OP1.1]
(2)	[F44-OS1.1,OH5]
(3)	[F01,F44-OS1.1]
	[F01,F44-OP1.1]
	[F56-OH3]
6.3.2.2. Drain Pans	
(1)	[F41,F44,F50-OH1.1]
6.3.2.3. Materials in Air Duct Systems	
(2)	[F20,F80-OH1.1,OH1.2]
(3)	[F81,F44-OS3.4]
	[F81-OH1.1]
(4)	[F20,F80-OH1.1,OH1.2]
6.3.2.4. Connections in Air Duct Systems	
(1)	[F81-OH1.1,OH1.2]
	[F81,F44-OS3.4]
6.3.2.5. Duct Coverings and Linings	
(2)	[F81-OH1.1,OH1.2]

	[F81-OS1.1]
	[F81-OP1.1]
6.3.2.7. Interconnection of Systems	
(1)	[F44-OS1.1]
	[F40-OH1.1]
(2)	[F81,F44-OH1.1]
	[F81,F44-OS1.1]
	[F81,F44-OP1.1]
(3)	[F81,F44-OH1.1]
6.3.2.8. Makeup Air	
(1)	[F50,F81-OH1.1]
	[F44,F81-OS3.4]
(2)	[F81-OH1.1]
	[F81,F44-OS3.4]
(3)	[F81-OH1.2]
6.3.2.9. Supply, Return, Intake and Exhaust Air Openings	
(1)	[F30-OS3.1]
	[F81-OH1.2]
(2)	[F44,F81-OH1.1]
	[F81,F44-OS3.4]
(3)	[F44,F81-OH1.1]
	[F44,F81-OS3.4]
(4)	[F81-OH1.1]
(5)	[F82,F81-OH1.1]
	[F82-OS3.4]
6.3.2.10. Exhaust Ducts and Outlets	
(1)	[F44-OH1.1]
(2)	[F44-OH1.1]
(3)	[F81-OH1.1]
	[F81-OH1.2]

(4)	[F81-OH1.1]
	[F81-OH1.2]
(5)	[F81-OH1.1]
(6)	[F81-OH1.1]
(7)	[F81-OS1.1]
(8)	[F40,F44,F50,F52-OH1.1]
	[F01-OS1.1]
	[F01-OP1.1]
(9)	[F40,F44,F50,F52-OH1.1]
	[F01-OS1.1]
	[F01-OP1.1]
(10)	[F81-OH1.1]
(11)	[F81,F44-OH1.1]
	[F81,F44-OS1.1]
(12)	[F81,F44-OH1.1]
(13)	[F81-OH1.2]
	[F81,F44-OH1.1]
6.3.2.11. Return-Air System	
(3)	[F10-OS1.5]
6.3.2.12. Underground Ducts	
(1)	(a) [F44,F81-OH1.2,OH1.3]
	(b) [F44,F81-OH1.1]
	(c) [F44,F81-OH1.1]
(2)	[F81-OH1.1,OH1.2,OH1.3]
6.3.2.13. Filters	
(1)	[F80-OS1.1]
	[F80-OP1.1]
(2)	[F30-OS3.3]
	[F81,F43-OH1.1]
6.3.2.14. Cleaning Devices	

(1)	[F30-OS3.3]
	[F81,F43-OH1.1]
(2)	[F40,F43,F44,F50-OH1.1]
	[F44-OS3.4]
6.3.2.15. Evaporative Cooling Towers, Evaporative Fluid Coolers and Evaporative Condensers	
(1)	[F41,F44-OH1.1]
(2)	[F41,F44-OH1.1]
(3)	[F46,F81-OH2.2]
(4)	[F41,F44-OH1.1]
	[F46,F81-OH2.2]
(5)	[F81-OH2.1]
(6)	[F82-OH1.1]
6.3.2.16. Evaporative Air Coolers, Misters, Atomizers, Air Washers and Humidifiers	
(1)	[F80,F81-OS1.1]
	[F80,F81-OP1.1]
(2)	[F82-OH1.1]
(3)	[F44-OH1.1]
6.3.2.17. Fans and Associated Air-Handling Equipment	
(1)	[F81,F44-OH1.1]
	[F81,F44-OS3.4]
(2)	[F81-OH1.1]
6.3.3.1. Requirement for Venting	
(2)	[F40,F44,F50-OH1.1]
6.3.3.2. Masonry or Concrete Chimneys	
(2)	[F01-OS1.1]
	[F01-OP1.1]
6.3.3.3. Metal Smoke Stacks	
(1)	[F01-OS1.1]
	[F01-OP1.1]
6.3.3.4. Access Ladders	

(1)	[F20,F80-OS3.1]
(2)	[F30-OS3.1]
6.3.4.2. General Ventilation	
(1)	(a),(b),(d),(e) [F01-OS1.1]
	(c) [F02-OP1.2]
	(c) [F02-OS1.2] [F81,F82-OS1.1]
(2)	[F11,F81-OS1.1]
6.3.4.3. Enclosure Exhaust Ventilation	
(1)	(a),(c),(d) [F01-OS1.1]
	(b) [F02-OP1.2]
	(e) [F12-OP1.1,OP1.2]
	(a) [F02-OP1.2]
	(b) [F02-OS1.2] [F81-OS1.1]
	(e) [F12-OS1.1,OS1.2]
	(a) [F02-OS1.2]
	(a) [F01-OS1.1]
6.3.4.4. Enclosure Construction	
(1)	(a) [F02-OS1.2] Applies to portion of By-law text: "… be constructed of noncombustible materials …"
	(b) [F02-OP1.2]
	(a) [F02-OP1.2] Applies to portion of By-law text: "… be constructed of noncombustible materials …"
	(a) [F80-OS3.4] Applies to portion of By-law text: "… be constructed of … materials … chemically resistant to the dangerous goods vapours and particles being exhausted …"
	(b) [F02-OS1.2] [F82-OS1.1]
	(a) [F80-OS1.1] Applies to portion of By-law text: "… be constructed of … materials … chemically resistant to the dangerous goods vapours and particles being exhausted …"
	(a) [F01-OS1.1] Applies to portion of By-law text: "… be constructed of … materials compatible with … the dangerous goods vapours and particles being exhausted …"
(3)	[F02-OS1.2]
	[F02-OP1.2]
6.4.1.2. Appliances Installed Outside the Building	
(1)	[F81-OP1.1]

	[F81-OH1.1]
	[F81-OS1.1]
6.4.2.1. Clearances	
(1)	[F01-OP1.1]
	[F01-OS1.1]
6.4.3.1. Lining or Backing	
(1)	[F01-OS1.1]
	[F01-OP1.1]
(2)	[F01-OS1.1]
6.5.1.1. Insulation and Coverings	
(2)	[F20,F30-OS3.2,OS3.4]
(3)	[F31-OS3.2]
6.6.1.1. Cooling Units	
(1)	[F43,F81-OS3.4]
6.7.1.1. Piping Materials and Installation	
(1)	[F20-OS3.2,OS3.4]
(2)	[F21-OH1.1]
(3)	[F20-OS2.2]
6.7.1.2. Clearances	
(1)	[F01-OS1.1]
	[F01-OP1.1]
6.7.1.3. Surface Temperature	
(1)	[F31-OS3.2]
6.7.1.4. Protection	
(1)	[F01-OS1.1]
	[F01-OP1.1]
6.7.2.1. Storage Bins	
(1)	[F30,F31,F43-OS3.2,OS3.4]
(2)	[F01-OS1.1]
	[F01-OP1.1]

6.8.1.1. Access Openings	
(1)	[F36-OS3.6]
6.8.1.2. Openings in Air Duct Systems	
(1)	[F81-OH1.1,OH1.2]
	[F81,F44-OS3.4]
(2)	[F82-OS1.1]
6.8.1.3. Odour Removal Equipment	
(1)	[F82-OH1.1]
(2)	[F82-OH1.1]
6.9.1.2. Hazardous Gases, Dusts or Liquids	
(1)	[F01-OP1.1]
	[F01-OS1.1]
(2)	[F01-OS1.1]
	[F01-OP1.1]
6.9.1.3. Commercial Cooking Equipment	
(1)	[F02,F81-OS1.2]
	[F02,F81-OP1.2]
6.9.3.1. Carbon Monoxide Alarms	
(2)	(a),(b),(d) [F44-OS3.4] (c) [F81-OS3.4]
(3)	[F44-OS3.4]
(4)	[F44-OS3.4]
(5)	[F44-OS3.4]
6.9.4.1. Ash Storage Bins	
(1)	[F01-OS1.1]
	[F01-OP1.1]
(2)	[F01-OS1.1]
	[F01-OP1.1]

Notes to Table6.10.1.1.:
See Parts 2 and 3 of DivisionA.

Notes to Part 6
Heating, Ventilating and Air-conditioning

A-6.2.1.1. Good Engineering Practice.

Building Pressurization
New buildings tend to be considerably more airtight than older ones. Consequently, these buildings may have a reduced pressurization requirement compared to the normal requirement in order to limit drafts and provide a reasonable level of comfort.

The humidification and relative pressurization of buildings and individual spaces in buildings can be significant factors in compromising the ongoing performance of the building envelope and other environmental separators.

In new construction, HVAC designers should take this issue into consideration and confer with those responsible for the design of the environmental separators so as to limit unintended effects on the environmental separators. In existing buildings, the ability of the environmental separators to resist or accommodate increases in pressure differential or moisture loading should be considered before changes are made to the HVAC system.

Radon Control
Measures may be necessary to reduce the radon concentration to a level below the guideline specified by Health Canada.

Further information on reducing the indoor concentration of radon can be found in the following Health Canada publications:

- “Guide for Radon Measurements in Public Buildings (Schools, Hospitals, Care Facilities, Detention Centres),” and
- “Radon: A Guide for Canadian Homeowners.”

A-6.2.1.2.(2) Outdoor Design Conditions. In the past, the practice of ventilating buildings with outdoor air assumed that the outdoor air was of better quality than the indoor air. It has become evident that the outdoor air in some areas of Canada may not be of an acceptable quality for ventilating buildings unless certain particles and gases are first removed or reduced. For particulate matter, the maximum acceptable level is the 98thpercentile of the average 24hour values; for ozone, the maximum acceptable level is the average of the average 8hour values. A recent estimate suggests that many Canadians are exposed to contaminated outdoor air via buildings’ ventilation systems, which may lead to health problems such as cardiovascular and cerebral vascular diseases, respiratory irritation and illnesses, asthma, allergies, cancer, mucus membrane disorders and possibly death.

In order to manage the air quality of a building’s indoor environment, thus reducing the potential for adverse effects on occupants’ health, the quality of outdoor air for building ventilation purposes must be addressed. The air pollutants for which standards have been developed are particulate matter and ground-level ozone. Sentence6.2.1.2.(2) sets limits on the maximum acceptable levels of these particles and gas that a building’s ventilation system should introduce directly to the indoor environment. These limits form part of the Canada-wide Standards for Particulate Matter (PM) and Ozone, which were established pursuant to the 1998 Canada-wide Accord on Environmental Harmonization of the Canadian Council of Ministers of the Environment (CCME) and its Canada-wide Environmental Standards Sub-Agreement. Information on related regulations is available from Environment Canada and the provincial/territorial ministries of the environment. A database of particle measurements for certain Canadian locations is available from the National Air Pollution Surveillance Network (NAPS), which is run by Environment

Canada in conjunction with the provinces and territories. (SeeSubsection1.3.2. for contact information for CCME, Environment Canada and NAPS.)

A-6.2.1.4. Structural Movement. This Article is intended to remind designers and installers of mechanical systems of one aspect of the "good engineering practice" referred to in Article6.2.1.1.
In determining how to accommodate structural movement, there are two important principles to bear in mind:

- The prime concern of the Building By-law is the safety of people in and around the building, as opposed to protection of the mechanical systems and equipment.
- The nature of the accommodation will vary with the type of movement being considered, taking into account particularly how often the movement is likely to be encountered over the life of the building.

For example, a gas line supported on columns that also support a crane must be installed in such a way that the movement of the columns, which occurs many times daily, does not cause the lines to break, thus creating a hazard. Even if the gas line installation could somehow be designed to break in a non-hazardous manner, it would hardly be recognized as good engineering practice if movement that occurs so frequently could disrupt the operation of the mechanical system.

On the other hand, earthquakes occur far less frequently and it would not be surprising to have a non-critical mechanical system fail as a result of an earthquake. However, even in this situation, the failure must occur in a manner that does not create a hazard to building occupants. For example, heavy mechanical equipment should be properly anchored so that it does not topple on building occupants during an earthquake. The design of the anchors should take into account accelerations consistent with the seismic data given in AppendixC for the location of the building. Part4 provides guidance on the calculation of the loads such equipment would exert on the building structure during an earthquake; these same loads can be used in designing the anchors.

Some mechanical equipment can be an important component of post-disaster life safety systems. In these cases, the measures needed to accommodate the movements caused by an earthquake become even more critical since failure of the equipment would not be acceptable.
Clearly, complying with this requirement will, in most cases, necessitate close coordination between the mechanical designer and the structural designer.
For additional information on the types of structural movement that may be encountered, see Article4.1.3.5., Sentence4.1.3.3.(2) and Subsection 4.1.8.

A-6.2.1.6.(1) Installation – General. Ducts or pipes without dampers or valves are generally not considered to constitute "equipment" and are therefore not subject to this requirement.

A-6.3.1.1.(4) Ventilation Air Supplied to Suites. The indirect supply of required outdoor ventilation air to normally occupied spaces through corridor pressurization or other indirect systems is not permitted.

A-6.3.1.2.(1) Ventilation and Venting of Crawl Spaces and Attic or Roof Spaces. The cross-reference to Part5 pertains to unconditioned and unoccupied crawl spaces, and attic or roof spaces, which are effectively within the building envelope. Thatis, unconditioned and unoccupied attic or roof spaces are located between the roof deck and roofing above, and the insulation, air barrier system and vapour barrier below. Unconditioned and unoccupied crawl spaces are located between the ground cover below and the insulation, air barrier system and vapour barrier above. Venting of these spaces has implications for the performance of the building envelope rather than having direct effects on indoor conditions. The ventilation of conditioned or occupied crawl spaces and attic or roof spaces must comply with Part 6.

The requirements in Part 5 are stated in terms of loads that must be resisted rather than in terms of building elements. Thus, the By-law user will not find explicit references in Part5 to crawl spaces, or attic or roof spaces. Part5 makes reference to the need for venting environmental separators, i.e.,the dissipation of heat or moisture.

Sentence6.3.1.2.(1) requires that crawl spaces be ventilated either by natural (above-grade only) or mechanical means. High moisture levels within the crawl space can lead to problems such as the formation of mould, lifting of flooring or long-term damage to structural components.

Crawl space ventilation cannot be expected to correct moisture-related problems caused by other factors like inadequate surface drainage from the foundation walls or improper protection against moisture from the ground. These conditions must be properly addressed so that crawl space ventilation can meet its intended objectives.

Several factors favour the use of mechanical ventilation rather than reliance on natural drafts. Local conditions, such as areas with high water tables, may dictate the need for mechanical ventilation to remove excessive moisture. Crawl spaces should be maintained at a negative pressure relative to the conditioned area above to prevent the migration of moisture into occupied areas. This can be achieved through the use of an exhaust fan and relying on air transfer through floor penetrations, suchas pipes.

A-6.3.1.4.(1) Storage Garages. Car dealership showrooms are not considered as storage garages.

A-6.3.1.4.(2) Ventilation of Storage Garages. Storage garages are ventilated to protect occupants from exposure to carbon monoxide and other vehicular exhaust fumes. In certain cases, such as small two- or three-bay storage garages that are used for occasional vehicle storage, and where occupants are not present, carbon monoxide or nitrogen dioxide monitoring devices may be omitted if the ventilation system is interlocked with a local light switch or other controls to ensure continuous system operation whenever the area is occupied. In any event, the ventilation system capacity must be designed to limit the concentrations of carbon monoxide or nitrogen dioxide at or below the prescribed values.

A-6.3.1.6. Indoor Air Contaminants.

Contaminants of Concern

Indoor air can contain complex mixtures of contaminants of concern such as formaldehyde, legionella, mould and emissions from building materials. While some contaminants may be knowingly introduced – as in the case of processing and manufacturing environments – others may be unintentionally released into indoor environments. “Industrial Ventilation: A Manual of Recommended Practice for Design,” published by the ACGIH, and the “Exposure Guidelines for Residential Indoor Air Quality,” published by Health Canada, are useful references on the control of contaminants in industrial workplace environments and residential settings, respectively. These and other guidelines and manuals should be interpreted while keeping in mind the settings and purposes for which they were developed compared to those to which they will be applied. Note that such documents do not necessarily consider the interactions between various contaminants.

Minimizing the Growth and Spread of Bio-contaminants

Bio-contaminants, such as bacteria, mould, mildew, fungi, viruses, and pollen, can thrive or be spread by sources like drain pans, spray-water air-washers, contaminated filters, poorly maintained cooling coils, water incursion into ductwork, cafeteria dishwasher drainage leaks, high humidity and stagnant water, potentially causing a wide range of adverse health effects including respiratory allergic reactions, asthma, and infectious diseases ranging from influenza to legionnaires’ disease.

Some of the control measures are as follows:

a) Air-handling equipment should be accessible for the maintenance of filters, cooling coils and condensate drain pans located below the cooling coils. Access doors should be large and easy to open to facilitate thorough and regular maintenance.

b) If moisture is added to building ventilation air to maintain humidity levels in a designated range, humidifiers that inject steam or water vapour into central air-handling units or main supply ducts are normally used. Injection nozzles should not be located in air-handling unit plenums or ductwork that is insulated with internal fibrous lining. If the lining becomes wet, conditions conducive to the growth and spread of bio-contaminants will result.

The above only addresses built-in features of an HVAC system that can help to minimize the growth and spread of bio-contaminants. Even more important than the built-in features is a program of regular maintenance and cleaning of those portions of the system where such growth is likely to occur.

A-6.3.1.7.(2) Commercial Cooking Equipment Refer to the City of Vancouver's Kitchen Ventilation Guidelines for further information. Included is information on Design Considerations for Development Permit, Vancouver Coastal Health policy, checklists for inspections, and requirements for maintenance. This guideline is available on the City of Vancouver website.

A-6.3.1.7.(3) Commercial Cooking Equipment The termination is also to be designed to the satisfaction of the Director of Planning. Where there is a canopy or awning, the discharge should be located above the canopy or awning. The exhaust and make-up air locations should be determined respectful of existing discharge, make-up air, operable window, and door locations of neighbouring properties.

In some cases, the Director of Planning may not approve exhaust or make-up air wall terminations on street frontages. Wall terminations should be located where they have the least impact on nearby properties, suites, amenity areas, the public realm, windows, and building design. Generally, roof terminations are preferred and wall terminations should be located in the lane.

A-6.3.1.7.(4) Ecologizers and Alternative Technologies It is not the intention of the Article 6.3.1.7.(2) to prohibit technologies other than ecologizers. Other technologies that are capable of demonstrating an equivalent or better level of performance to devices listed to ULC-S647, "Standard for Exhaust Cleaning and Recirculation Assemblies for Commercial and Institutional Kitchen Exhaust Systems," may be permitted at the discretion of the Chief Building Official provided that an *acceptable* technical demonstration of performance has been provided as part of a building permit submission. Such devices must also comply with all applicable metro Vancouver regulations related to air emissions, odour, and low level ozone.

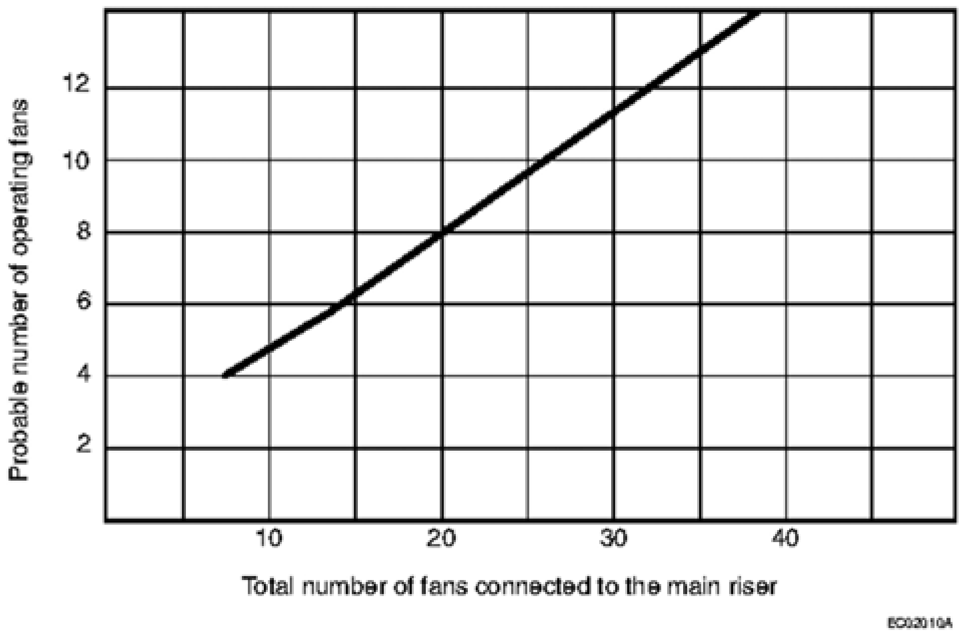
A-6.3.2.5. Duct Coverings and Linings. The TIAC "Mechanical Insulation Best Practices Guide" is a comprehensive source of information on the selection, installation and proper use of thermal insulation materials. (Note that Section4 of this Guide is not included in the scope of this Note as it contains information on proprietary products, which are not within the mandate of theBy-law.)

A-6.3.2.10.(5) and (6) Exhausting to Garages. A frequent practice in the design of ventilation systems serving buildings which have associated parking garages is to discharge exhaust air from the building to the garage in order to reduce the cost of heating the garage or reduce the length of the exhaust ducts. However, this practice entails a certain amount of risk since, when the exhaust system is not running, stack effect may turn the exhaust outlets into intakes and exhaust fumes (including carbon monoxide) can be drawn from the garage into the building. Incorporating a backdraft damper at the exhaust outlet provides some additional protection but backdraft dampers are generally not regarded as being very reliable. Therefore this practice is only permitted in very limited circumstances.

A-6.3.2.10.(6)(b) Air Contaminants. For the purpose of Clause6.3.2.10.(6)(b), washroom exhaust air is not considered to contain contaminants that would adversely affect the air quality in the storage garage.

A-6.3.2.10.(7) and (8) Exhaust Ducts Connected to Laundry-Drying Equipment. Clothes dryers are a major cause of fires in buildings often due to a build-up of lint in the system, which then ignites or obstructs the venting or ventilation. Propercleaning and regular maintenance of lint traps is directly proportional to the ease of access to the lint traps. It is therefore important to ensure that lint traps in multiple installations of laundry-drying equipment are installed in such a way as to allow easy access for inspection, maintenance, repair and cleaning.

A-6.3.2.10.(12)(b) Operation Diversity Factor. The operation diversity factor has to be assessed for each specific application. Good engineering practice (See Article6.2.1.1.) design guidelines can provide information on the subject. FigureA-6.3.2.10.(12)(b), which originates from ASHRAE handbooks, provides an example of factors that can be used for generalapplications.



FigureA-6.3.2.10.(12)(b)
Operation diversity factor

A-6.3.3.1.(2) Requirement for Venting. Sentence6.3.3.1.(2) requires that vented products of combustion from appliances be discharged a minimum distance away from certain outdoor spaces and building components in cases where the vented products could contaminate the air of occupiable spaces. These minimum distances may need to be increased due to local conditions such as prevailing winds, adjacent structures, special processes being carried out, specific contaminants or effluent discharges, all of which would require further analysis.

“Occupiable outdoor spaces” refers to areas that could be occupied for a duration of more than fifteen minutes at any time, but does not include maintenance spaces. Occupiable outdoor spaces are located adjacent to an indoor space and are considered to be an extension of this indoor space: e.g. main entries, balconies, patios, decks, green roofs and other public assembly areas. Although sidewalks and driveways are mentioned in the provision, these areas are not considered as occupiable outdoor spaces since they are used as transport routes to and from the building, and people are not expected to remain there for extended periods of time.

The requirements of Sentence6.3.3.1.(2) are not meant to override similar requirements found in the installation standards referenced in Article6.2.1.5. that address identical situations.

A-6.5.1.1.(3) Temperature of Exposed Piping. Normally piping carrying steam or high-temperature hot water at pressures above atmospheric (corresponding temperature 100°C or above) will be insulated to reduce heat losses as an economy measure. Abovea temperature of approximately 70°C, however, a bare pipe can cause a burn to human flesh coming in contact with the pipe. Ifpipes above this temperature are normally out of reach of all persons other than maintenance personnel or are properly guarded, it would be expected that no insulation would be needed for public safety.

A-6.9.1.2.(1) NFPA Publications Pertaining to the Heating, Ventilating and Air-Conditioning of Spaces Containing Hazardous Gases, Dusts or Liquids.
NFPA 30, "Flammable and Combustible Liquids Code"
NFPA 30A, "Motor Fuel Dispensing Facilities and Repair Garages"
NFPA 32, "Drycleaning Plants"
NFPA 33, "Spray Application Using Flammable or Combustible Materials"
NFPA 34, "Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids"
NFPA 35, "Manufacture of Organic Coatings"
NFPA 36, "Solvent Extraction Plants"
NFPA 40, "Storage and Handling of Cellulose Nitrate Film"
NFPA 51, "Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes"
NFPA 51A, "Acetylene Cylinder Charging Plants"
NFPA 55, "Compressed Gases and Cryogenic Fluids Code"
NFPA 61, "Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities"
NFPA 68, "Explosion Protection by Deflagration Venting"
NFPA 69, "Explosion Prevention Systems"
NFPA 85, "Boiler and Combustion Systems Hazards Code"
NFPA 86, "Ovens and Furnaces"
NFPA 88A, "Parking Structures"
NFPA 91, "Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids"
NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations"
NFPA 204, "Smoke and Heat Venting"
NFPA 303, "Marinas and Boatyards"
NFPA 307, "Construction and Fire Protection of Marine Terminals, Piers, and Wharves"
NFPA 409, "Aircraft Hangars"
NFPA 415, "Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways"
NFPA 484, "Combustible Metals"
NFPA 654, "Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible ParticulateSolids"
NFPA 655, "Prevention of Sulfur Fires and Explosions"
NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities"
NFPA "Fire Protection Guide to Hazardous Materials"

A-6.9.3.1.(2)(c) Carbon Monoxide Alarms. Battery-powered carbon monoxide alarms are acceptable provided that they are mechanically fastened in place.

Part 7
Plumbing Services

Section 7.1. General

7.1.1. Scope

7.1.1.1. Scope

1) The scope of this Part shall be as described in Subsection 1.3.3. of Division A.

7.1.1.2. Application

1) This Part applies to the design, construction, extension, *alteration*, renewal or repair of *plumbing systems*.

7.1.2. Design and Installation

7.1.2.1. Conformance

1) Every *plumbing system* shall be designed and installed in conformance with Book II (Plumbing Systems) of this By-law.

7.1.3. Required Facilities

7.1.3.1. All Buildings Except Dwelling Units

1) *Buildings* shall be equipped with plumbing facilities as required in Subsection 3.7.2. and Article 3.8.2.8.

7.1.3.2. Dwelling Units

1) *Dwelling units* shall be equipped with plumbing facilities as required in Section 9.31.

7.1.4. Definitions

7.1.4.1. Defined Terms

1) Words that appear in italics are defined in Article 1.4.1.2. of Division A.

Section 7.2. Objectives and Functional Statements

7.2.1. Objectives and Functional Statements

7.2.1.1. Attributions to Acceptable Solutions

1) For the purpose of compliance with this By-law as required in Clause 1.2.1.1.(1)(b) of Division A, the objectives and functional statements attributed to the acceptable solutions in this Part shall be the objectives and functional statements listed in Table 7.2.1.1. (See Note A-1.1.2.1.(1).)

Table 7.2.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 7
Forming Part of Sentence 7.2.1.1.(1)

Functional Statements and Objectives(1)
7.1.2.1. Conformance

(1)	[F30-OS3.1] [F31-OS3.2] [F43-OS3.4]
	[F70-OH2.2] [F72-OH2.1]

Notes to Table 7.2.1.1.:
(1) See Parts 2 and 3 of Division A.

Part 8
Safety Measures at Construction and Demolition Sites

Section 8.1. General

8.1.1. Scope

8.1.1.1. Scope

1) The scope of this Part shall be as described in Subsection 1.3.3. of Division A.

2) This Part applies to fire safety and the protection of the public during the construction, *alteration* or demolition of every *building*, including any incompleted or abandoned *building*.

3) Fire safety at construction and demolition sites shall conform to CAN/CSA S350-M, "Code of Practice for Safety in Demolition of Structures," the Fire By-law and Subsection 8.2.6 of this By-law.

8.1.1.2. Reserved

8.1.1.3. Deconstruction and Demolition Procedures

1) Measures shall be taken during demolition to protect the public in conformance with Section 5.6. of Division B.

8.1.2. Application

8.1.2.1. Application

1) Where a *building* is undergoing construction, *construction* and fire safety, measures shall be taken at the *building* site in conformance with this Code. (See Note A-8.1.2.1.(1).)

8.1.2.2. Protection from Risk

1) Precautions shall be taken to ensure that no person is exposed to undue risk.

8.1.3. Construction Safety Program

8.1.3.1. Requirements for Construction Safety Program

1) Unless otherwise provided in Article 8.1.3.2., before the commencement of any construction a *Construction Safety Program* shall be submitted to the *Chief Building Official*.

2) A *Construction Safety Program* shall include

a) the names and emergency phone numbers of the constructor, the coordinating registered professional and the *Construction Safety Officer*,

b) details of the construction procedures relating to site access, traffic control, scaffolding and swing stages, protection at excavations, hoisting equipment (including its location and scheduling), fire protection facilities, material storage, waste material disposal, control of dust and debris, protection at the perimeters of all floor levels, barricades, covered walkways and any other details required by the *City Engineer*, the *Chief Building Official* or any other city official having jurisdiction, and

c) a *construction* site plan showing the location on the site of the equipment, facilities and safety measures detailed in the *Construction Safety Program* in accordance with Clause (b).

3) The *Construction Safety Program* shall be amended from time to time to reflect the current stage of construction.

8.1.3.2. Exemptions

1) A *Construction Safety Program* is not required for minor interior alterations contained within a suite or for minor alterations or additions to a *building* contain only one *dwelling unit* and its contained *ancillary residential suites*, except that the *Chief Building Official* may require a *Construction Safety Program* if, in the opinion of the *Chief Building Official*, the work may cause a hazard for persons occupying the *building*, construction workers or the public.

8.1.3.3. Posting Requirements

1) No construction shall commence until a copy of the *Construction Safety Program* which complies with this subsection is posted on the *project* site in accordance with Sentence (2).

2) The copy of the *Construction Safety Program* required by Sentence (1) shall be

a) posted on a plywood board measuring no less than 600 mm by 600 mm, which is staked into the ground, protected from the weather and visible from the street, or

b) posted on the exterior of the principal *construction* site shelter.

3) Notwithstanding the exceptions of 8.1.4.1.(1), a copy of the *Construction Safety Program* shall be posted on the *project* site at all times during construction.

8.1.4. Construction Safety Officer

8.1.4.1. Requirement for Construction Safety Officer

1) Except for a *building* containing only 2 primary *dwelling units* and their contained *ancillary residential units*, where construction of a *building* includes the services of a *Coordinating Registered Professional*, a full-time *Construction Safety Officer* shall be present on the *project* site at all times during construction.

8.1.4.2. Requirement for Site Reviews

1) During construction, the *Construction Safety Officer* shall carry out site reviews at least twice daily to ensure that work is proceeding safely and in conformance with the *Construction Safety Program*.

2) After each site review, the *Construction Safety Officer* shall post a copy of the site review in a location adjacent to the posted copy of the *Construction Safety Program*.

8.1.4.3. Site Safety Meetings Required

1) The *Construction Safety Officer* shall hold regular construction site safety meetings at least monthly with the constructor and a representative of each trade.

8.1.4.4. Safety Meeting Minutes

1) The *Construction Safety Officer* shall keep minutes of the construction site safety meetings held in accordance with Article 8.1.4.3. and copies of those minutes shall be provided to the *coordinating registered professional* and shall be available at the *construction* site for inspection by the *Chief Building Official*.

8.1.4.5. Violation of Construction Safety Program

1) If the *Construction Safety Officer* observes that a procedure set out in the *Construction Safety Program* is not being followed, the *Construction Safety Officer* shall immediately inform the appropriate trades safety coordinator or, if that person is unavailable at the site, the supervisor of the appropriate sub-contractor.

2) If corrective measures are not taken immediately by the person informed in accordance with Sentence (1), the *Construction Safety Officer* shall promptly inform the constructor or an agent of the constructor.

Section 8.2. Protection of the Public

8.2.1. Walkways, Fencing, Boarding and Barricades

8.2.1.1. Covered Walkways

1) If *construction* of a *building* may cause a hazard for persons using the adjacent sidewalk, work shall not commence until a covered walkway has been provided on the sidewalk in accordance with Article 8.2.1.2.

2) Despite the provisions of Sentence (1) a covered walkway is not required on a sidewalk if

a) the work is carried out entirely behind fencing, boarding or barricades which separate the *construction* site from the sidewalk, or

b) the *building* is located no less than 2 m from a sidewalk used by pedestrians, except that the *Chief Building Official* may require a covered walkway for a site which contains a *project* located more than 2 m from a sidewalk if, in the opinion of the *Chief Building Official*, site conditions so warrant.

8.2.1.2. Covered Walkway Construction

1) A covered way shall

a) have a clear height of not less than 2.5 m,

b) have a clear width of not less than 1.5 m or the width of the sidewalk, whichever is the lesser,

c) be designed and constructed to support safely all loads that may be reasonably expected to be applied to it, but in no case less than 2.4 kPa on the roof

d) have a weathertight roof sloped towards the site or, if flat, be equipped with a splash board not less than 300 mm high on the *street* side,

e) be totally enclosed,

i) on the *construction* site side with a structure having a reasonably smooth surface facing the *public way*,

ii) on the *construction* site side of the sidewalk, and

iii) walls with a smooth surface facing the sidewalk,

f) have a railing 1 070 mm high measured from the walking surface and located on the *street* side of the sidewalk if the covered way is supported by posts on the *street* side of the sidewalk, and

g) constructed with sufficient lighting to enable the public to walk safely through anywalkway which

h) is constructed on a sidewalk which is illuminated by overhead *street* lighting at night.

8.2.1.3. Fencing, Boarding or Barricades

1) If *construction* which may cause a hazard to the public is located 2 m or more from a street, fencing, boarding or barricades not less than 1.8 m high shall be erected between the *construction* site and the *street*.

2) Fencing, boarding, and barricades erected in accordance with Sentence (1) shall have a smooth surface facing the *street* and shall be without openings, except those required for access to the *construction* site.

3) Access openings through fencing, boarding or barricades erected in accordance with Sentence (1) shall be equipped with gates that shall be

a) kept closed and locked when the *construction* site is unattended, and

b) maintained in place until *construction* is completed.

8.2.1.4. Special Hazards

1) If an unusual hazard exists on a *construction* site, security guards shall be posted 24 hours a day and 7 days a week, to prevent public access to the area where the unusual hazard is located.

8.2.1.5. Work Shutdown

1) All hazardous areas on a *project* site shall be secured against unauthorized entry at all times.

2) If workers are not present on a construction site during normal working hours,

a) all windows, doors and other openings located within 3 m of the ground shall be secured with barricades, or
b) a fencing, boarding or barricades shall be constructed around the entire site in accordance with Article 8.2.1.3.

8.2.2. Excavation

8.2.2.1. Water Removal

1) *Excavations* shall be kept reasonably clear of water.

8.2.2.2. Protection of Adjoining Property

(See Note A-8.2.2.2.)

1) If the stability of adjoining *buildings* may be endangered by the work of excavating, adequate underpinning, shoring and bracing shall be provided to prevent

a) damage to, or movement of, any part of the adjoining *building*, and
b) the creation of a hazard to the public.

8.2.3. Use of Streets or Public Property

8.2.3.1. Safe Passage Past Site

1) Except as provided in Article 8.2.3.2., provisions shall be made at all times for the safe passage of pedestrian and vehicular traffic past the *project* site.
2) Material or equipment shall not be placed on any *public way* except as authorized by the *City Engineer*, the *General Manager, Real Estate and Facilities Management*, or the *General Manager, Park Board*, as the case may be.
3) Except as provided in Sentence (4), where a sidewalk exists adjacent to the *construction* site it shall be kept clear of obstructions at all times.
4) Where construction operations necessitate the obstruction of a sidewalk, a temporary sidewalk shall be provided and it shall be kept clear of obstruction at all times.
5) If *construction* necessitates the movement of material or equipment on or across a *public way* a person shall be posted to supervise the movement of the material or equipment and shall take all steps necessary to ensure the safety of pedestrians and vehicular traffic on the *public way*.

8.2.3.2. Overhead Construction Activities

1) Overhead operations which may create a hazard to pedestrian or vehicular traffic shall only be carried out if the *public way* is closed to pedestrian and vehicular traffic.
2) For the purposes of Sentence (1), closure of a *street*, other than momentary interruptions in public use, shall only be permitted by the *City Engineer* if the *City Engineer* is satisfied that no other reasonable alternative exists to minimize the hazard to pedestrians and vehicular traffic.
3) For the purposes of Sentence (1), closure of a *public way* other than a *street* or park shall only be permitted by the *General Manager, Real Estate and Facilities Management* if the *General Manager, Real Estate and Facilities Management* is satisfied that no other reasonable alternative exists to minimize the hazard to pedestrians and vehiculartraffic.
4) For the purposes of Sentence (1), closure of a park shall only be permitted by the *General Manager, Park Board* if the *General Manager, Park Board is* satisfied that no other reasonable alternative exists to minimize the hazard to pedestrians and vehiculartraffic.
5) Permission to close a *street* , park or other *public way* as required in Sentences (2),(3),and (4) shall be applied for and obtained before the *street*, park or other *public way* is closed.

8.2.3.3. Barriers

1) An excavation in a *street* or other *public way* or adjacent to a traffic lane where there is no sidewalk or

curb, shall be protected by barriers.
2) Barriers provided for in Sentence (1**)** shall be constructed of concrete interlocking barriers or plastic water filled interlocking barriers sufficient to prevent pedestrian or vehicular trafficfrom entering the excavation.
3) Barriers provided for in Sentence (1) shall be marked with retro reflective tape, paint or delineators sufficient to make the barriers visible from dusk untildawn."

8.2.3.4. Restoration and Repair of Streets or City Property

1) All *streets,* parks or other public property that have been damaged shall be restored to the satisfaction of the City Engineer, the General Manager, Real Estate and Facilities Management, or the General Manager, Park Board, as the case may be.
2) All obstructions on *streets*, park or other public property shall be removed as soon as the need for such obstructions is ended.

8.2.3.5. Warning Lights

1) Warning lights shall be placed and shall be in operation from dusk until dawn at all obstructions on *streets* or other *public ways*.

8.2.3.6. Maintenance of Public Ways

1) Public ways adjacent to *projects* shall be cleaned and maintained to the satisfaction ofthe *City Engineer*., the *General Manager, Real Estate and Facilities Management*, or the *General Manager, Park Board,* as the case may be.
2) No person shall place, park or leave *construction* vehicles on *public ways* or *City*property.
3) No person shall place or leave *construction* materials, overspills, debris, excavated materials or mud on *public ways* or *City* property.
4) No person shall dump or discharge waste water from *construction* activities or vehicle wash water from concrete trucks or dump trucks on *public ways* or *City*property.

8.2.4. Traffic Control

8.2.4.1. Protection of the Public on Public Ways

1) If work on a *project* site creates a traffic hazard on or adjacent to a *public way*, traffic control measures for the duration of the hazard shall include
a) persons to direct *construction* workers,
b) persons to direct traffic,
c) appropriate warning signs indicating the presence of *construction* work and flagpersons.
d) warning signs indicating any lane closures,
e) if there is a lane closure of a vehicle travel lane, retro reflective lane control devices set up in a gradual taper to close the vehicle travel lane,
f) if there is a lane closure of a vehicle travel lane at night, yellow flashing lights mounted on retro reflective barricades at the closure point of the vehicle travel lane,
g) retro reflective lane control devices surrounding the closed portion of any *public way*, and
h) at night, retro reflective barricades with yellow flashing lights in front of any construction material or equipment which is not marked with retro reflective sheeting.

2) If work on a *construction* site creates a hazard to bicycle traffic on a bikeway for more than 15 minutes, traffic control measures for the duration of the hazard must include
a) a safe delineated continuous path for bicycle traffic or a safe alternative delineated pathfor pedestrian traffic,
b)persons to supervise and direct bicycle traffic past the hazard, and
c) if a safe alternative pedestrian path is provided, a bicycle dismount sign at either end of the path.

8.2.4.2. Traffic Control and Hazard Signs

1) Traffic control and traffic hazard signs shall be

a) at least 75 cm by 75 cm,
b) backed with retro reflective sheeting,
c) marked with black text or symbols on an fluorescent orange background for hazard signs, and
d) marked with black text or symbols on a white background for traffic control signs.

8.2.4.3. Lane Control Devices

1) A lane control device shall be

a) a fluorescent red or orange plastic tubular marker 100 cm in diameter marked with two 8cm retro reflective bands,
b) a fluorescent red or orange plastic cone 45 cm or 70 cm in diameter at the base with a 15 cm retro reflective band, or
c) a fluorescent red or orange plastic flexible drum with two 10 inch retro reflective bands.

8.2.4.4. Traffic Control Person

1) A person directing traffic on a *public way* shall

a) carry written proof of completion of a traffic control course approved under the authority of the Workers' Compensation Act of British Columbia or the British Columbia Safety Council,
b)wear personal protective equipment approved under the authority of the Workers' Compensation Act of British Columbia including a safety vest, hard hat, reflective wrist straps, and safety footwear approved under the authority of the Canadian Standards Association,
c) use a traffic control paddle consisting of a "STOP" sign marked with white letters on a retro reflective red background and a "SLOW" sign marked with black letters on a retro reflective yellow background, and
d) use a flashlight that includes a red signaling hood for night traffic conditions.

8.2.4.5. Construction Vehicle Traffic Hazard

1) If the location or use of a vehicle related to a *construction* site creates a traffic hazard on a *public way* adjacent to a *construction* site, the vehicle shall display

a) a 360 degree yellow flashing light,
b) four way flashers, and
c) a flashing arrow board.

8.2.5. Waste Material

8.2.5.1. Control of Waste Material

1) Waste material or other material shall not be permitted to fall freely from one *storey* to another.

8.2.5.2. Removal of Waste Material

1) Waste material shall be removed as quickly as possible by means of

a) appropriate containers,
b) an enclosed shaft or chute conforming to Sentence 8.2.5.4.(1), or
c) a hoisting apparatus if large pieces or objects are involved.

8.2.5.3. Enclosures for Waste Material

1) Waste material removed in accordance with Sentence 8.2.5.2.(1) shall be deposited in a container which is

a) designed to ensure that waste material cannot escape from the container, and
b) secure and inaccessible to the public.

8.2.5.4. Chutes for Waste Material

1) The chute described in Clause 8.2.5.2.(1)(b) shall be closed if it is inclined more than 45° to the horizontal.

8.2.5.5. Disposal of Waste Material

1) Except as provided in Sentence (2), all waste material on a *construction* site shall be sorted, diverted and disposed of in a manner satisfactory to the *Chief Building Official.* (See Note A-8.2.5.5.(1).)

2) Sentence (1) does not apply to

a) proposed work of a value of $50,000 or less, and

b) corrective measures or immediate measures carried out by the *Chief Building Official* in accordance with Articles 1.5.3.4. and 1.5.3.5.

8.2.6. Fire Safety Measures

8.2.6.1. Application

(See Note A-8.2.6.1.)

1) This Subsection applies to fire safety for *projects* undergoing *construction* and adjacent *projects*.

8.2.6.2. Protection of Adjacent Buildings

(See Note A-8.2.6.2.)

1) Protection shall be provided for adjacent *buildings* that could be exposed to fire originating from *buildings* undergoing *construction*.

8.2.6.3. Fire Safety Plan

1) Before the commencement of *construction*, a fire safety plan for the *project* site shall be submitted to and accepted by the *Chief Building Official.*

2) Unless otherwise required by Sentence (3), a fire safety plan shall conform with the requirements of the Fire By-law and shall include

a) measures to reduce fire hazards in and around the *building* (See Note A-8.2.6.3.(2)(a).), and

b) a maintenance program for firefighting measures required by the Fire By-law.

3) Where *construction* occurs in an *existing building* that is required to have a fire safety plan conforming to the Fire By-law, the existing fire safety plan shall be modified to incorporate the alterations to the *existing building*.

8.2.6.4. Access for Firefighting

1) Unobstructed access to fire hydrants, portable extinguishers and fire department connections for standpipe and *sprinkler systems* shall be maintained on all *construction* sites.

2) Firefighters shall be provided with unobstructed access to all levels of the *building.*

3) Firefighters shall be provided with unobstructed access to all elevators, hoists or lifts in the *building.*

4) Firefighters shall be provided with unobstructed access to access routes for fire department vehicles.

5) Where a *project* site is enclosed by fencing, boarding or barricades, firefighters shall be provided with 24 hour emergency access for fire department equipment and personnel.

8.2.6.5. Portable Extinguishers

1) Portable extinguishers shall be provided in unobstructed locations in all areas where

a) hot work operations are carried out,

b) *combustibles* are stored,

c) internal combustion engines are located,

d) flammable liquids and *combustible* liquids or gases are stored or handled, and temporary fuel-fired equipment is used.

2) Portable extinguishers required by Sentence (1) shall have a minimum rating of

a) 2-A:10-B:C on moveable equipment, and

b) 4-A:40-B:C in all other locations.

8.2.6.6. Standpipe Systems

(See Note A-8.2.6.6.)

1) Where a standpipe system is installed in a *building* under *construction*, the standpipe system shall be installed progressively, in conformance with Subsection 3.2.5. of Division B of this By- law, in occupied portions of a *building.*

2) Where a standpipe system is to be installed progressively in unoccupied portions of a *building* under *construction*, a permanent or temporary standpipe system is permitted, and the standpipe system shall have

a) conspicuously marked and readily accessible fire department connections on the outside of the *building* at street level

b) at least one hose outlet at each floor,

c) pipe size, hose valves and water supply conforming to Subsection 3.2.5. of Division B of this By-law,

d) as a minimum, secure supports and restraints on alternate floors,

e) at least one hose valve for attaching fire department hose at each intermediate landing or floor level in the exit stairway, and

f) valves which are kept closed and protected from mechanical damage at all times.

3) A standpipe system installed in accordance with Sentence (2) shall be progressively installed so that it is no more than one floor below the highest forms, staging, and similar *combustible construction* materials at all times.

4) A temporary standpipe system shall remain in service until the installation of the permanent standpipe system is complete.

5) If a *building* equipped with a standpipe system is being deconstructed or demolished floor by floor, the standpipe system, together with all fire department connections and valves, shall be maintained in operable condition at all times on all *storeys*, except for the *storey* located immediately below the *storey* being deconstructed or demolished.

8.2.6.7. Hot Surface Applications

1) Roofing operations and other surface applications that involve heat sources and hot processes shall be considered hot works and shall conform to the requirements in the Fire By-law.

2) Bitumen kettles shall not be located on roofs, and shall be

a) provided with a close-fitting cover constructed of steel with a minimum thickness of No. 14 sheet metal gauge,

b) under constant supervision when in operation, and

c) maintained free of excessive residue.

3) Mops used to spread bitumen shall be stored in a safe location at a safe distance away from *buildings,* when not in use.

8.2.6.8. Ignition Sources

(See Note A-8.2.6.8.)

1) Internal combustion engines, temporary heating equipment and other equipment capable of causing ignition shall be kept at a safe distance away from *combustible* materials.

2) The clearance between *combustible* materials and temporary heating equipment, including flues, shall be in conformance with Part 6 or in conformance with the minimum clearances shown on certified heating equipment.

8.2.6.9. Utility Services to Buildings under Construction

1) Except as required in Sentence (3) and except for water supplies for firefighting, utility services shall be terminated at a point located outside the *building* undergoing *deconstruction* or *demolition*.

2) A utility service provider whose service connections will be affected by *construction,* shall be notified before any service connections are terminated in accordance with Sentence (1).

3) If it is necessary to maintain any utility service, during *deconstruction* or *demolition*, the utility service shall be

a) relocated as necessary, and

b) protected from damage.

4) Temporary electrical installations shall be installed in conformance with the British Columbia Electrical Safety Regulation.

8.2.6.10. Fuel Supply Installation

1) Fuel supplies for heating equipment and internal combustion engines shall conform to

a) CAN/CSA-B139-M, "Installation Code for Oil-Burning Equipment," or

b) the British Columbia Gas Safety Regulation.

8.2.6.11. Safety of Fuel Tanks and Piping at Construction Sites

1) Fuel tanks and piping at a *deconstruction* or *demolition* site which contain or may have contained flammable or combustible liquids or vapours shall be decommissioned in conformance with the Fire By-law.

2) Fuel tanks and piping at a *deconstruction* or *demolition* site which contain or may have contained flammable or combustible liquids or vapours shall be drained or vented and removed prior to the deconstruction or demolition of a *building,* except as permitted by Sentence (3).

3) Where it is impracticable to remove fuel tanks or piping from the *construction* site prior to *deconstruction* or *demolition* of a *building*, such equipment shall be tagged for identification and removed as soon as conditions permit.

4) Fuel tanks and piping referred to in Sentences (1), (2) and (3) shall be purged with inert materials prior to *deconstruction or demolition* of a *building.* (See Note A-8.2.6.11.(4).)

8.2.6.12. Fire Separations in Partly Occupied Buildings

1) Where part of a *building* under *construction* is occupied, the occupied part of the *building* shall be separated from the part of the *building* under construction by a *fire separation* having a *fire-resistance rating* of no less than 1 h.

8.2.6.13. Protection During Fire Protection System Shutdown

1) Except as permitted in Sentence (2), where a fire protection system is provided, it shall remain operational throughout the entire *building* during *construction*.

2) If any portion of a fire protection system is temporarily shut down during *construction*, protection of the *building* shall comply with the Fire By-law.

8.2.6.14. Requirement for Fire Watch

1) If a *building* is partly occupied and part of the *building* is undergoing *deconstruction* or *demolition,* a fire watch shall be maintained at all times, unless the *building* is provided with an active fire alarm system.

2) A fire watch as required by Sentence (1) shall include:

a) a complete tour of inspection of the *project* at least once every hour,

b) facilities to provide a fire warning to occupants, to the satisfaction of the *Chief Building Official,* and

c) facilities to communicate with the fire department in the event of fire, to the satisfaction of the *Chief Building Official*.

8.2.6.15. Smoking Restrictions on Construction Sites

1) Smoking shall only be permitted on *construction* sites in accordance with the Fire By-law.

8.2.6.16. Egress from Buildings under Construction

1) In *buildings* under *construction*, there shall be at least one *exit* which is accessible and usable at all times.

2) In *buildings* under *construction* there shall be least one stairway maintained in usable condition at all times.

8.2.6.17. Fire Warning in Buildings under Construction

1) Facilities shall be provided to alert persons on a *project* to the presence of a fire and such facilities shall be audible throughout the *building.*

8.2.6.18. Storage and Use of Dangerous Goods on Construction Sites

1) *Combustible* liquids and *flammable liquids* shall be stored and used in conformance with the Fire By-law.

2) Dangerous goods and materials shall be stored and used in conformance with the Fire By-law.

3) Dangerous goods and materials shall be stored and used in conformance with the British Columbia Gas Safety Regulations.

8.2.6.19. Temporary Enclosures on Construction Sites

1) Fabrics and films used to temporarily enclose *buildings* shall be securely fastened to prevent contact with heaters or other ignition sources.

8.2.6.20. Storage of Combustible Refuse

1) *Combustible* refuse shall be stored a safe distance away from *buildings,* and at a safe location. (See also Subsection 8.2.5.)

8.2.6.21. Shut-off of Utility Services at Excavation Sites

1) Except as provided in Article 8.2.6.22., before excavation begins, utility services shall be shut off, and terminated outside the limits of the excavation and the terminations shall be labeled so as to be easily identifiable. (See also Sentence 8.2.6.9.(1).)

2) A utility service provider whose service connections will be affected by *construction* shall be notified before any service connections are terminated in accordance with Sentence (1).

3) If it is necessary to maintain any utility service, during excavation, the utility service shall be

a) relocated as necessary, and

b) protected from damage.

8.2.6.22. Maintaining Existing Utility Services

1) Existing utility services may be left within the area of the excavation if

a) the service company consents to the location of the services before the excavation begins,

b) a method of excavation is adopted which ensures that the services are not damaged, and the services are provided with temporary support."

Section 8.3. Objectives and Functional Statements

8.3.1. Objectives and Functional Statements

8.3.1.1. Attributions to Acceptable Solutions

1) For the purpose of compliance with this Code as required in Clause 1.2.1.1.(1)(b) of Division A, the objectives and functional statements attributed to the acceptable solutions in this Part shall be the objectives and functional statements listed in Table 8.3.1.1. (See Note A-1.1.2.1.(1).)

Table 8.3.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 8
Forming Part of Sentence 8.3.1.1.(1)

Functional Statements and Objectives[1]	
8.1.1.3. Deconstruction and Demolition Procedures	
(1)	[F01-OS1.1]
	[F30-OS5.1,OS5.3,OS5.8] [F34-OS5.5] [F31,F32,F43,F44-OS5.6]
8.1.2.2. Protection from Risk	
(1)	[F01-OS1.1]
	[F30-OS5.1,OS5.3,OS5.8] [F34-OS5.5] [F31,F32,F43,F44-OS5.6]
8.1.3.1. Requirements for Construction Safety Program	
(1)	[F12, F30-OS5.1, OS5.2, OS5.3, OD5.4, OS5.5, OS5.6, OS5.7]
(2)	[F12, F30-OS5.1, OS5.2, OS5.3, OD5.4, OS5.5, OS5.6, OS5.7]
8.1.3.3. Posting Requirements	
(1)	[F12, F30-OS5.1, OS5.2, OS5.3, OD5.4, OS5.5, OS5.6, OS5.7]
(2)	[F12, F30-OS5.1, OS5.2, OS5.3, OD5.4, OS5.5, OS5.6, OS5.7]
8.1.4.1. Requirements for Construction Safety Officer	
(1)	[F12, F30-OS5.1, OS5.2, OS5.3, OD5.4, OS5.5, OS5.6, OS5.7]
8.1.4.2. Requirements for Site Reviews	
(1)	[F12, F30-OS5.1, OS5.2, OS5.3, OD5.4, OS5.5, OS5.6, OS5.7]
8.1.4.3. Site Safety Meeting Required	
(1)	[F12, F30-OS5.1, OS5.2, OS5.3, OD5.4, OS5.5, OS5.6, OS5.7]
8.1.4.4. Safety Meeting Minutes	
(1)	[F12, F30-OS5.1, OS5.2, OS5.3, OD5.4, OS5.5, OS5.6, OS5.7]
8.2.1.1 Covered Walkways	

8.2.1.2. Covered Walkway Construction	
(1)	(a),(b),(d),(e),(f),(g) [F30-OS5.1,OS5.2] [F34-OS5.5]
	(c) [F20-OS5.7]
8.2.1.3. Fencing, Boarding or Barricades	
(1)	[F30-OS5.1,OS5.3,OS5.6] [F34-OS5.5]
(2)	[F34-OS5.5] [F30-OS5.3]
(3)	[F34-OS5.5]
8.2.1.4. Special Hazards	
(1)	[F34-OS5.5]
8.2.1.5. Work Shutdown	
(1)	[F34-OS5.5]
(2)	[F34-OS5.5.]
8.2.2.1. Water Removal	
(1)	[F60-OS5.8]
	[F60-OS5.4]
8.2.2.2. Protection of Adjoining Property	
(1)	(a) [F21-OP4.1]
	(b) [F21-OS5.8]
8.2.3.1. Safe Passage Past Site	
(1)	[F30-OS5.1,OS5.3,OS5.2]
(2)	[F30-OS5.3,OS5.2]
(3)	[F30-OS5.3,OS5.2]
(4)	[F30-OS5.3,OS5.2]
(5)	[F30-OS5.3]
8.2.3.2. Overhead Construction Activities	

(1)	[F30-OS5.1]
8.2.3.3. Barriers	
(1)	[F30-OS5.1,OS5.3,OS5.2] [F34-OS5.5]
8.2.3.4. Restoration and Repair of Streets or City Property	
(1)	[F30-OS5.3]
(2)	[F30-OS5.3,OS5.2]
8.2.3.5. Warning Lights	
(1)	[F30-OS5.3,OS5.2]
8.2.4.1. Protection of Public on Public Ways	
(1)	[F30-OS5.2]
8.2.4.2. Traffic Control and Hazard Signs	
(1)	[F30-OS5.2]
8.2.4.3. Lane Control Devices	
(1)	[F30-OS5.2]
8.2.4.4. Traffic Control Devices	
(1)	[F30-OS5.2]
8.2.4.5. Construction Vehicle Traffic Hazard	
(1)	[F30-OS5.2]
8.2.5.1. Control of Waste Material	
(1)	[F30-OS5.1]
8.2.5.2. Removal of Waste Material	
(1)	[F30-OS5.1,OS5.3]
8.2.5.3. Enclosures for Waste Material	
(1)	[F30-OS5.1,OS5.3] [F34-OS5.6]
8.2.5.4. Chutes for Waste Material	

(1)	[F30-OS5.1]
8.2.6.2. Protection of Adjacent Buildings	
(1)	[F03-OS1.2, OP3.1]
8.2.6.4. Access to Firefighting	
(1)	[F12-OS1.2, OP3.1]
8.2.6.5. Portable Extinguishers	
(1)	[F12-OS1.2, OP3.1]
8.2.6.6. Standpipe Systems	
(1)	[F12-OS1.2, OP3.1]
8.2.6.7. Hot Surface Application	
(1)	[F03-OS1.1] [F31-OS5.6]
8.2.6.8. Ignition Source	
(1)	[F03-OS1.2]
8.2.6.12. Fire Separation in Partly Occupied Buildings	
(1)	[F03-OS1.2]
8.2.6.14. Requirements for Fire Watch	
(1)	[F11-OS5.9]
8.2.6.15. Smoke Restrictions on Construction Sites	
(1)	[F02-OS1.1]
8.2.6.16. Egress from Buildings under Construction	
(1)	[F10-OS1.5]
8.2.6.20. Storage of Combustible Refuse	
(1)	[F01-OS1.2]

Notes to Table 8.3.1.1.:
(1) See Parts 2 and 3 of Division A.

Notes to Part 8
Safety Measures at Construction and Demolition Sites

A-8.1.2.1.(1) Application. The use of streets or public property and vehicular traffic during construction or demolition is normally controlled by regulations of authorities other than the building department (e.g., police department).

A-8.2.2.2. Protection of Adjacent Properties The requirements of 8.2.2.2. apply to projects of all sizes where there exists the potential for unintended movement of bearing surfaces as a consequence of proposed or prior, soil disturbance or excavation. Designers should take care that appropriate assessments of the existing conditions have been carried out before relying upon shallow foundation design principles, as this may lead to concerns over soil movement, slope stability and the impact on adjacent properties and City infrastructure.
Owners considering deeper basements, or work in areas containing peat, liquefiable, or potentially unstable soils (such as adjacent to site where the amount of native untouched fill is unknown), should obtain assistance from qualified professionals before undertaking such this work. Guidance for geotechnical and foundation design work for one and two family homes are provided in the "Housing Foundations and Geotechnical Challenges – Best Practices for Residential Builders in BC" publication.

A-8.2.5.5.(1) Disposal of Waste Material Certain waste materials are banned or prohibited from disposal at a garbage or landfill site. The Greater Vancouver Sewerage and Drainage District Act and its regulations, and the City of Vancouver Solid Waste By-law No. 8417 lists materials that are restricted or prohibited from disposal at a garbage or landfill sites. Sorted material means the separation of waste materials into like type materials at the construction site prior to disposal. Diverted material means the reuse, recycle or recovery of sorted waste material to avoid disposal at a garbage, landfill or incinerator facility.

A-8.2.6.1. Application The degree of application should be determined in advance in conjunction with the Chief building Official. Each operation should be determined in advance, as part of the fire safety plan for the operation, taking into consideration such issues as the size of the operation, exposure of adjacent buildings or facilities to hazards and the site conditions. Operations can range from large multi-storey buildings to small single-storey residences and may include additions or alterations to existing buildings. Where the work does not pose an exposure hazard to other buildings or to occupants, the application of Subsection 8.2.6. may be minimal.

A-8.2.6.2. Protection of Adjacent Buildings Methods and materials used to protect adjacent buildings and facilities can range from active to passive systems such as spatial separation, installing water curtains, using construction methods and materials that include gypsum sheathing or erecting a temporary fire barrier such as a fire tarpaulin.

A-8.2.6.3.(2)(a) Fire Safety Plan The control of fire hazards in and around buildings under construction, renovation or demolition includes fire protection for combustible material construction and combustible refuse on the site. The size of material and refuse piles and
the location of these piles in relation to adjacent buildings are factors that should be taken into consideration in determining which fire protection measures to implement. The selection of fire protection measures for demolition operations will also depend on the demolition procedure being used, the specific conditions existing on the site and the firefighting capabilities of the responding fire department. It is the intent of this By-law that the Outdoor Storage requirements of the Fire By-law are in compliance on all construction and demolition sites.

A-8.2.6.6. Standpipe Systems Not all aspects of Subsection 3.2.5. of Division B of the Building By-law are applicable to unoccupied areas of buildings, parts of buildings, facilities and associated areas undergoing construction, alteration or demolition operations. When the temperature causes freezing conditions, the standpipe should be drained to prevent damage to the equipment. It is not expected that hoses and nozzles be made available in the building undergoing construction, alteration or demolition operations, as they will be brought to the relevant floor by the responding fire department.

A-8.2.6.8. Ignition Sources Minimum clearances shown on certified heating equipment or as described in Part 6 of Division B of the Building By-law should be provided between combustible materials and temporary heating equipment, including flues such as exhaust discharges from internal combustion engines.

A-8.2.6.11.(4) Safety of Fuel Tanks and Piping at Construction Sites Guidance on methods of rendering inert tanks, piping and machinery reservoirs is available in NFPA 326, “Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair.”

Part 9
Housing and Small Buildings

Section 9.1. General

9.1.1. Application

9.1.1.1. General Application

1) The application of this Part shall be as described in Subsection 1.3.3. of Division A. (See Note A-9.1.1.1.(1) regarding application to seasonally and intermittently occupied *buildings*.)
2) When an *existing building* is altered and the *alteration* triggers upgrading as determined in Division B Section 11.2., the alternative *acceptable* solutions provided in Division B, Sections 11.3., 11.4., 11.5. and 11.6. may apply in lieu of the requirements of this Part. (See Article 1.1.1.2. of Division A.)

9.1.2. Reserved

Section 9.2. Definitions

9.2.1. General

9.2.1.1. Defined Words

1) Words in italics are defined in Article 1.4.1.2. of Division A.

Section 9.3. Materials, Systems and Equipment

9.3.1. Concrete

9.3.1.1. General

1) Except as provided in Sentence (2) and Articles 9.3.1.6. and 9.3.1.7., unreinforced and nominally reinforced concrete shall be designed, mixed, placed, cured and tested in accordance with the requirements for "R" class concrete stated in Section 9 of CSA A23.1, "Concrete Materials and Methods of Concrete Construction."
2) Unreinforced and nominally reinforced site-batched concrete shall be designed, mixed, placed and cured in accordance with Articles 9.3.1.2. to 9.3.1.9.
3) Except as provided in Sentence (4), reinforced concrete shall be designed to conform to the requirements of Part 4.
4) For flat insulating concrete form walls not exceeding 2 *storeys* in *building height* and having a maximum floor to floor height of 3 m, in *buildings* of light-frame construction containing only a single *dwelling unit*, the concrete and reinforcing shall comply with Part 4 or

- a) the concrete shall conform to CSA A23.1, "Concrete Materials and Methods of Concrete Construction," with a maximum aggregate size of 19 mm, and
- b) the reinforcing shall
  - i) conform to CSA G30.18, "Carbon Steel Bars for Concrete Reinforcement,"
  - ii) have a minimum specified yield strength of 400 MPa, and
  - iii) be lapped a minimum of 450 mm for 10M bars and 650 mm for 15M bars (See also Articles 9.15.4.5. and 9.20.17.2. to 9.20.17.4.).

9.3.1.2. Cement

1) Cement shall meet the requirements of CSA A3001, “Cementitious Materials for Use in Concrete.”

9.3.1.3. Concrete in Contact with Sulphate Soil

1) Concrete in contact with sulphate *soil*, which is deleterious to normal cement, shall conform to the requirements in Clause 4.1.1.6 of CSA A23.1, “Concrete Materials and Methods of Concrete Construction.”

9.3.1.4. Aggregates

1) Aggregates shall

a) consist of sand, gravel, crushed *rock*, crushed air-cooled blast *furnace* slag, expanded shale or expanded clay conforming to CSA A23.1, “Concrete Materials and Methods of Concrete Construction,” and

b) be clean, well-graded and free of injurious amounts of organic and other deleterious material.

9.3.1.5. Water

1) Water shall be clean and free of injurious amounts of oil, organic matter, sediment or any other deleterious material.

9.3.1.6. Compressive Strength

(See also Article 9.12.4.1., Sentence 9.15.4.2.(1) and Article 9.18.6.1.)

1) Except as provided elsewhere in this Part, the compressive strength of unreinforced concrete after 28 days shall be not less than

a) 15 MPa for walls, columns, fireplaces and *chimneys*, footings, *foundation* walls, grade beams and piers,

b) 20 MPa for floors other than those in garages and carports, and

c) for garage and carport floors, and the exterior steps,

i) 32 MPa, or

ii) 30 MPa where indigenous aggregates do not achieve 32 MPa with a 0.45 water to cementing material ratio.

2) Site-batched concrete used for garage and carport floors and exterior steps shall have air entrainment of 5 to 8%.

9.3.1.7. Concrete Mixes

(See Note A-9.3.1.7.)

1) For pre-mixed concrete and for the site-batched concrete mixes described in Table 9.3.1.7., the maximum ratio of water to cementing materials measured by weight shall not exceed

a) 0.70 for walls, columns, fireplaces and *chimneys*, footings, *foundation* walls, grade beams and piers,

b) 0.65 for floors other than those in garages and carports, and

c) 0.45 for garage and carport floors, and exterior steps.

Table 9.3.1.7.
Site-Batched Concrete Mixes
Forming Part of Sentence 9.3.1.7.(1)

Maximum Size of Coarse Aggregate, mm	Materials, volume					
	Cementing Material		Fine Aggregate (damp average coarse sand)		Coarse Aggregate (gravel or crushed stone)	
	Parts(1)	L	Parts	L	Parts	L

14	1	28	1.75	49	2	56
20	1	28	1.75	49	2.5	70
28	1	28	2	56	3	84
40	1	28	2	56	3.5	98

Notes to Table 9.3.1.7.:
(1)1 part cementing material = 1 × 40 kg bag

2) The size of aggregate in unreinforced site-batched concrete mixes referred to in Sentence (1) shall not exceed
a) 1/5 the distance between the sides of vertical forms, or
b) 1/3 the thickness of flatwork.

9.3.1.8. Admixtures

1) Admixtures shall conform to ASTM C 260, "Air-Entraining Admixtures for Concrete," or ASTM C 494/C 494M, "Chemical Admixtures for Concrete," as applicable.

9.3.1.9. Cold Weather Requirements

1) When the air temperature is below 5°C, concrete shall be
a) kept at a temperature of not less than 10°C or more than 25°C while being mixed and placed, and
b) maintained at a temperature of not less than 10°C for 72 h after placing.

2) No frozen material or ice shall be used in concrete described in Sentence (1).

9.3.2. Lumber and Wood Products

9.3.2.1. Grade Marking

1) Lumber for joists, rafters, trusses and beams and for the uses listed in Table 9.3.2.1. shall be identified by a grade stamp to indicate its grade as determined by NLGA 2014, "Standard Grading Rules for Canadian Lumber." (See Note A-9.3.2.1.(1).)

Table 9.3.2.1.
Minimum Lumber Grades for Specific End Uses
Forming Part of Sentence 9.3.2.1.(1)

Use	Boards(1)			Framing
	Paragraph in the NLGA Grading Rules under which boards are graded			
	All Species		Eastern White Pine & Red Pine	All Species
	Para 113	Para 114	Para 118	
Stud wall framing (*loadbearing* members)	–	–	–	Stud, Standard, No. 2
Stud wall framing (non-*loadbearing* members)	–	–	–	Stud, Utility, No. 3

Plank frame construction (*loadbearing* members)	No. 3 Common	–	No. 3 Common	No. 2
Plank frame construction (non-*loadbearing* members)	No. 5 Common	–	No. 5 Common	Economy, No. 3
Posts and beams less than 114 mm in thickness	–	–	–	Standard, No. 2
Posts and beams not less than 114 mm in thickness	–	–	–	Standard
Roof sheathing	No. 3 Common	Standard	No. 4 Common	–
Subflooring	No. 3 Common	Standard	No. 3 Common	–
Wall sheathing when required as a nailing base	No. 4 Common	Utility	No. 4 Common	–
Wall sheathing not required as a nailing base	No. 5 Common	Economy	No. 5 Common	–

Notes to Table 9.3.2.1.:
(1)See Note A-Table 9.3.2.1.

9.3.2.2. Lumber Grades

1) Except for joists, rafters, trusses and beams, visually graded lumber shall conform to the grades in Table 9.3.2.1. (See Article 9.23.4.2. for joists, rafters and beams and Article 9.23.14.11. for trusses.)

9.3.2.3. Machine Stress Rated Lumber

1) Machine stress rated lumber shall conform to the requirements of Subsection 4.3.1.

9.3.2.4. OSB, Waferboard and Plywood Marking

1) OSB, waferboard and plywood used for roof sheathing, wall sheathing and subflooring shall be legibly identified on the face of the material indicating

a) the manufacturer of the material,
b) the standard to which it is produced, and
c) that the material is of an exterior type.

9.3.2.5. Moisture Content

1) Moisture content of lumber shall be not more than 19% at the time of installation.

9.3.2.6. Lumber Dimensions

1) Lumber dimensions referred to in this Part are actual dimensions determined in conformance with CSA O141, "Softwood Lumber."

9.3.2.7. Panel Thickness Tolerances

1) The thicknesses specified in this Part for plywood, hardboard, particleboard, OSB and waferboard shall be subject to the tolerances permitted in the standards referenced for these products unless specifically indicated herein.

9.3.2.8. Undersized Lumber

1) Joist, rafter, lintel and beam members up to 5% less than the actual Canadian standard sizes are permitted to be used provided the allowable spans for the grade and species of lumber under consideration are reduced 5% from those shown in the Span Tables for full size members. (See Note A-9.3.2.8.(1).)

9.3.2.9. Termite and Decay Protection

1) In localities where termites are known to occur,

a) clearance between structural wood elements and the finished ground level directly below them shall be not less than 450 mm and, except as provided in Sentence (2), all sides of the supporting elements shall be visible to permit inspection, or

b) structural wood elements, supported by elements in contact with the ground or exposed over bare soil, shall be pressure-treated with a chemical that is toxic to termites.

(See Note A-9.3.2.9.(1).)

2) In localities where termites are known to occur and *foundations* are insulated or otherwise finished in a manner that could conceal a termite infestation,

a) a metal or plastic barrier shall be installed through the insulation and any other separation or finish materials above finished ground level to control the passage of termites behind or through the insulation, separation or finish materials, and

b) all sides of the finished supporting assembly shall be visible to permit inspection.

3) Structural wood elements shall be pressure-treated with a preservative to resist decay,

a) where the vertical clearance between structural wood elements and the finished ground level is less than 150 mm (See also Articles 9.23.2.2. and 9.23.2.3.), or

b) where

i) the wood elements are not protected from exposure to precipitation,

ii) the configuration is conducive to moisture accumulation, and

iii) the moisture index is greater than 1.00.

(See Note A-9.3.2.9.(3).)

4) Structural wood elements used in retaining walls and cribbing shall be pressure-treated with a preservative to resist decay, where

a) the retaining wall or cribbing supports ground that is critical to the stability of *building foundations*, or

b) the retaining wall or cribbing is greater than 1.2 m in height.

(See Note A-9.3.2.9.(4).)

5) Where wood is required by this Article to be treated to resist termites or decay, such treatment shall be in accordance with Table 2, Use Categories for Specific Products, Uses, and Exposures, of CAN/CSA-O80.1, “Specification of Treated Wood,” as follows:

a) Use Category 1 (UC1), where the wood member is used in

i) interior *construction*,

ii) above-ground applications, and

iii) applications where the wood member remains dry,

b) Use Category 2 (UC2), where the wood member is used in

i) interior *construction*,

ii) above-ground applications, and

iii) applications where the wood member may be subjected to occasional sources of moisture,

c) Use Category 3.2 (UC3.2), where the wood member is used in

i) exterior *construction*,

ii) above-ground applications, and

iii) applications where the wood member is uncoated or is used in a configuration conducive to moisture accumulation,

d) Use Category 4.1 (UC4.1), where

i) the wood member is in contact with the ground,

ii) the wood member is in contact with fresh water, or
iii) the vertical clearance between the wood element and the finished ground level is less than 150 mm and the wood elements are not separated from permeable supporting materials by a moisture barrier, or

e) Use Category 4.2 (UC4.2), where the wood member is used in critical structural components, including permanent wood *foundations*.

6) Where wood is protected in accordance with UC1 or UC2 using an inorganic boron preservative, the wood shall be

a) protected from direct exposure to water during and after the completion of *construction*, and
b) separated from permeable supporting materials by a moisture barrier that is resistant to all expected mechanisms of deterioration in the service environment if the vertical clearance to the ground is less than 150 mm.

7) Wood that is required by this Article to be treated to resist termites or decay shall be identified by a mark to indicate the type of preservative used and conformance to the relevant required Use Category.

9.3.3. Metal

9.3.3.1. Sheet Metal Thickness

1) Minimum thicknesses for sheet metal material that are stated in this Part refer to the actual minimum base metal thicknesses measured at any point of the material and, in the case of galvanized steel described in Sentence 9.3.3.2.(1), include the thickness of the galvanizing coating unless otherwise indicated.

9.3.3.2. Galvanized Sheet Steel

1) Where sheet steel is required to be galvanized, it shall be metallic-coated with zinc or an alloy of 55% aluminum-zinc meeting the requirements of

a) ASTM A 653/A 653M, "Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process," or
b) ASTM A 792/A 792M, "Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process."

2) Where galvanized sheet steel is intended for use in locations exposed to the weather or as a flashing material, it shall have a zinc coating not less than the G90 [Z275] coating designation or an aluminum-zinc alloy coating not less than the AZM150 coating designation, as referred to in Sentence (1).

Section 9.4. Structural Requirements

9.4.1. Structural Design Requirements and Application Limitations

9.4.1.1. General

(See Note A-9.4.1.1.)

1) Subject to the application limitations defined elsewhere in this Part, structural members and their connections shall

a) conform to requirements provided elsewhere in this Part,
b) be designed according to good engineering practice such as that provided in CWC 2014, "Engineering Guide for Wood Frame Construction," or
c) be designed according to Part 4 using the loads and deflection and vibration limits specified in
i) Part 9, or
ii) Part 4.

2) Where floor framing is designed in accordance with Clause (1)(b) or (c), and where supporting wall framing and fastenings, or footings, are designed according to Clause (1)(a), the maximum specified *live load* on the floor according to Table 4.1.5.3. shall not exceed 2.4 kPa.

3) Location-specific information for structural design, including snow and wind loads and seismic spectral response accelerations, shall be determined according to Subsection 1.1.3.

4) A *registered professional* who undertakes design work and *field review* for the structural design of a *building* of *residential occupancy* containing not more than two principal *dwelling units* shall provide a note on the structural drawings which provides assurance that the design of the structure has been reviewed for resistance to the structural requirements of Division B Section 9.4.

9.4.2. Specified Loads

9.4.2.1. Application

1) This Subsection applies to light-frame constructions whose wall, floor and roof planes are generally comprised of frames of small repetitive structural members, and where

a) the roof and wall planes are clad, sheathed or braced on at least one side,
b) the small repetitive structural members are spaced not more than 600 mm o.c.,
c) the clear span of any structural member does not exceed 12.2 m,
d) the maximum deflection of the structural roof members conforms to Article 9.4.3.1.,
e) the maximum total roof area, notwithstanding any separation of adjoining *buildings* by *firewalls*, is 4 550 m^2, and
f) for flat roofs, there are no significant obstructions on the roof, such as parapet walls, spaced closer than the distance calculated by

$$D_0 = 10(H_0 - 0.8S_s/\gamma)$$

where

D_o = minimum distance between obstructions, m,
H_o = height of the obstruction above the roof, m,
S_s = ground snow load, kPa, and
γ = specific weight of snow, kN/m^3.

(See Note A-9.4.2.1.(1).)

9.4.2.2. Specified Snow Loads

(See Note A-9.4.2.2.)

1) Except as provided in Sentences (2) and (3), specified snow loads shall be not less than those calculated using the following formula:

$$S = C_b S_s + S_r$$

where

S = specified snow load,
C_b = basic snow load roof factor, which is 0.45 where the entire width of the roof does not exceed 4.3 m and 0.55 for all other roofs,
S_s = 1-in-50-year ground snow load in kPa, determined according to Subsection 1.1.3., and
S_r = associated 1-in-50-year rain load in kPa, determined according to Subsection 1.1.3.

2) In no case shall the specified snow load be less than 1 kPa.

3) Bow string, arch or semi-circular roof trusses having an unsupported span greater than 6 m shall be designed in conformance with the snow load requirements in Subsection 4.1.6.

9.4.2.3. Platforms Subject to Snow and Occupancy Loads

1) Balconies, decks and other accessible exterior platforms intended for an *occupancy* and subject to snow loads shall be designed to carry the specified roof snow load or 1.9 kPa, whichever is greater, where the platform, or each segregated area of the platform, serves a single *dwelling unit*. (See Note A-9.4.2.3.(1).)

9.4.2.4. Attics and Roof Spaces

1) The ceiling joists or truss bottom chords in residential *attic or roof spaces* having limited accessibility that precludes the storage of equipment or material shall be designed for a total specified load of not less than

0.35 kPa, where the total specified load is the sum of the specified *dead load* plus the specified *live load* of the ceiling. (See Note A-9.4.2.4.(1).)

9.4.3. Deflections

9.4.3.1. Deflections

1) The maximum deflection of structural members shall conform to Table 9.4.3.1.

2) Dead loads need not be considered in computing deflections referred to in Sentence (1).

Table 9.4.3.1.
Maximum Deflections
Forming Part of Sentence 9.4.3.1.(1)

Structural Members	Type of Ceiling Supported	Max. Allowable Deflection as an Expressed Ratio of the Clear Span
Roof rafters, roof joists and roof beams	No ceiling	1/180
	Other than plaster or gypsum board	1/240
	Plaster or gypsum board	1/360
Ceiling joists	Other than plaster or gypsum board	1/240
	Plaster or gypsum board	1/360
Floor beams, floor joists and floor decking	All cases	1/360
Beams, joists and decking for balconies, decks and other accessible exterior platforms	Serving a single *dwelling unit*	1/240
	Other	1/360

9.4.4. Foundation Conditions

9.4.4.1. Allowable Bearing Pressures

1) Footing sizes for *shallow foundations* shall be

a) determined in accordance with Section 9.15., or

b) designed in accordance with Section 4.2. using

i) the maximum allowable bearing pressures in Table 9.4.4.1., or

ii) allowable bearing pressures determined from *subsurface investigation*.

Table 9.4.4.1.
Allowable Bearing Pressure for Soil or Rock
Forming Part of Sentence 9.4.4.1.(1)

Type and Condition of *Soil* or *Rock*	Maximum Allowable Bearing Pressure, kPa
Dense or compact sand or gravel(1)	150
Loose sand or gravel(1)	50
Dense or compact silt(1)	100

Stiff clay(1)	150
Firm clay(1)	75
Soft clay(1)	40
Till	200
Clay shale	300
Sound *rock*	500

Notes to Table 9.4.4.1.:
(1) See Note A-Table 9.4.4.1.

9.4.4.2. Foundation Capacity in Weaker Soil and Rock

1) Where a *soil* or *rock* within a distance equal to twice the footing width below the *bearing surface* has a lower allowable bearing pressure than that at the *bearing surface* as shown in Article 9.4.4.1., the design capacity of the *foundation* shall not be greater than would cause the weakest *soil* or *rock* to be stressed beyond its allowable bearing pressure.
2) In calculating subsurface pressures referred to in Sentence (1), the loads from the footings shall be assumed to be distributed uniformly over a horizontal plane within a frustum extending downward from the footing at an angle of 60° to the horizontal.

9.4.4.3. High Water Table

1) Where a *foundation* bears on gravel, sand or silt, and the water table is within a distance below the *bearing surface* equal to the width of the *foundation*, the allowable bearing pressure shall be 50% of that determined in Article 9.4.4.1.

9.4.4.4. Soil Movement

1) Where a *foundation* is located in an area where *soil* movement caused by changes in *soil* moisture content, freezing, or chemical-microbiological oxidation is known to occur to the extent that it will damage a *building*, measures shall be taken to preclude such movement or to reduce its effects on the *building* so that the *building's* stability and the performance of assemblies will not be adversely affected. (See Note A-9.4.4.4.(1).)
2) The potential for slope instability and its consequences, such as slope displacement, shall be evaluated based on site-specific material properties and ground motion parameters referenced in Subsection 1.1.3. and shall be taken into account in the design of the structure and its *foundations*.

9.4.4.5. Retaining Walls

1) Walls shall be designed to resist the lateral pressure of the retained material.

9.4.4.6. Walls Supporting Drained Earth

(See Note A-9.4.4.6. and Article 9.15.1.1.)
1) Except where constructed in accordance with Section 9.15., walls supporting drained earth shall be designed

for a pressure equivalent to that exerted by a fluid that has a density of not less than 480 kg/m^3 and a depth equal to a) that of the retained earth, or
b) in accordance with Section 4.2. so as to be able to resist the loads and effects described in Article 4.1.2.1.

2) Walls supporting other than drained earth shall be designed

a) for the pressure described in Clause (1)(a) plus the fluid pressure of the surcharge, or
b) in accordance with Section 4.2. so as to be able to resist the loads and effects described in Article 4.1.2.1.

Section 9.5. Design of Areas and Spaces

9.5.1. General

9.5.1.1. Method of Measurement

1) Unless otherwise indicated herein, dimensions of rooms or spaces shall be measured between finished wall surfaces and between finished floor and ceiling surfaces.

9.5.1.2. Combination Rooms

(See Note A-9.5.1.2.)

1) Two or more areas may be considered as a combination room if the opening between the areas occupies the larger of 3 m^2 or 40% or more of the area of the wall measured on the side of the dependent area.

2) Where the dependent area is a bedroom, direct passage shall be provided between the two areas.

9.5.2. Access for Persons with Disabilities

9.5.2.1. General

1) Except as provided in Article 3.8.2.1., every *building* shall be designed in conformance with Section 3.8.

9.5.2.2. Protection on Accessible Floor Areas

1) Where *access* is required on any *floor area*, the requirements in Article 3.3.1.7. shall apply.

9.5.2.3. Reserved

9.5.3. Ceiling Heights

9.5.3.1. Ceiling Heights of Rooms or Spaces

1) The ceiling heights and clear heights in rooms or spaces in *residential occupancies* shall conform to Table 9.5.3.1.

2) Reserved.

3) Reserved.

4) Areas in rooms or spaces over which ceiling height and clear height are not less than the minimum specified in Table 9.5.3.1. shall be contiguous with the entry or entries to those rooms or spaces

Table 9.5.3.1.
Room Ceiling Heights
Forming Part of Sentences 9.5.3.1.(1) and (4)

Room or Space	Minimum Ceiling Height, m	Minimum Clear Height, m	Minimum Area Over Which Minimum Ceiling Height Shall Be Provided(1)
Living room or space	2.1		Lesser of area of the space or 10.0 m^2
Dining room or space	2.1		Lesser of area of the space or 5.2 m^2
Kitchen or kitchen space	2.1		Lesser of area of the space or 3.2 m^2

Master bedroom or bedroom space	2.1		Lesser of area of the space or 4.9 m²
Other bedroom or sleeping space	2.1		Lesser of area of the space or 3.5 m²
Unfinished *basement* including laundry area therein		2.0	Clear height under beams and in any location that would normally be used for passage
Bathroom, water-closet room or laundry area above *grade*	2.1		Lesser of area of the space or 2.2 m²
Passage, hall or main entrance vestibule	2.1		Area of the space
Habitable rooms and spaces not specifically mentioned above	2.1		Lesser of area of the space or 2.2 m²

Notes to Table 9.5.3.1.:

(1) Area of the space shall be measured at floor level.

9.5.3.2. Mezzanines

1) The ceiling height above and below a *mezzanine* floor assembly in *occupancies* other than *residential occupancies* shall be not less than 2.1 m.

9.5.3.3. Storage Garages

1) The clear height in a *storage garage* shall be not less than 2 m.

9.5.4. Hallways

9.5.4.1. Hallway Width

1) The unobstructed width of a hallway within a *dwelling unit* shall be not less than 860 mm, except that the hallway width is permitted to be 710 mm where

a) there are only bedrooms and bathrooms at the end of the hallway furthest from the living area, and

b) a second *exit* is provided

i) in the hallway near the end farthest from the living area, or

ii) in each bedroom served by the hallway.

9.5.5. Doorway Sizes

9.5.5.1. Doorway Opening Sizes

1) Except as provided in Articles 9.5.5.3., 9.9.6.2. and 9.9.6.3., doorway openings within *dwelling units* shall be designed to accommodate at least the door sizes given in Table 9.5.5.1. for swing-type and folding doors.

2) Reserved.

Table 9.5.5.1.
Size of Doors
Forming Part of Sentence 9.5.5.1.(1)

At Entrance to:	Minimum Width, mm	Minimum Height, mm
Dwelling unit (required entrance)	810	1 980
Vestibule or entrance hall		
Stairs to a floor level that contains a finished space	810	1 980
All doors in at least one line of passage from the exterior to the *basement*		
Utility rooms		
Walk-in closet	610	1 980
Bathroom, water-closet room, shower room(1)	610	1 980
Rooms located off hallways that are permitted to be 710 mm wide	610	1 980
Rooms not mentioned above, exterior balconies	760	1 980

Notes to Table 9.5.5.1.:
(1) See Article 9.5.5.3.

9.5.5.2. Doorways to Public Water-Closet Rooms
1) Doorways to public water-closet rooms shall be not less than 810 mm wide and 2 030 mm high.

9.5.5.3. Doorways to Rooms with a Bathtub, Shower or Water Closet
(See Note A-9.5.5.3.)
1) This Article applies where a hallway of not less than 860 mm wide serves one or more rooms containing a bathtub, shower or water closet.
2) At least one doorway in a hallway described in Sentence (1) shall be constructed
a) so that access is provided to not less than 1 of each type of fixture described in Sentence (1), and
b) to accommodate a door not less than 760 mm wide.

9.5.6. Automatic Overhead Garage Doors

9.5.6.1. Automatic Overhead Garage Doors
1) Automatic overhead garage doors equipped with openers shall be designed in accordance with Articles 3.3.7.6. and 3.3.7.7.

Section 9.6. Glass

9.6.1. General

9.6.1.1. Application

1) This Section applies to glass, and the protection of glass, in

a) doors, including closet doors and sidelights for doors,
b) windows,
c) skylights as defined in Sentence 9.7.1.1.(2),
d) shower or bathtub enclosures,
e) glazed panels and partitions, and
f) glass guards.

(See Note A-9.6.1.1.)

9.6.1.2. Material Standards for Glass

1) Glass shall conform to

a) CAN/CGSB-12.1-M, "Tempered or Laminated Safety Glass,"
b) CAN/CGSB-12.2-M, "Flat, Clear Sheet Glass,"
c) CAN/CGSB-12.3-M, "Flat, Clear Float Glass,"
d) CAN/CGSB-12.4-M, "Heat Absorbing Glass,"
e) CAN/CGSB-12.8, "Insulating Glass Units,"
f) CAN/CGSB-12.10-M, "Glass, Light and Heat Reflecting,"
g) CAN/CGSB-12.11-M, "Wired Safety Glass," or
h) ASTM E 2190, "Insulating Glass Unit Performance and Evaluation."

2) Mirrored glass doors are only permitted to be used at the entrance to clothes closets and shall conform to the requirements of CAN/CGSB-82.6-M, "Doors, Mirrored Glass, Sliding or Folding, Wardrobe." (See Note A-9.6.1.2.(2).)

9.6.1.3. Structural Sufficiency of Glass

1) Except as provided in Sentence (3), glass shall be designed in conformance with

a) CAN/CGSB-12.20-M, "Structural Design of Glass for Buildings," or
b) ASTM E 1300, "Standard Practice for Determining Load Resistance of Glass in Buildings." (See also Article 4.3.6.1.).

2) Reserved.

3) Deleted.

Table 9.6.1.3.
Glass Area for Doors
Forming Part of Sentence 9.6.1.3.(3)

Glass Thickness, mm	Maximum Glass Area, m^2 (1)						
	Type of Glass						
	Annealed	Annealed, Multiple-Glazed, Factory-Sealed Units	Laminated	Wired	Heat-Strengthened	Fully Tempered	Fully Tempered, Multiple-Glazed, Factory-Sealed
3	0.50	0.70	(2)	(2)	1.00	1.00	2.00
4	1.00	1.50	(2)	(2)	1.50	4.00	4.00

5	1.50	1.50	(2)	(2)	1.50	No limit	No limit
6	1.50	1.50	1.20	1.00	1.50	No limit	No limit

Notes to Table 9.6.1.3.:
(1) See Note A-Table 9.6.1.3.
(2) Not generally available.

9.6.1.4. Types of Glass and Protection of Glass

1) Glass sidelights and windows located within 915 mm of doors and greater than 500 mm wide that could be mistaken for doors, glass in storm doors and glass in sliding doors within or at every entrance to a *dwelling unit* and in public areas shall be

a) safety glass of the tempered or laminated type conforming to CAN/CGSB-12.1-M, "Tempered or Laminated Safety Glass," or

b) wired glass conforming to CAN/CGSB-12.11-M, "Wired Safety Glass."

2) Except as provided in Sentence (4), glass in entrance doors to *dwelling unit*s and in public areas, other than the entrance doors described in Sentence (1), shall be safety glass or wired glass of the type described in Sentence (1).

3) Except as provided in Sentence (4), transparent panels that could be mistaken as a *means of egress* shall be protected by barriers or railings.

4) Sliding glass *partitions* that separate a *public corridor* from an adjacent *occupancy* and that are open during normal working hours need not conform to Sentences (2), (3) and (5), except that such *partitions* shall be suitably marked to indicate their existence and position.

5) Except as provided in Sentence (4), every glass or transparent door accessible to the public shall be equipped with hardware, bars or other permanent fixtures designed so that the existence and position of such doors is readily apparent.

6) Glass other than safety glass shall not be used for a shower or bathtub enclosure.

7) All skylights shall be glazed with wired glass, laminated safety glass or *combustible* glazing, which is anchored to the skylight frame and to the *building* structure. (See Note A-3.1.14.3.)

Section 9.7. Windows, Doors and Skylights

(See Note A-9.7. and Note A-9.7.4.)

9.7.1. General

9.7.1.1. Application

1) This Section applies to

a) windows, doors and skylights separating *conditioned space* from unconditioned space or the exterior, and

b) entrance doors to *dwelling units*.

2) For the purpose of this Section, the term "skylight" refers to unit skylights, roof windows and tubular daylighting devices.

3) For the purpose of this Section, the term "doors" includes glazing in doors and sidelights for doors but does not include vehicular access doors.

9.7.2. Required Windows, Doors and Skylights

9.7.2.1. Entrance Doors

1) A door shall be provided at each entrance to a *dwelling unit*.

2) Main entrance doors to *dwelling units* shall be provided with

a) a door viewer or transparent glazing in the door, or

b) a sidelight.

9.7.2.2. Reserved

9.7.3. Performance of Windows, Doors and Skylights

9.7.3.1. General

1) Skylights and their components shall be designed, constructed and installed so that they resist snow loads.

2) Reserved.

3) Reserved.

4) Reserved.

5) Reserved.

9.7.3.2. Heat Transfer Performance

1) Windows, doors and skylights and their components described in Sentence 9.7.1.1.(1) shall be designed, constructed and installed to

a) minimize surface condensation on the warm side of the component (See Note A-9.7.3.2.(1)(a)), and

b) ensure comfortable conditions for occupants.

2) Compliance with the heat transfer performance requirements described in Sentence (1) shall be demonstrated by

a) complying with the requirements in Article 9.7.3.3., or

b) design and construction conforming to Part 5.

3) Windows, doors and skylights shall conform to the energy efficiency requirements of Part 10

9.7.3.3. Thermal Characteristics of Windows, Doors and Skylights

1) Except as permitted in Sentence (2), metal frames and sash of windows, doors and skylights shall incorporate a thermal break.

2) Windows and doors described in Sentence (1) do not require a thermal break where they

a) **reserved**,

b) are installed as storm windows and doors, or

c) are required to have a *fire-protection rating*.

3) Reserved.

4) Windows, doors and skylights with or without storm doors or sash that are installed in portions of *buildings* where the intended use of the interior space will result in high moisture generation shall be designed in conformance with Section 5.3. (See Note A-9.25.5.2.)

9.7.4. Design and Construction

9.7.4.1. General

1) Except as provided by Sentence (2), windows, doors, skylights and their components shall be designed and constructed in accordance with

a) Article 9.7.4.2., or

b) Part 5.

2) Windows, doors, skylights and their components that are required to have a *fire-protection rating* need not conform to this Subsection.

9.7.4.2. Standards

1) Except as permitted by Sentence (2) and Article 9.7.4.3., windows, doors and skylights and their components shall conform to

a) AAMA/WDMA/CSA 101/I.S.2/A440, "NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights" (Harmonized Standard), and
b) CSA A440S1, "Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights".

(See Note A-9.7.4.2.(1).)

2) A door designated as a "Limited Water" door in accordance with the standard referenced in Clause (1)(a) shall not be used unless the door
a) separates a *dwelling unit* from an unconditioned *storage garage* or a carport,
b) conforms to Clauses 3.3.1.13.(1)(a), (b) and (c) and Sentences 3.3.1.13.(5) and (10), or
c) is not required by Sentence 9.27.3.8.(3) to have flashing installed.

9.7.4.3. Performance Requirements

1) For the purposes of compliance with the standard referenced in Clause 9.7.4.2.(1)(b), windows, doors and their components in a *building* of no more than 10 m in height, measured from *grade*, may conform to the design pressure, performance grade and water resistance values in Table C-5 of Appendix C instead of the values calculated in the CSA A440S1, "Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights,"

2) For *buildings* described in Sentence 1.3.3.3.(1) of Division A, where design pressure, performance grade and water resistance values are calculated in accordance with the standard referenced in Clause 9.7.4.2.(1)(b), the driving rain wind pressure (DRWP) values in Table A.1 of CSA A440S1, "Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights," shall be used.
(See Note A-9.7.4.3.(2).)

3) Reserved.

4) Reserved.

9.7.5. Resistance to Forced Entry

9.7.5.1. Resistance to Forced Entry for Sliding Doors

1) This Article applies to sliding doors serving *dwelling units*, other than exterior doors to garages and to other ancillary spaces.

2) Sliding doors shall not permit the removal of the sliding panel when in the locked position.

3) Exterior doors shall
a) have a pin type locking mechanism, with a minimum 9 mm throw into the frame, or an equivalent locking mechanism, operable from the interior without the use of keys, special devices or specialized knowledge of the locking mechanism, or
b) conform to at least Grade 10 in ASTM F842, "Standard Test Methods for Measuring the Forced Entry Resistance of Sliding Door Assemblies, Excluding Glazing Impact."

9.7.5.2. Resistance to Forced Entry for Swinging Doors

1) Except for exterior doors to ancillary spaces other than garages, this Article applies to
a) swinging entrance doors to *dwelling units*,
b) swinging doors between *dwelling units* and attached garages or other ancillary spaces,
c) swinging doors that provide access directly or indirectly from a *storage garage* to a *dwelling unit*, and
d) swinging entrance doors to detached *storage garages*.

(See Note A-9.7.5.2.(1).)

2) Doors, frames and hardware that conform to AAMA 1304, "Voluntary Specification for Forced Entry Resistance of Side-Hinged Door Systems," are not required to conform to Sentences (3) to (7).
(See Note A-9.7.5.2.(2).)

3) Where doors as described in Sentence (1) are constructed of wood, they shall

a) be solid core or stile-and-rail type,
b) be not less than 45 mm thick, and
c) if of the stile-and-rail type, have a panel thickness of not less than 19 mm, with a total panel area not more than half of the door area.

4) Doors described in Sentence (1) shall be provided with
a) a deadbolt lock with a cylinder having no fewer than 5 pins, and
b) a bolt throw not less than 25 mm long, protected with a solid or hardened free-turning ring or beveled cylinder housing.
(See Article 9.9.6.7.)

5) An inactive leaf in double doors used in locations specified in
Sentence (1) shall be provided with heavy-duty bolts top and bottom having an engagement of not less than 15 mm.

6) Hinges for doors described in Sentence (1) shall be fastened
a) to wood doors with wood screws not less than 25 mm long and to wood frames with wood screws so that at least 2 screws per hinge penetrate not less than 30 mm into solid wood, or
b) to metal doors and metal frames with machine screws not smaller than No. 10 and not less than 10 mm long.
(See Note A-9.7.5.2.(6).)

7) Strikeplates for deadbolts described in Sentence (4) shall be fastened
a) to wood frames with wood screws that penetrate not less than 30 mm into solid wood, or
b) to metal frames with machine screws not smaller than No. 8 and not less than 10 mm long.
(See Note A-9.7.5.2.(6))

8) Except for storm or screen doors, doors described in Sentence (1) that swing outward shall be provided with hinges or pins so that the doors cannot be removed when they are in the closed position.
(See Note A-9.7.5.2.(8).)

9) Solid blocking shall be provided on both sides at the lock height between the jambs for doors described in Sentence (1) and the structural framing so that the jambs will resist spreading by force.

10) Except as permitted by Sentences (11) and (12), a door frame reinforcement plate shall be installed between the jack stud and door frame, and shall be:
a) constructed of minimum 18 gauge steel plate;
b) provided with an integral metal tongue that is:
i) at right angles to the plate located and designed so as to resist the inwards movement of the door when the deadbolt is engaged, and
ii) inset into the door frame to a minimum 15.9 mm depth; and
c) screwed into the door frame or adjacent jack stud with wood screws that are:
i) are not smaller than No. 10,
ii) penetrate at least 50 mm into wood studs,
iii) have at least two points of attachment on each side of the deadbolt, and
iv) are located at least 38 mm away from the deadbolt throw.
(See Notes A-9.7.5.2.(10) and (11).)

11) Except as permitted by Sentence (12), strikeplates required by Clause 9.7.5.2.(7)(a) and installed in a wood door frame without the reinforcement plate of Sentence (10), shall be:
a) constructed from minimum 18 gauge steel plate;
b) provided with an integral door reinforcement by means of a minimum 13 mm long metal tongue inset into the frame at right angles to the strike plate and arranged so as to resist forced entry when the deadbolt is engaged; and
c) attached to the door frame by means of wood screws penetrating at least 30 mm into the wood at least two points of attachment on each side of the deadbolt, at least 38 mm away from the deadbolt throw.
(See Note A-9.7.5.2.(10) and (11).)

12) A door provided with a multi-point locking system is not required to comply with Sentences (10) or (11).

9.7.5.3. Resistance to Forced Entry for Windows

1) In *dwelling units*, windows, any part of which is located within 2 m of adjacent ground level, shall conform to the requirements for resistance to forced entry as described in Clause 5.3.5 of AAMA/WDMA/CSA 101/I.S.2/A440, "NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights."
(See Note A-9.7.5.3.(1).)

9.7.5.4. Resistance to Forced Entry for Skylights

1) All openable skylights shall be designed to prevent opening from the outside when in the closed and locked position.
2) All exterior skylight fasteners shall be tamperproof.

9.7.6. Installation

9.7.6.1. Installation of Windows, Doors and Skylights

1) Except as provided by Sentence (2), the installation of manufactured and pre-assembled windows, doors and skylights and the field assembly of manufactured window and door combination units shall conform to the instructions, if any, provided by the manufacturer.
2) In case of conflict between the provisions of this By-law and instructions referred to in Sentence (1), the provisions of this By-law shall govern.
3) Windows, doors and skylights shall be sealed to air barriers.

9.7.6.2. Sealants, Trim and Flashing

1) The sealing compound used to seal the glass component of an insulating glazing unit to the sash component shall be compatible with the sealing compound used to edge seal the glass component.
2) Flashing used to protect openings shall conform to Articles 9.27.3.7. and 9.27.3.8.
3) Sealants shall be applied between window frames or trim and the exterior cladding or masonry in conformance with Subsection 9.27.4.
4) All unfinished portions of the frame and other components of aluminum windows, doors or skylights in contact with the edges of masonry, concrete, stucco or plaster shall be protected with an alkali-resistant coating.

Section 9.8. Stairs, Ramps, Handrails and Guards

9.8.1. Application

9.8.1.1. General

1) This Section applies to the design and construction of interior and exterior stairs, steps, ramps, handrails and *guards*.

9.8.1.2. Stairs, Ramps, Landings, Handrails and Guards in Garages

1) Where stairs, ramps, landings, handrails or *guards* are installed in garages that serve a single *dwelling unit*, the garage shall be considered to be part of the *dwelling unit* and the requirements for stairs, ramps, landings, handrails and *guards* within *dwelling units* shall apply.

9.8.1.3. Exit Stairs, Ramps and Landings

1) Where a stair, ramp or landing forms part of an *exit*, the appropriate requirements in Sections 9.9. and 9.10. shall also apply.

9.8.1.4. Escalators and Moving Walkways

1) Escalators and moving *walkways* shall conform to the appropriate requirements in Part 3.

9.8.2. Stair Dimensions

9.8.2.1. Stair Width

1) Except as provided in Sentence (2), required *exit* stairs and public stairs serving *buildings* of *residential occupancy* shall have a width of not less than 900 mm.

2) Exit stairs serving a single *dwelling unit* shall have a width of not less than 860 mm.

3) Required *exit* stairs and public stairs serving *buildings* of other than *residential occupancy* shall have a width of not less than the greater of

a) 900 mm, or

b) 8 mm per person based on the *occupant load* limits specified in Table 3.1.17.1.

4) At least one stair between each floor level within a *dwelling unit*, and exterior stairs serving a single *dwelling unit* except required *exit* stairs, shall have a width of not less than 860 mm.

9.8.2.2. Height over Stairs

1) The clear height over stairs shall be measured vertically, over the clear width of the stair, from a straight line tangent to the tread and landing nosings to the lowest point above. (See Note A-3.4.3.4.)

2) Except as provided in Sentence (3), the clear height over stairs shall not be less than 2 050 mm.

3) The clear height over stairs serving a single *dwelling unit* shall not be less than 1 950 mm.

9.8.3. Stair Configurations

9.8.3.1. Permitted Configurations

(See Note A-9.8.4.)

1) Except as provided by Sentence (2), stairs in *buildings* shall consist of

a) straight *flights*, or

b) except as provided in Sentence (4), curved *flights,*

2) Stairs within *dwelling units* shall consist of

a) straight *flights*,

b) except as provided in Sentence (4), curved *flights*,

c) **reserved**,

d) except as provided in Sentence (3), flights with rectangular treads and winders, or

e) **reserved**.

3) Only one set of winders described in Article 9.8.4.6. shall be permitted between floor levels.

4) Curved *flights* in *exits* shall comply with Sentence 3.4.6.9.(2).

5) All *tapered treads* within a *flight* shall turn in the same direction.

9.8.3.2. Minimum Number of Risers

1) Except for stairs within a *dwelling unit*, at least 3 risers shall be provided in interior *flights*.

9.8.3.3. Maximum Height of Stairs

1) The vertical height of any *flight* of stairs shall not exceed 3.7 m.

9.8.4. Step Dimensions

(See Note A-9.8.4.)

9.8.4.1. Dimensions for Risers

(See Note A-9.8.4.)

1) Except for stairs serving areas only used as *service rooms* or *service spaces*, the rise, which is measured as the vertical nosing-to-nosing distance, shall comply with Table 9.8.4.1.

Table 9.8.4.1.
Rise for Rectangular Treads and Tapered Treads (Including Winders)
Forming Part of Sentence 9.8.4.1.(1)

Stair Type	Rectangular Treads *and Tapered Treads* (Including Winders)	
	Rise, mm	
	Max.	Min.
Private[1]	200	125
Public[2]	180	125

Notes to Table 9.8.4.1.:
[1] Private stairs are exterior and interior stairs that serve single *dwelling units* or that serve garages that serve single *dwelling units*.
[2] Public stairs are all stairs not described as service stairs or private stairs.

9.8.4.2. Dimensions for Rectangular Treads

(See Note A-9.8.4.)

1) Except for stairs serving areas only used as *service rooms* or *service spaces*, the *run* shall comply with Table 9.8.4.2.

Table 9.8.4.2.
Run for Rectangular Treads
Forming Part of Sentence 9.8.4.2.(1)

Stair Type	Rectangular Treads	
	Run, mm	
	Max.	Min.
Private[1]	355	255
Public[2]	No limit	280

Notes to Table 9.8.4.2.:
[1] Private stairs are exterior and interior stairs that serve single *dwelling units* or that serve garages that serve single *dwelling units*.
[2] Public stairs are all stairs not described as service stairs or private stairs.

2) The depth of a rectangular tread shall be not less than its *run* and not more than its *run* plus 25 mm.

9.8.4.3. Dimensions of Tapered Treads

(See Note A-9.8.4.)

1) Except as provided in Sentence (3) and Article 9.8.4.6., *tapered treads* shall have a *run* that

a) is not less than 150 mm at the narrow end of the tread, and

b) complies with the dimensions stated in Table 9.8.4.2. when measured at a point 300 mm from the centre line of the handrail at the narrow end of the tread.

2) Tapered treads in required *exit* stairs shall conform to the requirements in Article 3.4.6.9.

3) The depth of a *tapered tread* shall be not less than its *run* at any point and not more than its *run* at any point plus 25 mm.

9.8.4.4. Uniformity and Tolerances for Risers, Runs and Treads

1) Except as provided in Sentence (2), risers shall be of uniform height in any one *flight*, with a maximum tolerance of

a) 5 mm between adjacent treads or landings, and
b) 10 mm between the tallest and shortest risers in a *flight*.

2) Except for required *exit* stairs, where the top or bottom riser in a stair adjoins a sloping finished walking surface, such as a garage floor, driveway or sidewalk, the height of the riser across the stair shall vary by not more than 1 in 12.

3) Rectangular treads shall have a uniform *run* with a maximum tolerance of

a) 5 mm between adjacent treads, and
b) 10 mm between the deepest and shallowest treads in a *flight*.

4) Tapered treads in a *flight* shall have a uniform *run* in accordance with the construction tolerances stipulated in Sentence (3) when measured at a point 300 mm from the centre line of the handrail as described in Sentence 9.8.7.1.(5).

5) The slope of treads shall not exceed 1 in 50.

9.8.4.5. Reserved

9.8.4.6. Winders

(See Note A-9.8.4.6.)

1) Individual treads in winders shall turn through an angle of

a) 30° with no deviation above or below 30°, or
b) 45° with no deviation above or below 45°.

2) Where winders are incorporated into a stair, each set shall not turn through more than 90°.

3) Treads in winders shall have a *run*, measured at a point 200 mm from the narrow end of the tread, conforming to the minimum *run* requirements for a private stair in Table 9.8.4.2.

9.8.4.7. Reserved

9.8.4.8. Tread Nosings

See Notes A-9.8.4.8. and A-9.8.4.)

1) Except as permitted by Sentence (2), the top of the nosings of stair treads shall have a rounded or beveled edge extending not less than 6 mm and not more than 14 mm measured horizontally from the front of the nosing.

2) If resilient material is used to cover the nosing of a stair tread, the minimum extension of the rounded or beveled edge required by Sentence (1) is permitted to be reduced to 3 mm.

9.8.5. Ramps

9.8.5.1. Application

1) This Subsection applies to pedestrian ramps, except ramps in an *accessible* path of travel.

2) Ramps in an *accessible* path of travel shall conform to the requirements in Section 3.8.

9.8.5.2. Ramp Width

(See also Article 9.9.3.2.)

1) Except as provided in Sentence (2), ramps shall be not less than 1 100 mm wide.

2) Ramps serving a single *dwelling unit* shall be not less than 860 mm wide.

9.8.5.3. Height over Ramps

1) The clear height over ramps shall be not less than 2 050 mm.

9.8.5.4. Ramp Slope

1) The slope of ramps shall be not more than

a) 1 in 10 for exterior ramps,
b) 1 in 10 for interior ramps serving *residential occupancies*,
c) 1 in 6 for *industrial occupancies*, and
d) 1 in 8 for all other *occupancies*.

9.8.5.5. Maximum Rise

1) Where the slope of the ramp is greater than 1 in 12, the maximum rise between floors or landings shall be 1 500 mm.

9.8.6. Landings

9.8.6.1. Application

1) This Subsection applies to landings, except landings for ramps in an *accessible* path of travel.

2) Landings for ramps in an *accessible* path of travel shall conform to the requirements in Section 3.8.

3) Finished floors, and ground surfaces with a slope not exceeding 1 in 50, at the top and bottom of stairs or ramps shall be considered as landings.

9.8.6.2. Required Landings

1) Except as provided in Sentences (2) to (4) and Sentence 9.9.6.6.(2), a landing shall be provided

a) at the top and bottom of each *flight* of interior and exterior stairs, including stairs in garages,
b) at the top and bottom of every ramp with a slope greater than 1 in 50,
c) where a doorway opens onto a stair or ramp,
d) where a ramp opens onto a stair, and
e) where a stair opens onto a ramp.

2) Where a door at the top of a stair within a *dwelling unit* swings away from the stair, no landing is required between the doorway and the stair.

3) A landing may be omitted at the top of an exterior *flight* serving a secondary entrance to a single *dwelling unit*, provided

a) the stair does not contain more than 3 risers,
b) the principal door is a sliding door or swings away from the stair, and
c) only a storm or screen door, if any, swings over the stair and is equipped with hardware to hold it open.

4) A landing may be omitted at the bottom of an exterior stair or ramp provided there is no obstruction, such as a gate or door, within the lesser of the width of the stair or ramp or

a) 900 mm for stairs or ramps serving a single *dwelling unit*, and
b) 1 100 mm for stairs or ramps not serving a single *dwelling unit*.

9.8.6.3. Dimensions of Landings

(See Note A-3.4.6.4.) (See also Articles 9.9.6.1. and 9.9.6.6. regarding landings in *exits*.)

1) Except as provided in Sentences (2) to (7), landings shall be at least as wide and as long as the width of the stair or ramp in which they occur.

2) Where the landing in a stairway or ramp does not turn or turns less than 90°, the length of the landing need not be more than the lesser of

a) the required width of the stair or ramp, or
b) 1 100 mm.

3) The length of a landing shall be measured perpendicular to the nosings of adjacent steps or to the end of the ramp, at a distance equal to half the length required in Sentence (2) from the narrow edge of the landing.

4) Where stair *flights* or ramps of different widths adjoin a single landing, the minimum width of the landing shall be

a) where one or more of the stair or ramp widths do not exceed their respective required widths, not less than the greater required stair or ramp width, or

b) where all of the widths of the stairs or ramps exceed their respective required widths, not less than the lesser actual stair or ramp width.

5) Where a door swings toward a stair, the full arc of the swing shall be over the landing.

6) The slope of landings shall not exceed 1 in 50.

7) Where a doorway or stairway opens onto the side of a ramp, the landing shall extend for a distance of not less than 300 mm on either side of the doorway or stairway, except on a side abutting an end wall.

9.8.6.4. Height over Landings

1) Except as permitted by Sentence (2), the clear height over landings shall be not less than 2 050 mm.

2) The clear height over landings serving a single *dwelling unit* shall be not less than 1 950 mm.

9.8.6.5. Tactile Warning

1) Landings required at the top of a *flight* of stairs shall be provided with tactile walking surface indicators conforming to Subsection 3.8.3., unless the stairs are

a) stairs within *dwelling units* or serving not more than two *dwelling units*,

b) exit stairs not normally used for access purposes, and

c) fire escape stairs.

9.8.7. Handrails

9.8.7.1. Required Handrails

1) Except as provided in Sentences (2) to (4), handrails shall be installed on stairs and ramps in accordance with Table 9.8.7.1.

Table 9.8.7.1.
Number of Sides of Stair or Ramp Required to Have a Handrail
Forming Part of Sentence 9.8.7.1.(1)

Location of Stair or Ramp	Handrails Serving Stairs			Handrails Serving Ramps	
	Stairs < 1 100 mm Wide		Stairs ≥ 1 100 mm Wide	Ramps < 1 100 mm Wide	Ramps ≥ 1 100 mm Wide
	Straight	Curved	All	Straight or Curved	All
	Number of Sides Required to Have a Handrail				
Within a *dwelling unit*	1	1	1	1	2
All other locations[(1)]	1	2	2	2	2

Notes to Table 9.8.7.1.:

(1) See Sentences 9.8.7.1.(2), (3) and (4) for exceptions.

2) Except where a stair or ramp serves not more than two *dwelling units*, at least one handrail shall be located not more than 750 mm from the natural path of travel on the stair or ramp. (See Note A-9.8.7.1.(2).)
3) Handrails are not required for stairs and ramps serving a single *dwelling unit*, where
a) interior stairs have not more than 2 risers,
b) exterior stairs have not more than 3 risers, or
c) ramps rise not more than 400 mm.
4) Only one handrail is required on exterior stairs having more than 3 risers provided such stairs serve not more than one *dwelling unit*.
5) Except for stairs with winders, where a *flight* of stairs within a *dwelling unit* consists of *tapered treads*, one handrail shall be installed along the narrow end of the treads.

9.8.7.2. Continuity of Handrails
(See Note A-9.8.7.2.)
1) Except as provided in Sentence (3), required handrails shall be continuously graspable throughout the length of
a) ramps, and
b) flights of stairs, from the bottom riser to the top riser.
2) Except for stairs or ramps serving a single *dwelling unit*, at least one required handrail shall be continuous throughout the length of the stair or ramp, including at the landing except where interrupted by doorways. (See Note A-3.4.6.5.(10).)
3) For stairs or ramps serving a single *dwelling unit* or a house with a *secondary suite* including their common spaces, a handrail is permitted to start from a newel post or volute installed on the bottom tread.

9.8.7.3. Termination of Handrails
1) Handrails shall be terminated in a manner that will not obstruct pedestrian travel or create a hazard. (See Note A-9.8.7.3.(1).)
2) Except for stairs and ramps serving only one *dwelling unit* at least one handrail at the sides of a stair or ramp shall extend horizontally not less than 300 mm beyond the top and bottom of each *flight* or ramp. (See Note A-9.8.7.3.(2).)

9.8.7.4. Height of Handrails
(See Note A-9.8.7.4.)
1) The height of handrails on stairs and ramps shall be measured vertically from the top of the handrail to
a) a straight line drawn tangent to the tread nosings of the stair served by the handrail, or
b) the surface of the ramp, floor or landing served by the handrail.
2) Except as provided in Sentence (3) and Clause 3.8.3.5.(1)(e), required handrails shall be 865 mm to 1070 mm high.
3) Handrails installed in addition to required handrails need not comply with Sentence (2).

9.8.7.5. Ergonomic Design
1) The clearance between a handrail and the surface behind it shall be not less than
a) 50 mm, or
b) where said surface is rough or abrasive, 60 mm.
2) All handrails shall be constructed so as to be continually graspable along their entire length with no obstruction on or above them to break a handhold. (See Note A-9.8.7.5.(2).)

9.8.7.6. Projections into Stairs and Ramps
1) Handrails and constructions below handrails, including handrail supports and stair stringers, shall not project more than 100 mm into the required width of a stair or ramp. (See Note A-9.8.7.6.(1).) (See also Articles 9.8.2.1. and 9.8.5.2.)

9.8.7.7. Design and Attachment of Handrails

(See Note A-9.8.7.7.)

1) Handrails and their supports shall be designed and constructed to withstand the following loads, which need not be considered to act simultaneously:

a) a concentrated load of not less than 0.9 kN applied at any point and in any direction for all handrails, and

b) for handrails other than those serving a single *dwelling unit*, a uniform load of not less than 0.7 kN/m.

2) Where exterior or interior handrails serving a single *dwelling unit* are attached to wood studs or blocking, the attachment shall be deemed to comply with Sentence (1), where

a) the attachment points are spaced not more than 1.2 m apart measured on the horizontal plane,

b) the first attachment point at either end is located no more than 300 mm from the end of the handrail, and

c) the fasteners consist of not less than 2 No. 8 wood screws at each point, penetrating not less than 32 mm into solid wood.

9.8.8. Guards

9.8.8.1. Required Guards

(See Note A-9.8.8.1.)

1) Except as provided in Sentence (2), every surface to which access is provided, including but not limited to *flights* of steps and ramps, exterior landings, porches, balconies, *mezzanines*, galleries and raised *walkways*, shall be protected by a *guard* on each side that is not protected by a wall for the length where

a) there is a difference in elevation of more than 600 mm between the walking surface and the adjacent surface,

b) the adjacent surface within 1.2 m of the walking surface has a slope of more than 1 in 2,

c) an interior stair has more than 2 risers, and

d) an interior ramp rises more than 400 mm

2) Guards are not required

a) at loading docks,

b) at floor pits in *repair garages*, or

c) where access is provided for maintenance purposes only.

3) Doors in *buildings* of *residential occupancy*, where the finished floor on one side of the door is more than 600 mm above the floor or other constructed surface or ground level on the other side of the door, shall be protected by

a) a *guard*, or

b) a mechanism capable of controlling the free swinging or sliding of the door so as to limit any clear unobstructed opening to not more than 100 mm.

4) Except as provided in Sentence (5), openable windows in *buildings* of *residential occupancy* shall be protected by

a) a *guard*, or

b) a mechanism capable of controlling the free swinging or sliding of the openable part of the window so as to limit any clear unobstructed opening to not more than 100 mm measured either vertically or horizontally where the other dimension is greater than 380 mm.

(See Note A-9.8.8.1.(4).)

5) Windows need not be protected in accordance with Sentence (4), where

a) **reserved**,

b) **reserved**,

c) the only opening greater than 100 mm by 380 mm is a horizontal opening at the top of the window, and

i) construction below the opening does not facilitate climbing, and

ii) guards are provided where required by this Subsection,

d) **deleted**, or

e) the window is located in a room or space with the finished floor described in Clause (c) located less than 1 800 mm above the floor or ground on the other side of the window.

(See Note A-9.8.8.1.(4).)

6) Except as provided in Sentence (7), glazing installed over *stairs*, ramps and landings that extends to less than 1 070 mm above the surface of the treads, ramp or landing shall be

a) protected by *guards*, in accordance with this Subsection, or

b) non-openable and designed to withstand the specified lateral loads for balcony *guards* as provided in Article 4.1.5.14.

7) In *dwelling units*, glazing installed over *stairs*, ramps and landings that extends to less than 900 mm above the surface of the treads, ramp or landing shall be

a) protected by *guards*, in accordance with this Subsection, or

b) non-openable and designed to withstand the specified lateral loads for balcony *guards* as provided in Article 4.1.5.14.

8) Glazing installed in public areas that extends to less than 1 m from the floor and is located above the second *storey* in *buildings* of *residential occupancy* shall be

a) protected by *guards* in accordance with this Subsection, or

b) non-openable and designed to withstand the specified lateral loads for balcony *guards* as provided in Article 4.1.5.14.

9) Swimming pools greater than 450 mm deep shall be enclosed within a sturdy fence no less than 1.22 m in height, with no openings in it greater than 100 mm, and with no member, attachment, or opening located between 100 mm and 900 mm above ground level which could facilitate climbing, except that heavy gauge chain link fencing with a maximum opening size of 35 mm square may be considered *acceptable* fencing for this purpose. (See Note A-9.8.8.1.(9) and (10).)

10) The fence described in Sentence (9)

a) shall enclose the pool and the principle *building* on the premises, except that the fence may enclose the pool separately if the pool is entirely visible from the principle *building* or through the fence, and

b) shall be continuous, except for points of access which shall be equipped with a self-closing gate, secured by a spring lock located no less than 1 070 mm above grade, and only openable from the pool side of the fence.

9.8.8.2. Loads on Guards

(See Note A-9.8.8.2.)

1) Except as provided in Sentences (2) and (4), *guards* shall be designed to resist the specified loads prescribed in Table 9.8.8.2.

Table 9.8.8.2.
Specified Loads for Guards
Forming Part of Sentence 9.8.8.2.(1)

Location of *Guard*	Minimum Specified Loads		
	Horizontal Load Applied Inward or Outward at any Point at the Minimum Required Height of the *Guard*	Horizontal Load Applied Outward on Elements Within the *Guard*, Including Solid Panels and Balusters	Evenly Distributed Vertical Load Applied at the Top of the *Guard*
Guards within *dwelling units*	0.5 kN/m OR concentrated	0.5 kN applied over a	1.5 kN/m

and exterior *guards* serving not more than 2 *dwelling units*	load of 1.0 kN applied at any point[1]	maximum width of 300 mm and a height of 300 mm[2]	
Guards serving access ways to equipment platforms and similar areas where the gathering of many people is improbable	Concentrated load of 1.0 kN applied at any point	Concentrated load of 0.5 kN applied over an area of 100 mm by 100 mm located at any point on the element or elements so as to produce the most critical effect	1.5 kN/m
All other *guards*	0.75 kN/m OR concentrated load of 1.0 kN applied at any point[1]	Concentrated load of 0.5 kN applied over an area of 100 mm by 100 mm located at any point on the element or elements so as to produce the most critical effect	1.5 kN/m

Notes to Table 9.8.8.2.:
(1) The load that creates the most critical condition shall apply.
(2) See Sentence (2).

2) For *guards* within *dwelling units* and for exterior *guards* serving not more than 2 *dwelling units*, where the width and spacing of balusters are such that 3 balusters can be engaged by a load imposed over a 300 mm width, the load shall be imposed so as to engage 3 balusters.
3) None of the loads specified in Table 9.8.8.2. need be considered to act simultaneously.
4) For *guards* within *dwelling units* and for exterior *guards* serving not more than 2 *dwelling units*, Table 9.8.8.2. need not apply where the *guard* construction used has been demonstrated to provide effective performance.

9.8.8.3. Height of Guards
(See Note A-9.8.8.3.)
1) Except as provided in Sentences (2) to (4), all *guards* shall be not less than 1 070 mm high.
2) All *guards* within *dwelling units* shall be not less than 900 mm high.
3) Exterior *guards* serving not more than one *dwelling unit* shall be not less than 900 mm high where the walking surface served by the *guard* is not more than 1 800 mm above the finished ground level.
4) Guards for *flights* of steps, except in required *exit* stairs, shall be not less than 900 mm high.
5) The height of *guards* for *flights* of steps shall be measured vertically from the top of the *guard* to a line drawn through the tread nosing served by the *guard*.

9.8.8.4. Guards for Floors and Ramps in Garages
1) Except for floors of garages referred to in Section 9.35., where garage floors or ramps are 600 mm or more above the adjacent ground or floor level, every opening through a garage floor and the perimeter of floors and ramps that have no exterior walls shall be provided with
a) a continuous curb not less than 140 mm in height, and
b) a *guard* not less than 1 070 mm above the floor level.
2) Vehicle guardrails shall be designed and constructed to withstand the loading values stipulated in Sentence 4.1.5.15.(1). (See Note A-4.1.5.14. and 4.1.5.15.(1).)

9.8.8.5. Openings in Guards
1) Except as permitted in Sentences (2) and (3), openings through *guards* shall be of a size that prevents the passage of a spherical object having a diameter of 100 mm. (See Note A-9.8.8.5.(1) and (2).)

2) Except where they serve *storage garages*, *guards* in *industrial occupancies* are permitted to consist of

a) a top railing, and

b) one or more horizontal intermediate rails spaced such that the size of the openings through the *guard* prevents the passage of a spherical object having a diameter of 535 mm.

(See Note A-9.8.8.5.(1) and (2).)

3) Openings through any *guard* that is not required by Article 9.8.8.1. and that serves an *occupancy* other than an *industrial occupancy* shall be of a size that

a) prevents the passage of a spherical object having a diameter of 100 mm, or

b) permits the passage of a spherical object having a diameter of 200 mm.

(See Note A-9.8.8.5.(3).)

9.8.8.6. Design of Guards to Not Facilitate Climbing

1) Except for *guards* in *industrial occupancies*, *guards* required by Article 9.8.8.1. that protect a level located more than 4.2 m above the adjacent level shall be designed so that no member, attachment or opening located between 140 mm and 900 mm above the level protected by the *guard* facilitates climbing. (See Note A-9.8.8.6.(1).)

9.8.8.7. Glass in Guards

1) Glass in *guards* shall be

a) safety glass of the laminated or tempered type conforming to CAN/CGSB-12.1-M, “Tempered or Laminated Safety Glass,” or

b) wired glass conforming to CAN/CGSB-12.11-M, “Wired Safety Glass.”

9.8.8.8. Glass Guards

1) All glass guards shall have a top rail capable of transferring the guard loads to adjacent glass panels or, in the event of the failure of a glass panel, to the structural component of the *building*.

9.8.9. Construction

9.8.9.1. Loads on Stairs and Ramps

1) Except as specified in Articles 9.8.9.4. and 9.8.9.5., stairs and ramps shall be designed for strength and rigidity under uniform loading criteria to support specified loads of

a) 1.9 kPa for stairs and ramps serving not more than one *dwelling unit*, and

b) 4.8 kPa for other stairs and ramps.

9.8.9.2. Exterior Concrete Stairs

1) Exterior concrete stairs with more than 2 risers and 2 treads shall be

a) supported on unit masonry or concrete walls or piers not less than 150 mm in cross section, or

b) cantilevered from the main *foundation* wall.

2) Stairs described in Sentence (1), when cantilevered from the *foundation* wall, shall be constructed and installed in conformance with Subsection 9.8.10.

3) The depth below ground level for *foundations* for exterior steps shall conform to the requirements in Section 9.12.

9.8.9.3. Exterior Wood Steps

1) Exterior wood steps shall not be in direct contact with the ground unless suitably treated with a wood preservative.

9.8.9.4. Wooden Stair Stringers

1) Wooden stair stringers shall

a) have a minimum effective depth of 90 mm, measured perpendicularly to the bottom of the stringer at the point of minimum cross-section, and an overall depth of not less than 235 mm,
b) be supported and secured top and bottom,
c) be not less than 25 mm actual thickness if supported along their length and 38 mm actual thickness if unsupported along their length, and
d) except as permitted in Sentence (2), be spaced not more than 900 mm o.c. in stairs serving not more than one *dwelling unit* and 600 mm o.c. in other stairs.

2) For stairs serving not more than one *dwelling unit*, where risers support the front portion of the tread, the space between stringers shall be not more than 1 200 mm.

9.8.9.5. Treads

1) Stair treads of lumber, plywood or O-2 grade OSB within *dwelling units* shall be not less than 25 mm actual thickness, except that if open risers are used and the distance between stringers exceeds 750 mm, the treads shall be not less than 38 mm actual thickness.

2) Stair treads of plywood or OSB that are not continuously supported by the riser shall have their face grain or direction of face orientation at right angles to the stringers.

9.8.9.6. Finish for Treads and Landings

1) The finish for treads and landings of interior stairs in *dwelling units*, other than stairs to unfinished *basements*, shall consist of hardwood, vertical grain softwood, resilient flooring or other material providing equivalent performance.

2) Treads and landings of interior and exterior stairs and ramps, other than those within *dwelling units* shall have a slip-resistant finish or be provided with slip-resistant strips that extend not more than 1 mm above the surface.

9.8.10. Cantilevered Precast Concrete Steps

9.8.10.1. Design

1) Exterior concrete steps and their anchorage system that are cantilevered from a *foundation* wall shall be designed and installed to support the loads to which they may be subjected.

9.8.10.2. Anchorage

1) Cantilevered concrete steps referred to in Article 9.8.10.1. shall be anchored to concrete *foundation* walls not less than 200 mm thick.

9.8.10.3. Prevention of Damage Due to Frost

1) Suitable precautions shall be taken during backfilling and grading operations to ensure that subsequent freezing of the *soil* will not cause uplift forces on the underside of cantilevered concrete steps to the extent that the steps or the walls to which they are attached will be damaged.

Section 9.9. Means of Egress

9.9.1. General

9.9.1.1. Application

1) Stairways, handrails and *guards* in a *means of egress* shall conform to the requirements in Section 9.8. as well as to the requirements in this Section.

9.9.1.2. Fire Protection

1) In addition to the fire protection requirements provided in Subsection 9.9.4., *flame-spread ratings*, *fire-resistance ratings* and *fire-protection ratings* for *means of egress* shall conform to Section 9.10.

9.9.1.3. Occupant Load

1) Except for *dwelling units*, the *occupant load* of a *floor area* or part of a *floor area* shall be the number of persons for which such areas are designed, but not fewer than that determined from Table 3.1.17.1., unless it can be shown that the area will be occupied by fewer persons.
2) The *occupant load* for *dwelling units* shall be based on 2 persons per bedroom or sleeping area.

9.9.2. Types and Purpose of Exits

9.9.2.1. Types of Exits

1) Except as otherwise provided in this Section, an *exit* from any *floor area* shall be one of the following used singly or in combination:

a) an exterior doorway,
b) an exterior passageway,
c) an exterior ramp,
d) an exterior stairway,
e) a fire escape,
f) a *horizontal exit*,
g) an interior passageway,
h) an interior ramp, or
i) an interior stairway.

2) Fire escapes shall only be used as *exits* on existing *buildings* and shall be designed and installed in conformance with Subsection 3.4.7.
3) Where a *horizontal exit* is used, it shall conform to Sentence 3.4.1.6.(1) and Article 3.4.6.10.

9.9.2.2. Purpose of Exits

1) An *exit* shall be designed for no purpose other than for exiting except that an *exit* may also serve as an access to a *floor area*.

9.9.2.3. Elevators, Slide Escapes and Windows as Means of Egress

1) Elevators, slide escapes and windows shall not be considered as part of a required *means of egress*.

9.9.2.4. Principal Entrances

1) Except for doors serving a single *dwelling unit*, at least one door at every principal entrance to a *building* providing access from the exterior at ground level shall be designed in accordance with the requirements for *exits*.

9.9.3. Dimensions of Means of Egress

9.9.3.1. Application

1) This Subsection applies to every *means of egress* except

a) exits that serve not more than one *dwelling unit*, and
b) access to exits within *dwelling units*.

9.9.3.2. Exit Width

1) Except for doors and corridors, the width of every *exit* facility shall be not less than 900 mm. (See Article 9.9.6.3. for doors, Article 9.8.2.1. for stairs, and Article 9.8.5.2. for ramps.)

9.9.3.3. Width of Corridors

1) The width of every *public corridor*, corridor used by the public, and *exit* corridor shall be not less than 1 100 mm. (See also Subsection 9.9.5. for obstructions in corridors.)

9.9.3.4. Clear Height

1) Except for stairways, doorways and *storage garages*, the minimum clear height in *exits* and *access to exits* shall be 2.1 m. (See Article 9.8.2.2. for stairs, Article 9.8.5.3. for ramps, Article 9.8.6.4. for landings and Article 9.9.6.2. for doorways.)

2) The clear height in *exits* and *access to exits* in *storage garages* shall be not less than 2 m.

9.9.4. Fire Protection of Exits

9.9.4.1. Application

1) Except as provided in Articles 9.9.4.4. and 9.9.4.6., this Subsection applies to the fire protection of all *exits* except *exits* serving not more than one *dwelling unit*.

9.9.4.2. Fire Separations for Exits

1) Except as provided in Sentences (2) and (5) and Article 9.9.8.5., every *exit* other than an exterior doorway shall be separated from each adjacent *floor area* or from another *exit*

a) where there is a floor assembly above the *floor area*, by a *fire separation* having a *fire-resistance rating* not less than that required for the floor assembly above the *floor area* (See Article 9.10.9.10.), and

b) where there is no floor assembly above the *floor area*, by a *fire separation* having a *fire-resistance rating* not less than the greater of

i) that required by Subsection 9.10.8. for the floor assembly below, or

ii) 45 min.

2) Reserved.

3) A *fire separation* common to 2 *exits* shall be smoke-tight and not be pierced by doorways, duct work, piping or any other opening that may affect the continuity of the separation.

4) A *fire separation* that separates an *exit* from the remainder of the *building* shall have no openings except those for electrical wiring, *noncombustible* conduit and *noncombustible* piping that serve only the *exit*, and for standpipes, sprinkler piping, *exit* doorways and wired glass and glass block permitted in Article 9.9.4.3.

5) The requirements in Sentence (1) do not apply to an exterior *exit* passageway provided the passageway has not less than 50% of its exterior sides open to the outdoors and is served by an *exit* stair at each end of the passageway.

9.9.4.3. Wired Glass or Glass Block

(See Note A-3.1.8.19.(1).)

1) This Article applies to wired glass in doors, and wired glass or glass block in sidelights, where these are installed in *fire separations* between *exit* enclosures and *floor areas*.

2) Except as provided in Sentence (3), the combined area of glazing in doors and sidelights shall not exceed 0.8 m^2.

3) Where an *exit* enclosure connects with a *floor area* through an enclosed vestibule or corridor separated from the *floor area* by *fire separations* having not less than a 45 min *fire-resistance rating*, the glazed areas described in Sentence (1) need not be limited as required in Sentence (2).

9.9.4.4. Openings Near Unenclosed Exterior Exit Stairs and Ramps

1) Unprotected openings in exterior walls of the building shall be protected with wired glass in fixed steel frames, glass block conforming to Articles 9.10.13.5. and 9.10.13.7., or protection complying with the requirements of Sentence 3.2.3.13.(5)., where

a) an unenclosed exterior exit stair or ramp provides the only means of egress from a suite and is exposed to fire from unprotected openings in the exterior walls of

i) another fire compartment, or
ii) another dwelling unit, and

b) unprotected openings in the exterior walls of the building are within 3 m horizontally and less than 10 m below or less than 5 m above the exit stair or ramp.

9.9.4.5. Openings in Exterior Walls of Exits

1) Either openings in exterior walls of an *exit* or openings in adjacent exterior walls of the *building* the *exit* serves shall be protected with wired glass in fixed steel frames or glass block installed in accordance with Articles 9.10.13.5. and 9.10.13.7., where

a) the *exit* enclosure has exterior walls that intersect the exterior walls of the *building* at an angle of less than 135° measured on the outside of the *building*, and

b) the openings in the exterior walls of the *building* are within 3 m horizontally and less than 2 m above the openings in the exterior walls of the *exit*.

(See Note A-9.9.4.5.(1).)

2) The opening protection referred to in Sentence (1) may conform to Sentence 3.2.3.13.(4).

9.9.4.6. Openings Near Exit Doors

1) Where an exterior *exit* door in one *fire compartment* is within 3 m horizontally of an *unprotected opening* in another *fire compartment* and the exterior walls of these *fire compartments* intersect at an exterior angle of less than 135°, the opening shall be protected with

a) wired glass in fixed steel frames conforming to Article 9.10.13.5.,

b) glass block conforming to Article 9.10.13.7., or

c) protection complying with the requirements of Sentence 3.2.3.13.(5).

2) The opening protection referred to in Sentence (1) may conform to Sentence 3.2.3.13.(4).

9.9.4.7. Stairways in 2 Storey, Group D or E Buildings

1) Where a *suite* of Group D or E *occupancy* is located partly on the *first storey* and partly on the second *storey*, stairways serving the second *storey* of that *suite* need not be constructed as *exit* stairs provided,

a) the *building* is not greater than 2 *storeys* in *building height*,

b) the *suite* is separated from other *occupancies* by at least a 45 min *fire separation*,

c) the area occupied by the *suite* is not greater than 100 m^2 per *storey*,

d) the maximum travel distance from any point in the *suite* to an exterior *exit* is not greater than 25 m,

e) the floor assemblies have a *fire-resistance rating* of not less than 45 min or are of *noncombustible construction*, and

f) the *basement* and *first storey* are separated by a *fire separation* having a *fire-resistance rating* of not less than 45 min.

9.9.5. Obstructions and Hazards in Means of Egress

9.9.5.1. Application

1) This Subsection applies to obstructions and hazards in every *means of egress* except those within a *dwelling unit* or serving not more than one *dwelling unit*.

9.9.5.2. Occupancies in Corridors

1) Where a corridor contains an *occupancy*, the *occupancy* shall not reduce the unobstructed width of the corridor to less than the required width of the corridor.

9.9.5.3. Obstructions in Public Corridors

1) Except as permitted in Sentence (2), obstructions located within 1 980 mm of the floor shall not project horizontally more than 100 mm into *exit* passageways, corridors used by the public or *public corridors* in a manner that would create a hazard for visually impaired persons travelling adjacent to walls.
2) The horizontal projection of an obstruction referred to in Sentence (1) is permitted to exceed 100 mm where the obstruction extends to less than 680 mm above the floor. (See Note A-3.3.1.9.(4).)

9.9.5.4. Obstructions in Exits
1) Except as permitted in Subsection 9.9.6. and Article 9.8.7.6., no fixture, turnstile or construction shall project within the required width of an *exit*.

9.9.5.5. Obstructions in Means of Egress
1) No obstructions such as posts or turnstiles shall be placed so as to restrict the width of a required *means of egress* from a *floor area* or part of a *floor area* to less than 750 mm unless an alternate unobstructed *means of egress* is provided adjacent to and plainly visible from the restricted egress.
2) Except as provided in Sentence (3), no obstructions, such as counter gates, that do not meet the requirements for *exit* doors, shall be placed in a required *means of egress* from a *floor area* or part of a *floor area* unless an alternate unobstructed *means of egress* is provided adjacent to and plainly visible from the restricted egress.
3) Obstructions, such as counter gates, that do not satisfy Sentence (2), are permitted to be placed in a required *means of egress* from a part of a *floor area* in *mercantile occupancies* and *business and personal services occupancies*, provided that the part of the *floor area* served by the obstructed *means of egress* is not generally accessible to the public.

9.9.5.6. Mirrors or Draperies
1) No mirror shall be placed in or adjacent to any *exit* so as to confuse the direction of *exit*, and no mirror or draperies shall be placed on or over *exit* doors.

9.9.5.7. Fuel-Fired Appliances
1) Fuel-fired *appliances* shall not be installed in an *exit* or corridor serving as an *access to exit*.

9.9.5.8. Service Rooms
1) Service rooms containing equipment subject to possible explosion, such as *boilers* designed to operate at a pressure in excess of 100 kPa, and certain types of refrigerating and transformer equipment, shall not be located under required *exits*.

9.9.5.9. Ancillary Rooms
1) Ancillary rooms such as storage rooms, washrooms, toilet rooms, laundry rooms and *service rooms* shall not open directly into an *exit*.

9.9.6. Doors in a Means of Egress

9.9.6.1. Obstructions by Doors
1) Except as provided in Sentence (4), obstructions created by doors shall be limited in accordance with Sentences (2) and (3)
a) at *exit* doors,
b) at doors that open into or are located within a *public corridor*, and
c) at doors that open into or are located within another facility that provides *access to exit* from a *suite*.
2) When fully open, doors described in Sentence (1) shall not decrease the required *exit* width by more than
a) 100 mm in *exit* corridors, and
b) 50 mm for other *exit* facilities.

3) The swing of doors described in Sentence (1) shall not reduce the width of the path of travel to less than

a) the required *exit* width in *exit* corridors and passageways, and

b) 750 mm on *exit* stairs or landings.

4) Doors serving a single *dwelling unit* need not comply with Sentences (2) and (3).

9.9.6.2. Clear Opening Height at Doorways

1) Except as provided in Sentences (2) and (3), the clear opening height of doorways shall be not less than 2 030 mm high at

a) exit doors,

b) doors that open into or are located within a *public corridor*, and

c) doors that open into or are located within another facility that provides *access to exit* from a *suite*.

2) The clear opening height under door closers and other devices in doorways described in Sentence (1) shall be not less than 1 980 mm.

3) Doorways serving a single *dwelling unit* need not comply with Sentences (1) and (2). (See also Article 9.5.5.1.)

9.9.6.3. Clear Opening Width at Doorways

1) Except as provided in Sentence (4), the clear opening width of doorways shall comply with Sentence (2) at

a) exit doors, and

b) doors that open into or are located within a *public corridor* or other facility that provides *access to exit* from a *suite*.

2) Doorways described in Sentence (1) shall be

a) not less than 800 mm wide where there is only one door leaf,

b) not less than 800 mm wide where multiple-leaf doors are installed with only one active leaf having a latching mechanism described in Article 9.9.6.7., and

c) not less than 1 210 mm wide where multiple-leaf doors are installed with two active leaves.

3) In doorways described in Sentence (1) that have multiple-leaf doors installed,

a) no active leaf shall be less than 810 mm wide where only one leaf is active, and

b) no single leaf shall be less than 610 mm wide where two leaves are active.

4) Doorways serving a single *dwelling unit* need not comply with Sentence (2). (See also Article 9.5.5.1.)

9.9.6.4. Door Action

1) Except as provided in Sentences (4) and (5), required *exit* doors and doors in required *means of egress*, except doors in *means of egress* within *dwelling units*, shall swing on the vertical axis.

2) Except as provided in Sentence (5), breakaway sliding doors, installed as required *exit* doors or required doors in *means of egress*, shall be identified as swinging doors by means of a label or decal affixed to the door.

3) Revolving doors shall comply with Article 3.4.6.15.

4) Movable *partitions* used to separate a *public corridor* from an adjacent *business and personal services occupancy* or a *mercantile occupancy* need not conform to Sentence (1), provided the partitions are not located in the only *means of egress*. (See Note A-3.3.1.12.(3).)

5*) Exit* doors need not conform to Sentences (1) or (2), where

a) the doors serve accessory *buildings* where life safety is not adversely affected,

b) the doors serve *storage garages* or other accessory *buildings* serving not more than one *dwelling unit*, or

c) the doors

i) serve storage *suites* of not more than 20 m^2 in gross area that are in warehousing *buildings* of not more than one *storey*, and

ii) open directly to the exterior at ground level.

9.9.6.5. Direction of Door Swing

1) Except for doors serving a single *dwelling unit*, *exit* doors that are required to swing shall swing in the direction of *exit* travel.

2) Doors that open onto a corridor or other facility that provides *access to exit* from a room or *suite* having an *occupant load* of more than 60 persons shall swing on the vertical axis in the direction of *exit* travel.

3) Doors that divide a corridor that is not wholly contained within a *suite* shall swing in the direction of *exit* travel.

4) Where a pair of doors is installed in a corridor that provides *access to exit* in both directions, the doors shall

a) swing in opposite directions, with the door on the right-hand side swinging in the direction of *exit* travel, or

b) swing in both directions.

5) Principal entrance doors opening to an *acceptable* open space at ground level are not required to swing in the direction of *exit* travel provided

a) the room or *suite* is located at ground level, and

b) the *occupant load* is not more than 60 persons.

9.9.6.6. Nearness of Doors to Stairs

1) Except as provided in Sentence (2), the distance between a stair riser and the leading edge of a door during its swing, except for doors serving a single *dwelling unit*, shall be not less than 300 mm.

2) Where there is a danger of blockage from ice or snow, an *exit* door, including doors serving a single *dwelling unit*, may open onto not more than one step, provided the riser of such a step does not exceed 150 mm.

9.9.6.7. Door Latching, Locking and Opening Mechanisms

1) Principal entrance doors, *exit* doors and doors to *suites*, including exterior doors of *dwelling units*, and other doors in an *access to exit* shall

a) be openable from the inside or in travelling to an *exit* without requiring keys, special devices or specialized knowledge of the door-opening mechanism, or

b) be controlled by electromagnetic locking mechanisms in accordance with Sentence 3.4.6.16.(4).

2) Except for doors serving a single *dwelling unit*, and doors to accessory *buildings* and to garages serving a single *dwelling unit*, door release hardware on doors in a *means of egress* shall be operable with one hand and the door shall be openable with not more than one releasing operation. (See also Sentence 3.8.3.6.(4) and Note A-3.3.1.13.(4).)

3) Door release hardware on doors in a *means of egress* shall be installed not more than 1 200 mm above the finished floor.

4) Except for hotels and motels, a door opening onto a *public corridor* that provides *access to exit* from *suites* shall be designed not to lock automatically if it is equipped with an automatic self-closing device. (See Note A-3.3.4.5.(1).)

9.9.6.8. Effort Required to Open

1) Every *exit* door, except doors serving a single *dwelling unit*, shall be designed and installed so that when the latch is released the door will open in the direction of *exit* travel under a force of not more than 90 N applied to the door release hardware. (See Sentence 3.8.3.6.(8) for door opening forces in an *accessible* path of travel.)

9.9.7. Access to Exits

9.9.7.1. Egress from Roof Area, Podiums, Terraces, Platforms and Contained Open Spaces

1) An *access to exit* shall be provided from every roof intended for *occupancy* and from every podium, terrace, platform or contained open space.
2) Where a roof is intended for an *occupant load* of more than 60 persons, at least 2 separate *means of egress* shall be provided from the roof to stairs designed in conformance with the requirements for *exit* stairs and located remote from each other.
3) Where a podium, terrace, platform or contained open space is provided, egress requirements shall conform to the appropriate requirements for rooms or *suites* in Article 9.9.7.4.

9.9.7.2. Means of Egress from Suites
1) Except as required in Sentence 9.9.9.3.(1), each *suite* in a *floor area* occupied by more than one *suite* shall have
a) an exterior *exit* doorway,
b) a doorway to a *public corridor*, or
c) a doorway to an exterior passageway.
2) Except as provided in Sentences 9.9.7.3.(1) and 9.9.8.2.(2), from the point where a doorway described in Clause (1)(b) or (c) enters the *public corridor* or exterior passageway, it shall be possible to go in opposite directions to each of 2 separate *exits*.

9.9.7.3. Dead-End Corridors
1) Except for a dead-end corridor that is entirely within a *suite* and except as permitted in Sentence 9.9.9.2.(1), a dead-end corridor is permitted provided it is not more than 6 m long.

9.9.7.4. Number and Spacing of Egress Doors
1) Except for *dwelling units*, at least 2 egress doors shall be provided when the area of a room or *suite*, or the distance measured from any point within the room or *suite* to the nearest egress door, exceeds the values in Table 9.9.7.4.
2) Doors required in Sentence (1) shall be spaced so that in the event that one door is made inaccessible by a fire within such room or *suite*, the other door will provide safe egress.
3) The travel distance required in Sentence (1) may be increased to 25 m for *sprinklered buildings*.

Table 9.9.7.4.
Maximum Areas and Travel Distances for Rooms, Suites and Mezzanines with a Single Means of Egress
Forming Part of Sentences 9.9.7.4.(1) and 9.9.8.6.(2)

Occupancy of Room, *Suite* or *Floor Area*	Maximum Area of Room, *Suite* or *Floor Area*, m^2	Maximum Distance to Egress Door, m
Group C (except *dwelling units*)	100	15
Group D	200	25
Group E	150	15
Group F, Division 2	150	10
Group F, Division 3	200	15

9.9.7.5. Independent Access to Exit
1) Required *access to exit* from *suites* shall not be through any other *dwelling unit*, *service room* or other *occupancy*.

9.9.7.6. Travel Distance within Rooms and Suites

1) Except for *dwelling units*, the travel distance from any point within the room or *suite* to the nearest egress door shall not exceed the maximum travel distance in Article 9.9.8.2.

9.9.8. Exits from Floor Areas

9.9.8.1. Measurement of Travel Distance

1) Except as provided in Sentences (2) and (3), for the purposes of this Subsection, travel distance means the distance from any point in the *floor area* to an *exit* measured along the path of *exit* travel.
2) Where a room or *suite* is separated from the remainder of the *floor area* by a *fire separation* having a *fire-resistance rating* of at least 45 min or, in a *sprinklered building*, by a *fire separation* which is not required to have a *fire-resistance rating*, the travel distance may be measured from an egress door of the room or *suite* to the nearest *exit*.
3) Where a *public corridor* is not less than 9 m wide and conforms to Subclauses 3.4.2.5.(1)(d)(i) to (d)(iv), the travel distance may be determined in accordance with those Subclauses.

9.9.8.2. Number of Required Exits

1) Except as provided in Sentence (2) and Subsection 9.9.9., at least 2 *exits* shall be provided from every *floor area*, spaced so that the travel distance to the nearest *exit* is not more than

a) 40 m in the case of *business and personal services occupancies*,
b) 45 m for all *occupancies* where the *floor area* is *sprinklered*, and
c) 30 m for all other *occupancies*.

2) Except as provided in Subsection 9.9.9., a single *exit* is permitted from each *storey* in *buildings* of 1 and 2 *storeys* in *building height* provided the *floor area* and travel distance requirements conform to those required in Article 9.9.7.4. and the total *occupant load* served by an *exit* facility does not exceed 60 persons.

9.9.8.3. Contribution of Each Exit

1) Where more than one *exit* is required from a *floor area*, each *exit* shall be considered as contributing not more than half the required *exit* width.

9.9.8.4. Location of Exits

1) Where more than one *exit* is required from a *floor area*, at least 2 *exits* shall be independent of each other and be placed remote from each other along the path of travel between them. (See Note A-9.9.8.4.(1).)

9.9.8.5. Exiting through a Lobby

1) Not more than one *exit* from a *floor area* above or below the *first storey* is permitted to lead through a lobby.
2) The lobby referred to in Sentence (1) shall be not more than 4.5 m above *grade*, and the path of travel through the lobby to the outdoors shall not exceed 15 m.
3) The lobby referred to in Sentence (1) shall conform in all respects to the requirements for *exits*, except that rooms other than *service rooms*, storage rooms and rooms of *residential* or *industrial occupancy* are permitted to open directly onto such lobby.
4) Where the lobby referred to in Sentence (1) and adjacent *occupancies* that are permitted to open into the lobby are *sprinklered*, the *fire separation* between such *occupancies* and the lobby need not have a *fire-resistance rating*. (See Note A-3.4.4.2.(2)(e).)
5) Passenger elevators are permitted to open onto the lobby referred to in Sentence (1) provided the elevator doors are designed to remain closed except while loading and unloading passengers.

9.9.8.6. Mezzanine Means of Egress

1) Except as permitted by Sentences (2) and (3), the space above a *mezzanine* shall be served by *means of egress* leading to *exits* accessible at the *mezzanine* level, on the same basis as *floor areas*.
2) The *means of egress* from a *mezzanine* need not conform to Sentence (1), provided

a) the *mezzanine* is not required to terminate at a vertical *fire separation*, as permitted by Sentence 9.10.12.1.(2),
b) the *occupant load* of the *mezzanine* is not more than 60,
c) the area of the *mezzanine* does not exceed the area limits stated in Table 9.9.7.4., and
d) the distance limits stated in Table 9.9.7.4., measured along the path of travel, are not exceeded from any point on the *mezzanine* to
i) an egress door serving the space that the *mezzanine* overlooks if the space is served by a single egress door, or
ii) an egress stairway leading to an *access to exit* in the space below if that space is required to be served by 2 or more egress doorways in conformance with Sentence 9.9.7.4.(1).

3) Notwithstanding the limitations of Sentence (2), one *means of egress* from a *mezzanine* complying with Sentence 9.10.12.1.(2), need not terminate at a *fire separation*, and is permitted to lead through the room in which the *mezzanine* is located, provided all other *means of egress* from that *mezzanine* lead to *exits* accessible at the *mezzanine* level.

4) Except as provided in Sentence (2), the maximum travel distance from any point on a *mezzanine* to the nearest *exit* shall be not more than
a) 40 m in a *business and personal services occupancy*,
b) 45 m in a *floor area* that is *sprinklered* throughout, provided it does not contain a *high-hazard industrial occupancy*, or
c) 30 m in any *floor area* not referred to in Clauses (a) or (b).

9.9.9. Egress from Dwelling Units

9.9.9.1. Travel Limit to Exits or Egress Doors

1) Except as provided in Sentences (2) and (3), every *dwelling unit* containing more than 1 *storey* shall have *exits* or egress doors located so that it shall not be necessary to travel up or down more than 1 *storey* in a *building*, or more than 2 *storeys* in a *sprinklered building*, to reach a level served by
a) an egress door to a *public corridor*, enclosed *exit* stair or exterior passageway, or
b) an *exit* doorway located within 1 *storey* of ground level.

2) Where a *dwelling unit* is not located above or below another *suite*, the travel limit from a floor level in the *dwelling unit* to an *exit* or egress door may exceed 1 *storey* where that floor level is served by an openable window
a) providing an unobstructed opening of not less than 1 m in height and 0.55 m in width, and
b) located so that the sill is not more than
i) 1 m above the floor, and
ii) 7 m above adjacent ground level.

3) The travel limit from a floor level in a *dwelling unit* to an *exit* or egress door may exceed 1 *storey* where that floor level has direct access to a balcony.

9.9.9.2. Two Separate Exits

1) Except as provided in Sentence 9.9.7.3.(1), where an egress door from a *dwelling unit* opens onto a *public corridor* or exterior passageway it shall be possible from the location where the egress door opens onto the corridor or exterior passageway to go in opposite directions to 2 separate *exits* unless the *dwelling unit* has a second and separate *means of egress*.

9.9.9.3. Shared Egress Facilities

1) A *dwelling unit* shall be provided with a second and separate *means of egress* where an egress door from the *dwelling unit* opens onto
a) an *exit* stairway serving more than one *suite*,
b) a *public corridor*

i) serving more than one *suite*, and
ii) served by a single *exit*,
c) an exterior passageway
i) serving more than one *suite*,
ii) served by a single *exit* stairway or ramp, and
iii) more than 1.5 m above adjacent ground level, or
d) a balcony
i) serving more than one *suite*,
ii) served by a single *exit* stairway or ramp, and
iii) more than 1.5 m above adjacent ground level.

2) Reserved.

9.9.10. Egress from Bedrooms

9.9.10.1. Egress Windows or Doors for Bedrooms

1) Except where the *suite* is *sprinklered*, each bedroom or combination bedroom shall have at least one outside window or exterior door openable from the inside without the use of keys, tools or special knowledge and without the removal of sashes or hardware. (See Article 9.5.1.2. and Note A-9.9.10.1.(1).)

2) The window referred to in Sentence (1) shall
a) provide an unobstructed opening of not less than 0.35 m^2 in area with no dimension less than 380 mm, and
b) maintain the required opening during an emergency without the need for additional support.
(See Note A-9.9.10.1.(2).)

3) Where a window required in Sentence (1) opens into a window well, a clearance of not less than 760 mm shall be provided in front of the window. (See Note A-9.9.10.1.(3).)

4) Where the sash of a window referred to in Sentence (3) swings towards the window well, the operation of the sash shall not reduce the clearance in a manner that would restrict escape in an emergency.

5) Where a protective enclosure is installed over the window well referred to in Sentence (3), the enclosure shall be openable from the inside without the use of keys, tools or special knowledge of the opening mechanism.

9.9.11. Signs

9.9.11.1. Application

1) This Subsection applies to all *exits* except those serving not more than one *dwelling unit*.

9.9.11.2. Visibility of Exits

1) Exits shall be located so as to be clearly visible or their locations shall be clearly indicated.

2) Where an *exit* door leading directly to the outside is subject to being obstructed by parked vehicles or storage because of its location, a visible sign or a physical barrier prohibiting such obstructions shall be installed on the exterior side of the door.

9.9.11.3. Exit Signs

1) Every *exit* door shall have an *exit* sign placed over it or adjacent to it if the *exit* serves
a) a *building* that is 3 *storeys* in *building height*,
b) a *building* having an *occupant load* of more than 150, or
c) a room or *floor area* that has a fire escape as part of a required *means of egress*.

2) Every *exit* sign shall
a) be visible on approach to the *exit*,

b) consist of a green and white or lightly tinted graphical symbol meeting the colour specifications referred to in ISO 3864-1, "Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs and safety markings," and

c) conform to ISO 7010, "Graphical symbols – Safety colours and safety signs – Registered safety signs," for the following symbols (See Note A-3.4.5.1.(2)(c)):

i) E001 emergency exit (left hand),

ii) E002 emergency exit (right hand),

iii) E005 Direction, arrow (90° increments), safe condition, and

iv) E006 Direction, 45° arrow (90° increments), safe condition.

3) Internally illuminated *exit* signs shall be continuously illuminated and

a) where illumination of the sign is powered by an electrical circuit, conform to CSA C22.2 No. 141, "Emergency Lighting Equipment," or

b) where illumination of the sign is not powered by an electrical circuit, conform to CAN/ULC-S572, "Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems."

4) Externally illuminated *exit* signs shall be continuously illuminated and conform to CAN/ULC-S572, "Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems." (See Note A-3.4.5.1.(4).)

5) The circuitry serving lighting for externally and internally illuminated *exit* signs shall

a) serve no equipment other than emergency equipment, and

b) be connected to an emergency power supply as described in Sentences 9.9.12.3.(2), (3) and (7).

6) Where no *exit* is visible from a *public corridor*, from a corridor used by the public, or from principal routes serving an open *floor area* having an *occupant load* of more than 150, an *exit* sign conforming to Clauses (2)(b) and (c) with an arrow or pointer indicating the direction of egress shall be provided.

9.9.11.4. Signs for Stairs and Ramps at Exit Level

1) In *buildings* that are 3 *storeys* in *building height*, any part of an *exit* ramp or stairway that continues up or down past the lowest *exit level* shall be clearly marked to indicate that it does not lead to an *exit*, if the portion beyond the *exit level* may be mistaken as the direction of *exit* travel.

9.9.11.5. Floor Numbering

1) Arabic numerals indicating the assigned floor number shall be

a) mounted permanently on the stair side of the wall at the latch side of doors to *exit* stair shafts,

b) not less than 60 mm high, raised approximately 0.8 mm above the surface,

c) located 1 500 mm from the finished floor and not more than 300 mm from the door, and

d) contrasting in colour with the surface on which they are applied. (See Note A-3.4.6.19.(1)(d).)

9.9.12. Lighting

9.9.12.1. Application

1) This Subsection applies to the lighting of all *means of egress* except those within *dwelling units*.

9.9.12.2. Required Lighting in Egress Facilities

1) Every *exit*, *public corridor* or corridor providing *access to exit* for the public shall be equipped to provide illumination to an average level of not less than 50 lx at floor or tread level and at all points such as angles and intersections at changes of level where there are stairs or ramps.

2) The minimum value of the illumination required by Sentence (1) shall be not less than 10 lx.

9.9.12.3. Emergency Lighting

1) Emergency lighting shall be provided in

a) exits,

b) principal routes providing *access to exit* in an open *floor area*,

c) corridors used by the public,
d) underground *walkways*, and
*e) public corridor*s.

2) Emergency lighting required in Sentence (1) shall be provided from a source of energy separate from the electrical supply for the *building*.

3) Lighting required in Sentence (1) shall be designed to be automatically actuated for a period of at least 30 min when the electric lighting in the affected area is interrupted.

4) Illumination from lighting required in Sentence (1) shall be provided to average levels of not less than 10 lx at floor or tread level.

5) The minimum value of the illumination required by Sentence (4) shall be not less than 1 lx.

6) Where incandescent lighting is provided, lighting equal to 1 W/m^2 of *floor area* shall be considered to meet the requirement in Sentence (4).

7) Where self-contained emergency lighting units are used, they shall conform to CSA C22.2 No. 141, "Emergency Lighting Equipment."

Section 9.10. Fire Protection

9.10.1. Definitions and Application

9.10.1.1. Sloped Roofs

1) For the purposes of this Section, roofs with slopes of 60° or more to the horizontal that are adjacent to a room or space intended for *occupancy* shall be considered as a wall.

9.10.1.2. Testing of Integrated Fire Protection and Life Safety Systems

1) Where life safety and fire protection systems and systems with fire protection and life safety functions are integrated with each other, they shall be tested as a whole in accordance with CAN/ULC-S1001, "Integrated Systems Testing of Fire Protection and Life Safety Systems," and the Fire By-law, to verify that they have been properly integrated. (See Note A-3.2.9.1.(1).)

9.10.1.3. Items under Part 3 Jurisdiction

1) Tents, *air-supported structures*, transformer vaults, *walkways*, elevators and escalators shall conform to Part 3.

2) Where rooms or spaces are intended for an *assembly occupancy*, such rooms or spaces shall conform to Part 3.

3) Basements containing more than 1 *storey* or exceeding 600 m^2 in area shall conform to Part 3.

4) Where rooms or spaces are intended for the storage, manufacture or use of hazardous or explosive material, such rooms or spaces shall conform to Part 3. (See Note A-3.3.1.2.(1).)

5) Except as provided in Article 3.3.5.8., facilities for the dispensing of fuel shall not be installed in any *building*.

6) Openings through floors that are not protected by shafts or *closures* shall be protected in conformance with Subsection 3.2.8. (See also Sentence 9.9.4.7.(1).)

7) Chutes and shafts shall conform to Subsection 3.6.3. except where they are entirely contained within a *dwelling unit*.

8) Sprinkler systems shall be designed, constructed and installed in conformance with Articles 3.2.5.12. to 3.2.5.15. and 3.2.5.17.

9) Standpipe and hose systems shall be designed, constructed and installed in conformance with Articles 3.2.5.8. to 3.2.5.11. and 3.2.5.17.

10) Fire pumps shall be installed in conformance with Articles 3.2.5.17. and 3.2.5.18.

11) Where fuel-fired *appliances* are installed on a roof, such *appliances* shall be installed in conformance with Article 3.6.1.5.

9.10.1.4. Items under Part 6 Jurisdiction

1) In kitchens containing commercial cooking equipment used in processes producing grease-laden vapours, the equipment shall be designed and installed in conformance with Article 6.3.1.7. (See Note A-9.10.1.4.(1).)

9.10.2. Occupancy Classification

9.10.2.1. Occupancy Classification

1) Except as provided in Article 9.10.2.2., every *building* or part thereof shall be classified according to its *major occupancy* as belonging to one of the groups or divisions described in Table 9.10.2.1.

Table 9.10.2.1.
Occupancy Classifications
Forming Part of Sentence 9.10.2.1.(1)

Group	Division	Description of *Major Occupancies*(1)
C	–	Residential *occupancies*
D	–	Business and personal services *occupancies*
E	–	Mercantile *occupancies*
F	2	Medium-hazard industrial *occupancies*
F	3	Low-hazard industrial *occupancies* (Does not include *storage garages* serving individual *dwelling units*)

Notes to Table 9.10.2.1.:
(1) See Note A-3.1.2.1.(1).

9.10.2.2. Custodial, Convalescent and Residential Care Homes

1) Children's custodial homes and convalescent homes for ambulatory occupants living as a single housekeeping unit in a *dwelling unit* with sleeping accommodation for not more than 10 persons are permitted to be classified as *residential occupancies*.

2) A care facility accepted for residential use pursuant to provincial legislation is permitted to be classified as a *residential occupancy*, provided

a) occupants live as a single housekeeping unit in a *dwelling unit* with sleeping accommodation for not more than 10 persons,
b) smoke alarms are installed in conformance with Subsection 9.10.19.,
c) emergency lighting is provided in conformance with Article 9.9.12.3., and
d) the *building* is *sprinklered* throughout.

9.10.2.3. Group A, Division 2, Low Occupant Load

1) This Part may apply to a Group A, Division 2 *assembly occupancy* that is permitted by Article 3.1.2.6. to be classified as a Group D, *business and personal services occupancy*, provided the *building* in which the *assembly occupancy* is located complies with Sentence 1.3.3.3.(1) of Division A.
(See Note A-3.1.2.6.)

9.10.2.4. Major Occupancies above Other Major Occupancies

1) Except as permitted in Article 9.10.2.4., in any *building* containing more than one *major occupancy* in which one *major occupancy* is located entirely above another, the requirements of Article 9.10.8.1. for each portion of the *building* containing a *major occupancy* shall be applied to that portion as if the entire *building* was of that *major occupancy*.

9.10.2.5. Buildings Containing More Than One Major Occupancy

1) In a *building* containing more than one *major occupancy*, where the aggregate area of all *major occupancies* in a particular group or division does not exceed 10% of the *floor area* on the *storey* on which they are located, they need not be considered as *major occupancies* for the purposes of Articles 9.10.8.1. and 9.10.2.3. provided they are not classified as Group F, Division 2 *occupancies*.

9.10.3. Ratings

9.10.3.1. Fire-Resistance and Fire-Protection Ratings

1) Where a *fire-resistance rating* or a *fire-protection rating* is required in this Section for an element of a *building*, such rating shall be determined in conformance with

a) the test methods described in Part 3,

b) the calculation method presented in Appendix D, or

c) the construction specifications presented in Tables 9.10.3.1.-A and 9.10.3.1.-B.

9.10.3.2. Flame-Spread Ratings

1) Where a *flame-spread rating* is required in this Section for an element of a *building*, such rating shall be determined in accordance with the test methods described in Part 3, or in accordance with Appendix D.

2) Unless the *flame-spread rating* is referred to herein as a “surface *flame-spread rating*,” it shall apply to any surface of the element being considered that would be exposed by cutting through it as well as to the exposed surface of the element.

9.10.3.3. Fire Exposure

1) Floor, roof and ceiling assemblies shall be rated for exposure to fire on the underside.

2) Exterior walls shall be rated for exposure to fire from inside the *building*, except that such walls need not comply with the temperature rise limitations required by the standard tests referred to in Article 9.10.3.1. if such walls have a *limiting distance* of not less than 1.2 m, and due allowance is made for the effects of heat radiation in accordance with the requirements in Part 3.

3) Interior vertical *fire separations* required to have *fire-resistance ratings* shall be rated for exposure to fire on each side.

9.10.3.4. Suspended Membrane Ceilings

1) Where a ceiling construction has a suspended membrane ceiling with lay-in panels or tiles which contribute to the required *fire-resistance rating*, hold down clips or other means shall be provided to prevent the lifting of such panels or tiles in the event of a fire.

9.10.4. Building Size Determination

9.10.4.1. Mezzanines not Considered as Storeys

1) Except as required by Sentences (2) and 9.10.4.2.(1), the space above a *mezzanine* is permitted to be excluded from the calculation of *building height*, provided

a) the aggregate area of *mezzanines* that are not superimposed does not exceed 10% of the *floor area* of the *building* in which they are located, and

b) the area of *mezzanine* in a *suite* does not exceed 10% of the area of that *suite* on the *storey* on which it is located.

2) Except as required by Sentence 9.10.4.2.(1), the space above a *mezzanine* need not be considered as a *storey* in calculating the *building height*, provided

a) not less than 60% of the horizontal plane separating the *mezzanine* from the room or floor space in which it is located is open, and

b) except from within enclosed spaces described in Sentence (3), the space above the *mezzanine* is used as an open area without *partitions* or subdividing walls higher than 1 070 mm above the *mezzanine* floor.

(See also Note A-3.2.1.1.(3).)

3) The space above a *mezzanine* conforming to Sentence (2) is permitted to include an enclosed space whose area does not exceed 10% of the open area of the room in which the *mezzanine* is located, provided the enclosed space does not obstruct visual communication between the open space above the *mezzanine* and the room in which it is located.

4) For the purpose of determining *occupant load*, the areas of *mezzanines* that are not considered as *storeys* shall be added to the *floor area* of the *storey* on which they are located. (See Note A-9.10.4.1.(4).)

5) Platforms and catwalks intended solely for periodic inspection and maintenance need not be considered as floor assemblies or *mezzanines* for the purpose of calculating *building height*, provided

a) they are not used for storage, and

b) they are constructed with *noncombustible* materials, unless the *building* is permitted to be of *combustible construction*.

9.10.4.2. More Than One Level of Mezzanine

1) Each level of *mezzanine* that is partly or wholly superimposed above the first level of *mezzanine* shall be considered as a *storey* in calculating the *building height*.

9.10.4.3. Basement Storage Garages

1) Where a *basement* is used primarily as a *storage garage*, the *basement* is permitted to be considered as a separate *building* for the purposes of this Section provided the floor above the *basement* and the exterior walls of the *basement* above the adjoining ground level are constructed as *fire separations* of masonry or concrete having a *fire-resistance rating* of not less than 2 h, except as permitted by Sentences 3.2.1.2.(2) and (3).

9.10.4.4. Roof-Top Enclosures

1) A roof-top enclosure shall not be considered as a *storey* in calculating the *building height* if the roof-top enclosure is

a) provided for elevator machinery, a stairway or a *service room*, and

b) used for no purpose other than for service to the *building*.

9.10.5. Permitted Openings in Wall and Ceiling Membranes

9.10.5.1. Permitted Openings in Wall and Ceiling Membranes

1) Except as permitted in Sentences (2) and (4), a membrane forming part of an assembly required to have a *fire-resistance rating* shall not be pierced by openings into the assembly unless the assembly has been tested and rated for such openings.

2) A wall or ceiling membrane forming part of an assembly required to have a *fire-resistance rating* is permitted to be pierced by openings for electrical and similar service outlet boxes provided such outlet boxes are tightly fitted.

3) Where boxes referred to in Sentence (2) are located on both sides of walls required to provide a *fire-resistance rating*, they shall be offset where necessary to maintain the integrity of the *fire separation*.

4) A membrane ceiling forming part of an assembly assigned a *fire-resistance rating* on the basis of Table 9.10.3.1.-B or Appendix D is permitted to be pierced by openings leading to ducts within the ceiling space provided the ducts, the amount of openings and their protection conform to the requirements of Appendix D.

9.10.6. Construction Types

9.10.6.1. Combustible Elements in Noncombustible Construction

1) Where a *building* or part of a *building* is required to be of *noncombustible construction*, *combustible* elements shall be limited in conformance with the requirements in Subsection 3.1.5.

9.10.6.2. Heavy Timber Construction

1) Heavy timber construction shall be considered to have a 45 min *fire-resistance rating* when it is constructed in accordance with the requirements for *heavy timber construction* in Article 3.1.4.7.

9.10.7. Steel Members

9.10.7.1. Protection of Steel Members

1) Except as permitted in Article 3.2.2.3., structural steel members used in construction required to have a *fire-resistance rating* shall be protected to provide the required *fire-resistance rating*.

9.10.8. Fire Resistance and Combustibility in Relation to Occupancy, Height and Supported Elements

9.10.8.1. Fire-Resistance Ratings for Floors and Roofs

1) Except as otherwise provided in this Subsection, the *fire-resistance ratings* of floors and roofs shall conform to Table 9.10.8.1. (See Subsection 9.10.2. for mixed *occupancies* and Subsection 9.10.21. for construction camps.)

Table 9.10.8.1.
Fire-Resistance Ratings for Structural Members and Assemblies
Forming Part of Sentence 9.10.8.1.(1)

Major Occupancy	**Maximum** *Building Height*, *storeys*	**Minimum** *Fire-Resistance Rating* **by** *Building* **Element, min**		
		Floors Except Floors over Crawl Spaces	*Mezzanine* **Floors**	**Roofs**
Residential (Group C)	3	45	45	–
All other *occupancies*	2	45	–	–
	3	45	45	45

9.10.8.2. Fire-Resistance Ratings in Sprinklered Buildings

1) The requirements in Table 9.10.8.1. for roof assemblies to have a *fire-resistance rating* are permitted to be waived in *sprinklered buildings* where

a) the sprinkler system is electrically supervised in conformance with Sentence 3.2.4.9.(3), and

b) the operation of the sprinkler system will cause a signal to be transmitted to the fire department in conformance with Sentence 3.2.4.7.(4).

9.10.8.3. Fire-Resistance Ratings for Walls, Columns and Arches

1) Except as otherwise provided in this Subsection, all *loadbearing* walls, columns and arches in the *storey* immediately below a floor or roof assembly shall have a *fire-resistance rating* of not less than that required for the supported floor or roof assembly.

2) Reserved.

9.10.8.4. Support of Noncombustible Construction

1) Where an assembly is required to be of *noncombustible construction* and to have a *fire-resistance rating*, it shall be supported by *noncombustible construction*.

9.10.8.5. Service Rooms

1) *Construction* supporting a *service room* need not conform to Article 9.10.8.3.

9.10.8.6. Mezzanines

1) Mezzanines required to be counted as *storeys* in Articles 9.10.4.1. and 9.10.4.2. shall be constructed in conformance with the requirements for "Floors Except Floors over Crawl Spaces" in Table 9.10.8.1.

9.10.8.7. Roofs Supporting an Occupancy

1) Where a portion of a roof supports an *occupancy*, that portion shall be constructed as a *fire separation* having a *fire-resistance rating* conforming to the rating for "Floors Except Floors over Crawl Spaces" in Table 9.10.8.1.

9.10.8.8. Floors of Exterior Passageways

1) Except as provided in Sentences (2) and (3), the floor assembly of every exterior passageway used as part of a *means of egress* shall have a *fire-resistance rating* of not less than 45 min or be of *noncombustible construction*.

2) No *fire-resistance rating* is required for floors of exterior passageways serving *buildings* of Group D, E or F *major occupancy* that are not more than 2 *storeys* in *building height*.

3) No *fire-resistance rating* is required for floors of exterior passageways serving a single *dwelling unit* where no *suite* is located above or below the *dwelling unit*.

9.10.8.9. Crawl Spaces

1) Where a crawl space exceeds 1.8 m in height or is used for any *occupancy* or as a *plenum* in *combustible construction* or for the passage of *flue pipes*, it shall be considered as a *basement* in applying the requirements in Article 9.10.8.1.

9.10.8.10. Application to Houses

1) Table 9.10.8.1. does not apply to

a) a *dwelling unit* that has no other *dwelling unit* above or below it,

b) **reserved**, or

c) a *dwelling unit* that is not above or below another *major occupancy*.

9.10.8.11. Part 3 as an Alternative

1) The *fire-resistance ratings* of floors, roofs, *loadbearing* walls, columns and arches need not conform to this Subsection if such assemblies conform in all respects to the appropriate requirements in Section 3.2.

9.10.9. Fire Separations between Rooms and Spaces within Buildings

9.10.9.1. Application

1) This Subsection applies to *fire separations* required between rooms and spaces in *buildings*, except between rooms and spaces within a *dwelling unit*.

9.10.9.2. Continuous Barrier

1) Except as permitted in Article 9.10.9.3., a wall or floor assembly required to be a *fire separation* shall be constructed as a continuous barrier against the spread of fire and retard the passage of smoke.

2) Reserved.

3) The continuity of a *fire separation* shall be maintained where it abuts another *fire separation*, a floor, a ceiling, a roof, or an exterior wall assembly. (See Note A-3.1.8.3.(4).)
4) Reserved.

9.10.9.3. Openings to be Protected with Closures

1) Except as permitted in Articles 9.10.9.5., 9.10.9.6. and 9.10.9.7., openings in required *fire separations* shall be protected with *closures* conforming to Subsection 9.10.13.
2) Reserved.

9.10.9.4. Floor Assemblies

1) Except as permitted in Sentences (2) to (4), all floor assemblies shall be constructed as *fire separations*.
2) Floor assemblies contained within *dwelling units* need not be constructed as *fire separations*.
3) Floor assemblies for which no *fire-resistance rating* is required by Subsection 9.10.8. and floors of *mezzanines* not required to be counted as *storeys* in Articles 9.10.4.1. and 9.10.4.2. need not be constructed as *fire separations*.
4) Where a crawl space is not required by Article 9.10.8.9. to be constructed as a *basement*, the floor above it need not be constructed as a *fire separation*.

9.10.9.5. Interconnected Floor Spaces

1) Interconnected floor spaces shall conform to Subsection 3.2.8.

9.10.9.6. Penetration of Fire Separations

(See Note A-3.1.9.)
1) Piping, tubing, ducts, *chimneys*, wiring, conduit, electrical outlet boxes and other similar service equipment that penetrate a required *fire separation* shall be tightly fitted or fire stopped to maintain the integrity of the separation. (See Note A-9.10.9.6.(1).)
2) Penetrations of a *firewall* shall be sealed at the penetration by a *fire stop* that, when subjected to the fire test method in CAN/ULC-S115, "Fire Tests of Firestop Systems," has an FT rating not less than the *fire-resistance rating* for the *fire separation*.
3) Except as provided in Sentences (4) to (12) and Article 9.10.9.7., pipes, ducts, electrical boxes, totally enclosed raceways or other similar service equipment that partly or wholly penetrate an assembly required to have a *fire-resistance rating* shall be *noncombustible* unless the assembly has been tested incorporating such equipment. (See Note A-3.1.9.2.(1).)
4) Electrical wires or similar wiring enclosed in *noncombustible* totally enclosed raceways are permitted to partly or wholly penetrate an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required in Sentence (3).
5) Single conductor metal-sheathed cables with *combustible* jacketing that are more than 25 mm in overall diameter are permitted to penetrate a *fire separation* required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required in Sentence (3), provided the cables are not grouped and are spaced a minimum of 300 mm apart.
6) Electrical wires or cables, single or grouped, with *combustible* insulation or jacketing that is not totally enclosed in raceways of *noncombustible* material, are permitted to partly or wholly penetrate an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required in Sentence (3), provided the overall diameter of the wiring is not more than 25 mm.
7) Combustible totally enclosed raceways which are embedded in a concrete floor slab are permitted in an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required in Sentence (3), where the concrete provides not less than 50 mm of cover between the raceway and the bottom of the slab.
8) Combustible outlet boxes are permitted in an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required in Sentence (3), provided the opening through the membrane into the box does not exceed 160 cm^2.

9) Combustible water distribution piping is permitted to partly or wholly penetrate a *fire separation* that is required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required in Sentence (3), provided the piping is protected with a *fire stop* in conformance with Sentence 3.1.9.5.(4).

10) Combustible sprinkler piping is permitted to penetrate a *fire separation* provided the *fire compartments* on each side of the *fire separation* are *sprinklered*.

11) Sprinklers are permitted to penetrate a *fire separation* or a membrane forming part of an assembly required to have a *fire-resistance rating* without having to meet the *fire stop* requirements of Sentence (1), provided the annular space created by the penetration of a fire sprinkler is covered by a metal escutcheon plate in accordance with NFPA 13, "Installation of Sprinkler Systems."

12) Combustible piping for central vacuum systems is permitted to penetrate a *fire separation* provided the installation conforms to the requirements that apply to *combustible* drain, waste and vent piping specified in Sentences 9.10.9.7.(2) to (6).

13) Fire dampers are permitted to penetrate a *fire separation* or a membrane forming part of an assembly required to have a *fire-resistance rating* without having to meet the *fire stop* requirements of Sentence (1), provided the *fire damper* is

a) installed in conformance with NFPA 80, "Fire Doors and Other Opening Protectives," or
b) specifically designed with a *fire stop*.

9.10.9.7. Combustible Drain, Waste and Vent Piping

(See Note A-3.1.9.)

1) Except as permitted in Sentences (2) to (6), *combustible* piping shall not be used in any part of a drain, waste and vent piping system where any part of that system partly or wholly penetrates a *fire separation* required to have a *fire-resistance rating* or penetrates a membrane that contributes to the required *fire-resistance rating* of an assembly.

2) Combustible drain, waste and vent piping not located in a vertical shaft is permitted to penetrate a *fire separation* required to have a *fire-resistance rating* or a membrane that forms part of an assembly required to have a *fire-resistance rating* provided the piping is sealed at the penetration by a *fire stop* that has an F rating not less than the *fire-resistance rating* required for the *fire separation*.

3) The rating referred to in Sentence (2) shall be based on CAN/ULC-S115, "Fire Tests of Firestop Systems," with a pressure differential of 50 Pa between the exposed and unexposed sides, with the higher pressure on the exposed side.

4) Combustible drain piping is permitted to penetrate a horizontal *fire separation* or a membrane that contributes to the required *fire-resistance rating* of a horizontal *fire separation*, provided it leads directly from a *noncombustible* watercloset through a concrete floor slab.

5) Combustible drain, waste and vent piping is permitted on one side of a vertical *fire separation* provided it is not located in a vertical shaft.

6) In *buildings* containing 2 *dwelling units* only, *combustible* drain, waste and vent piping is permitted on one side of a horizontal *fire separation*.

9.10.9.8. Collapse of Combustible Construction

1) Combustible construction that abuts on or is supported by a *noncombustible fire separation* shall be constructed so that its collapse under fire conditions will not cause collapse of the *fire separation*.

9.10.9.9. Reduction in Thickness of Fire Separation by Beams and Joists

1) Where pockets for the support of beams or joists are formed in masonry or concrete *fire separation*, the remaining total thickness of masonry and/or grout and/or concrete shall be not less than the required equivalent thickness shown for Type S monolithic concrete in Table D-2.1.1. in Appendix D for the required *fire-resistance rating*.

9.10.9.10. Concealed Spaces above Fire Separations

1) Except as provided in Sentence (2), a *horizontal service space* or other concealed space located above a required vertical *fire separation* shall be divided at the *fire separation* by an equivalent *fire separation* within the space.
2) Where a *horizontal service space* or other concealed space is located above a required vertical *fire separation* other than a vertical shaft, such space need not be divided as required in Sentence (1) provided the construction between such space and the space below is constructed as a *fire separation* having a *fire-resistance rating* not less than that required for the vertical *fire separation*, except that where the vertical *fire separation* is not required to have a *fire-resistance rating* greater than 45 min, the *fire-resistance rating* of the ceiling may be reduced to 30 min.

9.10.9.11.Separation of Residential Occupancies

1) Except as provided in Sentence (2), *residential occupancies* shall be separated from all other *major occupancies* by a *fire separation* having a *fire-resistance rating* of not less than 1 h.
2) Except as provided in Sentence (3), a *major occupancy* classified as a *residential occupancy* shall be separated from other *major occupancies* classified as *mercantile* or *medium-hazard industrial occupancies* by a *fire separation* having a *fire-resistance rating* of not less than 2 h.
3) Where not more than 2 *dwelling units* are located in a *building* containing a *mercantile occupancy*, such *mercantile occupancy* shall be separated from the *dwelling units* by a *fire separation* having not less than 1 h *fire-resistance rating*.

9.10.9.12.Residential Suites in Industrial Buildings

1) Not more than one *suite* of *residential occupancy* shall be contained within a *building* classified as a Group F, Division 2 *major occupancy*.

9.10.9.13.Separation of Suites

1) Except as required in Article 9.10.9.14. and as permitted by Sentences (2) and (3), a *suite* shall be separated from adjoining *suites* by a *fire separation* having a *fire-resistance rating* of not less than 45 min.
2) In *sprinklered buildings*, *suites* of *business and personal services occupancy* and *mercantile occupancy* that are served by *public corridors* conforming with Clause 3.3.1.4.(4)(b) are not required to be separated from each other by *fire separations*.
3) No *fire separation* is required between *suites* of *business and personal services occupancy*.

9.10.9.14.Separation of Residential Suites

1) Except as provided in Sentences (2) and (3) and Article 9.10.21.2., *suites* in *residential occupancies* shall be separated from adjacent rooms and *suites* by a *fire separation* having a *fire-resistance rating* of not less than 45 min.
2) Sleeping rooms in boarding and lodging houses where sleeping accommodation is provided for not more than 8 boarders or lodgers need not be separated from the remainder of the *floor area* as required in Sentence (1) where the sleeping rooms form part of the proprietor's residence and do not contain cooking facilities.
3) Dwelling units that contain 2 or more *storeys* including *basements* shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* of not less than 1 h. (See Note A-3.3.4.4.(1).)
4) Reserved.

9.10.9.15.Separation of Public Corridors

1) Except as provided in Sentences (2) and (3), *public corridors* shall be separated from the remainder of the *building* by a *fire separation* having not less than a 45 min *fire-resistance rating*.
2) In other than *residential occupancies*, no *fire-resistance rating* is required for *fire separations* between a *public corridor* and the remainder of the *building* if

a) the *floor area* is *sprinklered*,

b) the sprinkler system is electrically supervised in conformance with Sentence 3.2.4.9.(3), and
c) the operation of the sprinkler system will cause a signal to be transmitted to the fire department in conformance with Sentence 3.2.4.7.(4).

3) In other than *residential occupancies*, no *fire separation* is required between a *public corridor* and the remainder of the *building* if
a) the *floor area* is *sprinklered*,
b) the sprinkler system is electrically supervised in conformance with Sentence 3.2.4.9.(3),
c) the operation of the sprinkler system will cause a signal to be transmitted to the fire department in conformance with Sentence 3.2.4.7.(4), and
d) the corridor exceeds 5 m in width.

4) Reserved.

9.10.9.16.Separation of Storage Garages

1) Except as provided in Sentences (2) and (3), a *storage garage* shall be separated from other *occupancies* by a *fire separation* having not less than a 1.5 h *fire-resistance rating*.

2) Except as permitted in Sentence (3), *storage garages* containing 5 motor vehicles or fewer shall be separated from other *occupancies* by a *fire separation* of not less than 1 h.

3) Where a *storage garage serves only the dwelling unit* to which it is attached or in which it is built, it shall be considered as part of that *dwelling unit* and the *fire separation* required in Sentence (2) need not be provided between the garage and the *dwelling unit*.

4) Except as provided in Sentence (5), where a *storage garage* is attached to or built into a *building* of *residential occupancy*,
a) an *air barrier system* conforming to Subsection 9.25.3. shall be installed between the garage and the remainder of the *building* to provide an effective barrier to gas and exhaust fumes, and
b) every door between the garage and the remainder of the *building* shall conform to Article 9.10.13.15.

(See Note A-9.10.9.16.(4).)

5) Where membrane materials are used to provide the required airtightness in the *air barrier system*, all joints shall be sealed and structurally supported.

9.10.9.17.Separation of Repair Garages

1) Except as provided in Sentences (2) and (3), a *repair garage* shall be separated from other *occupancies* by a *fire separation* having a *fire-resistance rating* of not less than 2 h.

2) Ancillary spaces directly serving a *repair garage*, including waiting rooms, reception rooms, tool and parts storage areas and supervisory office space, need not be separated from the *repair garage* but shall be separated from other *occupancies* as required in Sentence (1).

3) The *fire separation* referred to in Sentence (1) shall have a *fire-resistance rating* of not less than 1 h, where
a) the *building* is not more than one *storey* in *building height*,
b) the *building* is operated as a single *suite*, and
c) the only *occupancy* other than the *repair garage* is a *mercantile occupancy*.

4) Except as provided in Sentence (5), where a *building* containing a *repair garage* also contains a *dwelling unit*, an *air barrier system* conforming to Subsection 9.25.3. shall be installed between the *dwelling unit* and the *suite* containing the garage to provide an effective barrier to gas and exhaust fumes. (See Note A-9.10.9.16.(4).)

5) Where membrane materials are used to provide the required airtightness in the *air barrier system*, all joints shall be sealed and structurally supported.

9.10.9.18.Exhaust Ducts Serving More Than One Fire Compartment

1) Where a *vertical service space* contains an *exhaust duct* that serves more than one *fire compartment*, the duct shall have a fan located at or near the exhaust outlet to ensure that the duct is under negative pressure.
2) Individual *fire compartments* referred to in Sentence (1) shall not have fans that exhaust directly into the duct in the *vertical service space*.

9.10.9.19.Central Vacuum Systems
1) A central vacuum system shall serve not more than one *suite*.

9.10.9.20.Multiple Tenant Self Storage Warehouses
1) Multiple tenant self-storage warehouses shall comply with Article 3.3.5.9.

9.10.10. Service Rooms

9.10.10.1.Application
1) This Subsection applies to *service rooms* in all *buildings* except rooms located within a *dwelling unit*.

9.10.10.2.Service Room Floors
1) The *fire-resistance rating* requirements in this Subsection do not apply to the floor assembly immediately below a *service room*.

9.10.10.3.Separation of Service Rooms
1) Except as provided in Sentence (2) and Articles 9.10.10.5. and 9.10.10.6., *service rooms* shall be separated from the remainder of the *building by a fire separation* having a *fire-resistance rating* of not less than 1 h when the *floor area* containing the *service room* is not *sprinklered*.
2) Where a room contains a limited quantity of service equipment and the service equipment does not constitute a fire hazard, the requirements in Sentence (1) shall not apply.

9.10.10.4.Location of Fuel-Fired Appliances
1) Except as provided in Sentences (2) and (3) and Article 9.10.10.5., fuel-fired *appliances* shall be located in a *service room* separated from the remainder of the *building* by a *fire separation* having not less than a 1 h *fire-resistance rating*.
2) Except as required in the *appliance* installation standards referenced in Sentences 6.2.1.5.(1), 9.33.5.2.(1) and 9.33.5.3.(1), fuel-fired *space-heating appliances*, space-cooling *appliances*, *service water heaters* and laundry *appliances* need not be separated from the remainder of the *building* as required in Sentence (1), where the *appliances* serve

a) not more than one room or *suite*, or

b) a *building* with a *building area* of not more than 400 m^2 and a *building height* of not more than 2 *storeys.*

3) Sentence (1) does not apply to fireplaces and cooking *appliances*.

9.10.10.5.Incinerators
1) Service rooms containing incinerators shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* of not less than 2 h.
2) The design, construction, installation and *alteration* of each indoor incinerator shall conform to NFPA 82, "Incinerators and Waste and Linen Handling Systems and Equipment."
3) Every incinerator shall be connected to a *chimney flue* conforming to the requirements in Section 9.21. and serving no other *appliance*.
4) An incinerator shall not be located in a room with other fuel-fired *appliances*.

9.10.10.6.Storage Rooms

1) Rooms for the temporary storage of *combustible* refuse in all *occupancies* or for public storage in *residential occupancies* shall be separated from the remainder of the *building* by a *fire separation* having not less than a 1 h *fire-resistance rating*, except that a 45 min *fire separation* is permitted where the *fire-resistance rating* of the floor assembly is not required to exceed 45 min, or where such rooms are *sprinklered*.

9.10.11. Firewalls

9.10.11.1. Required Firewalls

1) Except as provided in Article 9.10.11.2., a *party wall* on a property line shall be constructed as a *firewall*. (See Note A-3.2.3.4.(1).)

9.10.11.2. Firewalls Not Required

1) In a *building* of *residential occupancy* in which there is no *dwelling unit* above another *dwelling unit*, a *party wall* on a property line between *dwelling units* need not be constructed as a *firewall* provided it is constructed as a *fire separation* having a *fire-resistance rating* of not less than a 1 h.

2) Reserved.

3) The wall described in Sentence (1) shall provide continuous protection from the top of the footings to the underside of the roof deck.

4) Any space between the top of the wall described in Sentence (1) and the roof deck shall be tightly filled with mineral wool or *noncombustible* material.

9.10.11.3. Construction of Firewalls

1) Where *firewalls* are used, the requirements in Part 3 shall apply.

9.10.12. Prevention of Fire Spread at Exterior Walls and between Storeys

9.10.12.1. Termination of Floors or Mezzanines

1) Except as provided in Sentence (2) and in Articles 9.10.1.3. and 9.10.9.5., the portions of a *floor area* or *mezzanine* that do not terminate at an exterior wall, a *firewall* or a vertical shaft, shall terminate at a vertical *fire separation* having a *fire-resistance rating* not less than that required for the floor assembly that terminates at the separation.

2) A *mezzanine* need not terminate at a vertical *fire separation* where the *mezzanine* is not required to be considered as a *storey* in Articles 9.10.4.1. and 9.10.4.2.

9.10.12.2. Location of Skylights

1) Where a wall in a *building* is exposed to a fire hazard from an adjoining roof of a separate unsprinklered *fire compartment* in the same *building*, the roof shall contain no skylights within a horizontal distance of 5 m of the windows in the exposed wall.

9.10.12.3. Exterior Walls Meeting at an Angle

1) Except as provided in Article 9.9.4.5., where exterior walls of a *building* meet at an external angle of 135° or less, the horizontal distance from an *unprotected opening* in one exterior wall to an *unprotected opening* in the other exterior wall shall be not less than 1.2 m, where these openings are

a) in different *fire compartments*, or

b) in different *dwelling units*.

2) The exterior wall of each *fire compartment* referred to in Sentence (1) within the 1.2 m distance shall have a *fire-resistance rating* not less than that required for the interior vertical *fire separation* between the compartment and the remainder of the *building*.

3) Reserved.

9.10.12.4.Protection of Soffits

1) This Article applies to the portion of any soffit enclosing a projection that is

a) less than 2.5 m vertically above a window or door, and

b) less than 1.2 m from either side of the window or door.

(See Note A-9.10.12.4.(1).)

2) Except as provided in Sentences (4) and (5), the construction described in Sentence (1) shall have no *unprotected openings* and shall be protected in accordance with Sentence (3), where the soffit encloses

a) a common *attic or roof space* that spans more than 2 *suites* of *residential occupancy* and projects beyond the exterior wall of the *building*,

b) a floor space where an upper *storey* projects beyond the exterior wall of a lower *storey* and

i) a *fire separation* is required at the floor between the two,

ii) **reserved**, or

c) a floor space where an upper *storey* projects beyond the exterior wall of a lower *storey*, and the projection is continuous across

i) a vertical *fire separation* separating two *suites*, or

ii) **reserved**.

3) Protection required by Sentence (2) shall be provided by

a) noncombustible material having a minimum thickness of 0.38 mm and a melting point not below 650°C,

b) not less than 12.7 mm thick gypsum soffit board or gypsum board installed according to CSA A82.31-M, “Gypsum Board Application,”

c) not less than 11 mm thick plywood,

d) not less than 12.5 mm thick OSB or waferboard, or

e) not less than 11 mm thick lumber.

(See Note A-9.10.12.4.(3).)

4) In the case of a soffit described in Sentence (1) that is at the edge of an *attic or roof space* and completely separated from the remainder of that *attic or roof space* by *fire blocks*, the requirements in Sentence (2) do not apply.

5) Where all *suites* spanned by a common *attic or roof space* or situated above or below the projecting floor are *sprinklered*, the requirements of Sentence (2) do not apply, provided that all rooms, including closets and bathrooms, having openings in the wall beneath the soffit are *sprinklered*, notwithstanding any exceptions in the sprinkler standards referenced in Article 3.2.5.12.

9.10.13. Doors, Dampers and Other Closures in Fire Separations

9.10.13.1.Closures

1) Except as provided in Article 9.10.13.2., openings in required *fire separations* shall be protected with a *closure* conforming to Table 9.10.13.1. and shall be installed in conformance with Chapters 2 to 14 of NFPA 80, “Fire Doors and Other Opening Protectives,” unless otherwise specified herein. (See also Article 9.10.3.1.)

Table 9.10.13.1.
Fire-Protection Ratings for Closures
Forming Part of Sentence 9.10.13.1.(1)

Required *Fire-Resistance Rating* **of** *Fire Separation*	**Minimum** *Fire-Protection Rating* **of** *Closure*
30 or 45 min	20 min(1)
1 h	45 min(1)

1.5 h	1 h
2 h	1.5 h
3 h	2 h
4 h	3 h

Notes to Table 9.10.13.1.:
(1) See Article 9.10.13.2.

9.10.13.2.Solid Core Wood Door as a Closure

1) A 45 mm thick solid core wood door is permitted to be used where a minimum *fire-protection rating* of 20 min is permitted, between an *ancillary residential unit* and its principal *dwelling unit*, or between a *public corridor* and a *suite provided that the door conforms to* CAN/ULC-S113, “Wood Core Doors Meeting the Performance Required by CAN/ULC-S104 for Twenty Minute Fire Rated Closure Assemblies.” (See Note A-9.10.13.2.(1).)
2) Doors described in Sentence (1) shall have not more than a 6 mm clearance beneath and not more than 3 mm at the sides and top.

9.10.13.3.Unrated Wood Door Frames

1) Doors required to provide a 20 min *fire-protection rating* or permitted to be 45 mm solid core wood shall be mounted in a wood frame of not less than 38 mm thickness where the frame has not been tested and rated.

9.10.13.4.Doors as a Means of Egress

1) Doors forming part of an *exit* or a public *means of egress* shall conform to Subsection 9.9.6. in addition to this Subsection.

9.10.13.5.Wired Glass as a Closure

1) Wired glass conforming to Article 9.6.1.2. which has not been tested in accordance with Article 9.10.3.1. is permitted as a *closure* in a vertical *fire separation* required to have a *fire-resistance rating* of not more than 1 h provided such glass is not less than 6 mm thick and is mounted in conformance with Sentence (2).
2) Wired glass described in Sentence (1) shall be mounted in fixed steel frames having a metal thickness of not less than 1.35 mm and a glazing stop of not less than 20 mm on each side of the glass.
3) Individual panes of glass described in Sentence (1) shall not exceed 0.8 m^2 in area or 1.4 m in height or width, and the area of glass not structurally supported by mullions shall not exceed 7.5 m^2.

9.10.13.6.Steel Door Frames

1) Steel door frames forming part of a *closure* in a *fire separation*, including anchorage requirements, shall conform to CAN/ULC-S105, “Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.”

9.10.13.7.Glass Block as a Closure

1) Glass block that has not been tested in accordance with Article 9.10.3.1. is permitted as a *closure* in a *fire separation* required to have a *fire-resistance rating* of not more than 1 h. (See Article 9.20.9.6.)

9.10.13.8.Maximum Size of Opening

1) The size of an opening in an interior fire separation, even where protected with a *closure*, shall not exceed 11 m^2, with no dimension greater than 3.7 m, when the *fire compartments* on both sides of the *fire separation* are not *sprinklered*.

2) The size of an opening in an interior *fire separation*, even where protected with a *closure*, shall not exceed 22 m^2, with no dimension greater than 6 m, when the *fire compartments* on both sides of the *fire separation* are *sprinklered*.

9.10.13.9.Door Latch

1) Every swing type door in a *fire separation* shall be equipped with a latch.

9.10.13.10.Self-closing Device

1) Except as described in Sentence (2), every door in a *fire separation* shall have a self-closing device.
2) Self-closing doors are not required between *public corridors* and *suites* in *business and personal services occupancies*, except in dead-end corridors.

9.10.13.11.Hold-Open Devices

1) Where hold-open devices are used on doors in required *fire separations*, they shall be installed in accordance with Article 3.1.8.14.

9.10.13.12.Service Room Doors

1) Swing-type doors shall open into *service rooms* containing fuel-fired equipment where such doors lead to *public corridors* or rooms used for assembly but shall swing outward from such rooms in all other cases.

9.10.13.13.Fire Dampers

1) Except as permitted by Sentences (2) to (5) and Sentence 9.10.5.1.(4), a duct that penetrates an assembly required to be a *fire separation* with a *fire-resistance rating* shall be equipped with a *fire damper* in conformance with Articles 3.1.8.4. and 3.1.8.10.
2) A *fire damper* is not required where a *noncombustible* branch duct pierces a required *fire separation* provided the duct
a) has a melting point not below 760°C,
b) has a cross-sectional area less than 130 cm^2, and
c) supplies only air-conditioning units or combined air-conditioning and heating units discharging air at not more than 1.2 m above the floor.
3) A *fire damper* is not required where a *noncombustible* branch duct pierces a required *fire separation* around an *exhaust duct* riser in which the airflow is upward provided
a) the melting point of the branch duct is not below 760°C,
b) the branch duct is carried up inside the riser not less than 500 mm, and
c) the *exhaust duct* is under negative pressure as described in Article 9.10.9.18.
4) Noncombustible ducts that penetrate a *fire separation* separating a *vertical service space* from the remainder of the *building* need not be equipped with a *fire damper* at the *fire separation* provided
a) the ducts have a melting point above 760°C, and
b) each individual duct exhausts directly to the outside at the top of the *vertical service space*.
5) A duct serving commercial cooking equipment and piercing a required *fire separation* need not be equipped with a *fire damper* at the *fire separation*. (See also Article 6.3.1.7.)

9.10.13.14.Fire Stop Flaps

1) Fire stop flaps in ceiling membranes referred to in Sentence 9.10.5.1.(4) shall
a) conform to CAN/ULC-S112.2, "Fire Test of Ceiling Firestop Flap Assemblies," and
b) activate at a temperature approximately 30°C above the normal maximum temperature that occurs in the ducts, whether the air duct system is operating or shut down.

9.10.13.15.Doors between Garages and Dwelling Units

1) A door between an attached or built-in garage and a *dwelling unit* shall be tight fitting and weather-stripped to provide an effective barrier against the passage of gas and exhaust fumes and shall be fitted with a self-closing device.
2) A doorway between an attached or built-in garage and a *dwelling unit* shall not be located in a room intended for sleeping.

9.10.13.16.Door Stops

1) Where a door is installed so that it may damage the integrity of a *fire separation* if its swing is unrestricted, door stops shall be installed to prevent such damage.

9.10.14. Spatial Separation Between Buildings

9.10.14.1.Application

1) This Subsection applies to *buildings* other than those to which Subsection 9.10.15. applies.

9.10.14.2.Area and Location of Exposing Building Face

1) Except as permitted by Sentence (2), the area of an *exposing building face* shall be
a) taken as the exterior wall area facing in one direction on any side of a *building*, and
b) calculated as the total area measured from the finished ground level to the uppermost ceiling.
2) If a *building* is divided by *fire separations* into *fire compartments*, the area of *exposing building face* is permitted to be calculated for each *fire compartment*, provided the *fire separations* have a *fire-resistance rating* not less than 45 min.
3) For the purpose of using Table 9.10.14.4.-A to determine the maximum aggregate area of *unprotected openings* in an irregularly shaped or skewed exterior wall, the location of the *exposing building face* shall be taken as a vertical plane located so that there are no *unprotected openings* between the vertical plane and the line to which the *limiting distance* is measured. (See Note A-3.2.3.1.(4).)
4) For the purpose of using Table 9.10.14.5.-A to determine the required type of construction, cladding and *fire-resistance rating* for an irregularly shaped or skewed exterior wall,
a) the location of the *exposing building face* shall be taken as a vertical plane located so that no portion of the actual *exposing building face* is between the vertical plane and the line to which the *limiting distance* is measured, and
b) the value for the maximum area of *unprotected openings* (See second column of Table 9.10.14.5.-A) shall be determined using the *limiting distance* measured from the location described in Clause (a). (See Note A-3.2.3.1.(4).)

9.10.14.3.Limiting Distance and Fire Department Response

1) Except for the purpose of applying Sentences 9.10.14.4.(2), (3), (8) and (9), and Sentences 9.10.14.5.(3), (8) and (13), a *limiting distance* equal to half the actual *limiting distance* shall be used as input to the requirements of this Subsection, where
a) the time from receipt of notification of a fire by the fire department until the first fire department vehicle arrives at the *building* exceeds 10 min in 10% or more of all calls to the *building*, and
b) any *storey* in the *building* is not *sprinklered*.
(See Notes A-3.2.3. and A-3.2.3.1.(8).)

9.10.14.4.Openings in Exposing Building Face

1) Except as provided in Sentences (6) to (10), the maximum aggregate area of *unprotected openings* in an *exposing building face* shall
a) conform to Table 9.10.14.4.-A,
b) conform to Subsection 3.2.3., or
c) where the *limiting distance* is not less than 1.2 m, be equal to or less than

i) the *limiting distance* squared, for *residential occupancies*, *business and personal services occupancies* and *low-hazard industrial occupancies*, and
ii) half the *limiting distance* squared, for *mercantile occupancies* and *medium-hazard industrial occupancies*.

Table 9.10.14.4.-A
Maximum Aggregate Area of Unprotected Openings in Exterior Walls[(1)]
Forming Part of Sentence 9.10.14.4.(1)

Occupancy **Classification of** *Building*	**Maximum Total Area of** *Exposing Building Face*, **m²**	**Maximum Aggregate Area of** *Unprotected Openings*, **% of** *Exposing Building Face* **Area**											
		Limiting Distance, **m**											
		Less than 1.2	**1.2**	**1.5**	**2.0**	**4.0**	**6.0**	**8.0**	**10.0**	**12.0**	**16.0**	**20.0**	**25.0**
Residential, *business and personal services*, and *low-hazard industrial*	30	0	7	9	12	39	88	100	–	–	–	–	–
	40	0	7	8	11	32	69	100	–	–	–	–	–
	50	0	7	8	10	28	57	100	–	–	–	–	–
	100	0	7	8	9	18	34	56	84	100	–	–	–
	Over 100	0	7	7	8	12	19	28	40	55	92	100	–
Mercantile and *medium-hazard industrial*	30	0	4	4	6	20	44	80	100	–	–	–	–
	40	0	4	4	6	16	34	61	97	100	–	–	–
	50	0	4	4	5	14	29	50	79	100	–	–	–
	100	0	4	4	4	9	17	28	42	60	100	–	–
	Over 100	0	4	4	4	6	10	14	20	27	46	70	100

Notes to Table 9.10.14.4.-A:
See also Sentences (6) and (7) to calculate the maximum permitted area of *unprotected openings* in sprinklered buildings or where wired glass or glass blocks are used.

2) Openings in a wall having a *limiting distance* of less than 1.2 m shall be protected by *closures*, of other than wired glass or glass block, whose *fire-protection rating* is in conformance with the *fire-resistance rating* required for the wall. (See Table 9.10.13.1.)
3) Except for *buildings* that are *sprinklered* and for openable windows having an unobstructed opening equal to 0.35 m² installed in accordance with Sentences 9.9.10.1.(1) and (2), where the *limiting distance* is 2 m or less, individual *unprotected openings* shall be no greater than
a) the area stated in Table 9.10.14.4.-B, or
b) where the *limiting distance* is equal to or greater than 1.2 m, the area calculated by

$$\text{Area} = 0.24(2 \times LD - 1.2)^2$$

where

Area = area of the *unprotected opening*, and
LD = *limiting distance*.

Table 9.10.14.4.-B
Maximum Concentrated Area of Unprotected Openings
Forming Part of Sentence 9.10.14.4.(3)

Limiting Distance, m	Maximum Area of Individual *Unprotected Openings*, m²
1.2	0.35
1.5	0.78
2.0	1.88

4) The spacing between individual *unprotected openings* described in Sentence (3) that serve a single room or space described in Sentence (5) shall be not less than
a) 2 m horizontally of another *unprotected opening* that is on the same *exposing building face* and serves the single room or space, or
b) 2 m vertically of another *unprotected opening* that serves the single room or space, or another room or space on the same *storey*.

5) For the purpose of Sentence (4), "single room or space" shall mean
a) two or more adjacent spaces having a full-height separating wall extending less than 1.5 m from the interior face of the exterior wall, or
b) two or more stacked spaces that are on the same *storey*.

6) If a *building* is not *sprinklered*, the maximum aggregate area of *unprotected openings* shall be not more than twice the area determined according to Sentence (1), where the *unprotected openings* are glazed with
i) wired glass in steel frames, as described in Article 9.10.13.5., or
ii) glass blocks, as described in Article 9.10.13.7.

7) Where the *building* is *sprinklered*, the maximum aggregate area of *unprotected openings* shall be not more than twice the area determined according to Sentence (1), provided all rooms, including closets and bathrooms, that are adjacent to the *exposing building face* and that have *unprotected openings* are *sprinklered*, notwithstanding any exemptions in the sprinkler standards referenced in Article 3.2.5.12.

8) The maximum aggregate area of *unprotected openings* in an *exposing building face* of a *storage garage* need not comply with Sentence (1), where
a) all *storeys* are constructed as *open-air storeys*, and
b) the *storage garage* has a *limiting distance* of not less than 3 m.

9) The maximum aggregate area of *unprotected openings* in an *exposing building face* of a *storey* that faces a *street* and is at the same level as the *street* need not comply with Sentence (1), where the *limiting distance* is not less than 9 m.

10) Except as provided in Sentence (11), for garages or accessory *building*s that serve a single *dwelling unit* only and are detached from any *building*, the maximum aggregate area of glazed openings shall comply with the requirements for *unprotected openings*.

11) The limits on the area of glazed openings stated in Sentence (10) need not apply to the *exposing building face* of a detached garage or accessory *building* facing a *dwelling unit*, where
a) the detached garage or accessory *building* serves only one *dwelling unit*,
b) the detached garage or accessory *building* is located on the same property as that *dwelling unit*, and

c) the *dwelling unit* served by the detached garage or accessory *building* is the only *major occupancy* on the property.

12) Where a *building* of *residential occupancy* is *sprinklered* and the *limiting distance* is less than 1.2 m but no less than 1 m, the maximum percentage of *unprotected openings* may be 10% provided

a) the windows are glazed with tempered, wired or laminated glass, or glass block, and

b) the *exposing building face* is constructed according to Article 9.10.14.5.

9.10.14.5. Construction of Exposing Building Face and Walls above Exposing Building Face

1) Except as permitted in Sentences (3) to (15), each *exposing building face* and any exterior wall located above an *exposing building face* that encloses an *attic or roof space* shall be constructed in conformance with Table 9.10.14.5.-A. (See Note A-9.10.14.5.(1).) (See also Subsection 9.10.8.)

Table 9.10.14.5.-A
Minimum Construction Requirements for Exposing Building Faces
Forming Part of Sentence 9.10.14.5.(1)

Occupancy **Classification of** *Building* **or** *Fire Compartment*	**Maximum Area of** *Unprotected Openings* **Permitted, % of** *Exposing Building Face* **Area**	**Minimum Required** *Fire-Resistance Rating*	**Type of Construction Required**	**Type of Cladding Required**
Residential, business and personal services, and *low-hazard industrial*	0 to 10	1 h	*Noncombustible*	*Noncombustible*
	> 10 to 25	1 h	*Combustible* or *noncombustible*	*Noncombustible*
	> 25 to 50	45 min	*Combustible* or *noncombustible*	*Noncombustible*
	> 50 to < 100	45 min	*Combustible* or *noncombustible*	*Combustible* or *noncombustible*
Mercantile and *medium-hazard industrial*	0 to 10	2 h	*Noncombustible*	*Noncombustible*
	> 10 to 25	2 h	*Combustible* or *noncombustible*	*Noncombustible*
	> 25 to 50	1 h	*Combustible* or *noncombustible*	*Noncombustible*
	> 50 to < 100	1 h	*Combustible* or *noncombustible*	*Combustible* or *noncombustible*

2) Except as provided in Sentences (3) to (8), cladding on *exposing building faces* and exterior walls located above *exposing building faces* that enclose an *attic or roof space*, for *buildings* or *fire compartments* where the maximum permitted area of *unprotected openings* is more than 10% of the *exposing building face*, need not be *noncombustible* where the wall assembly complies with the requirements of Clause 3.1.5.5.(1)(b) when tested in conformance with CAN/ULC-S134, "Fire Test of Exterior Wall Assemblies."

3) Except as provided in Sentences (4) to (8) and permitted by Sentence (9), cladding on *exposing building faces* and on exterior walls located above *exposing building faces* of *buildings* or *fire compartments* where the maximum permitted area of *unprotected openings* is more than 25% but not more than 50% of the *exposing building face* need not be *noncombustible*, where

a) the *limiting distance* is greater than 5.0 m,

b) the *limiting distance* is greater than 2.5 m where the area and width-to-height ratio of the *exposing building face* conform to Table 9.10.14.5.-B,

c) the *building or fire compartment is sprinklered,*

d) the cladding

i) conforms to Subsections 9.27.6., 9.27.7., 9.27.8. or 9.27.9.,

ii) is installed without furring members, or on furring not more than 25 mm thick, over gypsum sheathing at least 12.7 mm thick or over masonry, and

iii) after conditioning in conformance with ASTM D 2898, "Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing," has a *flame-spread rating* not greater than 25 when tested in accordance with Sentence 3.1.12.1.(2), or

e) the cladding

i) conforms to Subsection 9.27.12.,

ii) is installed with or without furring members over a gypsum sheathing at least 12.7 mm thick or over masonry,

iii) has a *flame-spread rating* not greater than 25 when tested in accordance with Sentence 3.1.12.1.(2), and

iv) does not exceed 2 mm in thickness exclusive of fasteners, joints and local reinforcements.

Table 9.10.14.5.-B
Maximum Allowable Area and Ratio of Width to Height of Exposing Building Face
Forming Part of Sentence 9.10.14.5.(3)

Maximum Ratio of Width to Height of ***Exposing Building Face***	**Maximum Area of** ***Exposing Building Face*****, m²**
1:1	88
2:1	102
3:1	129
4:1	161
5:1	195

4) Except as provided in Sentence (5), if a detached garage or accessory *building* serves one *dwelling unit*; or if a detached garage serves both units in a *building* containing not more than two *principal dwelling units* and has a continuous internal *fire separation*, with a 45 minute *fire resistance rating* from the floor slab to the roof sheathing separating the parking spaces for each unit, the *exposing building face*

a) need not conform to the minimum required *fire-resistance rating* stated in Table 9.10.14.5.-A, where the *limiting distance* is 0.6 m or more,

b) shall have a *fire-resistance rating* of not less than 45 min, where the *limiting distance* is less than 0.6 m, and

c) need not conform to the type of cladding required by Table 9.10.14.5.-A, regardless of the *limiting distance*.

5) The requirements regarding *fire-resistance rating*, type of construction and type of cladding need not apply to the *exposing building face* of a detached garage or accessory *building* conforming to Sentence 9.10.14.5.(4) facing a building containing not more than two principal *dwelling units*, where

a) the detached garage or accessory *building* serves only a building containing not more than two principal *dwelling units,*

b) the detached garage or accessory *building* is located on the same property as that *building* containing not more than two principal *dwelling units,* and

c) the *building* containing not more than two principal *dwelling units* served by the detached garage or accessory *building* is the only *major occupancy* on the property.

6) Except as provided in Sentence (7), *combustible* projections on the exterior of a wall that are more than 1 m above ground level and that could expose an adjacent *building* to fire spread shall not be permitted within

a) 1.2 m of a property line or the centre line of a *public way*, or

b) 2.4 m of a *combustible* projection on another *building* on the same property.

7) Except as provided in Sentences (9) to (12), Sentence (6) shall not apply to

a) buildings containing not more than two *principal dwelling units* only, and

b) detached garages or accessory *buildings*, where

i) the detached garage or accessory *building* conforming to Sentence 9.10.14.5.(4) serves only *a building containing not more than two principal dwelling units*,

ii) the detached garage or accessory *building* conforming to Sentence 9.10.14.5.(4)is located on the same property as that building containing not more than two principal *dwelling units*, and

iii) the building containing not more than two principal *dwelling units* served by the detached garage or accessory *building* is the only *major occupancy* on the property.

(See Note A-9.10.14.5.(7).)

8) Where *combustible* projections on an *exposing building face* are permitted by Sentence (7), are totally enclosed and constructed with solid faces, such as for fireplaces and *chimneys*, and extend within 1.2 m of a property line,

a) the construction of the face and sides of the projection shall comply with the corresponding requirements for *exposing building faces* for *limiting distances* less than 1.2 m as stated in Sentence (2) or (3), and

b) where the underside of the projection is more than 0.6 m above finished ground level, it shall be protected by

i) not less than 0.38 mm thick *noncombustible* material,

ii) unvented aluminum conforming to CAN/CGSB-93.2-M, “Prefinished Aluminum Siding, Soffits, and Fascia, for Residential Use,”

iii) not less than 12.7 mm thick gypsum soffit board or gypsum ceiling board installed according to CSA A82.31-M, “Gypsum Board Application,”

iv) not less than 11 mm thick plywood,

v) not less than 12.5 mm thick OSB or waferboard, or

vi) not less than 11 mm thick lumber.

(See Note A-9.10.14.5.(8).)

9) Except as provided in Sentence (11), where the *exposing building face* has a *limiting distance* of not more than 0.45 m, projecting roof soffits shall not be constructed above the *exposing building face*. (See Note A-3.2.3.6.(2).)

10) Except as provided in Sentence (11), where the *exposing building face* has a *limiting distance* of more than 0.45 m, the face of roof soffits shall not project to less than 0.45 m from the property line. (See Note A-3.2.3.6.(2).)

11) The face of a roof soffit is permitted to project to the property line, where it faces a *street*, lane or public thoroughfare. (See Note A-9.10.14.5.(11) and 9.10.15.5.(10).)

12) Where roof soffits project to less than 1.2 m from the property line, the centre line of a lane or public thoroughfare, or an imaginary line between two *buildings or fire compartments* on the same property, they shall

a) have no openings, and

b) be protected by

i) not less than 0.38 mm thick sheet steel,

ii) unvented aluminum conforming to CAN/CGSB-93.2-M, “Prefinished Aluminum Siding, Soffits, and Fascia, for Residential Use,”

iii) not less than 12.7 mm thick gypsum soffit board or gypsum ceiling board installed according to CSA A82.31-M, “Gypsum Board Application,”

iv) not less than 11 mm thick plywood,

v) not less than 12.5 mm thick OSB or waferboard, or

vi) not less than 11 mm thick lumber.

(See Note A-3.2.3.6.(2).)

13) Heavy timber and steel columns need not conform to the requirements of Sentence (1), provided the *limiting distance* is not less than 3 m.

14) Non-*loadbearing* wall components need not have a minimum *fire-resistance rating*, where the *building*

a) is 1 *storey* in *building height*,

b) is of *noncombustible construction*,

c) is classified as a *low-hazard industrial occupancy* and used only for low *fire load occupancies*, such as power-generating plants or plants for the manufacture or storage of *noncombustible* materials, and

d) has a *limiting distance* of 3 m or more.

15) Where a *residential building* is *sprinklered*, and Table 9.10.14.5.A requires *non-combustible construction*, the *exposing building faces* may use a wood stud wall assembly having a 1 hour *fire-resistance rating* provided the *limiting distance* is at least 1.0 m and the wall assembly is of *non-combustible* construction throughout excepting structural elements and sheathing.

9.10.15. Spatial Separation Between Residential Buildings

(See Note A-9.10.15.)

9.10.15.1.Application

1) This Subsection applies to

a) residential *buildings* containing not more than two principal *dwelling units* where no principal *dwelling unit*, including their contained *ancillary residential unit*, is above another.

b) accessory *buildings* that serve a *building* described in Clause (a).

9.10.15.2.Area and Location of Exposing Building Face

1) Except as permitted by Sentences (2) and (3), the area of an *exposing building face* shall be

a) taken as the exterior wall area facing in one direction on any side of a *building*, and

b) calculated as

i) the total area measured from the finished ground level to the uppermost ceiling,

ii) reserved, or

iii) except as provided in Sentence (3), where Table 9.10.15.4. is used to determine the maximum aggregate area of *unprotected openings*, the area of any number of individual vertical portions of the wall measured from the finished ground level to the uppermost ceiling. (See Note A-9.10.15.4.(2).)

2) If a *building* is divided by *fire separations* into *fire compartments*, the area of e*xposing building face* is permitted to be calculated for each *fire compartment* provided the *fire separations* have a *fire-resistance ratings* not less than 45 min.

3) Where the *exposing building face* of any section of an exterior wall enclosing a single room or space, or combination room and space, has a *limiting distance* of 2 m or less, that section of the *exposing building face* serving the room or space shall not be divided into portions for the purpose of calculating area of *exposing building face*. (See Sentence 9.10.15.4.(5) and Note A-9.10.15.4.(2).)

4) For the purpose of using Table 9.10.15.4. to determine the maximum permitted area of *unprotected openings* in an irregularly shaped or skewed exterior wall, the location of the *exposing building face* shall be taken as a vertical plane located so that there are no *unprotected openings* between the vertical plane and the line to which the *limiting distance* is measured. (See Note A-3.2.3.1.(4).)

5) In determining the required cladding-sheathing assembly and *fire-resistance rating* for an irregularly shaped or skewed exterior wall, the location of the *exposing building face* shall be taken as a vertical plane located so that no portion of the actual *exposing building face* is between the vertical plane and the line to which the *limiting distance* is measured. (See Article 9.10.15.5. and Note A-3.2.3.1.(4).)

9.10.15.3.Limiting Distance and Fire Department Response

1) Except for the purpose of applying Sentences 9.10.15.2.(2), 9.10.15.4.(3) and 9.10.15.5.(13), a *limiting distance* equal to half the actual *limiting distance* shall be used as input to the requirements of this Subsection, where

a) the time from receipt of notification of a fire by the fire department until the first fire department vehicle arrives at the *building* exceeds 10 min in 10% or more of all calls to the *building*, and

b) any *storey* in the *building* is not *sprinklered*.

(See Notes A-3.2.3. and A-3.2.3.1.(8).)

9.10.15.4. Unprotected Openings in Exposing Building Face

1) Except as provided in Sentences (6), (7) and (8), the maximum aggregate area of glazed openings in an *exposing building face* shall

a) conform to Table 9.10.15.4.,

b) in a building which conforms to Sentence (8), comply with Subsection 3.2.3., or

c) where the *limiting distance* is not less than 1.2 m, be equal to or less than the *limiting distance* squared.

2) Where the limits on the area of *unprotected openings* glazed openings are determined for individual portions of the exterior wall, as described in Sentence 9.10.15.2.(3), the maximum aggregate area of *unprotected openings* glazed openings for any portion shall conform to the values in the row of Table 9.10.15.4. corresponding to the maximum total area of *exposing building face* (See column 1 of the Table) that is equal to the sum of all portions of the *exposing building face*. (See Note A-9.10.15.4.(2).)

3) Except for *buildings* that are *sprinklered* and for openable windows having an unobstructed opening equal to 0.35 m^2 installed in accordance with Sentences 9.9.10.1.(1) and (2), where the *limiting distance* is 2 m or less, individual *unprotected openings* glazed openings or a group of *unprotected openings* glazed openings in an *exposing building face* shall not exceed 50% of the maximum allowable aggregate area *unprotected openings* of glazed openings determined in Sentence (1).

4) The spacing between individual *unprotected openings* described in Sentence (3) serving a single room or space described in Sentence (5) shall be not less than

a) 2 m horizontally of another *unprotected openings* that is on the same *exposing building face* and serves the single room or space, or

b) 2 m vertically of another *unprotected openings* that serves the single room or space, or another room or space on the same *storey*.

5) For the purpose of Sentence (4), “single room or space” shall mean

a) two or more adjacent spaces having a full-height separating wall extending less than 1.5 m from the interior face of the exterior wall, or

b) two or more stacked spaces that are on the same *storey*.

6) The limits on the area of *unprotected openings* shall not apply to the *exposing building face* of a *building* containing not more than two principal *dwelling units* facing a detached garage or accessory *building*, where

a) the detached garage or accessory *building* conforming to Sentence 9.10.15.5.(4)serves only one *building* containing not more than two principal *dwelling units*,
b) the detached garage or accessory *building* conforming to Sentence 9.10.15.5.(4)is located on the same property as that *building* containing not more than two principal *dwelling units*, and
c) the *building* containing not more than two principal *dwelling units* served by the detached garage or accessory *building* conforming to Sentence 9.10.15.5.(4)is the only *major occupancy* on the property.

7) If a *building* is *sprinklered* and the *limiting distance* is less than 1.2 m but not less than 1 m, the maximum percentage of *unprotected openings* shall be 10% provided
a) the windows are glazed with tempered , wired, or laminated glass or glass block, and
b) the *exposing building face* is constructed according to Sentence 9.10.15.5.(13).

8) If a *building* is *sprinklered*, the maximum aggregate area of *unprotected openings* may be no more than twice the area as determined in Table 9.10.15.4. provided all rooms, including closets and bathrooms, that are adjacent to the *exposing building face* and that have *unprotected openings* shall be *sprinklered*, notwithstanding any exemptions in the sprinkler standards referenced in Article 3.2.5.12.

9) If a *storage garage* has a *limiting distance* of no less than 3 m, the *exposing building face* of such *storage garage* may have unlimited *unprotected openings*.

Table 9.10.15.4.
Maximum Area of Unprotected Openings in Exterior Walls of Houses
Forming Part of Sentences 9.10.15.4.(1) and (2)

Maximum Total Area of *Exposing Building Face*, m²	Maximum Aggregate Area of Unprotected Openings, % of *Exposing Building Face* Area											
	Limiting Distance, m											
	Less than 1.2	1.2	1.5	2.0	4.0	6.0	8.0	10.0	12.0	16.0	20.0	25.0
30	0	7	9	12	39	88	100	–	–	–	–	–
40	0	7	8	11	32	69	100	–	–	–	–	–
50	0	7	8	10	28	57	100	–	–	–	–	–
100	0	7	8	9	18	34	56	84	100	–	–	–
Over 100	0	7	7	8	12	19	28	40	55	92	100	–

9.10.15.5.Construction of Exposing Building Face of Houses

1) Except as provided in Sentences (4), (13) and (14), each *exposing building face* and any exterior wall located above an *exposing building face* that encloses an *attic or roof space* shall be constructed in conformance with Sentences (2) and (3)
a) for the *exposing building face* as a whole, or
b) for any number of separate portions of the *exposing building face* (See Subclause 9.10.15.2.(1)(b)(iii), Sentence 9.10.15.4.(2), and Note A-9.10.15.4.(2)).
(See also Subsection 9.10.8.)

2) Except as provided in Sentences (4) and (5), where the *limiting distance* is less than 0.6 m, the *exposing building face* and exterior walls located above the *exposing building face* that enclose an *attic or roof space* shall have a *fire-resistance rating* of not less than 45 min, and

a) the cladding shall be metal or *noncombustible* cladding installed in accordance with Section 9.20., 9.27. or 9.28. (See Note A-9.10.14.5.(1)),

b) the cladding shall

i) conform to Subsection 9.27.12.,

ii) be installed without furring members over gypsum sheathing at least 12.7 mm thick or over masonry,

iii) have a *flame-spread rating* not greater than 25 when tested in accordance with Sentence 3.1.12.1.(2), and

iv) not exceed 2 mm in thickness exclusive of fasteners, joints and local reinforcements, or

c) the wall assembly shall comply with Clause 3.1.5.5.(1)(b) when tested in conformance with CAN/ULC-S134, “Fire Test of Exterior Wall Assemblies.”

3) Except as provided in Sentence (4), where the *limiting distance* is equal to or greater than 0.6 m and less than 1.2 m, the *exposing building face* and any exterior wall located above the *exposing building face* that encloses an *attic or roof space* shall have a *fire-resistance rating* of not less than 45 min, and

a) the cladding shall be metal or *noncombustible* cladding installed in accordance with Section 9.20., or 9.28. (See Note A-9.10.14.5.(1)),

b) the cladding shall

i) conform to Subsection 9.27.6., 9.27.7., 9.27.8., 9.27.9., or 9.27.10.,

ii) be installed without furring members, or on furring not more than 25 mm thick, over gypsum sheathing at least 12.7 mm thick or over masonry, and

iii) after conditioning in conformance with ASTM D 2898, “Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing,” have a *flame-spread rating* not greater than 25 when tested in accordance with Sentence 3.1.12.1.(2),

c) the cladding shall

i) conform to Subsection 9.27.12.,

ii) be installed with or without furring members over gypsum sheathing at least 12.7 mm thick or over masonry,

iii) have a *flame-spread rating* not greater than 25 when tested in accordance with Sentence 3.1.12.1.(2), and

iv) not exceed 2 mm in thickness exclusive of fasteners, joints and local reinforcements, or

d) the wall assembly shall comply with Clause 3.1.5.5.(1)(b) when tested in conformance with CAN/ULC-S134, “Fire Test of Exterior Wall Assemblies.”

4) The requirements regarding *fire-resistance rating* and type of cladding-sheathing assembly shall not apply to the *exposing building face* or projections from an *exposing building face* of a *dwelling unit* facing a detached garage or accessory *building*, or a garage or accessory *building* facing a *dwelling unit*, where

a) the detached garage or accessory *building* serves only one *dwelling unit*,

b) the detached garage or accessory *building* is located on the same property as that *dwelling unit*, and

c) the *dwelling unit* served by the detached garage or accessory *building* is the only *major occupancy* on the property.

5) Except as provided in Sentence (6), *combustible* projections on the exterior of a wall that are more than 1 m above ground level and that could expose an adjacent *building* to fire spread shall not be permitted within

a) 1.2 m of a property line or the centre line of a *public way*, or

b) 2.4 m of a *combustible* projection on another *building* on the same property.

6) Except as provided in Sentences (8) to (11), Sentence (5) shall not apply to

a) buildings containing 1 or 2 *dwelling units* only, and

b) detached garages or accessory *buildings*, where

i) the detached garage or accessory *building* serves only one *dwelling unit*,

ii) the detached garage or accessory *building* is located on the same property as that *dwelling unit*, and
iii) the *dwelling unit* served by the detached garage or accessory *building* is the only *major occupancy* on the property.

(See Note A-9.10.14.5.(7).)

7) Where *combustible* projections on an *exposing building face* are permitted by Sentence (6), are totally enclosed and constructed with solid faces, such as for fireplaces and *chimneys*, and extend within 1.2 m of a property line,

a) the construction of the face and sides of the projection shall comply with the corresponding requirements for *exposing building faces* for *limiting distances* less than 1.2 m as stated in Sentence (2) or (3), and
b) where the underside of the projection is more than 0.6 m above finished ground level, it shall be protected by
i) not less than 0.38 mm thick *noncombustible* material,
ii) unvented aluminum conforming to CAN/CGSB-93.2-M, "Prefinished Aluminum Siding, Soffits, and Fascia, for Residential Use,"
iii) not less than 12.7 mm thick gypsum soffit board or gypsum ceiling board installed according to CSA A82.31-M, "Gypsum Board Application,"
iv) not less than 11 mm thick plywood,
v) not less than 12.5 mm thick OSB or waferboard, or
vi) not less than 11 mm thick lumber.

(See Note A-9.10.14.5.(8).)

8) Except as provided in Sentence (10), where the *exposing building face* has a *limiting distance* of not more than 0.45 m, projecting roof soffits shall not be constructed above the *exposing building face*. (See Note A-3.2.3.6.(2).)

9) Except as provided in Sentence (10), where the *exposing building face* has a *limiting distance* of more than 0.45 m, the face of roof soffits shall not project to less than 0.45 m from the property line. (See Note A-3.2.3.6.(2).)

10) The face of a roof soffit is permitted to project to the property line, where it faces a *street*, lane or public thoroughfare. (See Note A-9.10.14.5.(11) and 9.10.15.5.(10).)

11) Where roof soffits project to less than 1.2 m from the property line, the centre line of a *public way*, or an imaginary line between two *buildings* or *fire compartments* on the same property, they shall

a) have no openings, and
b) be protected by
i) not less than 0.38 mm thick sheet steel,
ii) unvented aluminum conforming to CAN/CGSB-93.2-M, "Prefinished Aluminum Siding, Soffits, and Fascia, for Residential Use,"
iii) not less than 12.7 mm thick gypsum soffit board or gypsum ceiling board installed according to CSA A82.31-M, "Gypsum Board Application,"
iv) not less than 11 mm thick plywood,
v) not less than 12.5 mm thick OSB or waferboard, or
vi) not less than 11 mm thick lumber.

(See Note A-3.2.3.6.(2).)

12) For *buildings* of *combustible* construction, materials installed to provide the required protection for soffits may be covered with a *combustible* or *noncombustible* finish material.

13) Heavy timber and steel columns need not conform to the requirements of Sentence (1), provided the *limiting distance* is not less than 3 m.

14) If a *building* is *sprinklered*, and the maximum percentage of *unprotected openings* complies with Sentence 9.10.15.4.(7), the *exposing building faces* may be constructed with a wood stud wall assembly provided

a) the *exposing building face* has a one hour *fire-resistance rating*,

b) the wall assembly is of *non-combustible* construction throughout excepting structural elements and sheathing, and
c) the wall assembly is clad with *non-combustible* cladding.

9.10.16. Fire Blocks

9.10.16.1.Required Fire Blocks in Concealed Spaces

1) Vertical concealed spaces in interior walls and exterior walls shall be separated by *fire blocks*
a) one from the other, and
b) from horizontal concealed spaces.

2) Horizontal concealed spaces in attics, roof spaces, ceilings, floors, and crawl spaces shall be separated by *fire blocks*
a) one from the other, and
b) from vertical concealed spaces.

3) Fire blocks shall be provided at all interconnections between concealed vertical and horizontal spaces in interior coved ceilings, drop ceilings and soffits where the exposed construction materials within the concealed spaces have a surface *flame-spread rating* greater than 25.

4) Fire blocks shall be provided at the top and bottom of each run of stairs where they pass through a floor containing concealed space in which the exposed construction materials within the space have a surface *flame-spread rating* greater than 25.

5) Unsprinklered concealed spaces of *combustible construction* created by a ceiling, roof space or unoccupied attic space shall be separated by *fire blocks* into compartments
a) not more than 60 m in greatest dimension, and
b) where such space contains exposed construction materials having a surface *flame-spread rating* greater than 25, not more than 300 m^2 in area.

6) No dimension of the concealed space described in Clause (5)(b) shall exceed 20 m.

7) Concealed spaces in mansard or gambrel style roofs, exterior cornices, balconies and canopies of *combustible construction* in which the exposed construction materials within the space have a surface *flame-spread rating* exceeding 25 shall have vertical *fire blocks* at intervals of not more than 20 m and at points where such concealed spaces extend across the ends of required vertical *fire separations*.

9.10.16.2.Required Fire Blocks in Wall Assemblies

1) Except as permitted in Sentence (2), *fire blocks* shall be provided to block off concealed spaces within wall assemblies, including spaces created by furring,
a) at each floor level,
b) at each ceiling level where the ceiling contributes to part of the required *fire-resistance rating*, and
c) at other locations within the wall, so that the distance between *fire blocks* does not exceed 20 m horizontally and 3 m vertically.

2) Fire blocks described in Sentence (1) are not required, provided
a) the insulated wall assembly contains not more than one concealed air space whose horizontal thickness is not more than 25 mm,
b) the exposed construction materials within the space are *noncombustible*,
c) the exposed construction materials within the space, including insulation, but not including wiring, piping or similar services, have a *flame-spread rating* of not more than 25, or
d) the concealed wall space is filled with insulation.

9.10.16.3.Fire Block Materials

1) Except as permitted by Sentences (2) and (3), *fire blocks* shall be constructed of materials that will remain in place and prevent the passage of flames for not less than 15 min when subjected to the standard

fire exposure in
CAN/ULC-S101, “Fire Endurance Tests of Building Construction and Materials.”

2) Fire blocks are deemed to comply with Sentence (1) if they are constructed of not less than

a) 0.38 mm sheet steel,
b)12.7 mm gypsum board,
c) 12.5 mm plywood, OSB or waferboard, with joints having continuous supports,
d) 2 layers of 19 mm lumber with joints staggered, or
e) 38 mm lumber.

3) In a *building* permitted to be of *combustible construction*, semi-rigid fibre insulation board produced from glass, rock or slag is permitted to be used to block the vertical space in a double-frame wall assembly formed at the intersection of the floor assembly and the walls, provided the width of the vertical space does not exceed 25 mm and the insulation board

a) has a density not less than 45 kg/m^3,
b) is securely fastened to one set of studs,
c) extends from below the bottom of the top plates in the lower *storey* to above the top of the bottom plate in the upper *storey*, and
d) completely fills the portion of the vertical space between the headers and between the wall plates.

(See Note A-3.1.11.7.(7).)

9.10.16.4.Penetration of Fire Blocks

1) Where *fire blocks* are pierced by pipes, ducts or other elements, the effectiveness of the *fire blocks* shall be maintained around such elements.

9.10.17. Flame-Spread Limits

9.10.17.1.Flame-Spread Rating of Interior Surfaces

1) Except as otherwise provided in this Subsection, the exposed surface of every interior wall and ceiling, including skylights and glazing, shall have a surface *flame-spread rating* of not more than 150.
2) Except as permitted in Sentence (3), doors need not conform to Sentence (1) provided they have a surface *flame-spread rating* of not more than 200.
3) Doors within *dwelling units*, other than garage doors, need not conform to Sentences (1) and (2).

9.10.17.2.Ceilings in Exits or Public Corridors

1) At least 90% of the exposed surface of every ceiling in an *exit* or unsprinklered ceiling in a *public corridor* shall have a surface *flame-spread rating* of not more than 25. (See Article 9.10.17.6.)

9.10.17.3.Walls in Exits

1) Except as provided in Sentence (2), at least 90% of the exposed surfaces of every wall in an *exit* shall have a surface *flame-spread rating* of not more than 25. (See Article 9.10.17.6.)
2) At least 75% of the wall surface of a lobby used as an *exit* in Article 9.9.8.5. shall have a surface *flame-spread rating* of not more than 25. (See Article 9.10.17.6.)

9.10.17.4.Exterior Exit Passageways

1) Where an exterior *exit* passageway provides the only *means of egress* from the rooms or *suites* it serves, the wall and ceiling finishes of that passageway, including the soffit beneath and the *guard* on the passageway, shall have a surface *flame-spread rating* of not more than 25, except that up to 10% of the total wall area and 10% of the total ceiling area is permitted to have a surface *flame-spread rating* of not more than 150.

9.10.17.5.Walls in Public Corridors

1) At least 90% of the total wall surface in any unsprinklered *public corridor* shall have a surface *flame-spread rating* of not more than 75, or at least 90% of the upper half of such walls shall have a surface *flame-spread rating* of not more than 25. (See Article 9.10.17.6.)

9.10.17.6.Calculation of Wall and Ceiling Areas

1) Skylights, glazing, *combustible* doors, and *combustible* light diffusers and lenses shall not be considered in the calculation of wall and ceiling areas in this Subsection.

9.10.17.7.Corridors Containing an Occupancy

1) Where a *public corridor* or a corridor used by the public contains an *occupancy*, the interior finish materials used on the walls or ceiling of such *occupancy*, shall have a surface *flame-spread rating* in conformance with that required for *public corridors*.

9.10.17.8.Light Diffusers and Lenses

1) Light diffusers and lenses having *flame-spread rating*s that exceed those permitted for the ceiling finish, shall conform to the requirements of Sentence 3.1.13.4.(1).

9.10.17.9.Combustible Skylights

1) Individual *combustible* skylights in corridors required to be separated from the remainder of the *building* by *fire separations* shall not exceed 1 m^2 in area and shall be spaced not less than 1.2 m apart.

9.10.17.10.Protection of Foamed Plastics

(See Note A-3.1.4.2.)

1) Except as provided in Sentences (2) and (3), foamed plastics that form part of a wall or ceiling assembly shall be protected from adjacent space in the *building*, other than adjacent concealed spaces within *attic or roof spaces*, crawl spaces, wall assemblies and ceiling assemblies

a) by one of the interior finishes described in Subsections 9.29.4. to 9.29.9.,

i) provided the *building* does not contain a Group C *major occupancy*, by sheet metal that

ii) is mechanically fastened to the supporting assembly independent of the insulation,

iii) is not less than 0.38 mm thick, and

b) has a melting point not less than 650°C, or

c) by any thermal barrier that meets the requirements of Sentence 3.1.5.15.(2).

(See Note A-3.1.4.2.(1)(c).)

2) A walk-in cooler or freezer consisting of factory-assembled wall, floor or ceiling panels containing foamed plastics is permitted to be used, provided the panels

a) are protected on both sides by sheet metal not less than 0.38 mm thick having a melting point not less than 650°C,

b) do not contain an air space, and

c) have a *flame-spread rating*, determined by subjecting a sample panel with an assembled joint typical of field installation to the applicable test described in Subsection 3.1.12., that is not more than that permitted for the room or space in which they are located or that they bound.

3) Thermosetting foamed plastic insulation having a *flame-spread rating* of not more than 200 is permitted to be used in factory-assembled doors in *storage garages* serving single *dwelling units* provided that

a) the insulation is covered on the interior with a metallic foil,

b) the assembly has a *flame-spread rating* of not more than 200, and

c) the assembly incorporates no air spaces.

9.10.17.11.Walls and Ceilings in Bathrooms

1) The interior finish of walls and ceilings in bathrooms within *suites* of *residential occupancy* shall have a surface *flame-spread rating* of not more than 200.

9.10.17.12.Coverings or Linings of Ducts

1) Where a covering or a lining is used with a duct, such lining or covering shall have a *flame-spread rating* conforming to Article 3.6.5.4. or 9.33.6.4.

9.10.18. Alarm and Detection Systems

9.10.18.1.Access Provided through a Firewall

1) Where access is provided through a *firewall*, the requirements in this Subsection shall apply to the *floor areas* on both sides of the *firewall* as if they were in the same *building*.

9.10.18.2.Fire Alarm System Required

1) Except as permitted in Sentences (3) and (4), a fire alarm system shall be installed in *buildings* in which a sprinkler system is required by this Part.

2) Except as provided in Sentence (5), a fire alarm system shall be installed

a) in every *building* that contains more than 3 *storeys*, including *storeys* below the *first storey*,

b) where the total *occupant load* exceeds 300, or

c) when the *occupant load* for any *major occupancy* in Table 9.10.18.2. is exceeded.

Table 9.10.18.2.
Maximum Occupant Load for Buildings without Fire Alarm Systems
Forming Part of Sentence 9.10.18.2.(2)

Major Occupancy **Classification**	*Occupant Load* **Above which a Fire Alarm System is Required**
Residential	10 (sleeping accommodation)
Business and personal services, *Mercantile*	150 above or below the *first storey*
Low- or *medium-hazard industrial*	75 above or below the *first storey*

3) In *buildings* in which a sprinkler system has been installed in accordance with NFPA 13D, "Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes," a fire alarm system need not be installed.

4) In *buildings* that contain fewer than 9 sprinklers conforming to Sentence 3.2.5.12.(4), a fire alarm system need not be installed.

5) A fire alarm system is not required in a *residential occupancy* where an *exit* or *public corridor* serves not more than 4 *suites* or where each *suite* has direct access to an exterior *exit* facility leading to ground level.

9.10.18.3.Design and Installation Requirements

1) Except as stated in Sentence (2) and as required by this Subsection, where fire alarm, fire detection and smoke detection devices and systems are installed, these devices and systems and their installation shall conform to Subsection 3.2.4.

2) The following Articles in Subsection 3.2.4. regarding fire alarm systems do not apply to Part 9 *buildings*: Articles 3.2.4.1., 3.2.4.10., 3.2.4.11., 3.2.4.12., 3.2.4.13. and 3.2.4.22.

9.10.18.4.Rooms and Spaces Requiring Heat Detectors or Smoke Detectors

1) Where a fire alarm system is required, every *public corridor* in *buildings* of *residential occupancy* and every *exit* stair shaft shall be provided with *smoke detectors*.

2) Except as provided in Sentence (3), if a fire alarm system is required in a *building* that is not *sprinklered*, *fire detectors* shall be installed in the following spaces:

a) storage rooms not within *dwelling units*,
b) service rooms not within *dwelling units*,
c) janitors' rooms
d) rooms in which hazardous substances are to be used or stored (See Note A-3.3.1.2.(1)),
e) elevator hoist ways, chutes and dumbwaiter shafts, and
f) laundry rooms in *buildings of residential occupancy*, but not those within *dwelling units.*

3) Except as required in Sentence (4), *heat detectors* and *smoke detectors* described in Sentence (2) are not required in *dwelling units* or in *sprinklered buildings* in which the sprinkler system is electrically supervised and equipped with a water flow alarm.

4) *Heat detectors* or *smoke detectors* shall be installed in any elevator hoist way or dumbwaiter shaft which is not equipped with a *sprinkler system*.

9.10.18.5.Smoke Detectors in Recirculating Air-Handling Systems

1) Except for a recirculating air system serving not more than one *dwelling unit*, where a fire alarm system is required to be installed, every recirculating air-handling system shall be designed to prevent the circulation of smoke upon a signal from a duct-type *smoke detector* where such system supplies more than one *suite* on the same floor or serves more than 1 *storey*.

9.10.18.6.Portions of Buildings Considered as Separate Buildings

1) Except as provided in Sentence (2), where a vertical *fire separation* having a *fire-resistance rating* of not less than 1 h separates a portion of a *building* from the remainder of the *building* and there are no openings through the *fire separation* other than those for piping, tubing, wiring and conduit, the requirements for fire alarm and detection systems may be applied to each portion so separated as if it were a separate *building*.

2) The permission in Sentence (1) to consider separated portions of a *building* as separate *buildings* does not apply to *service rooms* and storage rooms.

9.10.18.7.Central Vacuum Systems

1) Central vacuum cleaning systems serving more than one *suite* or *storey* in *buildings* equipped with a fire alarm system shall be designed to shut down upon activation of the fire alarm system.

9.10.18.8.Open-Air Storage Garages

1) A fire alarm system is not required in a *storage garage* conforming to Article 3.2.2.90. provided there are no other *occupancies* in the *building*.

9.10.19. Smoke Alarms

9.10.19.1.Required Smoke Alarms

1) Except as permitted by Article 9.10.19.8., *smoke alarms* conforming to CAN/ULC-S531, "Standard for Smoke Alarms," shall be installed in

a) each *dwelling unit*, and
b) each sleeping room not within a *dwelling unit*, and
c) **Reserved**.

2) All *smoke alarms* installed in *dwelling units* in unsprinklered *buildings* shall be equipped with a battery powered back up system and a wired in manually operated device which is capable of silencing a *smoke alarm* signal for a period of not more than 10 minutes and re-sounding the signal if smoke levels in the vicinity trigger the *smoke alarm*.

9.10.19.2.Sound Patterns of Smoke Alarms

1) The sound patterns of *smoke alarms* shall

a) meet the temporal patterns of *alarm signals* (See Note A-3.2.4.18.(2)), or
b) be a combination of temporal pattern and voice relay.

9.10.19.3.Location of Smoke Alarms

1) Within *dwelling units*, sufficient *smoke alarms* shall be installed so that

a) there is at least one *smoke alarm* installed on each *storey*, including *basements*, and

b) on any *storey* of a *dwelling unit* containing sleeping rooms, a *smoke alarm* is installed

i) in each sleeping room, and

ii) in a location between the sleeping rooms and the remainder of the *storey*, and if the sleeping rooms are served by a hallway, the *smoke alarm* shall be located in the hallway.

(See Note A-9.10.19.3.(1).)

2) A *smoke alarm* required by Sentence (1) shall be installed in conformance with CAN/ULC-S553, "Installation of Smoke Alarms."

3) Smoke alarms required in Article 9.10.19.1. and Sentence (1) shall be installed on or near the ceiling.

9.10.19.4.Power Supply

1) Except as provided in Sentences (2) and (3), *smoke alarms* described in Sentence 9.10.19.1.(1) shall

a) be installed with permanent connections to an electrical circuit (See Note A-3.2.4.20.(7)(a)),

b) have no disconnect switch between the overcurrent device and the *smoke alarm*, and

c) in case the regular power supply to the *smoke alarm* is interrupted, be provided with a battery as an alternative power source that can continue to provide power to the *smoke alarm* for a period of no less than 7 days in the normal condition, followed by 4 minutes of alarm.

2) Where the *building* is not supplied with electrical power, *smoke alarms* are permitted to be battery-operated.

3) Suites of *residential occupancy* are permitted to be equipped with *smoke detectors* in lieu of *smoke alarms*, provided the *smoke detectors*

a) are capable of independently sounding audible signals within the individual *suites*,

b) except as permitted in Sentence (4), are installed in conformance with CAN/ULC-S524, "Installation of Fire Alarm Systems," and

c) form part of the fire alarm system.

(See Note A-3.2.4.20.(8).)

4) Smoke detectors permitted to be installed in lieu of *smoke alarms* as stated in Sentence (3) are permitted to sound localized alarms within individual *suites*, and need not sound an alarm throughout the rest of the *building*.

9.10.19.5.Interconnection of Smoke Alarms

1) Where more than one *smoke alarm* is required in a *dwelling unit*, the *smoke alarms* shall be wired so that the activation of one alarm will cause all alarms within the *dwelling unit* to sound.

2) Reserved.

9.10.19.6.Silencing of Smoke Alarms

1) Except as permitted in Sentence (2), a manually operated device shall be incorporated within the circuitry of a *smoke alarm* installed in a *dwelling unit* so that the signal emitted by the *smoke alarm* can be silenced for a period of not more than 10 min, after which the *smoke alarm* will reset and sound again if the level of smoke in the vicinity is sufficient to re-actuate it.

2) Suites of *residential occupancy* equipped with *smoke detectors* installed to CAN/ULC-S524, "Installation of Fire Alarm Systems," which are part of the fire alarm system in lieu of *smoke alarms* as permitted in Sentence 9.10.19.4.(3), need not incorporate the manually operated device required in Sentence (1).

9.10.19.7.Instructions for Maintenance and Care

1) Where instructions are necessary to describe the maintenance and care required for *smoke alarms* to ensure continuing satisfactory performance, they shall be posted in a location where they will be readily available to the occupants for reference.

9.10.19.8.Residential Fire Warning Systems

1) Except where a fire alarm system is installed or required in a *building*, *smoke detectors* forming part of a residential fire warning system installed in conformance with CAN/ULC-S540, "Residential Fire and Life Safety Warning Systems: Installation, Inspection, Testing and Maintenance," are permitted to be installed in lieu of all *smoke alarms* required by Articles 9.10.19.1. and 9.10.19.3., provided that the fire warning system

a) is capable of sounding audible signals as stated in Articles 9.10.19.2. and 9.10.19.5.,
b) is powered as stated in Article 9.10.19.4., and
c) is equipped with a silencing device as stated in Article 9.10.19.6.

9.10.20. Firefighting

9.10.20.1.Windows or Access Panels Required

1) Except as provided in Sentence (3), a window or access panel providing an opening not less than 1 100 mm high and 550 mm wide and having a sill height of not more than 900 mm above the floor shall be provided on the second and third *storeys* of every *building* in at least one wall facing on a *street* if such *storeys* are not *sprinklered*.

2) Access panels required in Sentence (1) shall be readily openable from both inside and outside or be glazed with plain glass.

3) Access panels required in Sentence (1) need not be provided in

a) buildings containing only *dwelling units* where there is no *dwelling unit* above another *dwelling unit*, or
b) **Reserved**.

9.10.20.2.Access to Basements

1) Except for *basements* serving not more than one *dwelling unit*, each unsprinklered *basement* exceeding 25 m in length or width shall be provided with direct access to the outdoors to at least one *street*.

2) Access required in Sentence (1) may be provided by a door, window or other means that provides an opening not less than 1 100 mm high and 550 mm wide, the sill height of which shall not be more than 900 mm above the floor.

3) Access required in Sentence (1) may also be provided by an interior stair accessible from the outdoors.

9.10.20.3.Fire Department Access to Buildings

1) Access for fire department vehicles shall be provided to each principal entrance of a *building* in accordance with Articles 3.2.5.4., 3.2.5.5. and 3.2.5.6. (See Notes A-9.10.20.3.(1) and A-3.2.5.6.(1).)

2) Where access to a *building* as required in Sentence (1) is provided by means of a roadway or yard, the design and location of such roadway or yard shall take into account connection with public thoroughfares, weight of firefighting equipment, width of roadway, radius of curves, overhead clearance, location of fire hydrants, location of fire department connections and vehicular parking.

3) Despite the provisions of Sentence (1), an unobstructed path of travel for firefighters shall be provided to an *ancillary residential building* and the path of travel shall:

a) lead continuously from the *street* to the *lane*,
b) have a travel distance of no more than 45 m from the *street* to the principal entrance of the *ancillary residential building*,
c) be at least 900 mm wide,
d) have an overhead clearance of at least 2 m, and
e) consist of concrete, asphalt, or similar material.

4) An *ancillary residential building* shall have a strobe light installed and maintained outside the principal entrance, connected to an internal *smoke alarm* within the *ancillary residential building*.

5) Despite Clause 9.10.20.3.(3)(b) the path of travel for firefighters towards not more than one *ancillary residential building* on a parcel may exceed 45 m to a maximum of 70 m provided the principal entrance to that *ancillary residential building* is visible from the *street*.

6) If the principal *building* and the *ancillary residential building* are adjacent to a *lane*, the path of foot travel for firefighters to the *ancillary residential building* may be through the *lane* if

a) the travel distance from the *street* to the principal entrance of the *ancillary residential building* is no more than 70 m,
b) the path has an overhead clearance of at least 3 m,
c) the path consists of concrete, asphalt, or similar material, and
d) the principal entrance of the *ancillary residential building* is visible from the *street*.

7) Two adjacent parcels may have a single shared path of travel for firefighters over the common property line and the adjacent specified area to access both, provided

a) each parcel contains an *ancillary residential building*,
b) each parcel is subject to a covenant registered on title which prohibits construction upon or obstruction of the common property line and of a specified area adjacent to the property line; and
c) the path of travel meets the requirements of Sentences (3) , (4) and (5).

9.10.20.4. Portable Extinguishers

1) Portable extinguishers shall be installed in all *buildings*, except within *dwelling units*, in conformance with the Fire By-law.

9.10.20.5. Freeze Protection of Fire Protection Systems

1) Equipment forming part of a fire protection system that may be adversely affected by freezing temperatures and that is located in an unheated area shall be protected from freezing.

9.10.21. Fire Protection for Construction Camps

9.10.21.1. Requirements for Construction Camps

1) Except as provided in Articles 9.10.21.2. to 9.10.21.9., construction camps shall conform to Subsections 9.10.1. to 9.10.20.

9.10.21.2. Separation of Sleeping Rooms

1) Except for sleeping rooms within *dwelling units*, sleeping rooms in construction camps shall be separated from each other and from the remainder of the *building* by a *fire separation* having not less than a 30 min *fire-resistance rating*.

9.10.21.3. Floor Assemblies between the First and Second Storey

1) Except in a *dwelling unit*, a floor assembly in a construction camp *building* separating the *first storey* and the second *storey* shall be constructed as a *fire separation* having not less than a 30 min *fire-resistance rating*.

9.10.21.4. Walkways Connecting Buildings

1) Walkways of *combustible construction* connecting *buildings* shall be separated from each connected *building* by a *fire separation* having not less than a 45 min *fire-resistance rating*.

9.10.21.5. Spatial Separations

1) Construction camp *buildings* shall be separated from each other by a distance of not less than 10 m except as otherwise permitted in Subsections 9.10.14. and 9.10.15.

9.10.21.6. Flame-Spread Ratings

1) Except in *dwelling units* and except as provided in Sentence (2), the surface *flame-spread rating* of wall and ceiling surfaces in corridors and *walkways*, exclusive of doors, shall not exceed 25 over not less than 90% of the exposed surface area and not more than 150 over the remaining surface area.
2) Except within *dwelling units*, corridors that provide *access to exit* from sleeping rooms and that have a *fire-resistance rating* of not less than 45 min shall have a *flame-spread rating* conforming to the appropriate requirements in Subsection 9.10.17.

9.10.21.7.Smoke Detectors

1) Except in *dwelling units*, corridors providing *access to exit* from sleeping rooms in construction camp *buildings* with sleeping accommodation for more than 10 persons shall be provided with a *smoke detector* connected to the *building* alarm system.

9.10.21.8.Portable Fire Extinguishers

1) Each construction camp *building* shall be provided with portable fire extinguishers in conformance with the Fire By-law.

9.10.21.9.Hose Stations

1) Every construction camp *building* providing sleeping accommodation for more than 30 persons shall be provided with a hose station that is protected from freezing and is equipped with a hose of sufficient length so that every portion of the *building* is within reach of a hose stream.
2) Hose stations required in Sentence (1) shall be located near an *exit*.
3) Hoses referred to in Sentence (1) shall be not less than 19 mm inside diam and shall be connected to a central water supply or to a storage tank having a capacity of not less than 4 500 L with a pumping system capable of supplying a flow of not less than 5 L/s at a gauge pressure of 300 kPa.

9.10.22. Fire Protection for Gas, Propane and Electric Cooktops and Ovens

(See Note A-9.10.22.)

9.10.22.1.Installation of Cooktops and Ovens

1) Except as required in Sentence (2), natural gas and propane *cooktops* and ovens shall be installed in accordance with the Gas Safety Regulation. (See also Article 9.34.1.1.)
2) Clearances for and protection around gas, propane and electric ranges shall be not less than those provided in Articles 9.10.22.2. and 9.10.22.3.

9.10.22.2.Vertical Clearances above Cooktops

1) Except as provided in Sentence (2), framing, finishes and cabinetry installed directly above the location of the *cooktop* shall be not less than 750 mm above the level of *cooktop* burners or elements.
2) The vertical clearance described in Sentence (1) for framing, finishes and cabinets located directly above the location of the *cooktop* may be reduced to 600 mm above the level of the elements or burners, provided the framing, finishes and cabinets

a) are *noncombustible*, or
b) are protected by
  i) *non-combustible* cementitious board not less than 6 mm thick, covered with sheet metal not less than 0.33 mm thick, or
  ii) a metal hood with a 125 mm projection beyond the framing, finishes and cabinets.

9.10.22.3.Protection around Cooktops

1) Except as provided in Sentences (2) and (3), *combustible* wall framing, finishes or cabinets within 450 mm of the area where the *cooktop* is to be located shall be protected above the level of the heating elements or burners by material providing fire resistance at least equivalent to that provided by a 9.5 mm thickness of gypsum board.

2) Counter-top splash boards or back plates that extend above the level of heating elements or burners need not be protected as described in Sentence (1).
3) Except for cabinetry described in Article 9.10.22.2., cabinetry located not less than 450 mm above the level of the heating elements or burners need not be protected as described in Sentence (1).

Section 9.11. Sound Transmission

(See Note A-9.11.)

9.11.1. Protection from Airborne Noise

9.11.1.1. Required Protection

1) Except as provided in Sentence (3), a *dwelling unit* shall be separated from every other space in a *building* in which noise may be generated by

a) a separating assembly and adjoining constructions, which together provide an *apparent sound transmission class (ASTC)* rating of not less than 47, or
b) a separating assembly providing a *sound transmission class (STC)* rating of not less than 50 and adjoining constructions that conform to Article 9.11.1.4.

(See Note A-9.11.1.4.)
2) Reserved.
3) Construction separating a *dwelling unit* from an elevator shaft or refuse chute shall have an STC rating of not less than 55.

9.11.1.2. Determination of Sound Transmission Ratings

1) The STC ratings shall be determined in accordance with ASTM E 413, "Classification for Rating Sound Insulation," using the results from measurements carried out in accordance with ASTM E 90, "Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements."
2) The ASTC ratings shall be

a) determined in accordance with ASTM E 413, "Classification for Rating Sound Insulation," using the results from measurements carried out in accordance with ASTM E 336, "Measurement of Airborne Sound Attenuation between Rooms in Buildings," or
b) calculated in accordance with Article 5.8.1.4. or 5.8.1.5.

9.11.1.3. Compliance with Required Ratings

1) Compliance with the required STC ratings shall be demonstrated through

a) measurements carried out in accordance with Sentence 9.11.1.2.(1), or
b) the construction of separating assemblies conforming to Table 9.10.3.1.-A or 9.10.3.1.-B, as applicable.

2) Compliance with the required ASTC ratings shall be demonstrated through

a) measurements or calculations carried out in accordance with Sentence 9.11.1.2.(2), or
b) the construction of separating assemblies conforming to Table 9.10.3.1.-A or 9.10.3.1.-B, as applicable, that have an STC rating of not less than 50 in conjunction with flanking assemblies constructed in accordance with Article 9.11.1.4. (See Note A-9.11.1.3.(2)(b)).

9.11.1.4. Adjoining Constructions

(See Note A-9.11.1.4.)
1) This Article applies where the required protection is provided in accordance with Clause 9.11.1.1.(1)(b) and compliance is demonstrated in accordance with Clause 9.11.1.3.(2)(b).
2) Flanking wall assemblies connected to a separating floor or ceiling assembly shall be constructed with

a) concrete or concrete block having a mass per area greater than 200 kg/m^2, or
b) gypsum board finish that

i) is supported on wood or steel framing, and
ii) ends or is interrupted where it meets the structure of the separating floor or ceiling assembly.

3) Flanking wall and ceiling assemblies connected to a separating wall assembly shall be constructed with
a) concrete or concrete block having a mass per area greater than 300 kg/m^2, or
b) gypsum board finish that
i) is supported on wood or steel framing, and
ii) ends or is interrupted where it meets the structure of the separating wall assembly or, for double-stud walls, where it meets the space between the two lines of studs.

4) Flanking floor assemblies connected to a separating wall assembly shall be
a) constructed
i) with concrete having a mass per area greater than 300 kg/m^2, or
ii) in accordance with Section 9.16., or
b) supported on joists or trusses that are not continuous across the junction and are covered with floor treatments in accordance with Table 9.11.1.4. for the applicable wall construction.

Table 9.11.1.4.
Floor Treatments for Flanking Wood-Framed Floor Assemblies in Horizontally Adjoining Spaces
Forming Part of Sentence 9.11.1.4.(4)

Type of Separating Wall Assembly with STC ≥ 50 from Table 9.10.3.1.-A	Minimum Requirements for Floor Treatments Applied Over Subfloor of Wood-Framed Flanking Floor Assemblies on Both Sides of Floor/Wall Junction
W5, W6, W10, W12 (staggered studs)	• wood strip flooring not less than 16 mm thick aligned parallel to separating wall, or • one layer of OSB or plywood not less than 15.5 mm thick plus finished flooring, or • one additional material layer plus finished flooring having a combined mass per area not less than 8 kg/m^2(1)
W4, W11 (staggered studs)	• one layer of OSB or plywood not less than 12.5 mm thick plus hardwood strip flooring not less than 19 mm thick aligned parallel to separating wall, or • one additional material layer plus finished flooring having a combined mass per area not less than 16 kg/m^2(1)
W8, W9 (staggered studs)	• concrete or gypsum concrete topping not less than 19 mm thick bonded to the subfloor plus finished flooring, or • one additional material layer plus finished flooring having a combined mass per area not less than 32 kg/m^2(1)
W13, W14, W15 (double stud walls)	• where a continuous subfloor or other rigid materials at the floor/wall junction provide structural connection between the two rows of studs in the separating wall: • hardwood strip flooring not less than 16 mm thick aligned parallel to separating wall, or • one layer OSB or plywood not less than 15.5. mm thick plus finished flooring, or • one additional material layer plus finished flooring having a combined mass per area not less than 8 kg/m^2(1) • any finished flooring where the subfloor and other rigid materials are not connected at the floor/wall junction and where there are no structural connections between the two rows of studs in the separating wall

B1 to B10	• any finished flooring

Notes to Table 9.11.1.4.:
(1) See Note A-Table 9.11.1.4.

9.11.1.5. Acoustical Sealant
1) If acoustical sealant is provided for walls, ceilings and floors, it shall conform to CAN/CSGB-19.21-M87, “Sealing and Bedding Compound, Acoustical”.

Section 9.12. Excavation

9.12.1. General

9.12.1.1. Removal of Topsoil and Organic Matter
1) The topsoil and vegetable matter in all unexcavated areas under a *building* shall be removed.
2) In localities where termite infestation is known to be a problem, all stumps, roots and other wood debris shall be removed from the *soil* to a depth of not less than 300 mm in unexcavated areas under a *building*.
3) The bottom of every *excavation* shall be free of all organic material.

9.12.1.2. Standing Water
1) Excavations shall be kept free of standing water.

9.12.1.3. Protection from Freezing
1) The bottom of *excavations* shall be kept from freezing throughout the entire construction period.

9.12.2. Depth

9.12.2.1. Excavation to Undisturbed Soil
1) Excavations for *foundations* shall extend to undisturbed *soil*.

9.12.2.2. Minimum Depth of Foundations
1) Except as provided in Sentences (4) to (7), the minimum depth of *foundations* below finished ground level shall conform to Table 9.12.2.2.

Table 9.12.2.2.
Minimum Depths of Foundations
Forming Part of Sentence 9.12.2.2.(1)

Type of *Soil*	Minimum Depth of *Foundation* Containing Heated *Basement* or Crawl Space(1)		Minimum Depth of *Foundation* Containing No Heated Space(2)	
	Good *Soil* Drainage	Poor *Soil* Drainage	Good *Soil* Drainage	*Poor Soil Drainage*
Rock	No limit	No limit	No limit	No limit
Coarse grained *soils*	No limit	No limit	No limit	Below the depth of frost penetration

Silt	No limit	No limit	Below the depth of frost penetration(3)	Below the depth of frost penetration
Clay or *soils* not clearly defined(4)	1.2 m(3)	1.2 m	1.2 m but not less than the depth of frost penetration(3)	1.2 m but not less than the depth of frost penetration

Notes to Table 9.12.2.2.:

(1) *Foundation* not insulated to reduce heat loss through the footings.

(2) Including *foundations* insulated to reduce heat loss through the footings.

(3) Good *soil* drainage to not less than the depth of frost penetration.

(4) See Note A-Table 9.12.2.2.

2) Where a *foundation* is insulated in a manner that will reduce heat flow to the *soil* beneath the footings, the *foundation* depth shall conform to that required for *foundations* containing no heated space. (See Note A-9.12.2.2.(2).)

3) The minimum depth of *foundations* for exterior concrete steps with more than 2 risers shall conform to Sentences (1), (2) and (5).

4) Concrete steps with 1 and 2 risers are permitted to be laid on ground level.

5) The *foundation* depths required in Sentence (1) are permitted to be decreased where experience with local *soil* conditions shows that lesser depths are satisfactory, or where the *foundation* is designed for lesser depths.

6) The *foundation* depths required by Sentence (1) do not apply to *foundations* for

- *a) buildings*
  - i) that are not of masonry or masonry veneer construction, and
  - ii) whose superstructure conforms to the requirements of the deformation resistance test in CSA Z240.2.1, “Structural Requirements for Manufactured Homes,” or
- b) accessory *buildings*
  - i) that are not of masonry or masonry veneer construction,
  - ii) not more than 1 *storey* in height,
  - iii) not more than 55 m^2 in *building area*, and
  - iv) where the distance from finished ground to the underside of the floor joists is not more than 600 mm.

7) The *foundation* depths required by Sentence (1) do not apply to *foundations* for decks and other accessible exterior platforms

- a) of not more than 1 *storey*,
- b) not more than 55 m^2 in area,
- c) where the distance from finished ground to the underside of the joists is not more than 600 mm,
- d) not supporting a roof, and
- e) not attached to another structure, unless it can be demonstrated that differential movement will not adversely affect the performance of that structure.

8) Where decks or other accessible exterior platforms are supported on surface *foundations* supported on other than coarse-grained *soil* with good drainage or *rock*, access to the *foundation* positions to permit re-levelling of the platform shall be provided

- a) by passageways with a clear height under the platform of not less than 600 mm and a width of not less than 600 mm, or
- b) by installing the decking in a manner that allows easy removal.

9.12.3. Backfill

9.12.3.1. Placement of Backfill

1) Backfill shall be placed to avoid damaging the *foundation* wall, the drainage tile, externally applied thermal insulation and waterproofing or dampproofing of the wall.

9.12.3.2. Grading of Backfill

1) Backfill shall be *graded* to prevent drainage towards the *foundation* after settling.

9.12.3.3. Deleterious Debris and Boulders

1) Backfill that is within 600 mm of the *foundation* shall be free of deleterious debris and boulders larger than 250 mm diam. (See Note A-9.12.3.3.(1).)
2) Except as provided in Sentence (3), backfill shall not contain pyritic material or material that is susceptible to ice lensing in concentrations that will damage the *building* to a degree that would adversely affect its stability or the performance of assemblies. (See Note A-9.4.4.4.(1).)
3) Backfill with material of any concentration that is susceptible to ice lensing is permitted where *foundation* walls are

a) cast-in-place concrete,
b) concrete block insulated on the exterior, or
c) concrete block protected from the backfill by a material that serves as a slip plane.

(See Note A-9.4.4.4.(1).)

9.12.4. Trenches beneath Footings

9.12.4.1. Support of Footings

1) The *soil* in trenches beneath footings for sewers and watermains shall be compacted by tamping up to the level of the footing base, or shall be filled with concrete having a strength not less than 10 MPa to support the footing.

Section 9.13. Dampproofing, Waterproofing and Soil Gas Control

9.13.1. General

9.13.1.1. Scope and Application

1) This Section presents measures to control the ingress of water, moisture and soil gas.
2) Subsection 9.13.2. applies to below-ground walls and floors-on-ground where drainage is provided in accordance with Section 9.14. over and along the entire below-ground portion of the *foundation* wall.
3) Subsection 9.13.3. applies to below-ground walls, floors-on-ground and roofs of underground structures that are subject to hydrostatic pressure.
4) Subsection 9.13.4. applies to walls, roofs and floors that are in contact with the ground.

9.13.2. Dampproofing

9.13.2.1. Required Dampproofing

1) Except as provided in Article 9.13.3.1., where the exterior finished ground level is at a higher elevation than the ground level inside the *foundation* walls, exterior surfaces of *foundation* walls below ground level shall be dampproofed.
2) Except as provided in Sentence (3) and Article 9.13.3.1., floors-on-ground shall be dampproofed.
3) Dampproofing required in Sentence (2) need not be provided for

a) floors in garages,

b) floors in unenclosed portions of *buildings*, or
c) floors installed over not less than 100 mm of coarse clean granular material containing not more than 10% of material that will pass a 4 mm sieve.

9.13.2.2. Dampproofing Materials

1) Materials installed to provide required dampproofing shall be
a) capable of protecting assemblies against moisture transfer from the ground,
b) compatible with adjoining materials, and
c) resistant to mechanisms of deterioration that may reasonably be expected, given the nature, function and exposure of the materials.

2) Except as otherwise specified in this Section, materials used for exterior dampproofing shall
a) conform to one of the following standards:
i) ASTM D 1227, "Emulsified Asphalt Used as a Protective Coating for Roofing," Type III, Class I,
ii) ASTM D 4479/D 4479M, "Asphalt Roof Coatings – Asbestos-Free," Type III,
iii) CAN/CGSB-51.34-M, "Vapour Barrier, Polyethylene Sheet for Use in Building Construction," or
iv) CAN/CSA-A123.4, "Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems, "or
b) have a water vapour permeance of not more than 43 ng/Pa·s·m^2 when tested in accordance with Procedure A (wet cup) of ASTM E 96/E 96M, "Water Vapor Transmission of Materials," and consist of one of the following material types:
i) a vapour-resistant coating,
ii) a cold-fluid-applied or hot-rubberized bituminous dampproofing membrane,
iii) a liquid-applied or spray-applied asphalt-based emulsion dampproofing, or
iv) a type III hot-applied asphalt.

9.13.2.3. Preparation of Surface

1) The area in which dampproofing is to be carried out shall be kept free of water during the application and curing of the dampproofing system.

2) The surface to be dampproofed shall be prepared in accordance with the instructions of the dampproofing material manufacturer.

3) Where the dampproofing material is to be applied on insulating concrete form (ICF) walls, the instructions of the ICF wall manufacturer shall be followed.

4) Unit masonry walls to be dampproofed shall be parged on the exterior face below ground level with not less than 6 mm of mortar conforming to Section 9.20. coved over the footing.

5) Concrete walls to be dampproofed shall have holes and recesses sealed with cement mortar or a mastic or sealant that is suitable for vertical applications and compatible with the dampproofing material.

6) The surface required to be dampproofed shall be clean and dry and free of ice, snow, frost, dust, dirt, oil, grease, cracks, projections and depressions, loose particles and debris that could be detrimental to the performance of the material to be applied.

9.13.2.4. Application of Dampproofing Material

1) Exterior dampproofing shall be applied from finished ground level to the top of the exterior of the footing.

2) Unless otherwise stated in this Subsection, dampproofing shall be installed in accordance with the manufacturer's instructions with regard to
a) surface priming,
b) conditions during application,
c) application quantity and rate, and
d) curing times.

3) Joints, cracks and penetrations shall be sealed to maintain the continuity of the dampproofing, where the dampproofing material is not capable of bridging such discontinuities.

9.13.2.5. Moisture Protection for Interior Finishes

(See Note A-9.13.2.5.)

1) The interior surface of *foundation* walls below ground level shall be protected by means that minimize the ingress of moisture from the *foundation* wall into interior spaces, where

a) a separate interior finish is applied to a concrete or unit masonry wall that is in contact with the *soil*, or

b) wood members are placed in contact with such walls for the installation of insulation or finish.

2) Except as provided in Sentence (3), where the protection of interior finishes required in Sentence (1) consists of membranes or coatings,

a) the membrane or coating shall extend from the *basement* floor surface up to the highest extent of the interior insulation or finish, but not higher than the exterior finished ground level, and

b) no membrane or coating with a permeance less than 170 ng/(Pa·s·m^2) shall be applied to the interior surface of the *foundation* wall above ground level between the insulation and the *foundation* wall.

3) Where insulation functions as both moisture protection for interior finishes and as a *vapour barrier* in accordance with Subsection 9.25.4., it shall be applied over the entire interior surface of the *foundation* wall.

9.13.2.6. Dampproofing of Floors-on-Ground

1) Where dampproofing is installed below the floor, it shall consist of

a) polyethylene not less than 0.15 mm thick with joints lapped not less than 100 mm,

b) type S roll roofing with joints lapped not less than 100 mm, or

c) rigid extruded/expanded polystyrene with sealed or ship-lapped joints that has

i) sufficient compressive strength to support the floor assembly, and

ii) a water vapour permeance complying with Clause 9.13.2.2.(2)(a).

2) Where dampproofing is installed between a floor-on-ground and a finished floor, it shall consist of

a) rigid extruded/expanded polystyrene with sealed or ship-lapped joints that has

i) sufficient compressive strength to support the floor assembly, and

ii) a water vapour permeance complying with Clause 9.13.2.2.(2)(b), or

b) polyethylene not less than 0.05 mm thick with joints lapped not less than 100 mm.

9.13.3. Waterproofing

9.13.3.1. Required Waterproofing

1) Where hydrostatic pressure occurs, waterproofing is required for assemblies separating interior space from the ground to prevent the ingress of water into *building* assemblies and interior spaces.

2) Waterproofing is required for roofs of underground structures to prevent the ingress of water into *building* assemblies and interior spaces.

9.13.3.2. Waterproofing Materials

1) Materials installed to provide required waterproofing shall be

a) compatible with adjoining materials,

b) resistant to mechanisms of deterioration that may reasonably be expected, given the nature, function and exposure of the materials, and

c) free of asbestos or components that contain asbestos

2) Materials used for exterior waterproofing shall conform to

a) ASTM D 1227, “Emulsified Asphalt Used as a Protective Coating for Roofing,” in which case, they shall be installed in accordance with Sentence 9.13.3.3.(3),

b) ASTM D 3019, “Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, Asbestos-Fibered, and Non-Asbestos-Fibered,” where non-fibered and non-asbestos-fibered types (I and III) asphalt roll roofing is permitted,
c) ASTM D 4479/D 4479M, “Asphalt Roof Coatings – Asbestos-Free,” in which case, they shall be installed in accordance with Sentence 9.13.3.3.(3) and with reinforcing material,
d) ASTM D 4637/D 4637M, “EPDM Sheet Used In Single-Ply Roof Membrane,”
e) ASTM D 4811/D 4811M, “Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing,”
f) ASTM D 6878/D 6878M, “Thermoplastic Polyolefin Based Sheet Roofing,”
g) CGSB 37-GP-9Ma, “Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing,” where a primer is required,
h) CAN/CGSB-37.50-M, “Hot-Applied, Rubberized Asphalt for Roofing and Waterproofing,”
i) CAN/CGSB-37.54, “Polyvinyl Chloride Roofing and Waterproofing Membrane,”
j) CGSB 37-GP-56M, “Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing,”
k) CAN/CGSB-37.58-M, “Membrane, Elastomeric, Cold-Applied Liquid, for Non-Exposed Use in Roofing and Waterproofing,”
l) CAN/CSA-A123.2, “Asphalt-Coated Roofing Sheets,”
m) CAN/CSA-A123.4, “Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems,” in which case, they shall be installed with reinforcing material, or
n) CSA A123.17, “Asphalt Glass Felt Used in Roofing and Waterproofing.”

9.13.3.3. Preparation of Surface

1) Surfaces to be waterproofed shall be prepared in accordance with the instructions of the waterproofing material manufacturer.
2) Where the waterproofing material is to be applied on ICF walls, the instructions of the ICF wall manufacturer shall be followed.
3) Unit masonry walls that are to be waterproofed shall be parged on exterior surfaces below ground level with not less than 6 mm of mortar conforming to Section 9.20. coved over the footing.
4) Concrete walls that are to be waterproofed shall have all holes and recesses sealed with mortar or waterproofing material.
5) Surfaces required to be waterproofed shall be clean and dry and free of ice, snow, frost, dust, dirt, oil, grease, cracks, projections and depressions, loose particles and debris that could be detrimental to the performance of the waterproofing material.

9.13.3.4. Application of Waterproofing Membranes

1) Unless otherwise stated in this Subsection, waterproofing shall be installed in accordance with the manufacturer’s instructions with regard to
a) surface priming,
b) conditions during application,
c) the required number of layers of reinforcing fabric on *foundation*, footings, floors, walls and structural slabs,
d) application quantity and rate, and
e) curing times.
2) Waterproofing shall be continuous across joints and at junctions between different *building* elements.
3) The waterproofed surface shall be protected with a suitable material to minimize mechanical damage during backfilling.
4) The area in which the waterproofing is to be carried out shall be kept free of water during the application and curing of the waterproofing system.

9.13.3.5. Floor Waterproofing System

1) Basement floors-on-ground to be waterproofed shall have a system of membrane waterproofing provided between 2 layers of concrete, each of which shall be not less than 75 mm thick, with the floor membrane made continuous with the wall membrane to form a complete seal.

9.13.4. Soil Gas Control

(See Note A-9.13.4.)

9.13.4.1. Application and Scope

1) This Subsection applies to

a) wall, roof and floor assemblies separating *conditioned space* from the ground, and

b) the rough-in of a radon vent pipe to allow the future protection of *conditioned space* that is separated from the ground by a wall, roof or floor assembly.

2) This Subsection addresses the leakage of *soil* gas from the ground into the *building*.

9.13.4.2. Protection from Soil Gas Ingress

1) All wall, roof and floor assemblies separating *conditioned space* from the ground shall be protected by an *air barrier system* conforming to Subsection 9.25.3.

2) Except as permitted by Sentence (4), unless the space between the *air barrier system* and the ground is designed to be accessible for the future installation of a subfloor depressurization system, *dwelling units* and *buildings* containing *residential occupancies* shall be provided with the rough-in for a radon extraction system conforming to Article 9.13.4.3.

3) Except as permitted by Sentence (4) or (5), where *buildings* are used for *occupancies* other than those described in Sentence (2) and are intended to be occupied on average for greater than 4 hours within a 24 hour period, protection from radon ingress and the means to address high radon concentrations in the future shall conform to

a) Article 9.13.4.3., or

b) Parts 5 and 6 (See Article 5.4.1.1. and 6.2.1.1.).

(See Note A-9.13.4.2.(3).)

4) Locations requiring radon rough-ins shall be determined in accordance with Article 1.1.3.3. of Division B. *Buildings* described in Clause 9.16.2.1.(2)(b) need not conform to Sentence (3).

9.13.4.3. Rough-in for a Subfloor Depressurization System

(See Note A-9.13.4.3.)

1) Floors-on-ground shall be provided with a rough-in for subfloor depressurization consisting of

a) a gas-permeable layer and a radon vent pipe as described in Sentence (2), or

b) a gas-permeable layer consisting of coarse clean granular material and a radon vent pipe as described in Sentence (3).

2) Where a rough-in referred to in Clause (1)(a) is provided, the rough-in shall include

a) a gas-permeable layer installed in the space between the *air barrier system* and the ground to allow the depressurization of that space,

b) **reserved**, and

c) a radon vent pipe that

i) has one or more inlets that allow for the effective depressurization of the gas-permeable layer (See Notes A-9.13.4.3.(2)(c)(i) and (3)(b)(i)),

ii) terminates outside the *building* in a manner that does not constitute a hazard, and

iii) is clearly labeled “RADON VENT PIPE”.

3) Where a rough-in referred to in Clause (1)(b) is provided, the rough-in shall include

a) a gas-permeable layer, consisting of not less than 100 mm of clean granular material containing not more than 10% of material that will pass a 4 mm sieve, installed below the floor-on-ground, and

b) a radon vent pipe not less than 100 mm in diameter that is constructed so as to be airtight and installed through the floor-on-ground, such that

i) it opens into each contiguous area of the granular layer required by Clause (a) and not less than 100 mm of granular material projects beyond the terminus of the pipe measured along its axis (See Note A-9.13.4.3.(2)(c)(i) and (3)(b)(i)),
ii) it terminates not less than 1 m above and not less than 3.5 m in any other direction from any air inlet, door or openable window,
iii) it terminates not less than 2 m above and not less than 3.5 m in any other direction from a roof that supports an *occupancy*,
iv) it terminates not less than 1.8 m from a property line,
v) it is shielded from the weather in accordance with Sentence 6.3.2.9.(4),
vi) it is protected from frost closure by insulating the pipe or by some other manner, if subject to frost closure,
vii)the accumulation of moisture in the pipe is prevented, and
viii) it is clearly labelled “RADON VENT PIPE” every 1.2 m and at every change in direction.

(See Note A-9.13.4.3.(3))

Section 9.14. Drainage

9.14.1. Scope

9.14.1.1. Application

1) This Section applies to subsurface drainage and to surface drainage.

9.14.1.2. Crawl Spaces

1) Drainage for crawl spaces shall conform to Section 9.18.

9.14.1.3. Floors-on-Ground

1) Drainage requirements beneath floors-on-ground shall conform to Section 9.16.

9.14.2. Foundation Drainage

9.14.2.1. Foundation Wall Drainage

1) Unless it can be shown to be unnecessary, the bottom of every exterior *foundation* wall shall be drained by drainage tile or pipe laid around the exterior of the *foundation* in conformance with Subsection 9.14.3. or by a layer of gravel or crushed *rock* in conformance with Subsection 9.14.4.

2) Where mineral fibre insulation or crushed *rock* backfill is provided adjacent to the exterior surface of a *foundation* wall,

a) the insulation or backfill shall extend to the footing level to facilitate the drainage of ground water to the *foundation*’s drainage system (See Note A-9.14.2.1.(2)(a)), and
b) any pyritic material in the crushed *rock* shall be limited to a concentration that will not damage the *building* to a degree that would adversely affect its stability or the performance of assemblies (See Sentence 9.12.3.3.(2) and Note A-9.4.4.4.(1)).

9.14.3. Drainage Tile and Pipe

9.14.3.1. Material Standards

1) Drain tile and drain pipe for *foundation* drainage shall conform to

a) ASTM C 4, “Clay Drain Tile and Perforated Clay Drain Tile,”
b) ASTM C 412M, “Concrete Drain Tile (Metric),”
c) ASTM C 444M, “Perforated Concrete Pipe (Metric),”

d) ASTM C 700, "Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated,"
e) BNQ 3624-115, "Polyethylene (PE) Pipe and Fittings – Flexible Pipes for Drainage – Characteristics and Test Methods,"
f) CAN/CSA-B182.1, "Plastic Drain and Sewer Pipe and Pipe Fittings," or
g) CSA G401, "Corrugated Steel Pipe Products."

9.14.3.2. Minimum Size

1) Drain tile or pipe used for *foundation* drainage shall be not less than 100 mm in diam.

9.14.3.3. Installation

1) Drain tile or pipe shall be laid on undisturbed or well-compacted *soil* so that the top of the tile or pipe is below the bottom of the floor slab or the ground cover of the crawl space.
2) Drain tile or pipe with butt joints shall be laid with 6 mm to 10 mm open joints.
3) The top half of joints referred to in Sentence (2) shall be covered with sheathing paper, 0.10 mm polyethylene or No. 15 asphalt or tar-saturated felt.
4) The top and sides of drain pipe or tile shall be covered with not less than 150 mm of crushed stone or other coarse clean granular material containing not more than 10% of material that will pass a 4 mm sieve.

9.14.4. Granular Drainage Layer

9.14.4.1. Type of Granular Material

1) Granular material used to drain the bottom of a *foundation* shall consist of a continuous layer of crushed stone or other coarse clean granular material containing
a) not more than 10% of material that will pass a 4 mm sieve, and
b) no pyritic material in a concentration that will damage the *building* to a degree that would adversely affect its stability or the performance of assemblies (See Note A-9.4.4.4.(1)).

9.14.4.2. Installation

1) Granular material described in Article 9.14.4.1. shall be laid on undisturbed or compacted *soil* to a minimum depth of not less than 125 mm beneath the footing of the *building* and extend not less than 300 mm beyond the outside edge of the footings.

9.14.4.3. Grading

1) The bottom of an *excavation* drained by a granular layer shall be graded so that the entire area described in Article 9.14.4.2. is drained to a sump conforming to Article 9.14.5.2.

9.14.4.4. Wet Site Conditions

1) Where because of wet site conditions *soil* becomes mixed with the granular drainage material, sufficient additional granular material shall be provided so that the top 125 mm are kept free of *soil*.

9.14.5. Drainage Disposal

9.14.5.1. Drainage Disposal

1) Foundation drains shall drain to a sewer, drainage ditch or dry well.

9.14.5.2. Sump Pits

1) Where a sump pit is provided it shall be
a) not less than 750 mm deep,
b) not less than 0.25 m^2 in area, and
c) provided with a cover.

2) Covers for sump pits shall be designed

a) to resist removal by children, and

b) to be airtight in accordance with Sentence 9.25.3.3.(7).

3) Where gravity drainage is not practical, an automatic sump pump shall be provided to discharge the water from the sump pit described in Sentence (1) into a sewer, drainage ditch or dry well.

9.14.5.3. Dry Wells

1) Dry wells may be used only when located in areas where the natural *groundwater level* is below the bottom of the dry well.

2) Dry wells shall be not less than 5 m from the *building foundation* and located so that drainage is away from the *building*.

9.14.6. Surface Drainage

9.14.6.1. Surface Drainage

1) The *building* shall be located or the *building* site graded so that water will not accumulate at or near the *building*.

9.14.6.2. Drainage away from Wells or Septic Disposal Beds

1) Surface drainage shall be directed away from the location of a water supply well or septic tank disposal bed.

9.14.6.3. Window Wells

1) Every window well shall be drained to the footing level or other suitable location.

9.14.6.4. Catch Basin

1) Where runoff water from a driveway is likely to accumulate or enter a garage, a catch basin shall be installed to provide adequate drainage.

9.14.6.5. Downspouts

1) Downspouts shall conform to Article 9.26.18.2.

Section 9.15. Footings and Foundations

9.15.1. Application

9.15.1.1. General

(See Notes A-9.15.1.1. and A-9.4.4.6. and 9.15.1.1.)

1) Except as provided in Articles 9.15.1.2. and 9.15.1.3., this Section applies to

a) concrete or unit masonry *foundation* walls and concrete footings not subject to surcharge

i) on stable *soils* with an allowable bearing pressure of 75 kPa or greater, and

ii) for *buildings* of wood-frame or masonry construction,

b) wood-frame *foundation* walls and wood or concrete footings not subject to surcharge

i) on stable *soils* with an allowable bearing pressure of 75 kPa or greater, and

ii) for *buildings* of wood-frame construction, and

c) flat insulating concrete form *foundation* walls and concrete footings not subject to surcharge (See Note A-9.15.1.1.(1)(c) and 9.20.1.1.(1)(b))

i) on stable *soils* with an allowable bearing pressure of 75 kPa or greater, and

ii) for *buildings* of light-frame or flat insulating concrete form construction that are not more than 2 *storeys* in *building height*, with a maximum floor to floor height of 3 m, and containing only a single *dwelling unit*.

2) Foundations for applications other than as described in Sentence (1) shall be designed in accordance with Section 9.4.

9.15.1.2. Permafrost

1) Buildings erected on permafrost shall have *foundations* designed by a *designer* competent in this field in accordance with the appropriate requirements of Part 4.

9.15.1.3. Foundations for Deformation-Resistant Buildings

1) Where the superstructure of a detached *building* conforms to the requirements of the deformation resistance test in CSA Z240.2.1, “Structural Requirements for Manufactured Homes,” the *foundation* shall be constructed in conformance with

a) the remainder of this Section, or

b) CSA Z240.10.1, “Site Preparation, Foundation, and Anchorage of Manufactured Homes.”

9.15.2. General

9.15.2.1. Concrete

1) Concrete shall conform to Section 9.3.

9.15.2.2. Unit Masonry Construction

1) Concrete block shall conform to CSA A165.1, “Concrete Block Masonry Units,” and shall have a compressive strength over the average net cross-sectional area of the block of not less than 15 MPa.

2) Mortar, grout, mortar joints, corbelling and protection for unit masonry shall conform to Section 9.20.

3) For concrete block *foundation* walls required to be reinforced,

a) mortar shall be Type S, conforming to CSA A179, “Mortar and Grout for Unit Masonry,”

b) grout shall be coarse, conforming to CSA A179, “Mortar and Grout for Unit Masonry,” and

c) placement of grout shall conform to CSA A371, “Masonry Construction for Buildings.”

9.15.2.3. Pier-Type Foundations

1) Where pier-type *foundations* are used, the piers shall be designed to support the applied loads from the superstructure.

2) Where piers are used as a *foundation* system in a *building* of 1 *storey* in *building height*, the piers shall be installed to support the principal framing members and shall be spaced not more than 3.5 m apart along the framing, unless the piers and their footings are designed for larger spacings.

3) The height of piers described in Sentence (2) shall not exceed 3 times their least dimension at the base of the pier.

4) Where concrete block is used for piers described in Sentence (2), they shall be laid with cores placed vertically, and where the width of the *building* is 4.3 m or less, placed with their longest dimension at right angles to the longest dimension of the *building*.

9.15.2.4. Wood-Frame Foundations

1) Foundations of wood-frame construction shall conform to

a) CSA S406, “Permanent Wood Foundations for Housing and Small Buildings,” or

b) Part 4.

(See Note A-9.15.2.4.(1).)

9.15.3. Footings

9.15.3.1. Footings Required

1) Footings shall be provided under walls, pilasters, columns, piers, fireplaces and *chimneys* that bear on *soil* or *rock*, except that footings may be omitted under piers or monolithic concrete walls if the safe *loadbearing* capacity of the *soil* or *rock* is not exceeded.

9.15.3.2. Support of Footings

1) Footings shall rest on undisturbed *soil*, *rock* or compacted granular *fill*.
2) Granular *fill* shall not contain pyritic material in a concentration that will damage the *building* to a degree that would adversely affect its stability or the performance of assemblies. (See also Article 9.4.4.4. and Note A-9.4.4.4.(1).)

9.15.3.3. Application of Footing Width and Area Requirements

1) Except as provided in Sentence 9.15.3.4.(2), the minimum footing width or area requirements provided in Articles 9.15.3.4. to 9.15.3.7. shall apply to footings, where
a) the footings support
i) *foundation* walls of masonry, concrete, or flat insulating concrete form walls,
ii) above-ground walls of masonry, flat insulating concrete form walls or light wood-frame construction, and
iii) floors and roofs of light wood-frame construction,
b) the span of supported joists does not exceed 4.9 m, and
c) the specified *live load* on any floor supported by the footing does not exceed 2.4 kPa (See Table 4.1.5.3.).
2) Except as provided in Sentence 9.15.3.4.(2), where the span of the supported joists exceeds 4.9 m, footings shall be designed in accordance with Section 4.2.
3) Where the specified *live load* exceeds 2.4 kPa, footings shall be designed in accordance with Section 4.2.

9.15.3.4. Basic Footing Widths and Areas

1) Except as provided in Sentences (2) and (3) and in Articles 9.15.3.5. to 9.15.3.7., the minimum footing width or area shall comply with Table 9.15.3.4.
2) Where the supported joist span exceeds 4.9 m in *buildings* with light wood-frame walls, floors and roofs, footing widths shall be determined according to
a) Section 4.2., or
b) the following formula

$$W = w \cdot \left| \sum sjs/(storeys \cdot 4.9) \right|$$

where
W = minimum footing width,
w = minimum width of footings supporting joists not exceeding 4.9 m, as defined by Table 9.15.3.4.,
Σ sjs = sum of the supported joist spans on each *storey* whose load is transferred to the footing, and
storeys = number of *storeys* supported by the footing.
(See Note A-9.15.3.4.(2).)
3) Where a *foundation* rests on gravel, sand or silt in which the water table level is less than the width of the footings below the *bearing surface*,
a) the footing width for walls shall be not less than twice the width required by Sentences (1) and (2), and Articles 9.15.3.5. and 9.15.3.6., and
b) the footing area for columns shall be not less than twice the area required by Sentences (1) and (2) and Article 9.15.3.7.

Table 9.15.3.4.
Minimum Footing Sizes
Forming Part of Sentence 9.15.3.4.(1)

No. of Floors Supported	Minimum Width of Strip Footings, mm		Minimum Footing Area for Columns Spaced 3 m o.c.,[(1)] m^2
	Supporting Exterior Walls[(2)]	Supporting Interior Walls[(3)]	
1	250	200	0.4
2	350	350	0.75
3	450	500	1.0

Notes to Table 9.15.3.4.:
(1) See Sentence 9.15.3.7.(1).
(2) See Sentence 9.15.3.5.(1).
(3) See Sentence 9.15.3.6.(1).

9.15.3.5. Adjustments to Footing Widths for Exterior Walls

1) The strip footing widths for exterior walls shown in Table 9.15.3.4. shall be increased by

a) 65 mm for each *storey* of masonry veneer over wood-frame construction supported by the *foundation* wall,

b) 130 mm for each *storey* of masonry construction supported by the *foundation* wall, and

c) 150 mm for each *storey* of flat insulating concrete form wall construction supported by the *foundation* wall.

9.15.3.6. Adjustments to Footing Widths for Interior Walls

1) The minimum strip footing widths for interior *loadbearing* masonry walls shown in Table 9.15.3.4. shall be increased by 100 mm for each *storey* of masonry construction supported by the footing.

2) Footings for interior non-*loadbearing* masonry walls shall be not less than 200 mm wide for walls up to 5.5 m high and the width shall be increased by 100 mm for each additional 2.7 m of height.

9.15.3.7. Adjustments to Footing Area for Columns

1) The footing area for column spacings other than shown in Table 9.15.3.4. shall be adjusted in proportion to the distance between columns.

9.15.3.8. Footing Thickness

1) Footing thickness shall be not less than the greater of

a) 100 mm, or

b) the width of the projection of the footing beyond the supported element.

9.15.3.9. Step Footings

1) Where step footings are used,

a) the vertical rise between horizontal portions shall not exceed 600 mm, and

b) the horizontal distance between risers shall not be less than 600 mm.

9.15.4. Foundation Walls

9.15.4.1. Permanent Form Material

1) Insulating concrete form units shall be manufactured of polystyrene conforming to the performance requirements of CAN/ULC-S701, "Thermal Insulation, Polystyrene, Boards and Pipe Covering," for Type 2, 3 or 4 polystyrene.

9.15.4.2. Foundation Wall Thickness and Required Lateral Support

1) Except as required in Sentence (2), the thickness of *foundation* walls made of unreinforced concrete block or solid concrete and subject to lateral earth pressure shall conform to Table 9.15.4.2.-A for walls not exceeding 3.0 m in unsupported height.

2) The thickness of concrete in flat insulating concrete form *foundation* walls shall be not less than the greater of

a) 140 mm, or

b) the thickness of the concrete in the wall above.

3) Foundation walls made of flat insulating concrete form units shall be laterally supported at the top and at the bottom.

Table 9.15.4.2.-A
Thickness of Solid Concrete and Unreinforced Concrete Block Foundation Walls
Forming Part of Sentence 9.15.4.2.(1)

Type of *Foundation* Wall	Minimum Wall Thickness, mm	Maximum Height of Finished Ground Above *Basement* Floor or Crawl Space Ground Cover, m			
		Height of *Foundation* Wall Laterally Unsupported at the Top(1)(2)	Height of *Foundation* Wall Laterally Supported at the Top(1)(2)		
		≤ 3.0 m	≤ 2.5 m	> 2.5 m and ≤ 2.75 m	> 2.75 m and ≤ 3.0 m
Solid concrete, 15 MPa min. strength	150	0.8	1.5	1.5	1.4
	200	1.2	2.15	2.15	2.1
	250	1.4	2.3	2.6	2.5
	300	1.5	2.3	2.6	2.85
Solid concrete, 20 MPa min. strength	150	0.8	1.8	1.6	1.6
	200	1.2	2.3	2.3	2.2
	250	1.4	2.3	2.6	2.85
	300	1.5	2.3	2.6	2.85
Unreinforced concrete block	140	0.6	0.8	–	–
	190	0.9	1.2	(3)	(3)
	240	1.2	1.8	(3)	(3)
	290	1.4	2.2	–	–

Notes to Table 9.15.4.2.-A:
(1) See Article 9.15.4.3.
(2) See Article 9.15.4.6.
(3) See Table 9.15.4.2.-B.

4) The thickness and reinforcing of *foundation* walls made of reinforced concrete block and subject to lateral earth pressure shall conform to Table 9.15.4.2.-B and Sentences (5) to (8), where
a) the walls are laterally supported at the top,
b) average stable *soils* are encountered, and
c) wind loads on the exposed portion of the *foundation* are no greater than 0.70 kPa.

5) For concrete block walls required to be reinforced, continuous vertical reinforcement shall
a) be provided at wall corners, wall ends, wall intersections, at changes in wall height, at the jambs of all openings and at movement joints,
b) extend from the top of the footing to the top of the *foundation* wall, and
c) where *foundation* walls are laterally supported at the top, have not less than 50 mm embedment into the footing, if the floor slab does not provide lateral support at the wall base.

6) For concrete block walls required to be reinforced, a continuous horizontal bond beam containing not less than one 15M bar shall be installed
a) along the top of the wall,
b) at the sill and head of all openings greater than 1.20 m in width, and
c) at structurally connected floors.

Table 9.15.4.2.-B
Reinforced Concrete Block Foundation Walls Laterally Supported at the Top(1)
Forming Part of Sentence 9.15.4.2.(4)

Maximum Height of Finished Ground Above *Basement* Floor or Crawl Space Ground Cover, m(2)	Size and Spacing of Continuous Vertical Reinforcement, M at mm o.c.					
	190 mm Minimum Wall Thickness			240 mm Minimum Wall Thickness		
	Foundation Wall Height			*Foundation* Wall Height		
	≤ 2.5 m	≤ 2.75 m	≤ 3.0 m	≤ 2.5 m	≤ 2.75 m	≤ 3.0 m
0.8	(3)	(3)	(3)	(3)	(3)	(3)
1	(3)	1-15M at 1 800	1-15M at 1 800	(3)	(3)	(3)
1.2	(3)	1-15M at 1 600	1-15M at 1 600	(3)	1-20M at 2 000	1-20M at 2 000
1.4	1-15M at 1 600	1-15M at 1 600	1-15M at 1 600	(3)	1-20M at 1 800	1-20M at 1 800
1.6	1-15M at 1 400	1-15M at 1 400	1-15M at 1 400	(3)	1-20M at 1 600	1-20M at 1 600
1.8	1-15M at 1 400	1-15M at 1 400	1-15M at 1 200	(3)	1-20M at 1 600	1-20M at 1 600

2	1-15M at 1 200	1-15M at 1 000 or 1-20M at 1 200	2-15M at 1 200	1-20M at 1 600	1-20M at 1 600	1-20M at 1 600
2.2	2-15M at 1 200	2-15M at 1 000	2-15M at 1 000	1-20M at 1 400	1-20M at 1 400	1-20M at 1 400
2.4	2-15M at 1 000	2-15M at 1 000	2-15M at 800	1-20M at 1 400	1-20M at 1 400	1-20M at 1 200
2.6	n/a	2-15M at 800 or 1-25M at 1 000	2-15M at 800 or 1-25M at 1 000	n/a	1-20M at 1 000	1-20M at 1 000
2.8	n/a	n/a	1-20M at 600	n/a	n/a	1-20M at 800 or 2-15M at 1 000
3	n/a	n/a	1-20M at 400 or 1-25M at 600	n/a	n/a	2-15M at 800

Notes to Table 9.15.4.2.-B:
(1) See Article 9.15.4.3.
(2) See Article 9.15.4.6.
(3) No reinforcement required.

7) In concrete block walls required to be reinforced, all vertical bar reinforcement shall be installed along the centre line of the wall.
8) In concrete block walls required to be reinforced, ladder- or truss-type lateral reinforcement not less than 3.8 mm in diameter (no. 9 ASWG) shall be installed in the bed joint of every second masonry course.

9.15.4.3. Foundation Walls Considered to be Laterally Supported at the Top

1) Sentences (2) to (4) pertain to lateral support for walls described in Sentence 9.15.4.2.(1).
2) Foundation walls shall be considered to be laterally supported at the top if
a) such walls support a *solid masonry* superstructure,
b) the floor joists are embedded in the top of the *foundation* walls, or
c) the floor system is anchored to the top of the *foundation* walls with anchor bolts, in which case the joists may run either parallel or perpendicular to the *foundation* walls.
3) Unless the wall around an opening is reinforced to withstand earth pressure, the portion of the *foundation* wall beneath an opening shall be considered laterally unsupported if
a) the opening is more than 1.2 m wide, or
b) the total width of the openings in the *foundation* wall constitutes more than 25% of the length of the wall.
4) For the purposes of Sentence (3), the combined width of the openings shall be considered as a single opening if the average width is greater than the width of solid wall between them.
5) Flat insulating concrete form *foundation* walls shall be considered to be laterally supported at the top if the floor joists are installed according to Article 9.20.17.5.

9.15.4.4. Foundation Walls Considered to be Laterally Supported at the Bottom

1) Flat insulating concrete form *foundation* walls shall be considered to be laterally supported at the bottom where the *foundation* wall
a) supports backfill not more than 1.2 m in height,
b) is supported at the footing by a shear key and at the top by the ground floor framing, or
c) is doweled to the footing with not less than 15M bars spaced not more than 1.2 m o.c.

9.15.4.5. Reinforcement for Flat Insulating Concrete Form Foundation Walls

1) Horizontal reinforcement in flat insulating concrete form *foundation* walls shall
a) consist of
i) one 10M bar placed not more than 300 mm from the top of the wall, and
ii) 10M bars at 600 mm o.c., and
b) be located
i) in the inside half of the wall section, and
ii) with a minimum cover of 30 mm from the inside face of the concrete.

2) Vertical reinforcement in flat insulating concrete form *foundation* walls shall be
a) provided in accordance with
i) Table 9.15.4.5.-A for 140 mm walls,
ii) Table 9.15.4.5.-B for 190 mm walls, and
iii) Table 9.15.4.5.-C for 240 mm walls,
b) located in the inside half of the wall section with a minimum cover of 30 mm from the inside face of the concrete wall, and
c) where interrupted by wall openings, placed not more than 600 mm from each side of the openings.

3) Cold joints in flat insulating concrete form *foundation* walls shall be reinforced with no less than one 15M bar spaced at not more than 600 mm o.c. and embedded 300 mm on both sides of the joint.

4) Reinforcing around openings in flat insulating concrete form *foundation* walls shall comply with Article 9.20.17.3. or 9.20.17.4.

Table 9.15.4.5.-A
Vertical Reinforcement for 140 mm Flat Insulating Concrete Form Foundation Walls
Forming Part of Sentence 9.15.4.5.(2)

Max. Height of Finished Ground Above Finished *Basement* Floor, m	Minimum Vertical Reinforcement		
	Maximum Unsupported *Basement* Wall Height		
	2.44 m	2.75 m	3.0 m
1.35	10M at 400 mm o.c.	10M at 400 mm o.c.	10M at 400 mm o.c.
1.6	10M at 400 mm o.c.	10M at 380 mm o.c.	10M at 380 mm o.c.
2	10M at 380 mm o.c.	10M at 380 mm o.c.	10M at 380 mm o.c.
2.2	10M at 250 mm o.c.	10M at 250 mm o.c.	10M at 250 mm o.c.
2.35	n/a	10M at 250 mm o.c.	10M at 250 mm o.c.
2.6	n/a	10M at 250 mm o.c.	10M at 250 mm o.c.
3	n/a	n/a	15M at 250 mm o.c.

Table 9.15.4.5.-B
Vertical Reinforcement for 190 mm Flat Insulating Concrete Form Foundation Walls
Forming Part of Sentence 9.15.4.5.(2)

Max. Height of Finished Ground Above Finished *Basement* Floor, m	Minimum Vertical Reinforcement		
	Maximum Unsupported *Basement* Wall Height		
	2.44 m	2.75 m	3.0 m
2.2	None required	10M at 400 mm o.c.	10M at 400 mm o.c.
2.35	n/a	10M at 300 mm o.c.	10M at 300 mm o.c.
2.6	n/a	10M at 300 mm o.c.	15M at 400 mm o.c.
3.0	n/a	n/a	15M at 400 mm o.c.

Table 9.15.4.5.-C
Vertical Reinforcement for 240 mm Flat Insulating Concrete Form Foundation Walls
Forming Part of Sentence 9.15.4.5.(2)

Max. Height of Finished Ground Above Finished *Basement* Floor, m	Minimum Vertical Reinforcement		
	Maximum Unsupported *Basement* Wall Height		
	2.44 m	2.75 m	3.0 m
2.2	None required	None required	None required
2.6	n/a	15M at 400 mm o.c.	15M at 400 mm o.c.
3.0	n/a	n/a	15M at 400 mm o.c.

9.15.4.6. Extension above Ground Level

1) Exterior *foundation* walls shall extend not less than 150 mm above finished ground level.

9.15.4.7. Reduction in Thickness

1) Where the top of a *foundation* wall is reduced in thickness to permit the installation of floor joists, the reduced section shall be not more than 350 mm high and not less than 90 mm thick.

2) Where the top of a *foundation* wall is reduced in thickness to permit the installation of a masonry exterior facing, the reduced section shall be

- a) not less than 90 mm thick, and
- b) tied to the facing material with metal ties conforming to Sentence 9.20.9.4.(3) spaced not more than
  - i) 200 mm o.c. vertically, and
  - ii) 900 mm o.c. horizontally.

3) The space between wall and facing described in Sentence (2) shall be filled with mortar.

9.15.4.8. Corbelling

1) Corbelling of masonry *foundation* walls supporting *cavity walls* shall conform to Article 9.20.12.2.

9.15.4.9. Crack Control Joints

1) Crack control joints shall be provided in *foundation* walls more than 25 m long at intervals of not more than 15 m.

2) Joints required in Sentence (1) shall be designed to resist moisture penetration and shall be keyed to prevent relative displacement of the wall portions adjacent to the joint.

9.15.4.10. Interior Masonry Walls

1) Interior masonry *foundation* walls not subject to lateral earth pressure shall conform to Section 9.20.

9.15.5. Support of Joists and Beams on Masonry Foundation Walls

9.15.5.1. Support of Floor Joists

1) Except as permitted in Sentence (2), *foundation* walls of hollow masonry units supporting floor joists shall be capped with

a) not less than 50 mm of concrete,

b) solid masonry units that are 100% solid and not less than 50 mm high, or

c) semi-solid or hollow *solid masonry units* that have the top course completely filled with mortar, grout or concrete.

2) Capping required in Sentence (1) need not be provided

a) in localities where termites are not known to occur,

b) when the joists are supported on a wood plate not less than 38 mm by 89 mm, and

c) when the siding overlaps the *foundation* wall not less than 12 mm.

9.15.5.2. Support of Beams

1) Not less than 190 mm depth of *solid masonry* shall be provided beneath beams supported on masonry.

2) Where the beam referred to in Sentence (1) is supported below the top of the *foundation* walls, the ends of such beams shall be protected from the weather.

9.15.5.3. Pilasters

1) Pilasters shall be provided under beams that frame into unit masonry *foundation* walls 140 mm or less in thickness.

2) Pilasters required in Sentence (1) shall be not less than 90 mm by 290 mm and shall be bonded or tied into the wall.

3) The top 200 mm of pilasters required in Sentence (1) shall be *solid masonry* with the cells of hollow or semi-solid units filled with mortar, grout or concrete.

9.15.6. Parging and Finishing of Masonry Foundation Walls

9.15.6.1. Foundation Walls below Ground

1) Concrete block *foundation* walls shall be parged on the exterior face below ground level as required in Section 9.13.

9.15.6.2. Foundation Walls above Ground

1) Exterior surfaces of concrete block *foundation* walls above ground level shall have tooled joints, or shall be parged or otherwise suitably finished.

9.15.6.3. Form Ties

1) All form ties shall be removed at least flush with the concrete surface.

Section 9.16. Floors-on-Ground

9.16.1. Scope

9.16.1.1. Application

1) This Section applies to floors supported on ground or on granular *fill* that do not provide structural support for the superstructure.

9.16.1.2. Structural Floors

1) Floors-on-ground that support loads from the superstructure shall be designed in conformance with Part 4.

9.16.1.3. Required Floors-on-Ground

1) All spaces within *dwelling units*, except crawl spaces, shall be provided with a floor-on-ground, where

a) access is provided to the space, and

b) a floor supported by the structure is not provided.

9.16.1.4. Dampproofing and Waterproofing

1) Dampproofing and waterproofing shall conform to Section 9.13.

9.16.2. Material beneath Floors

9.16.2.1. Required Installation of Granular Material

1) Except as provided in Sentence (2), a drainage layer shall be installed beneath floors-on-ground. (See Note A-9.16.2.1.(1) and see also Subsection 9.13.4. and Note A-9.13.4.)

2) The drainage layer required in Sentence (1) need not be installed beneath

a) slabs in garages, carports or accessory *buildings*, or

b) buildings of *industrial occupancy* where the nature of the process contained therein permits or requires the use of large openings in the *building* envelope even during the winter.

9.16.2.2. Support of Floors

1) Material that is susceptible to changes in volume due to variations in moisture content or chemical-microbiological oxidation shall not be used as *fill* beneath floors-on-ground in a concentration that will damage the *building* to a degree that would adversely affect its stability or the performance of assemblies. (See also Article 9.4.4.4. and Note A-9.4.4.4.(1).)

2) Material that is susceptible to changes in volume due to freezing shall not be used as *fill* beneath floors-on-ground that will be subjected to freezing temperatures. (See also Article 9.4.4.4. and Note A-9.4.4.4.(1).)

3) Except as provided in Sentence (4), *fill* beneath floors-on-ground shall be compacted.

4) Fill beneath floors-on-ground need not be compacted where the material is coarse clean granular material containing not more than 10% of material that will pass a 4 mm sieve.

9.16.3. Drainage

9.16.3.1. Control of Water Ingress

1) Except as provided in Article 9.16.3.2. or where it can be shown to be unnecessary, ingress of water underneath a floor-on-ground shall be prevented by grading or drainage.

9.16.3.2. Hydrostatic Pressure

1) Where *groundwater levels* may cause hydrostatic pressure beneath a floor-on-ground, the floor-on-ground shall be

a) a poured concrete slab, and

b) designed to resist such pressures.

9.16.3.3. Floor Drains

1) When floor drains are required (See Section 9.31.), the floor surface shall be sloped so that no water can accumulate.

9.16.4. Concrete

9.16.4.1. Surface Finish

1) The finished surface of concrete floor slabs shall be troweled smooth and even.

2) Dry cement shall not be added to the floor surfaces to absorb surplus water.

9.16.4.2. Topping Course

1) When a topping course is provided for a concrete floor slab, it shall consist of 1 part cement to 2.5 parts clean, well graded sand by volume, with a water/cement ratio approximately equal to that of the base slab.

2) When concrete topping is provided, it shall not be less than 20 mm thick.

9.16.4.3. Thickness

1) Concrete slabs shall not be less than 75 mm thick exclusive of concrete topping.

9.16.4.4. Bond Break

1) A bond-breaking material shall be placed between the slab and footings or *rock*.

9.16.5. Wood

9.16.5.1. Wood-Frame Floors

1) Floors-on-ground constructed of wood shall conform to CSA S406, “Permanent Wood Foundations for Housing and Small Buildings.”

Section 9.17. Columns

9.17.1. Scope

9.17.1.1. Application

1) This Section applies to columns used to support

a) beams carrying loads from not more than 2 wood-frame floors where

i) the supported length of joists bearing on such beams does not exceed 5 m, and

ii) the *live load* on any floor does not exceed 2.4 kPa (See Table 4.1.5.3.),

b) beams or header joists carrying loads from not more than 2 levels of wood-frame balconies, decks or other accessible exterior platforms, or 1 level plus the roof, where

i) the supported length of joists bearing on such beams or joists does not exceed 5 m,

ii) the sum of the specified snow and *occupancy* loads does not exceed 4.8 kPa (See Sentence 9.4.2.3.(1) for iii) the determination of load on platform-type constructions), and

iii) the platform serves only a single *suite* of *residential occupancy*, or

c) carport roofs (See Section 9.35.).

2) Columns for applications other than as described in Sentence (1) shall be designed in accordance with Part 4.

9.17.2. General

9.17.2.1. Location

1) Columns shall be centrally located on a footing conforming to Section 9.15.

9.17.2.2. Lateral Support

1) Columns shall be securely fastened to the supported member to reduce the likelihood of lateral differential movement between the column and the supported member. (See also Article 9.23.6.2.)

2) Except as permitted by Sentence (3), columns shall be laterally supported to resist racking

a) directly, or

b) by connection to the supported members.

(See Note A-9.17.2.2.(2).)

3) Columns need not be provided with lateral support as described in Sentence (2), where

a) the distance from finished ground to the underside of the joists is not more than 600 mm, and

b) the columns support a deck with no superstructure.

9.17.3. Steel Columns

9.17.3.1. Size and Thickness

1) Except as permitted in Sentence (2), steel pipe columns shall have an outside diameter of not less than 73 mm and a wall thickness of not less than 4.76 mm.

2) Columns of sizes other than as specified in Sentence (1) are permitted to be used where the *loadbearing* capacities are shown to be adequate.

9.17.3.2. End Bearing Plates

1) Except as permitted in Sentence (2), steel columns shall be fitted with not less than 100 mm by 100 mm by 6.35 mm thick steel plates at each end, and where the column supports a wooden beam, the top plate shall extend across the full width of the beam.

2) The top plate required in Sentence (1) need not be provided where a column supports a steel beam and provision is made for the attachment of the column to the beam.

9.17.3.3. Paint

1) Exterior steel columns shall be treated on the outside surface with at least one coat of rust-inhibitive paint.

9.17.3.4. Design of Steel Columns

(See Note A-9.17.3.4.)

1) Where the imposed load does not exceed 36 kN, adjustable steel columns shall conform to CAN/CGSB-7.2, “Adjustable Steel Columns.”

2) Steel columns other than those described in Sentence (1) shall be designed in accordance with Part 4.

9.17.4. Wood Columns

9.17.4.1. Column Sizes

1) The width or diameter of a wood column shall be not less than the width of the supported member.

2) Except as provided in Article 9.35.4.2., columns shall be not less than 184 mm for round columns and 140 mm by 140 mm for rectangular columns, unless calculations are provided to show that lesser sizes are adequate.

9.17.4.2. Materials

1) Wood columns shall be either solid, glued-laminated or built-up.
2) Built-up columns shall consist of not less than 38 mm thick full-length members
a) bolted together with not less than 9.52 mm diam bolts spaced not more than 450 mm o.c., or
b) nailed together with not less than 76 mm nails spaced not more than 300 mm o.c.
3) Glued-laminated columns shall conform to Section 4.3.

9.17.4.3. Columns in Contact with Concrete

1) Wood columns shall be separated from concrete in contact with the ground by 0.05 mm polyethylene film or Type S roll roofing.

9.17.5. Unit Masonry Columns

9.17.5.1. Materials

1) Unit masonry columns shall be built of masonry units
a) conforming to CSA A165.1, “Concrete Block Masonry Units,” and
b) having a compressive strength over the net area of the block of not less than 15 MPa.

9.17.5.2. Sizes

1) Unit masonry columns shall be not less than 290 mm by 290 mm or 240 mm by 380 mm in size.

9.17.6. Solid Concrete Columns

9.17.6.1. Materials

1) Concrete shall conform to Section 9.3.

9.17.6.2. Sizes

1) Concrete columns shall be not less than 200 mm by 200 mm for rectangular columns and 230 mm diam for circular columns.

Section 9.18. Crawl Spaces

9.18.1. General

9.18.1.1. Application

1) This Section applies to crawl spaces whose exterior walls have less than 25% of their total area above exterior ground level open to the outdoors.

9.18.1.2. Foundations

1) Foundations enclosing crawl spaces shall conform to Section 9.15.

9.18.1.3. Heated and Unheated Crawl Spaces

1) Crawl spaces shall be considered to be heated where the space
a) is used as a hot air *plenum*,
b) contains heating ducts that are not sealed and insulated to minimize heat loss to the space, or
c) is not separated from heated space in accordance with Section 9.25.
2) Heating of heated crawl spaces shall conform to Section 9.33.
3) Insulation, an *air barrier system* and a *vapour barrier* shall be installed in the walls of heated crawl spaces in accordance with Section 9.25.

9.18.2. Access

9.18.2.1. Access Openings

1) An access opening of not less than 500 mm by 700 mm shall be provided to each crawl space where the crawl space serves a single *dwelling unit*, and not less than 550 mm by 900 mm for other crawl spaces.
2) Access openings shall be fitted with a door or hatch, except when the crawl space is heated and the access opening into the crawl space is from an adjacent heated space.

9.18.3. Ventilation

9.18.3.1. Ventilation of Unheated Crawl Spaces

1) Unheated crawl spaces shall be ventilated by natural or mechanical means.
2) Where an unheated crawl space is ventilated by natural means, ventilation shall be provided to the outside air by not less than 0.1 m^2 of unobstructed vent area for every 50 m^2 of *floor area*.
3) Vents shall be
- a) uniformly distributed on opposite sides of the *building*, and
- b) designed to prevent the entry of snow, rain and insects.

9.18.3.2. Ventilation of Heated Crawl Spaces

1) Heated crawl spaces shall be ventilated in accordance with Section 9.32.

9.18.4. Clearance

(See also Article 9.3.2.9.)

9.18.4.1. Access Way to Services

1) Where equipment requiring service such as plumbing cleanouts, traps and burners is located in crawl spaces, an access way with a height and width of not less than 600 mm shall be provided from the access door to the equipment and for a distance of 900 mm on the side or sides of the equipment to be serviced.

9.18.5. Drainage

9.18.5.1. Drainage

1) Except where it can be shown to be unnecessary, the ingress of water into a crawl space shall be controlled by grading or drainage.
2) Drainage of *foundation* walls shall conform to Article 9.14.2.1.
3) Drainage of the ground cover or floor-on-ground in the crawl space shall conform to Subsection 9.16.3.
4) Drains shall conform to Section 9.14.

9.18.6. Ground Cover

9.18.6.1. Ground Cover in Unheated Crawl Spaces

1) Where a crawl space is unheated, a ground cover shall be provided consisting of not less than
- a) 50 mm of asphalt,
- b) 100 mm of 15 MPa Portland cement concrete,
- c) Type S roll roofing, or
- d) 0.10 mm polyethylene.

2) Joints in sheet-type ground cover required in Sentence (1) shall be lapped not less than 100 mm and weighted down.

9.18.6.2. Ground Cover in Heated Crawl Spaces

1) Where a crawl space is heated, a ground cover consisting of not less than 0.15 mm polyethylene sheet conforming to CAN/CGSB-51.34-M, "Vapour Barrier, Polyethylene Sheet for Use in Building Construction," shall be installed as part of an *air barrier system* in accordance with Subsection 9.25.3.

2) The ground cover required in Sentence (1) shall have its joints lapped not less than 300 mm, and

a) be sealed and evenly weighted down, or

b) be covered with concrete not less than 50 mm thick.

3) The perimeter of the ground cover required in Sentence (1) shall be sealed to the *foundation* wall. (See Notes A-9.13.4., A-9.25.3.4. and 9.25.3.6., and A-9.25.3.6.(2) and (3).)

4) All penetrations of the ground cover required in Sentence (1) shall be sealed against air leakage. (See Subsection 9.25.3.)

9.18.7. Fire Protection

9.18.7.1. Crawl Spaces as Warm Air Plenums

1) Only crawl spaces under 1-*storey* portions of *dwelling units* shall be used as warm-air *plenums*.

2) Enclosing material in crawl spaces described in Sentence (1), including insulation, shall have a surface *flame-spread rating* not greater than 150.

3) Combustible ground cover in crawl spaces described in Sentence (1) shall be protected beneath each register opening with *noncombustible* material.

4) The *noncombustible* register protection described in Sentence (3) shall

a) extend not less than 300 mm beyond the projection of the register opening, and

b) have up-turned edges.

(See Note A-9.18.7.1.(4).)

Section 9.19. Roof Spaces

9.19.1. Venting

9.19.1.1. Required Venting

1) Except where it can be shown to be unnecessary, where insulation is installed between a ceiling and the underside of the roof sheathing, a space shall be provided between the insulation and the sheathing, and vents shall be installed to permit the transfer of moisture from the space to the exterior. (See Note A-9.19.1.1.(1).)

9.19.1.2. Vent Requirements

1) Except as provided in Sentence (2), the unobstructed vent area shall be not less than 1/300 of the insulated ceiling area.

2) Where the roof slope is less than 1 in 6 or in roofs that are constructed with roof joists, the unobstructed vent area shall be not less than 1/150 of the insulated ceiling area.

3) Required vents may be roof type, eave type, gable-end type or any combination thereof, and shall be distributed

a) uniformly on opposite sides of the *building*,

b) with not less than 25% of the required openings located at the top of the space, and

c) with not less than 25% of the required openings located at the bottom of the space.

4) Except where each joist space is separately vented, roof joist spaces shall be interconnected by installing purlins not less than 38 mm by 38 mm on the top of the roof joists.

5) Vents shall comply with CAN3-A93-M, "Natural Airflow Ventilators for Buildings."

9.19.1.3. Clearances

1) Except as provided in Sentence (2), not less than 63 mm of space shall be provided between the top of the insulation and the underside of the roof sheathing.
2) At the junction of sloped roofs and exterior walls, where preformed baffles are used to contain the insulation, the baffles shall
- a) provide an unobstructed air space, between the insulation and the underside of the roof sheathing, that is
  - i) not less than 25 mm in dimension, and
  - ii) of sufficient cross area to meet the *attic or roof space* venting requirements of Article 9.19.1.2., and
- b) extend vertically not less than 50 mm above the top of the insulation.

3) Ceiling insulation shall be installed in a manner that will not restrict the free flow of air through roof vents or through any portion of the *attic or roof space*.

9.19.1.4. Mansard or Gambrel Roof

1) The lower portion of a mansard or gambrel style roof need not be ventilated.
2) The upper portion of roofs described in Sentence (1) shall be ventilated in conformance with Articles 9.19.1.1. to 9.19.1.3.

9.19.2. Access

9.19.2.1. Access

1) Every *attic or roof space* shall be provided with an access hatch where the open space in the *attic or roof space* measures
- a) 3 m^2 or more in area,
- b) 1 m or more in length or width, and
- c) 600 mm or more in height over at least the area described in Clauses (a) and (b).

(See Note A-9.19.2.1.(1).)
2) The hatch required in Sentence (1) shall be not less than 550 mm by 900 mm except that, where the hatch serves not more than one *dwelling unit*, the hatch may be reduced to 0.32 m^2 in area with no dimension less than 500 mm.
3) Hatchways to *attic or roof spaces* shall be fitted with doors or covers.

Section 9.20. Masonry and Insulating Concrete Form Walls Not In Contact with the Ground

9.20.1. Application

9.20.1.1. General

1) Except as provided in Article 9.20.1.2., this Section applies to
- a) unreinforced masonry and masonry veneer walls not in contact with the ground, where
  - i) the height of the walls constructed on the *foundation* walls does not exceed 11 m, and
  - ii) the roof or floor assembly above the *first storey* is not of concrete construction, and
- b) flat insulating concrete form walls not in contact with the ground that (See Note A-9.15.1.1.(1)(c) and 9.20.1.1.(1)(b))
  - i) have a maximum floor-to-floor height of 3 m,
  - ii) are erected in *buildings* not more than 2 *storeys* in *building height* and containing only a single *dwelling unit*, and
  - iii) are erected in locations where the seismic spectral response acceleration, $S_a(0.2)$, is not greater than 0.4 (See Note A-9.20.1.2.).

2) For walls other than those described in Sentence (1), or where the masonry walls or insulating concrete form walls not in contact with the ground are designed for specified loads on the basis of ultimate and serviceability limit states, Subsection 4.3.2. shall apply.

9.20.1.2. Earthquake Reinforcement

(See Note A-9.20.1.2.)

1) In locations where the spectral response acceleration, $S_a(0.2)$, is greater than 0.55, *loadbearing* elements of masonry *buildings* more than 1 *storey* in *building height* shall be reinforced with not less than the minimum amount of reinforcement required by Subsection 9.20.15.

2) In locations where the spectral response acceleration, $S_a(0.2)$, is greater than 0.35 but less than or equal to 0.55, *loadbearing* elements of masonry *buildings* 3 *storeys in building height* shall be reinforced with not less than the minimum amount of reinforcement required by Subsection 9.20.15.

9.20.2. Masonry Units

9.20.2.1. Masonry Unit Standards

1) Masonry units shall comply with

a) ASTM C 73, “Calcium Silicate Brick (Sand-Lime Brick),”

b) ASTM C 126, “Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units,”

c) ASTM C 212, “Structural Clay Facing Tile,”

d) CAN/CSA-A82, “Fired Masonry Brick Made from Clay or Shale,”

e) CSA A165.1, “Concrete Block Masonry Units,”

f) CSA A165.2, “Concrete Brick Masonry Units,” or

g) CSA A165.3, “Prefaced Concrete Masonry Units.”

9.20.2.2. Used Brick

1) Used bricks shall be free of old mortar, soot or other surface coating and shall conform to Article 9.20.2.1.

9.20.2.3. Glass Blocks

1) Glass blocks shall not be used as *loadbearing* units or in the construction of fireplaces or *chimneys*.

9.20.2.4. Cellular Concrete

1) Masonry made with cellular concrete shall not be used in contact with the *soil* or exposed to the weather.

9.20.2.5. Stone

1) Stone shall be sound and resistant to deterioration.

9.20.2.6. Concrete Blocks Exposed to the Weather

1) Concrete blocks exposed to the weather shall have density and water absorption characteristics conforming to concrete types A, B, C, or D described in CSA A165.1, “Concrete Block Masonry Units.”

9.20.2.7. Compressive Strength

1) The compressive strength of concrete blocks shall conform to Table 9.20.2.7.

Table 9.20.2.7.
Compressive Strength of Concrete Blocks
Forming Part of Sentence 9.20.2.7.(1)

Type of Unit	Minimum Compressive Strength Over Net Area, MPa	
	Exposed to Weather	Not Exposed to Weather
Solid or hollow concrete blocks	15	10
Solid *loadbearing* cellular blocks	Not permitted	5
Solid non-*loadbearing* cellular blocks	Not permitted	2

9.20.3. Mortar and Grout

9.20.3.1. Materials

1) Cementitious materials and aggregates for mortar and grout shall comply with CSA A179, "Mortar and Grout for Unit Masonry."
2) Water and aggregate shall be clean and free of significant amounts of deleterious materials.
3) Lime used in mortar shall be hydrated.
4) If lime putty is used in mortar, it shall be made by slaking quicklime in water for not less than 24 h or soaking hydrated lime in water for not less than 12 h.

9.20.3.2. Mortar and Grout Mixes

1) Mortar types shall be in accordance with Table 9.20.3.2.-A.
2) Mortar for glass block masonry shall be
a) Type S Portland cement-lime where exposed to the exterior, or
b) Type S or N where protected from the exterior.
3) Mortar shall be mixed within the proportion limits provided in Table 9.20.3.2.-B, with sufficient water to bring the mixture to a consistency adequate for laying masonry units.
4) Grout shall be mixed within the proportion limits provided in Table 9.20.3.2.-C, with sufficient water to provide a suitable flow to fill all voids completely, without excessive segregation or bleeding.
5) Except as provided in Sentence (6), mortar shall be used and placed in final position
a) within 1.5 h after mixing when the air temperature is 25°C or higher, or
b) within 2.5 h after mixing when the air temperature is less than 25°C.
6) Mortar and grout containing a set-control admixture shall be manufactured off-site in a batching plant and shall be used and placed in final position within a time not exceeding the useful life stipulated by the manufacturer.
7) Grout used for reinforced masonry shall be placed in accordance with the requirements of CSA A371, "Masonry Construction for Buildings."

Table 9.20.3.2.-A
Mortar Use
Forming Part of Sentence 9.20.3.2.(1)

Location	*Building* Element	Mortar Type
Exterior, Above Ground	*Loadbearing* walls and columns	S
	Non-*loadbearing* walls and columns	N or S
	Parapets, *chimneys*, masonry veneer	N or S
Exterior, At or Below Ground	*Foundation* walls and columns	S
Interior	*Loadbearing* walls and columns	N
	Non-*loadbearing* walls and columns	N

Table 9.20.3.2.-B
Mortar Mix Proportions (by volume)
Forming Part of Sentence 9.20.3.2.(3)

Mortar Type	Portland Cement	Lime	Masonry Cement Type N	Masonry Cement Type S	Fine Aggregate (damp, loose-state sand)
Type S	1	½	–	–	3½ to 4½
	–	–	–	1	2¼ to 3
	½	–	1	–	3½ to 4½
Type N	1	1	–	–	4½ to 6
	–	–	1	–	2¼ to 3

Table 9.20.3.2.-C
Grout Mix Proportions (by volume)
Forming Part of Sentence 9.20.3.2.(4)

Portland Cement	Lime	Fine Aggregate (sand)	Coarse Aggregate
1	0 to 1/10	2¼ to 3 times the sum of the cement and lime volumes	1 to 2 times the sum of the cement and lime volumes

9.20.4. Mortar Joints

9.20.4.1. Thickness

1) Except as provided in Sentence (2), mortar joint thickness for burned clay brick and concrete masonry units shall be 10 mm.

2) Permitted tolerances in head and bed joints shall be not more than ± 5 mm.

9.20.4.2. Solid Masonry Units

1) Solid masonry units shall be laid with full head and bed joints.

9.20.4.3. Laying of Masonry Units

1) Hollow masonry units shall be laid with mortar applied to head and bed joints of both inner and outer face shells.

2) Vertically aligned webs of hollow masonry units shall be laid in a full bed of mortar

a) under the starting course,

b) in all courses of columns, and

c) where adjacent to cells or cavities that are to be filled with grout.

3) Except for head joints left open for weep holes and ventilation, *solid masonry units* shall be laid with full head and bed joints.

9.20.5. Masonry Support

9.20.5.1. Masonry Support

1) All masonry shall be supported on masonry, concrete or steel, except that masonry veneer walls may be supported on *foundations* of wood frame constructed in conformance with Sentence 9.15.2.4.(1). (See Note A-9.20.5.1.(1).)

2) Every masonry wall shall be at least as thick as the wall it supports, except as otherwise permitted in Article 9.20.12.2.

9.20.5.2. Lintels or Arches

1) Masonry over openings shall be supported by steel, masonry or reinforced concrete lintels, or masonry arches.

2) Steel angle lintels supporting masonry veneer above openings shall

a) conform to Table 9.20.5.2., and

b) have a bearing length not less than 90 mm.

Table 9.20.5.2.
Maximum Allowable Spans for Steel Lintels Supporting Masonry Veneer
Forming Part of Sentence 9.20.5.2.(2)

Minimum Angle Size, mm			Maximum Allowable Spans, m		
Vertical Leg	Horizontal Leg	Thickness	Supporting 75 mm Brick	Supporting 90 mm Brick	Supporting 100 mm Stone
89	76	6.4	2.55	–	–
89	89	6.4	2.59	2.47	2.30
102	89	6.4	2.79	2.66	2.48
127	89	7.9	3.47	3.31	3.08

127	89	11	3.64	3.48	3.24

3) Steel angle lintels supporting masonry other than veneer, masonry and reinforced concrete lintels, and masonry arches shall be designed in accordance with Part 4 to support the imposed load.
4) Steel angle lintels supporting masonry shall be prime painted or otherwise protected from corrosion.

9.20.6. Thickness and Height

9.20.6.1. Thickness of Exterior Walls

1) Masonry exterior walls, other than *cavity walls*, in 1-*storey buildings* and the top *storeys* of 2- and 3-*storey buildings* shall be not less than 140 mm thick, provided the walls are not more than 2.8 m high at the eaves and 4.6 m high at the peaks of gable ends.
2) The exterior walls of the bottom *storeys* of 2-*storey buildings*, and exterior walls of the bottom 2 *storeys* of 3-*storey buildings* shall be not less than 190 mm thick.
3) In exterior walls composed of more than one wythe, each wythe shall be not less than 90 mm thick.

9.20.6.2. Cavity Walls

1) Cavity walls shall be made with not less than 90 mm wide units if the joints are raked and not less than 75 mm wide units if the joints are not raked.
2) The width of a cavity in a *cavity wall* shall be not less than 50 mm and not greater than 150 mm.
3) The minimum thickness of *cavity walls* above the supporting base shall be 230 mm for the top 7.6 m and 330 mm for the remaining portion, except that where 75 mm wide units are used, the wall height above the top of the *foundation* wall shall not exceed 6 m.

9.20.6.3. Thickness of Interior Walls

1) The thickness of *loadbearing* interior walls shall be determined on the basis of the maximum lateral support spacing as provided in Sentences 9.20.10.1.(2) and (3).
2) The thickness of interior non-*loadbearing* walls shall be
- a) determined on the basis of the maximum lateral support spacing as provided in Sentences 9.20.10.1.(2) and (3), and
- b) in any case, not less than 65 mm.

9.20.6.4. Masonry Veneer

1) Except for masonry veneer where each masonry unit is supported individually by the structural backing, masonry veneer shall consist of *solid masonry units* not less than 75 mm thick.
2) Veneer described in Sentence (1) over wood-frame walls shall have not less than a 25 mm air space behind the veneer.
3) Masonry veneer less than 90 mm thick shall have unraked joints.
4) Masonry veneer shall conform to Subsection 4.3.2., where the masonry units are required to be individually supported by the structural backing.

9.20.6.5. Parapet Walls

1) The height of parapet walls above the adjacent roof surface shall be not more than 3 times the parapet wall thickness.
2) Parapet walls shall be *solid masonry*
- a) with the cells of hollow or semi-solid units filled with mortar, grout, or concrete, and
- b) that extends from the top of the parapet to not less than 300 mm below the adjacent roof level.

9.20.6.6. Stone or Concrete Facings

1) Slab and panel facings of precast concrete and natural or artificial stone shall conform to Subsection 4.3.2.

9.20.7. Chases and Recesses

9.20.7.1. Maximum Dimensions

1) Except as permitted in Sentence 9.20.7.2.(2) and Article 9.20.7.4., the depth of any chase or recess shall not exceed one third the thickness of the wall, and the width of the chase or recess shall not exceed 500 mm.

9.20.7.2. Minimum Wall Thickness

1) Except as permitted in Sentence (2) and Article 9.20.7.4., no chase or recess shall be constructed in any wall 190 mm or less in thickness.
2) Recesses may be constructed in 190 mm walls provided they do not exceed 100 mm in depth, 750 mm in height and 500 mm in width.

9.20.7.3. Separation of Chases or Recesses

1) Chases and recesses shall be not less than
- a) 4 times the wall thickness apart, and
- b) 600 mm away from any pilaster, cross wall, buttress or other vertical element providing required lateral support for the wall.

9.20.7.4. Non-Conforming Chases or Recesses

1) Chases or recesses that do not conform to the limits specified in Articles 9.20.7.1. to 9.20.7.3. shall be considered as openings, and any masonry supported above such a chase or recess shall be supported by a lintel or arch as provided in Article 9.20.5.2.

9.20.7.5. Chases or Recesses Cut into Walls

1) Chases and recesses shall not be cut into walls made with hollow units after the masonry units are in place.

9.20.8. Support of Loads

9.20.8.1. Capping of Hollow Masonry Walls

1) Except as permitted in Sentence (2), *loadbearing* walls of hollow masonry units supporting roof or floor framing members shall be capped with not less than 50 mm of *solid masonry* or have the top course filled with concrete.
2) Capping required in Sentence (1) may be omitted where the roof framing is supported on a wood plate not less than 38 mm by 89 mm.

9.20.8.2. Cavity Walls Supporting Framing Members

1) Floor joists supported on *cavity walls* shall be supported on *solid masonry units* not less than 57 mm high.
2) Floor joists described in Sentence (1) shall not project into the cavity.
3) Roof and ceiling framing members bearing on *cavity walls* shall be supported on
- *a) solid masonry units* not less than 57 mm high that bridge the full thickness of the wall, or
- b) a wood plate not less than 38 mm thick, bearing not less than 50 mm on each wythe.

9.20.8.3. Bearing of Beams and Joists

1) The bearing area under beams and joists shall be sufficient to carry the supported load.
2) In no case shall the minimum length of end bearing of beams supported on masonry be less than 90 mm.

3) The length of end bearing of floor, roof or ceiling joists supported on masonry shall be not less than 40 mm.

9.20.8.4. Support of Beams and Columns

1) Beams and columns supported on masonry walls shall be supported on pilasters where the thickness of the masonry wall or wythe is less than 190 mm.
2) Not less than 190 mm depth of *solid masonry* or concrete shall be provided under the beam or column referred to in Sentence (1).
3) Pilasters required in Sentence (1) shall be bonded or tied to masonry walls.
4) Concrete pilasters required in Sentence (1) shall be not less than 50 mm by 300 mm.
5) Unit masonry pilasters required in Sentence (1) shall be not less than 100 mm by 290 mm.

9.20.8.5. Projection of Masonry Veneer Beyond Supporting Members

1) Masonry veneer of hollow and *solid masonry units* resting on a bearing support shall not project more than one third of the thickness of the veneer. (See Note A-9.20.8.5.(1).)
2) Where the masonry veneer described in Sentence (1) is rough stone masonry,
- a) the projection shall be measured as the average projection of the units, and
- b) the thickness of the veneer shall be measured as the average thickness of the veneer.

9.20.9. Bonding and Tying

9.20.9.1. Joints to be Offset or Reinforced

1) Vertical joints in adjacent masonry courses shall be offset unless each wythe of masonry is reinforced with the equivalent of not less than 2 corrosion-resistant steel bars of 3.76 mm diam placed in the horizontal joints at vertical intervals not exceeding 460 mm.
2) Where joints in the reinforcing referred to in Sentence (1) occur, the bars shall be lapped not less than 150 mm.

9.20.9.2. Bonding or Tying of Other than Masonry Veneer

1) Except as provided in Article 9.20.9.5. regarding masonry veneer, masonry walls that consist of 2 or more wythes shall have the wythes bonded or tied together with masonry bonding units as described in Article 9.20.9.3. or with metal ties as described in Article 9.20.9.4.

9.20.9.3. Bonding

1) Where wythes are bonded together with masonry units, the bonding units shall comprise not less than 4% of the wall surface area.
2) Bonding units described in Sentence (1) shall be spaced not more than 600 mm vertically and horizontally in the case of brick masonry and 900 mm o.c. in the case of block or tile.
3) Units described in Sentence (1) shall extend not less than 90 mm into adjacent wythes.

9.20.9.4. Tying

1) Where 2 or more wythes are tied together with metal ties of the individual rod type, the ties shall conform to the requirements in Sentences (3) to (6).
2) Other ties may be used where it can be shown that such ties provide walls that are at least as strong and as durable as those made with the individual rod type.
3) Metal ties of the individual rod type shall
- a) be corrosion-resistant,
- b) have a minimum cross-sectional area of not less than 17.8 mm^2, and
- c) have not less than a 50 mm portion bent at right angles at each end.

4) Metal ties of the individual rod type shall

a) extend from within 25 mm of the outer face of the wall to within 25 mm of the inner face of the wall,
b) be completely embedded in mortar except for the portion exposed in *cavity walls*, and
c) be staggered from course to course.

5) Where 2 or more wythes in walls other than *cavity walls* and masonry veneer/masonry backing walls are tied together with metal ties of the individual rod type, the space between wythes shall be completely filled with mortar.

6) Ties described in Sentence (5) shall be
a) located within 300 mm of openings and spaced not more than 900 mm apart around openings, and
b) spaced not more than 900 mm apart horizontally and 460 mm apart vertically at other locations.

7) Except as required in Sentences (8) and (9), where the inner and outer wythes of *cavity walls* are tied with individual wire ties, the ties shall be spaced not more than 900 mm apart horizontally and 400 mm apart vertically.

8) Within 100 mm of the bottom of each floor or roof assembly where the cavity extends below the assemblies, the ties described in Sentence (7) shall be spaced not more than 600 mm apart horizontally.

9) Within 300 mm of any openings, the ties described in Sentence (7) shall be spaced not more than 900 mm apart.

9.20.9.5. Ties for Masonry Veneer

1) Masonry veneer 75 mm or more in thickness and resting on a bearing support shall be tied to masonry backing or to wood framing members with straps that are
a) corrosion-resistant,
b) not less than 0.76 mm thick,
c) not less than 22 mm wide,
d) shaped to provide a key with the mortar, and
e) spaced in accordance with Table 9.20.9.5.

Table 9.20.9.5.
Veneer Tie Spacing
Forming Part of Sentence 9.20.9.5.(1)

Maximum Vertical Spacing, mm	Maximum Horizontal Spacing, mm
400	800
500	600
600	400

2) Straps described in Sentence (1) that are fastened to wood framing members shall be
a) bent at a right angle within 6 mm from the fastener, and
b) fastened with corrosion-resistant 3.18 mm diam screws or spiral nails having a wood penetration of not less than 63 mm.

3) Masonry veneer individually supported by masonry or wood-frame backing shall be secured to the backing in conformance with Subsection 4.3.2.

9.20.9.6. Reinforcing for Glass Block

1) Glass block shall have horizontal joint reinforcement of 2 corrosion-resistant bars of not less than 3.76 mm diam or expanded metal strips not less than 75 mm wide

a) spaced at vertical intervals of not more than 600 mm for units 200 mm or less in height, and
b) installed in every horizontal joint for units higher than 200 mm.

2) Reinforcement required in Sentence (1) shall be lapped not less than 150 mm.

9.20.10. Lateral Support

9.20.10.1. Lateral Support Required

1) Masonry walls shall be laterally supported by floor or roof construction or by intersecting masonry walls or buttresses.

2) The spacing of supports required in Sentence (1) shall be not more than
a) 20 times the wall thickness for all *loadbearing* walls and exterior non-*loadbearing* walls, and
b) 36 times the wall thickness for interior non-*loadbearing* walls.

3) In applying Sentence (2), the thickness of *cavity walls* shall be taken as the greater of
a) two-thirds of the sum of the thicknesses of the wythes, or
b) the thickness of the thicker wythe.

4) Floor and roof constructions providing lateral support for walls as required in Sentence (1) shall be constructed to transfer lateral loads to walls or buttresses approximately at right angles to the laterally supported walls.

9.20.11. Anchorage of Roofs, Floors and Intersecting Walls

9.20.11.1. Anchorage to Floor or Roof Assemblies where Masonry Walls Require Lateral Support

1) Where required to receive lateral support (See Subsection 9.20.10.), masonry walls shall be anchored to each floor or roof assembly at maximum intervals of 2 m, except that anchorage to floor joists not more than 1 m above *grade* may be omitted.

2) Anchors required in Sentence (1) shall be corrosion-resistant and be not less than the equivalent of 40 mm by 4.76 mm thick steel straps.

3) Anchors required in Sentence (1) shall be shaped to provide a mechanical key with the masonry and shall be securely fastened to the horizontal support to develop the full strength of the anchor.

4) When joists are parallel to the wall, anchors required in Sentence (1) shall extend across not less than 3 joists.

9.20.11.2. Bonding and Tying Intersecting Masonry Walls where Walls Require Lateral Support

1) Where required to provide lateral support, intersecting walls shall be bonded or tied together.

2) Where bonding is used to satisfy the requirements of Sentence (1), 50% of the adjacent masonry units in the intersecting wall, distributed uniformly over the height of the intersection, shall be embedded in the laterally supported wall.

3) Where tying is used to satisfy the requirements of Sentence (1), the ties shall be
a) corrosion-resistant metal,
b) equivalent to not less than 4.76 mm by 40 mm steel strapping,
c) spaced not more than 800 mm o.c. vertically, and
d) shaped at both ends to provide sufficient mechanical key to develop the strength of the ties.

9.20.11.3. Anchoring Intersecting Wood-Frame Walls to Masonry Walls

1) Wood-frame walls shall be anchored to masonry walls that they intersect with not less than 4.76 mm diam corrosion-resistant steel rods spaced not more than 900 mm o.c. vertically.

2) Anchors required in Sentence (1) shall be fastened to the wood framing at one end and shaped to provide a mechanical key at the other end to develop the strength of the anchor.

9.20.11.4. Anchoring Wood-Frame Roof Systems to Masonry Walls

1) Except as permitted in Sentence (2), roof systems of wood-frame construction shall be anchored to exterior masonry walls by not less than 12.7 mm diam anchor bolts,

a) spaced not more than 2.4 m apart,

b) embedded not less than 90 mm into the masonry, and

c) fastened to a rafter plate of not less than 38 mm thick lumber.

2) The roof system described in Sentence (1) is permitted to be anchored by nailing the wall furring strips to the side of the rafter plate.

9.20.11.5.Anchoring Masonry Cornices, Sills and Trim to Masonry Walls

1) Cornices, sills or other trim of masonry material which project beyond the wall face shall have not less than 65% of their mass, but not less than 90 mm, within the wall or shall be adequately anchored to the wall with corrosion-resistant anchors.

9.20.11.6.Anchoring to Masonry Piers

1) Where anchor bolts are to be placed in the top of a masonry pier, the pier shall conform to the requirements of Sentence 9.15.2.3.(4) and shall be capped with concrete or reinforced masonry not less than 200 mm thick.

9.20.12. Corbelling

9.20.12.1.Corbelling

1) All corbelling shall consist of *solid masonry units*.

2) The units referred to in Sentence (1) shall be corbelled so that the horizontal projection of any unit does not exceed 25 mm and the total projection does not exceed one third of the total wall thickness.

9.20.12.2.Corbelling for Cavity Walls

1) Cavity walls of greater thickness than the *foundation* wall on which they rest shall not be corbelled but may project 25 mm over the outer face of the *foundation* wall disregarding parging.

2) Where the *foundation* wall referred to in Sentence (1) is unit masonry, it is permitted to be corbelled to meet flush with the inner face of a *cavity wall* provided

a) the projection of each course does not exceed half the height or one third the thickness of the corbelled unit, and

b) the total corbel does not exceed one third of the *foundation* wall thickness.

(See Note A-9.20.12.2.(2).)

9.20.12.3.Corbelling for Masonry Veneer

1) Masonry veneer resting on a bearing support shall not project more than 25 mm beyond the supporting base where the veneer is not less than 90 mm thick, and 12 mm beyond the supporting base where the veneer is less than 90 mm thick.

2) In the case of rough stone veneer, the projection, measured as the average projection of the stone units, shall not exceed one-third the bed width beyond the supporting base.

9.20.13. Control of Rainwater Penetration

9.20.13.1.Materials for Flashing

1) Materials used for flashing shall conform to Table 9.20.13.1.

Table 9.20.13.1.
Flashing Materials
Forming Part of Sentence 9.20.13.1.(1)

Material	Minimum Thickness, mm	
	Exposed Flashing	Concealed Flashing
Aluminum	0.48	–
Copper	0.46	0.46
Copper or aluminum laminated to felt or kraft paper	–	0.05
Galvanized steel	0.33	0.33
Lead sheet	1.73	1.73
Polyethylene	–	0.50
Roll roofing, Type S	–	standard
Zinc	0.46	0.46

2) Aluminum flashing in contact with masonry or concrete shall be effectively coated or separated from the masonry or concrete by an impervious membrane.

9.20.13.2.Fastening of Flashing

1) Fastening devices for flashing shall be corrosion-resistant and, where metal flashing is used, shall be compatible with the flashing with respect to galvanic action.

9.20.13.3.Location of Flashing

1) Flashing shall be installed in masonry and masonry veneer walls

a) beneath jointed masonry window sills,

b) over the back and top of parapet walls,

c) over the heads of glass block panels,

d) beneath weep holes, and

e) over the heads of window or door openings in exterior walls when the vertical distance between the top of a window or door frame and the bottom edge of the eave exceeds one-quarter of the horizontal eave overhang.

9.20.13.4.Extension of Flashing

1) When installed beneath jointed masonry window sills or over the heads of openings, flashing shall extend from the front edge of the masonry up behind the sill or lintel.

9.20.13.5.Flashing for Weep Holes in Masonry/Masonry Walls

1) Flashing beneath weep holes in *cavity walls* and masonry veneer/masonry backing walls shall

a) be bedded not less than 25 mm in the inside wythe,

b) extend to not less than 5 mm beyond the outer face of the *building* element below the flashing, and

c) be installed with a nominally horizontal slope toward the outside wythe.

9.20.13.6.Flashing for Weep Holes in Masonry Veneer

1) Flashing beneath weep holes in masonry veneer over masonry backing walls shall conform to the flashing requirements for *cavity walls* and masonry veneer/masonry backing walls in Article 9.20.13.5.

2) Flashing beneath weep holes in masonry veneer over wood-frame walls shall be installed so that it extends from a point not less than 5 mm beyond the outer face of the *building* element below the flashing to a point 150 mm up the wood-frame wall.

3) Where the frame wall is sheathed with a sheathing membrane, a non-wood-based rigid exterior insulating sheathing or a semi-rigid insulating sheathing with an integral sheathing membrane, the flashing shall be installed behind the sheathing membrane or insulating sheathing.

4) Flashing described in Sentence (2) is permitted to conform to the requirements for concealed flashing in Table 9.20.13.1.

9.20.13.7.Flashing Joints

1) Joints in flashing shall be made watertight.

9.20.13.8.Required Weep Holes

1) Weep holes spaced not more than 800 mm apart shall be provided at the bottom of

a) cavities in *cavity walls*, and

b) cavities or air spaces in masonry veneer walls.

2) The cavities or air spaces described in Sentence (1) shall include those above lintels over window and door openings required to be flashed in conformance with Article 9.20.13.3.

9.20.13.9.Protection of Interior Finish

1) Except as provided in Sentence (3), where the interior finish of the exterior walls of a *building* is a type that may be damaged by moisture, exterior masonry walls, other than *cavity walls* or walls that are protected for their full height by a roof of a carport or porch, shall be covered on the interior surface with sheathing membrane conforming to CAN/CGSB-51.32-M, “Sheathing, Membrane, Breather Type,” lapped not less than 100 mm at the joints.

2) In situations described in Sentence (1), flashing shall be provided where water will accumulate, to lead it to the exterior.

3) Where insulation that effectively limits the passage of water is applied by a waterproof adhesive or mortar directly to parged masonry, the requirements for sheathing membrane in Sentence (1) do not apply. (See Note A-9.20.13.9.(3).)

9.20.13.10.Mortar Droppings

1) Cavity walls shall be constructed so that mortar droppings are prevented from forming a bridge to allow the passage of rain water across the cavity.

9.20.13.11.Caulking at Door and Window Frames

1) The junction of door and window frames with masonry shall be caulked in conformance with Subsection 9.27.4.

9.20.13.12.Drips beneath Window Sills

1) Where no flashing is installed beneath window sills, such sills shall be provided with a drip not less than 25 mm from the wall surface.

9.20.14. Protection during Work

9.20.14.1.Laying Temperature of Mortar and Masonry

1) Mortar and masonry shall be maintained at a temperature not below 5°C during installation and for not less than 48 h after installation.
2) No frozen material shall be used in mortar mix.

9.20.14.2.Protection from Weather

1) The top surface of uncompleted masonry exposed to the weather shall be completely covered with a waterproofing material when construction is not in progress.

9.20.15. Reinforcement for Earthquake Resistance

9.20.15.1.Amount of Reinforcement

1) Where reinforcement is required in this Section, masonry walls shall be reinforced horizontally and vertically with steel having a total cross-sectional area of not less than 0.002 times the horizontal cross-sectional area of the wall, so that not less than one-third of the required steel area is installed either horizontally or vertically and the remainder in the other direction.

9.20.15.2.Installation Standard

1) Where reinforcement for masonry is required in this Section, it shall be installed in conformance with the requirements for reinforced masonry as contained in CSA A371, "Masonry Construction for Buildings."

9.20.16. Corrosion Resistance

9.20.16.1.Corrosion Resistance of Connectors

1) Carbon steel connectors required to be corrosion-resistant shall be galvanized to at least the minimum standards in Table 9.20.16.1.

Table 9.20.16.1.
Minimum Requirements for Galvanizing
Forming Part of Sentence 9.20.16.1.(1)

Connector Material	ASTM Standard	Coating Class or Thickness
Wire ties and continuous reinforcing (hot-dipped galvanizing)	ASTM A 153/A 153M	Class B2 or 458 g/m^2
Hardware and bolts	ASTM A 153/A 153M	See ASTM A 153/A 153M
Strip, plate, bars and rolled sections (not less than 3.18 mm thick)	ASTM A 123/A 123M	610 g/m^2
Sheet (less than 3.18 mm thick)	ASTM A 123/A 123M	305 g/m^2 on material 0.76 mm thick(1)

Notes to Table 9.20.16.1.:
(1) ASTM A 123/A 123M does not apply to metal less than 3.18 mm thick. Galvanizing coatings may be interpolated for thicknesses between 3.18 mm and 0.76 mm.

9.20.17. Above-Ground Flat Insulating Concrete Form Walls

9.20.17.1.Thickness of Flat Insulating Concrete Form Walls

1) The thickness of the concrete in flat insulating concrete form walls not in contact with the ground shall be
a) not less than 140 mm, and

b) constant for the entire height of the wall.

9.20.17.2. Reinforcement for Flat Insulating Concrete Form Walls

1) Horizontal reinforcement in above-grade flat insulating concrete form walls shall
a) consist of
i) one 10M bar placed not more than 300 mm from the top of the wall, and
ii) 10M bars at 600 mm o.c., and
b) be placed in the middle third of the wall section.

2) Vertical reinforcement in above-grade flat insulating concrete form walls shall
a) consist of 10M bars at 400 mm o.c., and
b) be placed in the middle third of the wall section.

3) Vertical reinforcement required by Sentence (2) and interrupted by wall openings shall be placed not more than 600 mm from each side of the opening.

9.20.17.3. Openings in Non-Loadbearing Flat Insulating Concrete Form Walls

1) No openings shall occur within 1 200 mm of interior and exterior corners of exterior non-*loadbearing* flat insulating concrete form walls.

2) Portions of walls above openings in non-*loadbearing* flat insulating concrete form walls shall have a minimum depth of concrete of no less than 200 mm across the width of the opening.

3) Openings that are more than 600 mm but not more than 3 000 mm in width in non-*loadbearing* flat insulating concrete form walls shall be reinforced at the top and bottom with one 10M bar.

4) Openings more than 3 000 mm in width in non-*loadbearing* flat insulating concrete form walls shall be reinforced on all four sides with two 10M bars.

5) Reinforcing bars described in Sentences (3) and (4) shall extend 600 mm beyond the edges of the opening.

6) The cumulative width of openings in non-*loadbearing* flat insulating concrete form walls shall not make up more than 70% of the length of any wall.

9.20.17.4. Openings in Loadbearing Flat Insulating Concrete Form Walls

1) No openings shall occur within 1 200 mm of interior and exterior corners of exterior *loadbearing* flat insulating concrete form walls.

2) In *loadbearing* flat insulating concrete form walls, lintels shall be provided over all openings wider than 900 mm.

3) Lintels described in Sentence (2) shall be constructed in accordance with Span Table 9.20.17.4.-A, 9.20.17.4.-B or 9.20.17.4.-C.

4) Lintels described in Sentence (2) over openings wider than 1 200 mm shall be reinforced for shear with 10M stirrups at a maximum spacing of half the distance from the bottom reinforcing bar to the top of the lintel.

9.20.17.5. Framing Supported on Flat Insulating Concrete Form Walls

1) Floor joists supported on the side of flat insulating concrete form walls shall be supported with joist hangers secured to wood ledger boards.

2) The ledger boards referred to in Sentence (1) shall be not less than
a) 38 mm thick, and
b) the depth of the floor joists.

3) Anchor bolts shall be used to secure ledger boards to flat insulating concrete form walls and shall be
a) embedded in the wall to a depth not less than 100 mm, and
b) spaced in accordance with Table 9.20.17.5.

4) Floor joists and *building* frames supported on the top of flat insulating concrete form walls shall be anchored in conformance with Article 9.23.6.1.

Table 9.20.17.5.
Maximum Anchor Bolt Spacing for the Connection of Floor Ledgers to Flat Insulating Concrete Form Walls
Forming Part of Sentence 9.20.17.5.(3)

Maximum Clear Floor Span, m	Maximum Anchor Bolt Spacing, mm	
	Staggered 12.7 mm Diameter Anchor Bolts	Staggered 16 mm Diameter Anchor Bolts
2.44	450	500
3.0	400	450
4.0	300	400
5.0	275	325

9.20.17.6.Anchoring of Roof Framing to the Top of Flat Insulating Concrete Form Walls

1) Roof framing supported on the top of flat insulating concrete form walls shall be fixed to the top plates, which shall be anchored to the wall with anchor bolts

a) not less than 12.7 mm in diameter, and
b) spaced at not more than 1 200 mm o.c.

2) The anchor bolts described in Sentence (1) shall be placed in the centre of the flat insulating concrete form wall and shall be embedded no less than 100 mm into the concrete.

3) Attachment of roof framing to wood top plates shall be in accordance with Table 9.23.3.4.

9.20.17.7.Protection from Precipitation and Damage

1) Above-ground flat insulating concrete form walls shall be protected from precipitation and damage in conformance with Section 9.27.

Section 9.21. Masonry and Concrete Chimneys and Flues

9.21.1. General

9.21.1.1.Application

1) This Section applies to

a) rectangular *masonry or concrete chimneys* not more than 12 m in height serving fireplaces or serving *appliances* having a combined total rated heat output of 120 kW or less, and
b) flue pipes connected to such *chimneys*.

2) Chimneys, other than those described in Sentence (1), *gas vents* and *flue pipes* serving gas-, oil- or solid-fuel-burning *appliances* and their associated equipment, including *stoves*, *cooktops*, ovens and *space heaters*, covered by the standards referenced in Sentences 9.33.5.2.(1) and 9.33.5.3.(1) shall conform to Subsection 9.33.10.

3) Chimneys and *flue pipes* other than those described in Sentences (1) and (2) shall conform to Section 6.3.

9.21.1.2.Chimney or Flue Pipe Walls

1) The walls of any *chimney* or *flue pipe* shall be constructed so as to be smoke- and flame-tight.

9.21.2. Chimney Flues

9.21.2.1. Chimney Flue Limitations

1) A *chimney flue* that serves a fireplace or incinerator shall not serve any other *appliance*.

2) A *chimney flue* that serves a solid-fuel-burning *appliance* shall not be connected to a natural-gas- or propane-fired *appliance*.

3) A *chimney flue* that serves a solid-fuel-burning *appliance* shall not be connected to an oil-burning *appliance* unless the solid-fuel-burning *appliance* is certified for such installation and the installation of both *appliances* meets the requirements of the relevant standards referenced in Article 9.33.5.2.

9.21.2.2. Connections of More Than One Appliance

1) Except as required by Article 9.21.2.1., where two or more fuel-burning *appliances* are connected to the same *chimney flue*, the connections shall be made as described in Sentences (2) to (4) and an adequate draft shall be provided for the connected *appliances* in conformance with the requirements of applicable provincial or municipal bylaws and regulations or, in the absence of such regulations or bylaws, with the requirements of the relevant standards listed in Subsection 9.33.10.

2) Where 2 or more fuel-burning *appliances* are connected to the same *chimney flue*, the *appliances* shall be located on the same *storey*.

3) The connection referred to in Sentence (2) for a solid-fuel-burning *appliance* shall be made below connections for *appliances* burning other fuels.

4) The connection referred to in Sentence (2) for a liquid-fuel-burning *appliance* shall be made below any connections for *appliances* burning natural gas or propane.

9.21.2.3. Inclined Chimney Flues

1) Chimney flues shall not be inclined more than 45° to the vertical.

9.21.2.4. Size of Chimney Flues

1) Except for *chimneys* serving fireplaces, the size of a *chimney flue* shall conform to the requirements of the *appliance* installation standards referenced in Sentences 9.33.5.2.(1) and 9.33.5.3.(1).

2) Where a *chimney flue* serves only one *appliance*, the *flue* area shall be at least equal to that of the *flue pipe* connected to it.

9.21.2.5. Fireplace Chimneys

1) The size of a *chimney flue* serving a masonry fireplace shall conform to Table 9.21.2.5.-A or 9.21.2.5.-B.

Table 9.21.2.5.-A
Diameter of Round Flues for Fireplace Chimneys
Forming Part of Sentence 9.21.2.5.(1)

Fireplace Opening, m²	Chimney Height, m							
	3.0 to 4.5		> 4.5 to 5.9		> 5.9 to 8.9		> 8.9 to 12	
	Flue Diameter, mm							
	min.	max.	min.	max.	min.	max.	min.	max.
up to 0.150	110	170	100	160	90	150	90	150
0.151 to 0.250	150	210	130	190	130	190	120	180
0.251 to 0.350	180	240	160	220	150	210	140	200

0.351 to 0.500	220	280	200	260	190	250	170	230
0.501 to 0.650	260	320	230	290	220	280	200	260
0.651 to 0.800	290	350	260	320	240	300	220	280
0.801 to 1.00	330	390	290	350	270	330	250	310
1.01 to 1.20	360	420	320	380	300	360	270	330
1.21 to 1.40	390	450	350	410	330	390	300	360
1.41 to 1.60	420	480	380	440	350	410	320	380
1.61 to 1.80	–	–	400	460	370	430	340	400
1.81 to 2.00	–	–	–	–	400	460	360	420
2.01 to 2.20	–	–	–	–	–	–	380	440

Table 9.21.2.5.-B
Rectangular Flue Sizes for Fireplace Chimneys
Forming Part of Sentence 9.21.2.5.(1)

Fireplace Opening, m^2	Chimney Height, m							
	3.0 to 4.5		> 4.5 to 5.9		> 5.9 to 8.9		> 8.9 to 12	
	Flue Size, mm							
	min.	max.	min.	max.	min.	max.	min.	max.
up to 0.150	200 × 200	200 × 200	100 × 200	100 × 200	100 × 200	100 × 200	100 × 200	100 × 200
0.151 to 0.250	200 × 200	200 × 200	200 × 200	200 × 200	200 × 200	200 × 200	200 × 200	200 × 200
0.251 to 0.350	200 × 300	200 × 300	200 × 200	200 × 300	200 × 200	200 × 200	200 × 200	200 × 200
0.351 to 0.500	300 × 300	300 × 300	200 × 300	200 × 300	200 × 300	200 × 300	200 × 200	200 × 300
0.501 to 0.650	300 × 300	300 × 400	300 × 300	300 × 300	300 × 300	300 × 300	200 × 300	200 × 300
0.651 to 0.800	300 × 400	300 × 400	300 × 300	300 × 400	300 × 300	300 × 300	300 × 300	300 × 300
0.801 to 1.00	400 × 400	400 × 400	300 × 400	300 × 400	300 × 400	300 × 400	300 × 300	300 × 300
1.01 to 1.20	400 × 400	400 × 400	400 × 400	400 × 400	300 × 400	300 × 400	300 × 400	300 × 400
1.21 to 1.40	–	–	400 × 400	400 × 400	400 × 400	400 × 400	300 × 400	300 × 400
1.41 to 1.60	–	–	–	–	400 × 400	400 × 400	400 × 400	400 × 400
1.61 to 1.80	–	–	–	–	–	–	400 × 400	400 × 400

1.81 to 2.00	–	–	–	–	–	–	400 × 400	400 × 400

9.21.2.6. Oval Chimney Flues

1) The width of an oval *chimney flue* shall be not less than two-thirds its breadth.

9.21.3. Chimney Lining

9.21.3.1. Lining Materials

1) Every *masonry or concrete chimney* shall have a lining of clay, concrete, firebrick or metal.

9.21.3.2. Joints in Chimney Liners

1) Joints of *chimney liners* shall be sealed to provide a barrier to the passage of *flue* gases and condensate into the cavity between the liner and the surrounding masonry.

2) Joints of clay, concrete or firebrick *chimney liners* shall be struck flush to provide a straight, smooth, aligned *chimney flue*.

9.21.3.3. Clay Liners

1) Clay liners shall conform to CAN/CSA-A324-M, “Clay Flue Liners.”

2) Liners referred to in Sentence (1) shall be not less than 15.9 mm thick and shall be capable of resisting, without softening or cracking, a temperature of 1 100°C.

9.21.3.4. Firebrick Liners

1) Firebrick liners shall conform to ASTM C 27, “Fireclay and High-Alumina Refractory Brick.”

2) Firebrick liners shall be laid with high temperature cement mortar conforming to CAN/CGSB-10.3, “Air Setting Refractory Mortar.”

9.21.3.5. Concrete Liners

1) Concrete *flue* liners shall conform to Clause 4.2.6.4 of CAN/CSA-A405-M, “Design and Construction of Masonry Chimneys and Fireplaces.”

9.21.3.6. Metal Liners

1) Metal liners shall be constructed of not less than 0.3 mm thick stainless steel.

2) Metal liners referred to in Sentence (1) shall only be used in *chimneys* serving gas- or oil-burning *appliances*. (See Note A-9.21.3.6.(2).)

9.21.3.7. Installation of Chimney Liners

1) Chimney liners shall be installed when the surrounding masonry or concrete is placed.

9.21.3.8. Spaces between Liners and Surrounding Masonry

1) A space not less than 10 mm wide shall be left between a *chimney liner* and surrounding masonry.

2) The space required in Sentence (1) shall not be filled with mortar.

9.21.3.9. Mortar for Chimney Liners

1) Chimney liners used in *chimneys* for solid-fuel-burning *appliances* shall be laid in a full bed of

a) high temperature cement mortar conforming to CAN/CGSB-10.3, “Air Setting Refractory Mortar,” or

b) mortar consisting of 1 part Portland cement to 3 parts sand by volume.

2) Chimney liners used in *chimneys* for oil- or gas-burning *appliances* shall be laid in a full bed of mortar consisting of 1 part Portland cement to 3 parts sand by volume.

9.21.3.10. Extension of Chimney Liners

1) Chimney liners shall extend from a point not less than 200 mm below the lowest *flue pipe* connection to a point not less than 50 mm or more than 100 mm above the *chimney* cap.

9.21.4. Masonry and Concrete Chimney Construction

9.21.4.1. Unit Masonry

1) Unit masonry shall conform to Section 9.20.

9.21.4.2. Concrete

1) Concrete shall conform to Section 9.3.

9.21.4.3. Footings

1) Footings for *masonry chimneys* and *concrete chimneys* shall conform to Section 9.15.

9.21.4.4. Height of Chimney Flues

1) A *chimney flue* shall extend not less than

a) 900 mm above the highest point at which the *chimney* comes in contact with the roof, and
b) 600 mm above the highest roof surface or structure within 3 m of the *chimney*.

(See Note A-9.21.4.4.(1).)

9.21.4.5. Lateral Stability

1) Except as provided in Sentence (2), *chimneys* shall be braced in accordance with Subsection 4.3.2. to provide lateral stability under wind loads.

2) A *chimney* need not be laterally braced provided

a) no horizontal outside dimension is less than 400 mm, and
b) the *chimney* extends not more than 3.6 m above a roof or the masonry wall of which it forms a part.

(See Note A-9.21.4.5.(2).)

9.21.4.6. Chimney Caps

1) The top of a *chimney* shall have a waterproof cap of reinforced concrete, masonry or metal.

2) The cap required in Sentence (1) shall slope from the lining and be provided with a drip not less than 25 mm from the *chimney* wall.

3) Cast-in-place concrete caps shall be separated from the *chimney liner* by a bond break and be sealed at that location.

4) Jointed precast concrete or masonry *chimney* caps shall have flashing installed beneath the cap extending from the liner to the drip edge.

9.21.4.7. Cleanout

1) A cleanout opening with a metal frame and a tight-fitting metal door shall be installed near the base of the *chimney flue*.

9.21.4.8. Wall Thickness

1) The walls of a masonry *chimney* shall be built of *solid masonry units* not less than 75 mm thick.

9.21.4.9. Separation of Flue Liners

1) Flue liners in the same *chimney* shall be separated by not less than 75 mm of masonry or concrete exclusive of liners where clay liners are used, or 90 mm of firebrick where firebrick liners are used.

2) Flue liners referred to in Sentence (1) shall be installed to prevent significant lateral movement.

9.21.4.10. Flashing

1) Junctions with adjacent materials shall be adequately flashed to shed water.

9.21.5. Clearance from Combustible Construction

9.21.5.1. Clearance from Combustible Materials

1) The clearance between *masonry or concrete chimneys* and *combustible* framing shall be not less than
a) 50 mm for interior *chimneys*, and
b) 12 mm for exterior *chimneys*.
(See Note A-9.21.5.1.(1).)

2) A clearance of not less than 150 mm shall be provided between a cleanout opening and *combustible* material.

3) Combustible flooring and subflooring shall have not less than a 12 mm clearance from *masonry or concrete chimneys*.

9.21.5.2. Sealing of Spaces

1) All spaces between *masonry or concrete chimneys* and *combustible* framing shall be sealed top or bottom with *noncombustible* material.

9.21.5.3. Support of Joists or Beams

1) Joists or beams may be supported on masonry walls which enclose *chimney flues* provided the *combustible* members are separated from the *flue* by not less than 290 mm of *solid masonry*.

Section 9.22. Fireplaces

9.22.1. General

9.22.1.1. Application

1) Except when otherwise specifically stated herein, this Section applies to masonry fireplaces constructed on-site.

9.22.1.2. Masonry and Concrete

1) Except as otherwise stated in this Section, unit masonry shall conform to Section 9.20. and concrete to Section 9.3.

2) Masonry above openings shall be supported by steel lintels conforming to Sentence 9.20.5.2.(2), reinforced concrete or a masonry arch.

9.22.1.3. Footings

1) Footings for masonry and concrete fireplaces shall conform to Section 9.15.

9.22.1.4. Combustion Air

1) Where a supply of combustion air is provided directly to the fire chamber of a fireplace, including a factory-built fireplace, the installation shall comply with the “Outdoor Air Supply” requirements provided in CAN/CSA-A405-M, “Design and Construction of Masonry Chimneys and Fireplaces.”

9.22.2. Fireplace Liners

9.22.2.1. Brick or Steel Liners

1) Except where a fireplace is equipped with a steel liner, every fireplace shall have a firebrick liner.

9.22.2.2. Firebrick Liners

1) Firebrick liners shall be not less than
- a) 50 mm thick for the sides and back, and
- b) 25 mm thick for the floor.

2) Firebrick liners shall be laid with high temperature cement mortar conforming to CAN/CGSB-10.3, "Air Setting Refractory Mortar."

3) Joints between a firebrick liner and the adjacent backing masonry shall be offset.

9.22.2.3. Steel Liners

1) Steel liners for fireplaces shall conform to CAN/ULC-S639-M, "Steel Liner Assemblies for Solid-Fuel Burning Masonry Fireplaces," and shall be installed in accordance with the installation instructions in that standard.

9.22.3. Fireplace Walls

9.22.3.1. Thickness of Walls

1) Except as provided in Sentence (2), the thickness of the back and sides of a fireplace, including the thickness of any firebrick liner, shall be not less than 190 mm where a metal liner or a firebrick liner less than 51 mm thick is used.

2) When a steel fireplace liner is used with an air circulating chamber surrounding the firebox, the back and sides of the fireplace shall consist of
- *a) solid masonry units* not less than 90 mm thick, or
- b) hollow masonry units not less than 190 mm thick.

9.22.4. Fire Chamber

9.22.4.1. Fire Chamber Dimensions

1) The distance from the back of the fire chamber to the plane of the fireplace opening shall be not less than 300 mm.

9.22.5. Hearth

9.22.5.1. Hearth Extension

1) Except as required in Sentence (2), fireplaces shall have a *noncombustible* hearth extending not less than 400 mm in front of the fireplace opening and not less than 200 mm beyond each side of the fireplace opening.

2) Where the fire chamber floor is elevated more than 150 mm above the hearth, the dimension of the hearth measured perpendicular to the plane of the fireplace opening shall be increased by not less than
- a) 50 mm for an elevation above 150 mm and not more than 300 mm, and
- b) an additional 25 mm for every 50 mm in elevation above 300 mm.

9.22.5.2. Support of Hearth

1) Except as permitted in Sentence (2), the fire chamber floor and hearth shall be supported on a reinforced concrete slab not less than 100 mm thick at its supports and, if cantilevered, not less than 50 mm thick at its unsupported edge.

2) A hearth for a fireplace with an opening raised not less than 200 mm from a *combustible* floor is permitted to be supported on that floor provided the requirements of Clauses 5.3.6.5. to 5.3.6.7. of CAN/CSA-A405-M, "Design and Construction of Masonry Chimneys and Fireplaces," are followed.

9.22.6. Damper

9.22.6.1. Required Damper and Size

1) The throat of every fireplace shall be equipped with a metal damper sufficiently large to cover the full area of the throat opening.

9.22.7. Smoke Chamber

9.22.7.1. Slope of Smoke Chamber

1) The sides of the smoke chamber connecting a fireplace throat with a *flue* shall not be sloped at an angle greater than 45° to the vertical.

9.22.7.2. Wall Thickness

1) The thickness of masonry walls surrounding the smoke chamber shall be not less than 190 mm at the sides, front and back, except that the portions of the back exposed to the outside may be 140 mm thick.

9.22.8. Factory-Built Fireplaces

9.22.8.1. Conformance to Standard

1) Factory-built fireplaces and their installation shall conform to CAN/ULC-S610-M, "Factory-Built Fireplaces."

9.22.9. Clearance of Combustible Material

9.22.9.1. Clearance to the Fireplace Opening

1) Combustible material shall not be placed on or near the face of a fireplace within 150 mm of the fireplace opening, except that where the *combustible* material projects more than 38 mm out from the face of the fireplace above the opening, such material shall be not less than 300 mm above the top of the opening.

9.22.9.2. Metal Exposed to the Interior

1) Metal exposed to the interior of a fireplace such as the damper control mechanism shall have not less than a 50 mm clearance from any *combustible* material on the face of the fireplace where such metal penetrates through the face of the fireplace.

9.22.9.3. Clearance to Combustible Framing

1) Not less than a 100 mm clearance shall be provided between the back and sides of a fireplace and *combustible* framing, except that a 50 mm clearance is permitted where the fireplace is located in an exterior wall.

2) Not less than a 50 mm clearance shall be provided between the back and sides of the smoke chamber of a fireplace and *combustible* framing, except that a 25 mm clearance is permitted where the fireplace is located in an exterior wall.

9.22.9.4. Heat-Circulating Duct Outlets

1) The clearance of *combustible* material above heat-circulating duct outlets from those outlets shall be not less than

- a) 300 mm where the *combustible* material projects not less than 38 mm from the face, and
- b) 150 mm where the projection is less than 38 mm.

9.22.10. Fireplace Inserts and Hearth-Mounted Stoves

9.22.10.1. Appliance Standard

1) Fireplace inserts and hearth-mounted *stoves* vented through the throat of a fireplace shall conform to ULC-S628, "Fireplace Inserts."

9.22.10.2. Installation

1) The installation of fireplace inserts and hearth-mounted stoves vented through the throat of a fireplace shall conform to CSA B365, "Installation Code for Solid-Fuel-Burning Appliances and Equipment."

Section 9.23. Wood-Frame Construction

9.23.1. Application

9.23.1.1. Limitations

(See Note A-9.23.1.1.) (See also Note A-9.4.2.1.(1).)

1) This Section applies to constructions where wall, floor and roof planes are generally comprised of lumber frames of small repetitive structural members, or engineered components, and where

a) roof and wall planes are clad, sheathed or braced on at least one side,
b) the small repetitive structural members are spaced not more than 600 mm o.c.,
c) the constructions do not serve as *foundations*,
d) the specified *live load* on supported subfloors and floor framing does not exceed 2.4 kPa, and
e) the span of any structural member does not exceed 12.20 m.

(See Note A-9.23.1.1.(1).)

2) Where the conditions in Sentence (1) are exceeded for wood constructions, the design of the framing and fastening shall conform to Subsection 4.3.1.

9.23.2. General

9.23.2.1. Strength and Rigidity

1) All members shall be so framed, anchored, fastened, tied and braced to provide the necessary strength and rigidity.

9.23.2.2. Protection from Decay

1) Ends of wood joists, beams and other members framing into masonry or concrete shall be treated to prevent decay where the bottom of the member is at or below ground level, or a 12 mm air space shall be provided at the end and sides of the member.

2) Air spaces required in Sentence (1) shall not be blocked by insulation, *vapour barriers* or airtight materials.

9.23.2.3. Protection from Dampness

1) Except as permitted in Sentence (2), wood framing members that are not pressure-treated with a wood preservative and that are supported on concrete in contact with the ground or *fill* shall be separated from the concrete by not less than 0.05 mm polyethylene film or Type S roll roofing.

2) Dampproofing material referred to in Sentence (1) is not required where the wood member is at least 150 mm above the ground.

9.23.2.4. Lumber

1) Lumber shall conform to Subsection 9.3.2.

9.23.3. Fasteners

9.23.3.1. Standards for Nails and Screws

1) Except as provided in Sentence (2) and unless otherwise indicated, nails specified in this Section shall be common steel wire nails or common spiral nails conforming to

a) ASTM F 1667, “Driven Fasteners: Nails, Spikes, and Staples,” or
b) CSA B111, “Wire Nails, Spikes and Staples.”

2) Nails used to comply with Table 9.23.3.4. shall have a diameter not less than that stated in Table 9.23.3.1. (See Note A-9.23.3.1.(2).)

Table 9.23.3.1.
Diameter of Nails
Forming Part of Sentence 9.23.3.1.(2)

Minimum Length of Nails, mm	Diameter of Nails, mm
57	2.87
63	3.25
76	3.66
82	3.66
101 or greater	4.88

3) Wood screws specified in this Section shall conform to ASME B18.6.1, “Wood Screws (Inch Series).” (See Note A-9.23.3.1.(3).)

9.23.3.2. Length of Nails

1) All nails shall be long enough so that not less than half their required length penetrates into the second member.

9.23.3.3. Prevention of Splitting

1) Splitting of wood members shall be minimized by staggering the nails in the direction of the grain and by keeping nails well in from the edges. (See Note A-9.23.3.3.(1).)

9.23.3.4. Nailing of Framing

1) Except as provided in Sentence (2), nailing of framing shall conform to Table 9.23.3.4.

2) Where the bottom wall plate or sole plate of an exterior wall is not nailed to floor joists, *rim joists* or blocking in conformance with Table 9.23.3.4., the exterior wall is permitted to be fastened to the floor framing by

a) having plywood, OSB or waferboard sheathing extend down over floor framing and fastened to the floor framing by nails or staples conforming to Article 9.23.3.5., or
b) tying the wall framing to the floor framing by galvanized-metal strips
  i) 50 mm wide,
  ii) not less than 0.41 mm thick,
  iii) spaced not more than 1.2 m apart, and
  iv) fastened at each end with at least two 63 mm nails.

Table 9.23.3.4.
Nailing for Framing
Forming Part of Sentence 9.23.3.4.(1)

Construction Detail	Minimum Length of Nails, mm	Minimum Number or Maximum Spacing of Nails
Floor joist or blocking perpendicular to sill plate or top wall plate below – toe nail	82	2 per floor joist or blocking
Rim joist, trimmer joist or blocking – supporting walls with required *braced wall panels* – to sill plate or top wall plate – toe nail	82	150 mm o.c.
Wood or metal strapping to underside of floor joists	57	2
Cross bridging to joists	57	2 at each end
Double header or trimmer joists	76	300 mm o.c.
Floor joist to stud (balloon construction)	76	2
Ledger strip to wood beam	82	2 per joist
Joist to joist splice (See also Table 9.23.14.8.)	76	2 at each end
Tail joist to adjacent header joist	82	5
(end nailed) around openings	101	3
Each header joist to adjacent trimmer joist	82	5
(end nailed) around openings	101	3
Stud to wall plate (each end) toe nail	63	4
or end nail	82	2
Doubled studs at openings, or studs at walls or wall intersections and corners	76	750 mm o.c.
Doubled top wall plates(1)	76	600 mm o.c.
Bottom wall plate or sole plate to floor joists, *rim joists* or blocking (exterior walls)(2)	82	400 mm o.c.
Bottom wall plate or sole plate – in required *braced wall panels* – to floor joists, *rim joists* or blocking (exterior walls)(2)	82	150 mm o.c.
Interior walls to framing or subflooring	82	600 mm o.c.

Required *braced wall panels* – in interior walls – to framing above and below	82	150 mm o.c.
Horizontal member over openings in non-*loadbearing* walls – each end	82	2
Lintels to studs	82	2 at each end
Ceiling joist to plate – toe nail each end	82	2
Roof rafter, roof truss or roof joist to plate – toe nail(3)	82	3
Rafter plate to each ceiling joist	101	2
Rafter to joist (with ridge supported)	76	3
Rafter to joist (with ridge unsupported)	76	see Table 9.23.14.8.
Gusset plate to each rafter at peak	57	4
Rafter to ridge board – toe nail – end nail	82	3
Collar tie to rafter – each end	76	3
Collar tie lateral support to each collar tie	57	2
Jack rafter to hip or valley rafter	82	2
Roof strut to rafter	76	3
Roof strut to *loadbearing wall – toe nail*	82	2
38 mm × 140 mm or less plank decking to support	82	2
Plank decking wider than 38 mm × 140 mm to support	82	3
38 mm edge laid plank decking to support (toe nail)	76	1
38 mm edge laid plank to each other	76	450 mm o.c.

Notes to Table 9.23.3.4.:

(1) See Article 9.23.11.4. for requirements on the nailing of top plates in *braced wall bands*.

(2) See Sentence 9.23.3.4.(2).

(3) See Sentence 9.23.3.4.(3).

3) Where the 1-in-50 hourly wind pressure is equal to or greater than 0.8 kPa, roof rafters, joists or trusses shall be tied to the wall framing with connectors that will resist a factored uplift load of 3 kN.

4) Galvanized-steel straps are deemed to comply with Sentence (3), provided they are

a) 50 mm wide,

b) not less than 0.91 mm thick, and

c) fastened at each end with at least four 63 mm nails.

9.23.3.5. Fasteners for Sheathing or Subflooring

1) Except as provided in Sentences (2) to (4), fastening of sheathing and subflooring shall conform to Table 9.23.3.5.-A.

Table 9.23.3.5.-A
Fasteners for Subflooring and for Sheathing where the 1-in-50 HWP < 0.8 kPa and $S_a(0.2) \le 0.70$
Forming Part of Sentence 9.23.3.5.(1)

Element	Minimum Length of Fasteners, mm				Minimum Number or Maximum Spacing of Fasteners
	Common or Spiral Nails	Ring Threaded Nails or Screws	Roofing Nails	Staples	
Board lumber 184 mm or less wide	51	45	n/a	51	2 per support
Board lumber more than 184 mm wide	51	45	n/a	51	3 per support
Fibreboard sheathing up to 13 mm thick	n/a	n/a	44	28	150 mm o.c. along edges and 300 mm o.c. along intermediate supports
Gypsum sheathing up to 13 mm thick	n/a	n/a	44	n/a	
Plywood, OSB or waferboard up to 10 mm thick	51	45	n/a	38	
Plywood, OSB or waferboard over 10 mm and up to 20 mm thick	51	45	n/a	51	
Plywood, OSB or waferboard over 20 mm and up to 25 mm thick	57	51	n/a	n/a	

2) Fastening of roof sheathing and sheathing in required *braced wall panels* shall conform to Table 9.23.3.5.-B, where

a) the 1-in-50 hourly wind pressure (HWP) is equal to or greater than 0.8 kPa and less than 1.2 kPa and the seismic spectral response acceleration, $S_a(0.2)$, is not more than 0.90, or

b) the seismic spectral response acceleration, $S_a(0.2)$, is greater than 0.70 and not more than 0.90.

Table 9.23.3.5.-B
Fasteners for Sheathing where 0.8 kPa ≤ 1-in-50 HWP < 1.2 kPa and $S_a(0.2) \leq 0.90$ or where $0.70 < S_a(0.2) \leq 0.90$
Forming Part of Sentence 9.23.3.5.(2)

Element	Minimum Length of Fasteners, mm			Minimum Number or Maximum Spacing of Fasteners
	Common, Spiral or Ring Thread Nails	Screws	14-gauge Staples	
Board lumber 184 mm or less wide	63	51	63	2 per support
Board lumber more than 184 mm wide	63	51	63	3 per support
Plywood, OSB or waferboard up to 20 mm thick(1)	63	51	63	150 mm o.c. along edges and 300 mm o.c. along intermediate supports; and for roof sheathing where HWP is equal to or greater than 0.8 kPa and less than 1.2 kPa, 50 mm o.c. within 1 m of the edges of the roof
Plywood, OSB or waferboard over 20 mm and up to 25 mm thick	63	57	n/a	

Notes to Table 9.23.3.5.-B:
(1) See Note A-Table 9.23.3.5.-B.

3) Fastening of roof sheathing and sheathing in required *braced wall panels* shall conform to Table 9.23.3.5.-C, where
a) the 1-in-50 hourly wind pressure (HWP) is equal to or greater than 0.8 kPa and less than 1.2 kPa and the spectral response acceleration, $S_a(0.2)$, is not more than 1.8, or
b) the seismic spectral response acceleration, $S_a(0.2)$, is greater than 0.90 and not more than 1.8.

Table 9.23.3.5.-C
Fasteners for Sheathing where 0.8 kPa ≤ 1-in-50 HWP < 1.2 kPa and $S_a(0.2) \le 1.8$ or where $0.90 < S_a(0.2) \le 1.8$
Forming Part of Sentence 9.23.3.5.(3)

Element	Minimum Length of Fasteners, mm		Minimum Number or Maximum Spacing of Fasteners
	Common, Spiral or Ring Thread Nails	Screws	
Plywood, OSB or waferboard up to 20 mm thick(1)	63	51	75 mm o.c. along edges and 300 mm o.c. along intermediate supports; and for roof sheathing where 1-in-50 HWP is equal to or greater than 0.8 kPa and less than 1.2 kPa, 50 mm o.c. within 1 m of the edges of the roof
Plywood, OSB or waferboard over 20 mm and up to 25 mm thick	63	57	

Notes to Table 9.23.3.5.-C:
(1) See Note A-Table 9.23.3.5.-B.

4) Fastening of sheathing shall conform to Part 4,
a) where the 1-in-50 hourly wind pressure is equal to or greater than 1.2 kPa, or
b) for required *braced wall panels*, where the seismic spectral response acceleration, $S_a(0.2)$, is greater than 1.8.

5) Staples shall not be less than 1.6 mm in diameter or thickness, with not less than a 9.5 mm crown driven with the crown parallel to framing.

6) Roofing nails for the attachment of fibreboard or gypsum sheathing shall not be less than 3.2 mm in diameter with a minimum head diameter of 11.1 mm.

7) Flooring screws shall not be less than 3.2 mm in diameter.

8) The edges of sheathing in a *braced wall panel* shall be supported and fastened to wood blocking where
a) the seismic spectral response acceleration, $S_a(0.2)$, is greater than 1.2, or
b) the *braced wall panel* supports more than a roof of lightweight construction.

9.23.4. Maximum Spans

9.23.4.1. Application

1) Spans provided in this Subsection for joists, beams and lintels supporting floors shall apply only where
a) the floors serve residential areas as described in Table 4.1.5.3., or
b) the uniformly distributed *live load* on the floors does not exceed that specified for residential areas as described in Table 4.1.5.3.

2) Spans for joists, beams and lintels supporting floors shall be determined according to Subsection 4.1.3. where the supported floors
a) serve other than residential areas, or
b) support a uniform *live load* in excess of that specified for residential areas.

9.23.4.2. Spans for Joists, Rafters and Beams

(See Note A-9.23.4.2.)

1) Except as required in Sentence (2) and Article 9.23.14.10., spans for wood joists and rafters shall conform to the spans shown in Span Tables 9.23.4.2.-A to 9.23.4.2.-G for the uniform *live loads* shown in the Tables. (See Article 9.4.2.2.)

2) Spans for floor joists that are not selected from Span Tables 9.23.4.2.-A and 9.23.4.2.-B and that are required to be designed for the same loading conditions, shall not exceed the design requirements for uniform loading and vibration criteria. (See Note A-9.23.4.2.(2).)

3) Spans for built-up wood and glued-laminated timber floor beams shall conform to the spans in Span Tables 9.23.4.2.-H to 9.23.4.2.-K. (See Article 9.4.2.2.)

4) Spans for roof ridge beams shall conform to the spans in Span Table 9.23.4.2.-L for the uniform snow load shown. (See Articles 9.4.2.2. and 9.23.14.8.)

9.23.4.3. Steel Beams

1) The spans for steel floor beams with laterally supported top flanges shall conform to Table 9.23.4.3. (See Note A-9.23.4.3.(1).)

2) Beams described in Sentence (1) shall at least meet the requirements for Grade 350 W steel contained in CSA G40.21, "Structural Quality Steel."

Table 9.23.4.3.
Maximum Spans for Steel Beams Supporting Floors in Dwelling Units(1)
Forming Part of Sentence 9.23.4.3.(1)

Section	Supported Joist Length, m (half the sum of joist spans on both sides of the beam)						
	2.4	3.0	3.6	4.2	4.8	5.4	6.0
One *Storey* Supported							
W150 × 22	5.5	5.2	4.9	4.8	4.6	4.5	4.3
W200 × 21	6.5	6.2	5.9	5.7	5.4	5.1	4.9
W200 × 27	7.3	6.9	6.6	6.3	6.1	5.9	5.8
W200 × 31	7.8	7.4	7.1	6.8	6.6	6.4	6.2
W250 × 24	8.1	7.6	7.3	7.0	6.6	6.2	5.9
W250 × 33	9.2	8.7	8.3	8.0	7.7	7.5	7.3
W250 × 39	10.0	9.4	9.0	8.6	8.4	8.1	7.9
W310 × 31	10.4	9.8	9.4	8.9	8.4	8.0	7.6
W310 × 39	11.4	10.7	10.2	9.8	9.5	9.2	9.0
Two *Storeys* Supported							
W150 × 22	4.9	4.4	4.1	3.8	3.5	3.4	3.2
W200 × 21	5.6	5.1	4.6	4.3	4.1	3.8	3.7

W200 × 27	6.4	6.1	5.6	5.3	4.9	4.7	4.4
W200 × 31	6.9	6.5	6.2	5.8	5.4	5.1	4.9
W250 × 24	6.8	6.1	5.6	5.2	4.9	4.6	4.4
W250 × 33	8.2	7.7	7.0	6.5	6.1	5.8	5.5
W250 × 39	8.8	8.3	7.8	7.2	6.8	6.4	6.1
W310 × 31	8.7	7.8	7.2	6.7	6.2	5.9	5.6
W310 × 39	10.0	9.3	8.5	7.9	7.4	7.0	6.7

Notes to Table 9.23.4.3.:

(1) See Note A-Table 9.23.4.3.

9.23.4.4. Concrete Topping

(See Note A-9.23.4.4.)

1) Except as permitted in Sentence (2), where a floor is required to support a concrete topping, the joist spans shown in Span Table 9.23.4.2.-A or the spacing of the members shall be reduced to allow for the loads due to the topping.

2) Where a floor is required to support a concrete topping, joist spans are permitted to be selected from Span Table 9.23.4.2.-B provided the concrete

a) is 38 to 51 mm thick,

b) is normal weight,

c) is placed directly on the subflooring, and

d) has not less than 20 MPa compressive strength after 28 days.

3) Where a floor is required to support a concrete topping not more than 51 mm thick, the allowable beam spans shown in Span Tables 9.23.4.2.-H to 9.23.4.2.-K shall be multiplied by 0.8 or the supported length of the floor joists shall be reduced to allow for the loads due to the topping.

9.23.4.5. Heavy Roofing Materials

1) Where a roof is required to support an additional uniform *dead load* from roofing materials such as concrete roofing tile, or materials other than as specified in Section 9.27., such as clay roofing tiles, the additional load shall be allowed for by reducing

a) the spans for roof joists and rafters in Span Tables 9.23.4.2.-D to 9.23.4.2.-G, or the spacing of the members, and

b) the spans for ridge beams and lintels in Span Tables 9.23.4.2.-L and 9.23.12.3.-A to 9.23.12.3.-D.

(See Note A-9.23.4.2.)

9.23.5. Notching and Drilling

9.23.5.1. Holes Drilled in Framing Members

1) Holes drilled in roof, floor or ceiling framing members shall be not larger than one-quarter the depth of the member and shall be located not less than 50 mm from the edges, unless the depth of the member is increased by the size of the hole.

9.23.5.2. Notching of Framing Members

1) Floor, roof and ceiling framing members are permitted to be notched provided the notch is located on the top of the member within half the joist depth from the edge of bearing and is not deeper than one-third the joist depth, unless the depth of the member is increased by the size of the notch.

9.23.5.3. Wall Studs

1) Wall studs shall not be notched, drilled or otherwise damaged so that the undamaged portion of the stud is less than two-thirds the depth of the stud if the stud is *loadbearing* or 40 mm if the stud is non-*loadbearing*, unless the weakened studs are suitably reinforced.

9.23.5.4. Top Plates

1) Top plates in walls shall not be notched, drilled or otherwise weakened to reduce the undamaged width to less than 50 mm unless the weakened plates are suitably reinforced.

9.23.5.5. Roof Trusses

1) Roof truss members shall not be notched, drilled or otherwise weakened unless such notching or drilling is allowed for in the design of the truss.

9.23.6. Anchorage

9.23.6.1. Anchorage of Building Frames

1) Except as required by Sentence 9.23.6.3.(1), *building* frames shall be anchored to the *foundation* unless a structural analysis of wind and earthquake pressures shows anchorage is not required.

2) Except as provided in Sentences (3) to (6), anchorage shall be provided by

a) embedding the ends of the first floor joists in concrete, or

b) fastening the sill plate to the *foundation* with not less than 12.7 mm diam anchor bolts spaced not more than 2.4 m o.c.

3) For *buildings* with 2 or more floors supported by frame walls that are in areas where the seismic spectral response acceleration, $S_a(0.2)$, is not greater than 0.70 or the 1-in-50 hourly wind pressure (HWP) is equal to or greater than 0.80 kPa but not greater than 1.20 kPa, anchorage shall be provided by fastening the sill plate to the *foundation* with not less than two anchor bolts per *braced wall panel*, where all anchor bolts used are

a) not less than 15.9 mm in diameter, located within 0.5 m of the end of the *foundation*, and spaced not more than 2.4 m o.c, or

b) not less than 12.7 mm in diameter, located within 0.5 m of the end of the *foundation*, and spaced not more than 1.7 m o.c.

4) For *buildings* supported by frame walls that are in areas where the seismic spectral response acceleration, $S_a(0.2)$, is greater than 0.70 but not greater than 1.8 and the 1-in-50 hourly wind pressure (HWP) is not greater than 1.20 kPa, anchorage shall be provided by fastening the sill plate to the *foundation* with not less than two anchor bolts per *braced wall panel* located within 0.5 m of the end of the *foundation* and spaced in accordance with Table 9.23.6.1.

Table 9.23.6.1.
Anchor Bolt Spacing where the 1-in-50 HWP $\le$ 1.20 kPa and $0.70 < S_a(0.2) \le 1.8$
Forming Part of Sentence 9.23.6.1.(4)

Anchor Bolt Diameter, mm	$S_a(0.2)$	Maximum Spacing of Anchor Bolts Along *Braced Wall Band*, m				
		Light Construction			Heavy Construction(1)	
		Number of Floors Supported(2)				
		1	2	3	1	2
12.7	$0.70 < S_a(0.2) \le 0.80$	2.4	2.3	1.8	2.4	2.0
	$0.80 < S_a(0.2) \le 0.90$	2.4	2.3	1.8	2.4	2.0
	$0.90 < S_a(0.2) \le 1.0$	2.4	2.2	1.5	2.4	1.8
	$1.0 < S_a(0.2) \le 1.1$	2.4	2.1	1.4	2.4	1.6
	$1.1 < S_a(0.2) \le 1.2$	2.4	2.0	1.3	2.4	1.5
	$1.2 < S_a(0.2) \le 1.3$	2.4	1.9	1.3	2.4	1.5
	$1.3 < S_a(0.2) \le 1.35$	2.4	1.8	1.2	2.3	1.4
	$1.35 < S_a(0.2) \le 1.8$	2.4	1.8	1.1	2.3	1.4
15.9	$0.70 < S_a(0.2) \le 0.80$	2.4	2.4	2.2	2.4	2.4
	$0.80 < S_a(0.2) \le 0.90$	2.4	2.4	2.2	2.4	2.4
	$0.90 < S_a(0.2) \le 1.0$	2.4	2.4	2.1	2.4	2.3
	$1.0 < S_a(0.2) \le 1.1$	2.4	2.4	1.9	2.4	2.3
	$1.1 < S_a(0.2) \le 1.2$	2.4	2.4	1.9	2.4	2.2
	$1.2 < S_a(0.2) \le 1.3$	2.4	2.4	1.8	2.4	2.1
	$1.3 < S_a(0.2) \le 1.35$	2.4	2.3	1.7	2.4	2.0
	$1.35 < S_a(0.2) \le 1.8$	2.4	2.2	1.6	2.4	1.9

Notes to Table 9.23.6.1.:

(1) See Note A-9.23.13.2.(1)(a)(i).

(2) All constructions include support of a roof load in addition to the indicated number of floors.

5) Anchor bolts referred to in Sentences (2) to (4) shall be
- a) fastened to the sill plate with nuts and washers,
- b) embedded not less than 100 mm in the *foundation*, and
- c) so designed that they may be tightened without withdrawing them from the *foundation*.

6) Where the seismic spectral response acceleration, $S_a(0.2)$, is greater than 1.8 or the 1-in-50 hourly wind pressure is equal to or greater than 1.2 kPa, anchorage shall be designed according to Part 4.

9.23.6.2. Anchorage of Columns and Posts

1) Except as provided in Sentences (2) and (3), exterior columns and posts shall be anchored to resist uplift and lateral movement.

2) Except as provided in Sentence (3), where columns or posts support balconies, decks, verandas or other exterior platforms, and the distance from finished ground to the underside of the joists is not more than 600 mm,
- a) the columns or posts shall be anchored to the foundation to resist uplift and lateral movement, or
- b) the supported joists or beams shall be directly anchored to the ground to resist uplift.

3) Anchorage is not required for platforms described in Sentence (2) that
- a) are not more than 1 storey in height,
- b) are not more than 55 m^2 in area,
- c) do not support a roof, and
- d) are not attached to another structure, unless it can be demonstrated that differential movement will not adversely affect the performance of the structure to which the platform is attached.

9.23.6.3. Anchorage of Smaller Buildings

1) Buildings not more than 4.3 m wide and not more than 1 storey in building height that are not anchored in accordance with Sentence 9.23.6.1.(1) shall be anchored in conformance with the requirements of CSA Z240.10.1, “Site Preparation, Foundation, and Anchorage of Manufactured Homes.”

9.23.7. Sill Plates

9.23.7.1. Size of Sill Plates

1) Where sill plates provide bearing for the floor system, they shall be not less than 38 mm by 89 mm material.

9.23.7.2. Levelling and Sealing of Sill Plates

1) Sill plates shall be
- a) levelled by setting them on a full bed of mortar, or
- b) laid directly on the foundation if the top of the foundation is level.

(See also Article 9.23.2.3.)

2) The joint between the sill plate for exterior walls and the foundation shall be sealed in accordance with Subsection 9.25.3.

9.23.8. Beams to Support Floors

9.23.8.1. Bearing for Beams

1) Beams shall have even and level bearing and the bearing at end supports shall be not less than 89 mm long, except as stated in the notes to Span Tables 9.23.4.2.-H to 9.23.4.2.-K.

9.23.8.2. Priming of Steel Beams

1) Exterior steel beams shall be shop primed.

9.23.8.3. Built-up Wood Beams

(See Note A-9.23.8.3.)

1) Where a beam is made up of individual pieces of lumber that are nailed together, the individual members shall be 38 mm or greater in thickness and installed on edge.

2) Except as permitted in Sentence (3), where individual members of a built-up beam are butted together to form a joint, the joint shall occur over a support.

3) Where a beam is continuous over more than one span, individual members are permitted to be butted together to form a joint at or within 150 mm of the end quarter points of the clear spans, provided the quarter points are not those closest to the ends of the beam.

4) Members joined at quarter points shall be continuous over adjacent supports.

5) Joints in individual members of a beam that are located at or near the end quarter points shall not occur in adjacent members at the same quarter point and shall not reduce the effective beam width by more than half.

6) Not more than one butt joint shall occur in any individual member of a built-up beam within any one span.

7) Except as provided in Sentence (8), where 38 mm members are laid on edge to form a built-up beam, individual members shall be nailed together with a double row of nails not less than 89 mm in length, spaced not more than 450 mm apart in each row with the end nails located 100 mm to 150 mm from the end of each piece.

8) Where 38 mm members in built-up wood beams are not nailed together as provided in Sentence (7), they shall be bolted together with not less than 12.7 mm diam bolts equipped with washers and spaced not more than 1.2 m o.c., with the end bolts located not more than 600 mm from the ends of the members.

9.23.9. Floor Joists

9.23.9.1. End Bearing for Joists

1) Except when supported on ribbon boards, floor joists shall have not less than 38 mm length of end bearing.

2) Ribbon boards referred to in Sentence (1) shall be not less than 19 mm by 89 mm lumber let into the studs.

9.23.9.2. Joists Supported by Beams

1) Floor joists may be supported on the tops of beams or may be framed into the sides of beams.

2) When framed into the side of a wood beam, joists referred to in Sentence (1) shall be supported on

a) joist hangers or other acceptable mechanical connectors, or

b) not less than 38 mm by 64 mm ledger strips nailed to the side of the beam, except that 38 mm by 38 mm ledger strips may be used provided each joist is nailed to the beam by not less than four 89 mm nails, in addition to the nailing for the ledger strip required in Table 9.23.3.4.

3) When framed into the side of a steel beam, joists referred to in Sentence (1) shall be supported on the bottom flange of the beam or on not less than 38 mm by 38 mm lumber bolted to the web with not less than 6.3 mm diam bolts spaced not more than 600 mm apart.

4) Joists referred to in Sentence (3) shall be spliced above the beam with not less than 38 mm by 38 mm lumber at least 600 mm long to support the flooring.

5) Not less than a 12 mm space shall be provided between the splice required in Sentence (4) and the beam to allow for shrinkage of the wood joists.

9.23.9.3. Restraint of Joist Bottoms

1) Except as provided in Sentence 9.23.9.4.(1), bottoms of floor joists shall be restrained from twisting at each end by toe-nailing to the supports, end-nailing to the header joists or by providing continuous strapping, blocking between the joists or cross-bridging near the supports.

9.23.9.4. Strapping, Bridging, Furring and Ceilings in Span Tables 9.23.4.2.-A and -B

(See Note A-9.23.4.2.(2).)

1) Except as permitted by Sentence (5), where strapping is specified in Span Table 9.23.4.2.-A, it shall be
- a) not less than 19 mm by 64 mm, nailed to the underside of floor joists,
- b) located not more than 2 100 mm from each support or other rows of strapping, and
- c) fastened at each end to a sill or header.

2) Where bridging is specified in Span Table 9.23.4.2.-A, it shall consist of not less than 19 mm by 64 mm or 38 mm by 38 mm cross bridging located not more than 2 100 mm from each support or other rows of bridging.

3) Where bridging and strapping are specified in Span Table 9.23.4.2.-A,
- a) bridging shall
  - i) comply with Sentence (2), or
  - ii) consist of 38 mm solid blocking located not more than 2 100 mm from each support or other rows of bridging and b) securely fastened between the joists, and
- b) except as provided in Sentence (5), strapping shall comply with Sentence (1) and be installed under the bridging.

4) Bridging specified in Span Table 9.23.4.2.-B shall consist of
- a) bridging as described in Sentence (2), or
- b) 38 mm solid blocking located not more than 2 100 mm from each support or other rows of bridging and securely fastened between the joists.

5) Strapping described in Sentence (1) and Clause (3)(b) is not required where
- a) furring strips complying with Table 9.29.3.1. are fastened directly to the joists, or
- b) a panel-type ceiling finish complying with Subsection 9.29.5., 9.29.6., 9.29.7., 9.29.8., or 9.29.9. is attached directly to the joists.

6) Where a ceiling attached to wood furring is specified in Span Table 9.23.4.2.-B,
- a) the ceiling finish shall consist of gypsum board, plywood or OSB not less than 12.7 mm thick, and
- b) the furring shall be
  - i) 19 mm by 89 mm wood furring spaced at not more than 600 mm o.c., or
  - ii) 19 mm by 64 mm wood furring spaced at not more than 400 mm o.c.

9.23.9.5. Header Joists

1) Header joists around floor openings shall be doubled when they exceed 1.2 m in length.

2) The size of header joists exceeding 3.2 m in length shall be determined by calculations.

9.23.9.6. Trimmer Joists

1) Trimmer joists around floor openings shall be doubled when the length of the header joist exceeds 800 mm.

2) When the header joist exceeds 2 m in length the size of the trimmer joists shall be determined by calculations.

9.23.9.7. Support of Tail and Header Joists

1) When tail joists and header joists are supported by the floor framing, they shall be supported by suitable joist hangers or nailing in accordance with Table 9.23.3.4.

9.23.9.8. Support of Walls

1) Non-*loadbearing* walls parallel to the floor joists shall be supported by joists beneath the wall or on blocking between the joists.

2) Blocking referred to in Sentence (1) for the support of non-*loadbearing* walls shall be

a) not less than 38 mm by 89 mm lumber, and

b) except as required for the fastening of walls constructed with required *braced wall panels*, spaced not more than 1.2 m apart.

3) Except as provided in Sentence (6), non-*loadbearing* interior walls at right angles to the floor joists are not restricted as to location.

4) *Loadbearing* interior walls parallel to floor joists shall be supported by beams or walls of sufficient strength to safely transfer the specified *live loads* to the vertical supports.

5) Unless the joist size is designed to support such loads, *loadbearing* interior walls at right angles to floor joists shall be located

a) not more than 900 mm from the joist support where the wall does not support a floor, and

b) not more than 600 mm from the joist support where the wall supports one or more floors.

6) *Loadbearing* and non-*loadbearing* walls constructed with required *braced wall panels* shall be continuously supported by floor joists, blocking or *rim joists* to allow for the required fastening (See Table 9.23.3.4.).

9.23.9.9. Cantilevered Floor Joists

1) Floor joists supporting roof loads shall not be cantilevered more than 400 mm beyond their supports where 38 mm by 184 mm joists are used and not more than 600 mm beyond their supports where 38 mm by 235 mm or larger joists are used.

2) The cantilevered portions referred to in Sentence (1) shall not support floor loads from other *storeys* unless calculations are provided to show that the design resistances of the cantilevered joists are not exceeded.

3) Where cantilevered floor joists described in Sentences (1) and (2) are at right angles to the main floor joists, the tail joists in the cantilevered portion shall extend inward away from the cantilever support a distance equal to not less than 6 times the length of the cantilever, and shall be end nailed to an interior doubled header joist in conformance with Table 9.23.3.4.

9.23.10. Wall Studs

9.23.10.1. Stud Size and Spacing

1) The size and spacing of studs shall conform to Table 9.23.10.1.

Table 9.23.10.1
Size and Spacing of Studs
Forming Part of Sentence 9.23.10.1.(1)

Type of Wall	Supported Loads (including *dead loads*)	Minimum Stud Size, mm	Maximum Stud Spacing, mm(1)	Maximum Unsupported Height, m
Interior	No load	38 × 38	400	2.4
		38 × 89 flat(2)	400	3.6
	Attic not accessible by a stairway	38 × 64	600	3.0
		38 × 64 flat(2)	400	2.4

		38 × 89	600	3.6
		38 × 89 flat(2)	400	2.4
	Attic accessible by a stairway plus one floor Roof load plus one floor Attic not accessible by stairway plus 2 floors	38 × 89	400	3.6
	Roof load Attic accessible by a stairway Attic not accessible by a stairway plus one floor	38 × 64	400	2.4
		38 × 89	600	3.6
	Attic accessible by a stairway plus 2 floors Roof load plus 2 floors	38 × 89	300	3.6
		64 × 89	400	3.6
		38 × 140	400	4.2
	Attic accessible by a stairway plus 3 floors Roof load plus 3 floors	38 × 140	300	4.2
Exterior	Roof with or without attic storage	38 × 64	400	2.4
		38 × 89	600	3.0
	Roof with or without attic storage plus one floor	38 × 89	400	3.0
		38 × 140	600	3.0
	Roof with or without attic storage plus 2 floors	38 × 89	300	3.0
		64 × 89	400	3.0
		38 × 140	400	3.6
	Roof with or without attic storage plus 3 floors	38 × 140	300	1.8

Notes to Table 9.23.10.1.:

(1) See Note A-9.4.2.1.(1).

(2) See Article 9.23.10.3.

9.23.10.2. Bracing and Lateral Support

1) Where loadbearing interior walls are not finished in accordance with Section 9.29., blocking or strapping shall be fastened to the studs at mid-height to prevent sideways buckling.

9.23.10.3. Orientation of Studs

1) Except as permitted in Sentences (2) and (3), all studs shall be placed at right angles to the wall face.

2) Studs on the flat are permitted to be used in gable ends of roofs that contain only unfinished space or in non-loadbearing interior walls within the limits described in Article 9.23.10.1.

3) Wall studs that support only a load from an attic not accessible by a stairway are permitted to be placed on the flat within the limits permitted in Article 9.23.10.1. provided

a) the studs are clad on not less than one side with plywood, OSB or waferboard sheathing fastened to the face of the studs with a structural adhesive, and
b) the portion of the roof supported by the studs does not exceed 2.1 m in width.

9.23.10.4.Continuity of Studs

1) Wall studs shall be continuous for the full storey height except at openings and shall not be spliced except by fingerjoining with a structural adhesive. (See Note A-9.23.10.4.(1).)

9.23.10.5.Support for Cladding, Sheathing and Finishing Materials

1) Corners and intersections shall be designed to provide adequate support for the vertical edges of interior finishes, sheathing and cladding materials, and in no instance shall exterior corners be framed with less than the equivalent of 2 studs.
2) Where the vertical edges of interior finishes at wall intersections are supported at vertical intervals by blocking or furring, the vertical distance between such supports shall not exceed the maximum distance between supports specified in Section 9.29.

9.23.10.6.Studs at Sides of Openings

1) Where the lintel spanning the opening is more than 3 m long, studs shall be tripled on each side of the opening so that
a) the two inner studs on each side extend from the bottom of the supported lintel to the top of the bottom wall plate, and
b) the outer stud on each side extends from the bottom of the top wall plate to the bottom wall plate.
2) Except as provided in Sentence (3), where the lintel spanning the opening is not more than 3 m long, studs shall be doubled on each side of the opening so that
a) the inner studs on each side extend from the bottom of the supported lintel to the top of the bottom wall plate, and
b) the outer stud on each side extends from the bottom of the top wall plate to the bottom wall plate.
3) Single studs are permitted to be used on either side of openings
a) in non-loadbearing interior walls not required to have fire-resistance ratings, provided the studs extend from the top wall plate to the bottom wall plate, or
b) in loadbearing or non-loadbearing interior or exterior walls, provided
i) the opening is less than and within the required stud spacing, and
ii) no 2 such openings of full stud-space width are located in adjacent stud spaces.
(See Note A-9.23.10.6.(3).)

9.23.11. Wall Plates

9.23.11.1.Size of Wall Plates

1) Except as provided in Sentence (2), wall plates shall be
a) not less than 38 mm thick, and
b) not less than the required width of the wall studs.
2) In non-loadbearing walls and in loadbearing walls where the studs are located directly over framing members, the bottom wall plate is permitted to be 19 mm thick.

9.23.11.2.Bottom Wall Plates

1) A bottom wall plate shall be provided in all cases.
2) The bottom plate in exterior walls shall not project more than one-third the plate width over the support.

9.23.11.3.Top Plates

1) Except as permitted in Sentences (2) to (4), at least 2 top plates shall be provided in loadbearing walls.
2) A single top plate is permitted to be used in a section of a loadbearing wall containing a lintel provided the top plate forms a tie across the lintel.
3) A single top plate is permitted to be used in loadbearing walls where the concentrated loads from ceilings, floors and roofs are not more than 50 mm to one side of the supporting studs and in all non-loadbearing walls.
4) The top plates need not be provided in a section of loadbearing wall containing a lintel provided the lintel is tied to the adjacent wall section with not less than

a) 75 mm by 150 mm by 0.91 mm thick galvanized steel, or
b) 19 mm by 89 mm by 300 mm wood splice nailed to each wall section with at least three 63 mm nails.

9.23.11.4.Joints in Top Plates

1) Joints in the top plates of loadbearing walls shall be staggered not less than one stud spacing.
2) The top plates in loadbearing walls shall be lapped or otherwise tied at corners and intersecting walls in accordance with Sentence (4).
3) Joints in single top plates used with loadbearing walls shall be tied in accordance with Sentence (4).
4) Ties referred to in Sentences (2) and (3) shall be the equivalent of not less than 75 mm by 150 mm by 0.91 mm thick galvanized steel nailed to each wall with at least three 63 mm nails.
5) Where the seismic spectral response acceleration, Sa(0.2), is greater than 0.70 but not more than 1.8, doubled top plates in braced wall bands shall be fastened on each side of a splice with 76 mm long common steel wire nails or spiral nails in accordance with Table 9.23.11.4.

Table 9.23.11.4.
Fasteners in Doubled Top Plate Splice Connections in Braced Wall Bands where $0.70 < S_a(0.2) \leq 1.8$
Forming Part of Sentence 9.23.11.4.(5)

$S_a(0.2)$	Minimum Number of Nails on Each Side of Doubled Top Plate Splice				
	Light Construction			Heavy Construction[1]	
	Number of Supported Floors[2]				
	0	1	2	0	1
$0.70 < S_a(0.2) \leq 0.80$	2	5	8	3	8
$0.80 < S_a(0.2) \leq 0.90$	2	5	8	4	8
$0.90 < S_a(0.2) \leq 1.0$	3	6	10	4	10
$1.0 < S_a(0.2) \leq 1.1$	3	7	11	5	11
$1.1 < S_a(0.2) \leq 1.2$	3	7	11	5	12
$1.2 < S_a(0.2) \leq 1.3$	3	8	12	5	12
$1.3 < S_a(0.2) \leq 1.35$	4	8	12	5	13

1.35 < $S_a(0.2)$ ≤ 1.8	4	8	13	5	13

Notes to Table 9.23.11.4.:

(1) See Note A-9.23.13.2.(1)(a)(i).

(2) All constructions include support of a roof load in addition to the number of floors indicated.

9.23.12. Framing over Openings

9.23.12.1.Openings in Non-Loadbearing Walls

1) Except as provided in Sentence (2), openings in non-loadbearing walls shall be framed with not less than 38 mm material the same width as the studs, securely nailed to adjacent studs.

2) Openings for doors in non-loadbearing walls required to be fire separations with a fire-resistance rating shall be framed with the equivalent of at least two 38 mm thick members that are the same width as the wall plates.

9.23.12.2.Openings in Loadbearing Walls

1) Openings in loadbearing walls greater than the required stud spacing shall be framed with lintels designed to carry the superimposed loads to adjacent studs. (See Note A-9.23.10.6.(3).)

2) Except as provided in Sentence 9.23.12.3.(2), where 2 or more members are used in lintels, they shall be fastened together with not less than 82 mm nails in a double row, with nails not more than 450 mm apart in each row.

3) Lintel members are permitted to be separated by filler pieces.

9.23.12.3.Lintel Spans and Sizes

1) Spans and sizes of wood lintels shall conform to the spans shown in Span Tables 9.23.4.2.-L and 9.23.12.3.-A to 9.23.12.3.-D

a) for buildings of residential occupancy,

b) where the wall studs exceed 38 mm by 64 mm in size,

c) where the spans of supported joists do not exceed 4.9 m, and

d) where the spans of trusses do not exceed 9.8 m.

2) In loadbearing exterior and interior walls of 38 mm by 64 mm framing members, lintels shall consist of

a) 64 mm thick members on edge, or

b) 38 mm thick and 19 mm thick members fastened together with a double row of nails not less than 63 mm long and spaced not more than 450 mm apart.

3) Lintels referred to in Sentence (2)

a) shall be not less than 50 mm greater in depth than those shown in Span Tables 9.23.4.2.-L and 9.23.12.3.-A to 9.23.12.3.-D for the maximum spans shown, and

b) shall not exceed 2.24 m in length.

9.23.13. Bracing to Resist Lateral Loads Due to Wind and Earthquake

(See Note A-9.23.13.)

9.23.13.1.Requirements for Low to Moderate Wind and Seismic Forces

(See Note A-9.23.13.1.)

1) This Article applies in locations where the seismic spectral response acceleration, Sa(0.2), is not more than 0.70 and the 1-in-50 hourly wind pressure is less than 0.80 kPa.

2) Bracing to resist lateral loads shall be designed and constructed as follows:

a) exterior walls shall be

i) clad with panel-type cladding in accordance with Section 9.27.,

ii) sheathed with plywood, OSB, waferboard, fibreboard, gypsum board or diagonal lumber sheathing complying with Subsection 9.23.167. and fastened in accordance with Table 9.23.3.5.-A, or

iii) finished on the interior with a panel-type material in accordance with the requirements of Section 9.29., or

b) in accordance with

i) Articles 9.23.13.4. to 9.23.13.7.,

ii) Part 4, or

iii) good engineering practice such as that provided in CWC 2014, "Engineering Guide for Wood Frame Construction."

9.23.13.2. Requirements for High Wind and Seismic Forces

1) Except as provided in Article 9.23.13.1., this Article applies in locations where

a) the seismic spectral response acceleration, Sa(0.2), is greater than 0.70 but not more than 1.8 and

i) the lowest exterior frame wall supports not more than 1 floor in buildings of heavy construction (See Note A-9.23.13.2.(1)(a)(i)), or

ii) the lowest exterior frame wall supports not more than 2 floors in other types of construction, and

b) the 1-in-50 hourly wind pressure is less than 1.20 kPa.

2) Bracing to resist lateral loads shall be designed and constructed in accordance with

a) Articles 9.23.13.4. to 9.23.13.7.,

b) Part 4, or

c) good engineering practice such as that provided in CWC 2014, "Engineering Guide for Wood Frame Construction."

9.23.13.3. Requirements for Extreme Wind and Seismic Forces

1) Except as provided in Articles 9.23.13.1. and 9.23.13.2., this Article applies in locations where

a) the seismic spectral response acceleration, Sa(0.2), is

i) greater than 1.8,

ii) greater than 0.70 and the lowest exterior frame wall supports more than 2 floors in buildings of light construction, or

iii) greater than 0.70 and the lowest exterior frame wall supports more than 1 floor in buildings of heavy construction, or

b) the 1-in-50 hourly wind pressure is equal to or greater than 1.20 kPa.

2) Bracing to resist lateral loads shall be designed and constructed in accordance with

a) Part 4, or

b) good engineering practice such as that provided in CWC 2014, "Engineering Guide for Wood Frame Construction."

9.23.13.4. Braced Wall Bands

(See Note A-9.23.13.4.)

1) Braced wall bands shall

a) be full storey height,

b) be not more than 1.2 m wide,

c) lap at both ends with another braced wall band,

d) be aligned with braced wall bands on storeys above and below, and

e) conform to the spacing and dimensions given in Table 9.23.13.5.

2) The perimeter of the building shall be located within braced wall bands.

3) For split-level buildings, a braced wall band shall be located where there is a change in floor level greater than the depth of one floor joist.

9.23.13.5.Braced Wall Panels in Braced Wall Bands

1) Except as provided in Sentences (2) to (5) and Article 9.23.13.7., braced wall panels shall

a) be located within braced wall bands,

b) extend, as applicable, from the top of the supporting footing, slab or subfloor to the underside of the floor, ceiling or roof framing above, and

c) conform to the spacing and dimensions given in Table 9.23.13.5.

Table 9.23.13.5.
Spacing and Dimensions of Braced Wall Bands and Braced Wall Panels
Forming Part of Sentences 9.23.13.4.(1) and 9.23.13.5.(1)

Description	Spacing and Dimensions of *Braced Wall Bands* and *Braced Wall Panels*(1)(2)(3)	
	Seismic and Wind Loads	
	$0.70 < S_a(0.2) < 1.0$	$1.0 \leq S_a(0.2) \leq 1.8$ or $0.80 \leq HWP < 1.2$ kPa
Maximum distance between centre lines of adjacent *braced wall bands* measured from the furthest points between centres of the bands	10.6 m	7.6 m
Maximum distance between required *braced wall panels* measured from the edges of the panels	6.4 m	6.4 m
Maximum distance from the end of a *braced wall band* to the edge of the closest required *braced wall panel*	2.4 m	2.4 m
Minimum length of individual *braced wall panels*:		
panel located at the end of a *braced wall band* where the *braced wall panel* connects to an intersecting *braced wall panel*	600 mm	
panel not located at the end of a *braced wall band* or *braced wall panel* located at the end of a *braced wall band* where the *braced wall panel* does not connect to an intersecting *braced wall panel*	750 mm	
Minimum total length of all *braced wall panels* in a *braced wall band*		
• supporting 3 floors, light construction	75% of length of *braced wall band*	
• supporting 2 floors, heavy construction(4)	75% of length of *braced wall band*	
• supporting 2 floors, light construction	40% of length of *braced wall band*	
• supporting 1 floor, heavy construction(4)	40% of length of *braced wall band*	
• supporting 1 floor, light construction	25% of length of *braced wall band*	
• not supporting a floor	25% of length of *braced wall band*	

Notes to Table 9.23.13.5.:

(1) See Note A-Table 9.23.13.5.

(2) All constructions include support of a roof load in addition to the indicated number of floors.

(3) See Article 9.23.13.7. for alternative methods of compliance.
(4) See Sentence 9.23.13.3.(1) for overall limit on application to heavy construction.

2) In basements or crawl spaces where the perimeter foundation walls extend from the footings to the underside of the supported floor, braced wall bands constructed with braced wall panels shall be spaced not more than

a) 15 m from the perimeter foundation walls,
b) 15 m from interior foundation walls, and
c) 15 m from adjacent braced wall bands constructed with braced wall panels.

(See Note A-9.23.13.5.(2).)

3) Portions of the perimeter of a single open or enclosed space need not comply with Sentence (1), where

a) the roof of the space projects not more than
i) 3.5 m from the face of the framing of the nearest parallel braced wall band, and
ii) half the perpendicular plan dimension,
b) that portion of the perimeter structure does not support a floor, and
c) the roof of the space is
i) integral with the roof of the rest of the building with framing members not more than 400 mm o.c., or
ii) constructed with roof framing not more than 400 mm o.c. fastened to the wall framing (See Table 9.23.3.4. and Article 9.23.9.1. for balloon framing).

(See Note A-9.23.13.5.(3).)

4) Walls in detached garages and in accessory buildings serving a single dwelling unit, and the front wall of attached garages serving a single dwelling unit need not comply with Sentence (1) where these walls do not support a floor.

5) Braced wall panels in the braced wall band at the front of an attached garage serving a single dwelling unit need not comply with Sentence (1), provided

a) the maximum spacing between the front of the garage and the back wall of the garage does not exceed 7.6 m,
b) there is not more than one floor above the garage,
c) not less than 50% of the length of the back wall of the garage is constructed of braced wall panels, and
d) not less than 25% of the length of the side walls is constructed of braced wall panels.

9.23.13.6.Materials in Braced Wall Panels

1) Required braced wall panels shall be

a) clad with panel-type cladding complying with Section 9.27. and Table 9.23.3.4.,
b) sheathed with plywood, OSB, waferboard or diagonal lumber sheathing complying with Subsection 9.23.167. and Table 9.23.13.6., and fastened in accordance with Article 9.23.3.5., or
c) finished on the interior with a panel-type material in accordance with the requirements of Section 9.29. and Table 9.23.13.6.

Table 9.23.13.6.
Minimum Thicknesses of Cladding, Sheathing or Interior Finish for Braced Wall Panels
Forming Part of Sentence 9.23.13.6.(1)

Panel-Type Cladding, Sheathing or Interior Finish	Minimum Thickness			
	Where $S_a(0.2) \leq 0.90$		Where $S_a(0.2) > 0.90$	
	With supports 400 mm o.c.	With supports 600 mm o.c.	With supports 400 mm o.c.	With supports 600 mm o.c.
Gypsum board interior finish(1)	12.7 mm	15.9 mm	12.7 mm	15.9 mm
Sheathing complying with CSA O325	W16	W24	W16	W24
OSB O-1 and O-2 grades	11 mm	12.5 mm	11 mm	12.5 mm
Waferboard R-1 grade	9.5 mm	12.5 mm	n/a	n/a
Plywood	11 mm	12.5 mm	11 mm	12.5 mm
Diagonal lumber	17 mm	17 mm	n/a	n/a

Notes to Table 9.23.13.6.:
(1) See Sentences (5) and (6).

2) Except as provided in Sentence (3), required interior braced wall panels shall be
a) sheathed or finished on both sides with a wood-based material, or
b) finished on both sides with gypsum board.

3) Required interior braced wall panels of wood-based material may be sheathed on one side only, provided
a) the sheathing material is plywood, OSB or waferboard, and
b) the maximum spacing of fasteners along the edge is half of the maximum spacing shown in Table 9.23.3.5.-B.

4) For stacked braced wall bands, where the construction of any one braced wall panel is required to be of a wood-based material, a wood-based material shall be installed in all the required braced wall panels in that braced wall band.

5) Gypsum board interior finish shall not be considered as an acceptable sheathing material to provide the required bracing in exterior walls. (See Note A-9.23.13.6.(5) and (6).)

6) At braced wall band spacing intervals of not more than 15 m, braced wall panels shall be constructed with OSB, plywood or diagonal lumber. (See Note A-9.23.13.6.(5) and (6).)

9.23.13.7. Additional System Considerations

1) Except as provided in Sentences (2) and (3), one exterior wall of the uppermost storey in each orthogonal direction may be set back from the exterior wall of the storey below, provided the adjacent interior braced wall band of the storey below the setback
a) is spaced not more than 10.6 m from the exterior wall of the storey below the setback wall,
b) consists of braced wall panels that are constructed of a wood-based material in conformance with Sentence 9.23.13.6.(2),
c) extends to the foundation, and
d) is not taken into consideration when providing braced wall panels constructed of a wood-based material at spacing intervals of not more than 15 m as per Sentence 9.23.13.6.(6).

2) Where the exterior wall of the uppermost storey is set back from the exterior wall of the storey below, the roof and floor space supporting the setback wall shall be sheathed with a wood-based material between the exterior wall of the storey below the setback and the adjacent interior braced wall bands of the storey below the setback.

3) Where the exterior wall of the uppermost storey is set back from the exterior wall of the storey below, the exterior walls perpendicular to the setback wall shall

a) have their top plate connected with nails that are spaced at no greater than half the spacing required in Table 9.23.3.4., and

b) have their top plate splices fastened with twice the number of nails specified in Sentences 9.23.11.4.(4) and (5).

4) The maximum distance between adjacent required braced wall panels in a braced wall band, measured from the edge of the panels, may be increased to 7.3 m provided that, throughout the height of the building, the length of any braced wall panel within the braced wall band is not less than 1.2 m.

5) The maximum spacing between the centre lines of required braced wall bands given in Table 9.23.13.5. may be increased from 7.6 m to no more than 10.6 m, provided that the interior braced wall band whose spacing is being increased is replaced with an interior braced wall band that

a) consists of braced wall panels that are constructed of a wood-based material in conformance with Sentence 9.23.13.6.(2),

b) extends to the foundation, and

c) is not taken into consideration when providing braced wall panels constructed of a wood-based material at spacing intervals no greater than 15 m as per Sentence 9.23.13.6.(6).

6) For each orthogonal direction of the building, the length of required braced wall panels of one exterior wall given in Table 9.23.13.5. may be reduced from 40% to no less than 25% of the length of the braced wall band, provided an additional parallel and adjacent interior braced wall band is constructed that

a) is spaced not more than 10.6 m from the exterior wall,

b) consists of braced wall panels that are constructed of a wood-based material in conformance with Sentence 9.23.13.6.(2) and whose lengths sum to no less than 25% of the length of the braced wall band,

c) extends to the foundation, and

d) is not taken into consideration when providing braced wall panels constructed of a wood-based material at spacing intervals no greater than 15 m as per Sentence 9.23.13.6.(6).

7) Where the length of required braced wall panels of an exterior wall is reduced as described in Sentence (6), the ratio of the length of braced wall panels in the respective upper braced wall bands to the length of braced wall panels in the reduced exterior braced wall band shall not exceed 2.

9.23.14. Roof and Ceiling Framing

9.23.14.1.Continuity of Rafters and Joists

1) Roof rafters and joists and ceiling joists shall be continuous or shall be spliced over vertical supports that extend to suitable bearing.

9.23.14.2.Framing around Openings

1) Roof and ceiling framing members shall be doubled on each side of openings greater than 2 rafter or joist spacings wide.

9.23.14.3.End Bearing Length

1) The length of end bearing of joists and rafters shall be not less than 38 mm.

9.23.14.4.Location and Attachment of Rafters

1) Rafters shall be located directly opposite each other and tied together at the peak, or may be offset by their own thickness if nailed to a ridge board not less than 17.5 mm thick.

2) Except as permitted in Sentence (3), framing members shall be connected by gusset plates or nailing at the peak in conformance with Table 9.23.3.4.
3) Where the roof framing on opposite sides of the peak is assembled separately, such as in the case of factory-built houses, the roof framing on opposite sides is permitted to be fastened together with galvanized-steel strips not less than 200 mm by 75 mm by 0.41 mm thick spaced not more than 1.2 m apart and nailed at each end to the framing by at least two 63 mm nails.

9.23.14.5.Shaping of Rafters
1) Rafters shall be shaped at supports to provide even bearing surfaces and supported directly above the exterior walls.

9.23.14.6.Hip and Valley Rafters
1) Hip and valley rafters shall be not less than 50 mm greater in depth than the common rafters and not less than 38 mm thick, actual dimension.

9.23.14.7.Intermediate Support for Rafters and Joists
1) Ceiling joists and collar ties of not less than 38 mm by 89 mm lumber are permitted to be assumed to provide intermediate support to reduce the span for rafters and joists where the roof slope is 1 in 3 or greater.
2) Collar ties referred to in Sentence (1) more than 2.4 m long shall be laterally supported near their centres by not less than 19 mm by 89 mm continuous members at right angles to the collar ties.
3) Dwarf walls and struts are permitted to be used to provide intermediate support to reduce the span for rafters and joists.
4) When struts are used to provide intermediate support they shall be not less than 38 mm by 89 mm material extending from each rafter to a loadbearing wall at an angle of not less than 45° to the horizontal.
5) When dwarf walls are used for rafter support, they shall be framed in the same manner as loadbearing walls and securely fastened top and bottom to the roof and ceiling framing to prevent over-all movement.
6) Solid blocking shall be installed between floor joists beneath dwarf walls referred to in Sentence (5) that enclose finished rooms.

9.23.14.8.Ridge Support
1) Except as provided in Sentence (4), roof rafters and joists shall be supported at the ridge of the roof by
a) a loadbearing wall extending from the ridge to suitable bearing, or
b) a ridge beam supported by not less than 89 mm length of bearing.
2) Except as provided in Sentence (3), the ridge beam referred to in Sentence (1) shall conform to the sizes and spans shown in Span Table 9.23.4.2.-L, provided
a) the supported rafter or joist length does not exceed 4.9 m, and
b) the roof does not support any concentrated loads.
3) The ridge beam referred to in Sentence (1) need not comply with Sentence (2) where
a) the beam is of not less than 38 mm by 140 mm material, and
b) the beam is supported at intervals not exceeding 1.2 m by not less than 38 mm by 89 mm members extending vertically from the ridge to suitable bearing.
4) When the roof slope is 1 in 3 or more, ridge support need not be provided when the lower ends of the rafters are adequately tied to prevent outward movement.
5) Ties required in Sentence (4) are permitted to consist of tie rods or ceiling joists forming a continuous tie for opposing rafters and nailed in accordance with Table 9.23.14.8.

Table 9.23.14.8.
Rafter-to-Joist Nailing (Unsupported Ridge)
Forming Part of Sentences 9.23.14.8.(5) and (6)

Roof Slope	Rafter Spacing, mm	Minimum Number of Nails not less than 76 mm Long											
		Rafter Tied to every Joist						Rafter Tied to Joist every 1.2 m					
		Building Width up to 8 m			*Building* Width up to 9.8 m			*Building* Width up to 8 m			*Building* Width up to 9.8 m		
		Roof Snow Load, kPa			Roof Snow Load, kPa			Roof Snow Load, kPa			Roof Snow Load, kPa		
		1.0 or less	1.5	2.0 or more	1.0 or less	1.5	2.0 or more	1.0 or less	1.5	2.0 or more	1.0 or less	1.5	2.0 or more
1 in 3	400	4	5	6	5	7	8	11	–	–	–	–	–
	600	6	8	9	8	–	–	11	–	–	–	–	–
1 in 2.4	400	4	4	5	5	6	7	7	10	–	9	–	–
	600	5	7	8	7	9	11	7	10	–	–	–	–
1 in 2	400	4	4	4	4	4	5	6	8	9	8	–	–
	600	4	5	6	5	7	8	6	8	9	8	–	–
1 in 1.71	400	4	4	4	4	4	4	5	7	8	7	9	11
	600	4	4	5	5	6	7	5	7	8	7	9	11
1 in 1.33	400	4	4	4	4	4	4	4	5	6	5	6	7
	600	4	4	4	4	4	5	4	5	6	5	6	7
1 in 1	400	4	4	4	4	4	4	4	4	4	4	4	5
	600	4	4	4	4	4	4	4	4	4	4	4	5

6) Ceiling joists referred to in Sentence (5) shall be fastened together with at least one more nail per joist splice than required for the rafter to joist connection shown in Table 9.23.14.8.
7) Members referred to in Sentence (6) are permitted to be fastened together either directly or through a gusset plate.

9.23.14.9. Restraint of Joist Bottoms

1) Roof joists supporting a finished ceiling, other than plywood, OSB or waferboard, shall be restrained from twisting along the bottom edges by means of furring, blocking, cross bridging or strapping conforming to Article 9.23.9.3.

9.23.14.10. Ceiling Joists Supporting Roof Load

1) Except as permitted in Sentence (2), ceiling joists supporting part of the roof load from the rafters shall be not less than 25 mm greater in depth than required for ceiling joists not supporting part of the roof load.
2) When the roof slope is 1 in 4 or less, the ceiling joist sizes referred to in Sentence (1) shall be determined from Span Tables 9.23.4.2.-C to 9.23.4.2.-F and 9.23.4.2.-L for roof joists.

9.23.14.11.Roof Trusses

1) Roof trusses which are not designed in accordance with Part 4 shall

a) be capable of supporting a total ceiling load (dead load plus live load) of 0.35 kPa plus two and two-thirds times the specified live roof load for 24 h, and

b) not exceed the deflections shown in Table 9.23.14.11. when loaded with the ceiling load plus one and one-third times the specified roof snow load for 1 h.

Table 9.23.14.11.
Maximum Roof Truss Deflections
Forming Part of Sentence 9.23.14.11.(1)

Truss Span	Type of Ceiling	Maximum Deflection
4.3 m or less	Plaster or gypsum board	1/360 of the span
	Other than plaster or gypsum board	1/180 of the span
Over 4.3 m	Plaster or gypsum board	1/360 of the span
	Other than plaster or gypsum board	1/240 of the span

2) The joint connections used in trusses described in Sentence (1) shall be designed in conformance with the requirements in Subsection 4.3.1. (See Note A-9.23.14.11.(2).)

3) Where the length of compression web members in roof trusses described in Sentence (1) exceeds 1.83 m, such web members shall be provided with continuous bracing to prevent buckling.

4) Bracing required in Sentence (3) shall consist of not less than 19 mm by 89 mm lumber nailed at right angles to the web members near their centres with at least two 63 mm nails for each member.

5) Where the ability of a truss design to satisfy the requirements of Sentence (1) is demonstrated by testing, it shall consist of a full scale load test carried out in conformance with CSA S307-M, “Load Test Procedure for Wood Roof Trusses for Houses and Small Buildings.”

6) Where the ability of a truss design to satisfy the requirements of Sentence (1) is demonstrated by analysis, it shall be carried out in accordance with good engineering practice such as that described in TPIC 2014, “Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses (Limit States Design).”

9.23.15. Subflooring

9.23.15.1.Subflooring Required

1) Subflooring shall be provided beneath finish flooring where the finish flooring does not have adequate strength to support the specified live loads (See Subsection 9.30.3.).

9.23.15.2.Material Standards

1) Except as provided in Sentence (2), wood-based panels for subfloors shall conform to

a) CSA O121, “Douglas Fir Plywood,”

b) CSA O151, “Canadian Softwood Plywood,”

c) CSA O153, “Poplar Plywood,”

d) CSA O325, “Construction Sheathing,” or

e) CSA O437.0, “OSB and Waferboard.”

2) Particleboard subflooring may be used only where a building is constructed in a factory so that the subfloor will not be exposed to the weather.

3) Subflooring described in Sentence (2) shall conform to grade D-2 or D-3 in ANSI A208.1, “Particleboard.”

4) Subflooring described in Sentence (2) shall have its upper surface and all edges treated to restrict water absorption, where the subfloor is used in bathrooms, kitchens, laundry rooms or other areas subject to periodic wetting. (See Note A-9.23.15.2.(4).)

9.23.15.3. Edge Support

1) Where the edges of panel-type subflooring are required to be supported (See Sentence 9.30.2.1.(2)), such support shall consist of tongue-and-groove panel edges or not less than 38 mm by 38 mm blocking securely nailed between framing members.

9.23.15.4. Direction of Installation

1) Plywood subflooring shall be installed with the surface grain at right angles to the joists and with joints parallel to floor joists staggered.
2) OSB subflooring conforming to CSA O325, “Construction Sheathing,” or to O-1 and O-2 grades in CSA O437.0, “OSB and Waferboard,” and waferboard subflooring conforming to R-1 grade in CSA O437.0 shall be installed so that the direction of face orientation is at right angles to the joists and the joints parallel to the floor joists are staggered. (See Note A-9.23.15.4.(2).)

9.23.15.5. Subfloor Thickness or Rating

1) Except as provided in Sentences (2) and (3), subfloors shall conform to either Table 9.23.15.5.-A or 9.23.15.5.-B.

Table 9.23.15.5.-A
Thickness of Subflooring
Forming Part of Sentences 9.23.15.5.(1) and 9.23.16.7.(1)

Maximum Spacing of Supports, mm	Minimum Thickness, mm			
	Plywood and OSB, O-2 Grade	OSB, O-1 Grade, and Waferboard, R-1 Grade	Particleboard	Lumber
400	15.5	15.9	15.9	17.0
500	15.5	15.9	19.0	19.0
600	18.5	19.0	25.4	19.0

Table 9.23.15.5.-B
Rating for Subfloor when Applying CSA O325
Forming Part of Sentences 9.23.15.5.(1) and 9.23.16.7.(1)

Maximum Spacing of Supports, mm	Panel Mark	
	Subfloor	Used with Panel-Type Underlay
400	1F16	2F16
500	1F20	2F20
600	1F24	2F24

2) Where the finished flooring consists of not less than 19 mm matched wood strip flooring laid at right angles to joists spaced not more than 600 mm o.c., subflooring shall be permitted to consist of not less than

a) 12.5 mm thick plywood,
b) 12.5 mm thick OSB conforming to O-2 grade,
c) 12.7 mm thick OSB conforming to O-1 grade,
d) 12.7 mm thick waferboard conforming to R-1 grade, or
e) OSB conforming to 2R32/2F16 grade.

3) Except where the flooring consists of ceramic tiles applied with adhesive, where a separate panel-type underlay or concrete topping is applied to a subfloor on joists spaced not more than 400 mm o.c., the subfloor is permitted to consist of not less than

a) 12.5 mm thick plywood,
b) 12.5 mm thick OSB conforming to O-2 grade,
c) 12.7 mm thick OSB conforming to O-1 grade,
d) 12.7 mm thick waferboard conforming to R-1 grade, or
e) OSB conforming to 2R32/2F16 grade.

9.23.15.6. Annular Grooved Nails

1) When resilient flooring is applied directly to an OSB, waferboard, particleboard or plywood subfloor, the subfloor shall be fastened to the supports with annular grooved nails.

9.23.15.7. Lumber Subflooring

1) Lumber subflooring shall be laid at an angle of not less than 45° to the joists.
2) Lumber subflooring shall be fully supported at the ends on solid bearing.
3) Lumber for subflooring shall be of uniform thickness and not more than 184 mm wide.

9.23.16. Roof Sheathing

9.23.16.1. Required Roof Sheathing

1) Except where the 1-in-50 hourly wind pressure is less than 0.8 kPa and the seismic spectral response acceleration, $S_a(0.2)$, is less than or equal to 0.70, continuous lumber or panel-type roof sheathing shall be installed to support the roofing.

9.23.16.2. Material Standards

1) Wood-based panels used for roof sheathing shall conform to the requirements of

a) CSA O121, “Douglas Fir Plywood,”
b) CSA O151, “Canadian Softwood Plywood,”
c) CSA O153, “Poplar Plywood,”
d) CSA O325, “Construction Sheathing,” or
e) CSA O437.0, “OSB and Waferboard.”

9.23.16.3. Direction of Installation

1) Plywood roof sheathing shall be installed with the surface grain at right angles to the roof framing.
2) OSB roof sheathing conforming to CSA O325, “Construction Sheathing,” or to O-1 and O-2 grades as specified in CSA O437.0, “OSB and Waferboard,” shall be installed with the direction of face orientation at right angles to the roof framing members. (See Note A-9.23.15.4.(2).)

9.23.16.4. Joints in Panel-Type Sheathing

1) Panel-type sheathing board shall be applied so that joints perpendicular to the roof ridge are staggered where

a) the sheathing is applied with the surface grain parallel to the roof ridge, and
b) the thickness of the sheathing is such that the edges are required to be supported.

2) A gap of not less than 2 mm shall be left between sheets of plywood, OSB or waferboard.

9.23.16.5.Lumber Roof Sheathing

1) Lumber roof sheathing shall not be more than 286 mm wide and shall be applied so that all ends are supported with end joints staggered.

2) Lumber roof sheathing shall be installed diagonally, where

a) the seismic spectral response acceleration, $S_a(0.2)$, is greater than 0.70 but not greater than 1.2, or

b) the 1-in-50 hourly wind pressure is equal to or greater than 0.80 kPa but less than 1.20 kPa.

3) Lumber roof sheathing shall be designed according to Part 4, where

a) the seismic spectral response acceleration, $S_a(0.2)$, is greater than 1.2, or

b) the 1-in-50 hourly wind pressure is equal to or greater than 1.20 kPa.

9.23.16.6.Edge Support

1) Where panel-type roof sheathing requires edge support, the support shall consist of metal H clips or not less than 38 mm by 38 mm blocking securely nailed between framing members.

9.23.16.7.Thickness or Rating

1) The thickness or rating of roof sheathing on a flat roof used as a walking deck shall conform to either Table 9.23.15.5.-A or Table 9.23.15.5.-B for subfloors.

2) The thickness or rating of roof sheathing on a roof not used as a walking deck shall conform to either Table 9.23.16.7.-A or Table 9.23.16.7.-B.

3) Asphalt-coated or asphalt-impregnated fibreboard not less than 11.1 mm thick conforming to CAN/ULC-S706, “Wood Fibre Insulating Boards for Buildings,” is permitted to be used as a roof sheathing over supports spaced not more than 400 mm o.c. provided the roofing consists of

a) a continuous sheet of galvanized steel not less than 0.33 mm in thickness, or

b) a continuous sheet of aluminum not less than 0.61 mm in thickness.

4) All edges of sheathing described in Sentence (3) shall be supported by blocking or framing.

Table 9.23.16.7.-A
Thickness of Roof Sheathing
Forming Part of Sentence 9.23.16.7.(2)

Maximum Spacing of Supports, mm	Minimum Thickness, mm				
	Plywood, and OSB, O-2 Grade		OSB, O-1 Grade, and Waferboard, R-1 Grade		Lumber
	Edges Supported	Edges Unsupported	Edges Supported	Edges Unsupported	
300	7.5	7.5	9.5	9.5	17.0
400	7.5	9.5	9.5	11.1	17.0
600	9.5	12.5	11.1	12.7	19.0

Table 9.23.16.7.-B
Rating for Roof Sheathing When Applying CSA O325
Forming Part of Sentence 9.23.16.7.(2)

Maximum Spacing of Supports, mm	Panel Mark	
	Edges Supported	Edges Unsupported

400	2R16	1R16
500	2R20	1R20
600	2R24	1R24

9.23.17. Wall Sheathing

9.23.17.1. Required Sheathing

1) Exterior walls and gable ends shall be sheathed when the exterior cladding requires intermediate fastening between supports or if the exterior cladding requires solid backing.

9.23.17.2. Thickness, Rating and Material Standards

1) Where wall sheathing is required for the purpose of complying with this Section, it shall conform to either Table 9.23.17.2.-A or 9.23.17.2.-B. (See also Article 9.25.5.1.)

Table 9.23.17.2.-A
Wall Sheathing Thickness and Specifications
Forming Part of Sentence 9.23.17.2.(1)

Type of Sheathing	Minimum Thickness, mm(1)		Material Standards
	With Supports 400 mm o.c.	With Supports 600 mm o.c.	
Fibreboard (insulating)	9.5	11.1	CAN/ULC-S706
Gypsum sheathing	9.5	12.7	ASTM C 1177/C 1177M ASTM C 1396/C 1396M(2)
Lumber	17.0	17.0	See Table 9.3.2.1.
Mineral Fibre, Rigid Board, Type 2	25	25	CAN/ULC-S702
OSB, O-2 Grade	6.0	7.5	CSA O437.0
OSB, O-1 Grade, and Waferboard, R-1 Grade	6.35	7.9	CSA O437.0
Phenolic, faced	25	25	CAN/CGSB-51.25-M
Plywood (exterior type)	6.0	7.5	CSA O121 CSA O151 CSA O153
Polystyrene, Types 1 and 2	38	38	CAN/ULC-S701
Polystyrene, Types 3 and 4	25	25	CAN/ULC-S701
Polyurethane and Polyisocyanurate Type 1, faced	38	38	CAN/ULC-S704
Polyurethane and Polyisocyanurate Types 2 and 3, faced	25	25	CAN/ULC-S704

Notes to Table 9.23.17.2.-A:
(1) See also Sentences 9.27.5.1.(2) to (4).
(2) The *flame-spread rating* of gypsum board shall be determined in accordance with CAN/ULC-S102, "Test for Surface Burning Characteristics of Building Materials and Assemblies."

Table 9.23.17.2.-B
Rating for Wall Sheathing when Applying CSA O325
Forming Part of Sentence 9.23.17.2.(1)

Maximum Spacing of Supports, mm	Panel Mark
400	W16
500	W20
600	W24

9.23.17.3. Attachment of Cladding to Sheathing

1) Gypsum sheathing, rigid insulation and fibreboard shall not be used for the attachment of cladding materials.

9.23.17.4. Lumber Sheathing

1) Lumber wall sheathing shall be applied so that all ends are supported.
2) Where lumber wall sheathing is required to provide bracing according to Article 9.23.10.2., it shall be applied with end joints staggered.

9.23.17.5. Joints in Panel-Type Sheathing

1) A gap of not less than 2 mm shall be left between sheets of plywood, OSB, waferboard or fibreboard.

9.23.17.6. Mansard Style Roofs

1) Where the bottom portions of mansard style roofs are vented, the vertical framing members behind the sloping portions shall be considered on the same basis as exterior wall studs and shall conform to Articles 9.27.3.2. to 9.27.3.6.

Section 9.24. Sheet Steel Stud Wall Framing

9.24.1. General

9.24.1.1. Application

1) This Section applies to sheet steel studs for use in non-loadbearing exterior and interior walls.
2) Where loadbearing steel studs are used, they shall be designed in conformance with Part 4.

9.24.1.2. Material Standards

1) Steel studs and runners shall conform to AISI S201, "North American Standard for Cold-Formed Steel Framing – Product Data."

9.24.1.3. Metal Thickness

1) Metal thickness specified in this Section shall be the minimum base steel thickness exclusive of coatings.

9.24.1.4. Screws

1) Screws for the application of cladding, sheathing or interior finish materials to steel studs, runners and furring channels shall conform to

a) ASTM C 954, "Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness," or

b) ASTM C 1002, "Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs."

9.24.1.5. Cladding, Sheathing and Interior Finish Required

1) Cladding or sheathing, and interior finish shall be installed on steel stud framing and shall be fastened with screws

a) spaced at the appropriate spacing described in Section 9.29., and

b) penetrating not less than 10 mm through the metal.

9.24.2. Size of Framing

9.24.2.1. Size and Spacing of Studs in Interior Walls

1) Except as required in Articles 9.24.2.3. and 9.24.2.4., the size and spacing of steel studs for non-loadbearing interior walls shall conform to Table 9.24.2.1.

Table 9.24.2.1.
Steel Studs for Non-Loadbearing Interior Walls[(1)]
Forming Part of Sentence 9.24.2.1.(1)

Minimum Stud Size, mm	Maximum Stud Spacing, mm	Maximum Wall Height, m
32 × 41	400	3.0
	600	2.7
32 × 64	300	4.4
	400	4.0
	600	3.5
32 × 89	300	5.2
	400	4.6
	600	3.9
32 × 152	300	6.6
	400	5.8
	600	4.9

Notes to Table 9.24.2.1.:

(1) The values in the Table are based on a single layer of 12.7 mm gypsum panel sheathing installed on each side of the studs. Where one side is not accessible, gypsum panels on only one side will suffice. The values are also based on attaching gypsum panel sheathing using screws not smaller than No. 6 spaced at a maximum of 300 mm at edges and at intermediate supports.

9.24.2.2. Thickness of Studs

1) Except as required in Article 9.24.2.4., steel studs in non-loadbearing interior walls shall have a metal thickness of not less than 0.46 mm.

9.24.2.3. Runners

1) Runners for interior and exterior non-loadbearing walls shall have a thickness not less than the thickness of the corresponding studs and shall have not less than 30 mm flanges.

9.24.2.4. Openings in Fire Separations

1) Where openings for doors in non-loadbearing fire separations required to have a fire-resistance rating do not exceed 1 200 mm in width,

a) the width of steel studs shall be not less than 63 mm, and

b) the metal thickness shall be not less than 0.46 mm.

2) Where openings described in Sentence (1) exceed 1 200 mm in width,

a) the width of steel studs shall be not less than 91 mm, and

b) the metal thickness shall be not less than 0.85 mm.

3) The distance to the first stud beyond the jamb of any door opening in a fire separation required to have a fire-resistance rating shall not exceed 400 mm.

4) Where the distance between the framing over the opening referred to in Sentence (3) and the top runner exceeds 400 mm in such walls, intermediate support shall be installed at intervals of not more than 400 mm above the opening.

9.24.2.5. Size and Spacing of Studs in Exterior Walls

1) The size and spacing of non-loadbearing steel studs for exterior walls shall conform to Table 9.24.2.5.

Table 9.24.2.5.
Size and Spacing of Steel Studs for Non-Loadbearing Exterior Walls
Forming Part of Sentence 9.24.2.5.(1)

Minimum Stud Size, mm	Minimum Metal Thickness, mm	Maximum Stud Length, m		
		Spacing of Studs		
		300 mm o.c.	400 mm o.c.	600 mm o.c.
30 × 91	0.53	3.0	2.4	–
30 × 91	0.69	3.3	2.7	2.4
30 × 91	0.85	3.6	3.0	2.7
30 × 91	1.0	4.0	3.3	3.0

9.24.3. Installation

9.24.3.1. Installation of Runners

1) Runners shall be provided at the tops and bottoms of walls.

2) Runners required in Sentence (1) shall be securely attached to the building at approximately 50 mm from the ends, and at intervals of not more than 600 mm o.c. for interior walls and 300 mm o.c. for exterior walls.

3) Fasteners used for attachment described in Sentence (2) shall consist of the equivalent of 63 mm nails or 25 mm screws.

4) Studs at openings and which are not full wall height shall be supported by a runner at the ends of the studs, securely fastened to the full length studs at the sides of the opening.

9.24.3.2. Fire-Rated Walls

1) Steel studs used in walls required to have a fire-resistance rating shall be installed so that there is not less than a 12 mm clearance between the top of the stud and the top of the runner to allow for expansion in the event of fire.
2) Except as provided in Article 9.24.3.6., studs in walls referred to in Sentence (1) shall not be attached to the runners in a manner that will prevent such expansion.
3) Framing above doors with steel door frames in non-loadbearing fire separations required to have a fire-resistance rating shall consist of 2 runners on the flat fastened back to back. (See Note A-9.24.3.2.(3).)
4) The upper runner required in Sentence (3) shall be bent at each end to extend upwards not less than 150 mm and fastened to the adjacent studs.
5) A gypsum board filler piece, the width and length of the runner, shall be provided between the door frame referred to in Sentence (3) and the adjacent runner.

9.24.3.3. Orientation of Studs

1) Steel studs shall be installed with webs at right angles to the wall face and, except at openings, shall be continuous for the full wall height.

9.24.3.4. Support for Cladding Materials

1) Corners and intersections of walls shall be constructed to provide support for the cladding materials.

9.24.3.5. Framing around Openings

1) Studs shall be doubled on each side of every opening where such openings involve more than one stud space, and shall be tripled where the openings in exterior walls exceed 2.4 m in width.
2) Studs described in Sentence (1) shall be fastened together by screws, crimping or welding to act as a single structural unit in resisting transverse loads.

9.24.3.6. Attachment of Studs to Runners

1) Studs shall be attached to runners by screws, crimping or welding around wall openings and elsewhere where necessary to keep the studs in alignment during construction.
2) Where clearance for expansion is required in Article 9.24.3.2., attachment required in Sentence (1) shall be applied between studs and bottom runners only.

9.24.3.7. Openings for Fire Dampers

1) Openings for fire dampers in non-loadbearing fire separations required to have a fire-resistance rating shall be framed with double studs on each side of the opening.
2) The sill and header for openings described in Sentence (1) shall consist of a runner track with right angle bends made on each end so as to extend 300 mm above the header or below the sill and fastened to the studs.
3) The openings described in Sentence (1) shall be lined with a layer of gypsum board not less than 12.7 mm thick fastened to stud and runner webs.

Section 9.25. Heat Transfer, Air Leakage and Condensation Control

9.25.1. General

9.25.1.1. Scope and Application

1) This Section is concerned with heat, air and water vapour transfer and measures to control condensation. (See Sentence 1.3.3.2. (3) of Division A for Part 5 application to Group C multi-family residential occupancies and artist live/work studios.)

2) All walls, ceilings and floors separating *conditioned space* from unconditioned space, the exterior air or the ground shall be

a) provided with

i) thermal insulation conforming to Subsection 9.25.2. and Part 10,

ii) an air barrier conforming to Subsection 9.25.3. and Part 10, and

iii) a vapour barrier conforming to Subsection 9.25.4., and

b) constructed in such a way that the properties and relative position of all materials conform to Subsection 9.25.5.

3) Insulation and sealing of heating and ventilating ducts shall conform to Sections 9.32., 9.33. and Part 10.

4) Except for *buildings* containing only *dwelling units* or for portions of *buildings* containing *dwelling units*, the design and installation of thermal insulation and measures to control heat transfer and condensation shall conform to Part 10.

9.25.2. Thermal Insulation

9.25.2.1. Required Insulation

1) All walls, ceilings and floors separating heated space from unheated space, the exterior air or the exterior *soil* shall be provided with sufficient thermal insulation to prevent moisture condensation on their room side during the winter and to ensure comfortable conditions for the occupants. (See Note A-9.1.1.1.(1).)

9.25.2.2. Insulation Materials

1) Except as required in Sentence (2), thermal insulation shall conform to the requirements of

a) ASTM C 726, "Mineral Wool Roof Insulation Board,"

b) CAN/CGSB-51.25-M, "Thermal Insulation, Phenolic, Faced,"

c) CGSB 51-GP-27M, "Thermal Insulation, Polystyrene, Loose Fill,"

d) CAN/ULC-S701, "Thermal Insulation, Polystyrene, Boards and Pipe Covering,"

e) CAN/ULC-S702, "Mineral Fibre Thermal Insulation for Buildings,"

f) CAN/ULC-S703, "Cellulose Fibre Insulation for Buildings,"

g) CAN/ULC-S704, "Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced,"

h) CAN/ULC-S705.1, "Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Material – Specification," or

i) CAN/ULC-S706, "Wood Fibre Insulating Boards for Buildings."

2) The *flame-spread ratings* requirements contained in the standards listed in Sentence (1) shall not apply. (See Note A-9.25.2.2.(2).)

3) Insulation in contact with the ground shall be inert to the action of *soil* and water and shall be such that its insulative properties are not significantly reduced by moisture.

9.25.2.3. Installation of Thermal Insulation

1) Insulation shall be installed so that there is a reasonably uniform insulating value over the entire face of the insulated area.

2) Insulation shall be applied to the full width and length of the space between furring or framing.

3) Except where the insulation provides the principal resistance to air leakage, thermal insulation shall be installed so that at least one face is in full and continuous contact with an element with low air permeance. (See Note A-9.25.2.3.(3).)

4) Insulation on the interior of *foundation* walls enclosing a crawl space shall be applied so that there is not less than 50 mm clearance above the crawl space floor, if the insulation is of a type that may be damaged by water.

5) Insulation around concrete slabs-on-ground shall be located so that heat from the *building* is not restricted from reaching the ground beneath the perimeter, where exterior walls are not supported by footings extending below frost level.

6) Where insulation is exposed to the weather and subject to mechanical damage, it shall be protected with not less than

a) **Reserved**,
b) 6 mm preservative-treated plywood, or
c) 12 mm cement parging on wire lath applied to the exposed face and edge.

7) Insulation located in areas where it may be subject to mechanical damage shall be protected by a covering such as gypsum board, plywood, particleboard, OSB, waferboard or hardboard.

8) Insulation in factory-built *buildings* shall be installed so that it will not become dislodged during transportation.

9.25.2.4. Installation of Loose-Fill Insulation

1) Except as provided in Sentences (2) to (6), loose-fill insulation shall be used on horizontal surfaces only.

2) Where loose-fill insulation is installed in an unconfined sloped space, such as an attic space over a sloped ceiling, the supporting slope shall not be more than

a) 4.5 in 12 for mineral fibre or cellulose fibre insulation, and
b) 2.5 in 12 for other types of insulation.

3) Loose-fill insulation is permitted to be used in wood-frame walls of existing *buildings*. (See Note A-9.25.2.4.(3).)

4) Where blown-in insulation is installed in above-ground or below-ground wood-frame walls of new *buildings*,

a) the density of the installed insulation shall be sufficient to preclude settlement,
b) the insulation shall be installed behind a membrane that will permit visual inspection prior to the installation of the interior finish,
c) the insulation shall be installed in a manner that will not interfere with the installation of the interior finish, and
d) no water shall be added to the insulation, unless it can be shown that the added water will not adversely affect other materials in the assembly.

5) Water repellent loose-fill insulation is permitted to be used between the outer and inner wythes of masonry *cavity walls*. (See Note A-9.25.2.4.(5).)

6) Where soffit venting is used, measures shall be taken

a) to prevent loose-fill insulation from blocking the soffit vents and to maintain an open path for circulation of air from the vents into the *attic or roof space*, and
b) to minimize airflow into the insulation near the soffit vents to maintain the thermal performance of the material. (See Article 9.19.1.3.)

9.25.2.5. Installation of Spray-Applied Polyurethane

1) Spray-applied polyurethane insulation shall be installed in accordance with CAN/ULC-S705.2, “Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Application.”

9.25.3. Air Barrier Systems

9.25.3.1. Required Barrier to Air Leakage

1) Wall, ceiling and floor assemblies separating *conditioned space* from unconditioned space or from the ground shall be constructed so as to include an *air barrier system* that will provide a continuous barrier to air leakage

a) from the interior of the *building* into wall, floor, *attic or roof spaces*, sufficient to prevent excessive moisture condensation in such spaces during the winter, and
b) from the exterior or the ground inward sufficient to
    i) prevent moisture condensation on the room side during winter,
    ii) ensure comfortable conditions for the occupants, and
    iii) minimize the ingress of *soil* gas.

(See Note A-9.25.3.1.(1).)

9.25.3.2. Air Barrier System Properties

(See Note A-9.25.5.1.(1).)

1) *Air barrier systems* shall possess the characteristics necessary to provide an effective barrier to air infiltration and exfiltration under differential air pressure due to stack effect, mechanical systems or wind.

2) Where polyethylene sheet is used to provide airtightness in the *air barrier system*, it shall conform to CAN/CGSB-51.34-M, "Vapour Barrier, Polyethylene Sheet for Use in Building Construction."

9.25.3.3. Continuity of the Air Barrier System

1) Where the *air barrier system* consists of an air-impermeable panel-type material, all joints shall be sealed to prevent air leakage.

2) Except as provided in Sentence 9.25.3.6.(3), where the *air barrier system* consists of flexible sheet material, all joints shall be

a) sealed, or

b) lapped not less than 100 mm and clamped, such as between framing members, furring or blocking, and rigid panels.

3) Where an interior wall meets an exterior wall, ceiling, floor or roof required to be provided with air barrier protection, the *air barrier system* shall extend across the intersection.

4) Where an interior wall projects through a ceiling or extends to become an exterior wall, spaces in the wall shall be blocked to provide continuity across those spaces with the *air barrier system* in the abutting walls or ceiling.

5) Where an interior floor projects through an exterior wall or extends to become an exterior floor, continuity of the *air barrier system* shall be maintained from the abutting walls across the floor assembly.

6) Penetrations of the *air barrier system*, such as those created by the installation of doors, windows, electrical wiring, electrical boxes, piping or ductwork, shall be sealed to maintain the integrity of the *air barrier system* over the entire surface.

7) Where access hatches and sump pit covers are installed through assemblies constructed with an *air barrier system*, they shall be weatherstripped around their perimeters to prevent air leakage.

8) Clearances between *chimneys* or *gas vents* and the surrounding construction that would permit air leakage from within the *building* into a wall or *attic or roof space* shall be sealed by *noncombustible* material to prevent such leakage.

9.25.3.4. Air Leakage Control in Masonry Walls

(See Note A-9.25.3.4. and 9.25.3.6.)

1) Masonry walls required to provide a barrier to the ingress of air from the ground shall

a) include a course of masonry units without voids, or

b) be sealed with flashing material extending across the full width of the masonry.

2) The masonry course or flashing described in Sentence (1) shall

a) be located at the level of the adjoining floor and be sealed to it in accordance with Article 9.25.3.6., or

b) in the absence of a floor, be located at the level of the ground cover required by Article 9.18.6.1. and be sealed to it.

9.25.3.5. Air Leakage Control in Underground Roofs

1) Waterproofing systems for roofs of underground structures shall be sealed to the air barrier in the walls.

9.25.3.6. Air Barrier Systems in Floors-on-ground

(See Note A-9.25.3.4. and 9.25.3.6.)

1) Materials used to provide a barrier to the ingress of air through floors-on-ground shall conform to CAN/CGSB-51.34-M, "Vapour Barrier, Polyethylene Sheet for Use in Building Construction."

2) Where the floor-on-ground is a concrete slab, the air barrier shall be

a) installed below the slab, or

b) applied to the top of the slab, provided a separate floor is installed over the slab.

(See Note A-9.25.3.6.(2) and (3).)

3) Where the air barrier installed below a floor-on-ground is flexible sheet material, joints in the barrier shall be lapped not less than 300 mm. (See Note A-9.25.3.6.(2) and (3).)

4) Where installed in conjunction with a framed floor-on-ground or above a floor-on-ground, the air barrier shall be installed in accordance with Article 9.25.3.3.

5) A floor-on-ground shall be sealed around its perimeter to the inner surfaces of adjacent walls using flexible sealant.

6) All penetrations of a floor-on-ground that are required to drain water from the floor surface shall be sealed in a manner that prevents the upward flow of air without preventing the downward flow of liquid water.

9.25.4. Vapour Barriers

9.25.4.1. Required Barrier to Vapour Diffusion

1) Thermally insulated wall, ceiling and floor assemblies shall be constructed with a *vapour barrier* so as to provide a barrier to diffusion of water vapour from the interior into wall spaces, floor spaces or *attic or roof spaces*.

9.25.4.2. Vapour Barrier Materials

1) *Vapour barriers* shall have a permeance not greater than 60 ng/(Pa•s•m^2) measured in accordance with ASTM E 96/E 96M, “Water Vapor Transmission of Materials,” using the desiccant method (dry cup).

2) Where the intended use of the interior space will result in high moisture generation, the assembly shall be designed according to Part 5. (See Note A-9.25.4.2.(2).)

3) Where polyethylene is installed to serve only as the *vapour barrier*, it shall comply with Clause 4.4, Thermal Stability, and Clause 5.7, Oxidative Induction Time, of CAN/CGSB-51.34-M, “Vapour Barrier, Polyethylene Sheet for Use in Building Construction.”

4) Membrane-type *vapour barriers* other than polyethylene shall conform to the requirements of CAN/CGSB-51.33-M, “Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.”

5) Where a coating is applied to gypsum board to function as the *vapour barrier*, the permeance of the coating shall be determined in accordance with CAN/CGSB-1.501-M, “Method for Permeance of Coated Wallboard.”

6) Where foamed plastic insulation functions as the *vapour barrier*, it shall be sufficiently thick so as to meet the requirement of Sentence (1).

9.25.4.3. Installation of Vapour Barriers

1) Products installed to function as the *vapour barrier* shall protect the warm side of wall, ceiling and floor assemblies.

2) Where different products are used for the *vapour barrier* and the insulation, the *vapour barrier* shall be installed sufficiently close to the warm side of the insulation to prevent condensation at design conditions. (See Note A-9.25.4.3.(2) and Note A-9.25.5.1.(1).)

3) Where the same product is used for the *vapour barrier* and the insulation, the product shall be installed sufficiently close to the warm side of the assembly to prevent condensation at design conditions. (See Notes A-9.25.4.3.(2), A-9.25.5.1.(1) and A-9.25.5.2.)

9.25.5. Properties and Position of Materials in the Building Envelope

9.25.5.1. General

(See Note A-9.25.5.1.)

1) Except as provided in Sentences (2) to (4), sheet and panel-type materials incorporated into assemblies described in Article 9.25.1.1. shall conform to Article 9.25.5.2., where

a) the material has

i) an air leakage characteristic less than 0.1 L/(s·m²) at 75 Pa, and

ii) a water vapour permeance less than 60 ng/(Pa·s·m²) when measured in accordance with ASTM E 96/E 96M, "Water Vapor Transmission of Materials," using the desiccant method (dry cup) (See Note A-9.25.5.1.(1)(a)(ii)), and

b) the intended use of the interior space where the materials are installed will not result in high moisture generation.

(See Note A-9.25.5.1.(1).)

2) Where the intended use of the interior space will result in high moisture generation, the assembly shall be designed according to Part 5.

3) Wood-based sheathing materials not more than 12.5 mm thick and complying with Article 9.23.17.2. need not comply with Sentence (1). (See Note A-9.25.5.1.(3).)

4) Where a material has a water vapour permeance not less than 30 ng/(Pa·s·m²) and a thermal resistance not less than 0.7 (m²·K)/W and the heating degree-days of the *building* location are less than 6 000, the assembly need not comply with Sentence (1).

9.25.5.2. Position of Low Permeance Materials

(See Note A-9.25.5.2.)

1) Sheet and panel-type materials described in Article 9.25.5.1. shall be installed

a) on the warm face of the assembly (See also Article 9.25.4.2.),

b) at a location where the ratio between the total thermal resistance of all materials outboard of its innermost impermeable surface and the total thermal resistance of all materials inboard of that surface is not less than that required by Table 9.25.5.2., or

c) outboard of an air space that is vented to the outdoors.

2) For walls, the air space described in Clause (1)(c) shall comply with Clause 9.27.2.2.(1)(a).

Table 9.25.5.2.
Ratio of Outboard to Inboard Thermal Resistance
Forming Part of Sentence 9.25.5.2.(1)

Heating Degree-Days of *Building* Location[(1)], Celsius degree-days	Minimum Ratio of Total Thermal Resistance Outboard of Material's Inner Surface to Total Thermal Resistance Inboard of Material's Inner Surface
up to 4 999	0.20
5 000 to 5 999	0.30
6 000 to 6 999	0.35
7 000 to 7 999	0.40
8 000 to 8 999	0.50
9 000 to 9 999	0.55
10 000 to 10 999	0.60
11 000 to 11 999	0.65
12 000 or higher	0.75

Notes to Table 9.25.5.2.:

(1) See Sentence 1.1.3.1.(1).

Section 9.26. Roofing

9.26.1. General

9.26.1.1. Definitions

1) For the purpose of this Section, the term “roof” shall mean sloped or near-horizontal assemblies that protect the spaces beneath them, including platforms that effectively serve as roofs with respect to the accumulation or drainage of precipitation. (See Note A-9.26.1.1.(1).)

2) For the purpose of this Section, the term “roofing” shall mean the primary covering for roofs.

9.26.1.2. Required Protection

1) Roofs shall be protected with roofing, including flashing, installed so as to

a) effectively shed water,

b) prevent the ingress of water and moisture into building assemblies and occupied space, and

c) minimize the ingress of water due to ice damming into building assemblies.

2) Compliance with Sentence (1) shall be demonstrated by conforming to

a) the remainder of this Subsection, or

b) Part 5.

9.26.1.3. Alternative Installation Methods

1) Methods described in CAN3-A123.51-M, “Asphalt Shingle Application on Roof Slopes 1:3 and Steeper,” or in CAN3-A123.52-M, “Asphalt Shingle Application on Roof Slopes 1:6 to Less Than 1:3,” are permitted to be used for asphalt shingle applications not described in this Section.

9.26.2. Roofing Materials

9.26.2.1. Material Standards

1) Materials used for the preparation of the substrate for roofing shall conform to the requirements of the applicable standards in Table 9.26.2.1.-A.

Table 9.26.2.1.-A
Materials for Preparation of the Substrate for Roofing
Forming Part of Sentence 9.26.2.1.(1)

Type of Material	Standards
Sheathing membranes	CAN/CGSB-51.32-M, “Sheathing, Membrane, Breather Type”
Primers	CGSB 37-GP-9Ma, “Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing”

2) Roofing materials shall conform to the requirements of the applicable standards in Table 9.26.2.1.-B.

Table 9.26.2.1.-B
Roofing Materials
Forming Part of Sentence 9.26.2.1.(2)

Types of Roof Covering	Standards
Built-up roofing (BUR)	ASTM D 3019, “Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, Asbestos-Fibered, and Non-Asbestos-Fibered”(1)
	ASTM D 4479/D 4479M, “Asphalt Roof Coatings – Asbestos-Free”
	CGSB 37-GP-56M, “Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing”
	CAN/CGSB-37.50-M, “Hot-Applied, Rubberized Asphalt for Roofing and Waterproofing”
	CAN/CSA-A123.2, “Asphalt-Coated Roofing Sheets”
	CSA A123.3, “Asphalt Saturated Organic Roofing Felt”
	CAN/CSA-A123.4, “Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems”
	CSA A123.17, “Asphalt Glass Felt Used in Roofing and Waterproofing”
Single-ply membranes	CAN/CGSB-37.54, “Polyvinyl Chloride Roofing and Waterproofing Membrane”
	CAN/CGSB-37.58-M, “Membrane, Elastomeric, Cold-Applied Liquid, for Non-Exposed Use in Roofing and Waterproofing”
	ASTM D 4637/D 4637M, “EPDM Sheet Used In Single-Ply Roof Membrane”
	ASTM D 4811/D 4811M, “Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing”
	ASTM D 6878/D 6878M, “Thermoplastic Polyolefin Based Sheet Roofing”
Shingles, shakes, tiles, panels	CSA A123.1/A123.5, “Asphalt Shingles Made From Organic Felt and Surfaced with Mineral Granules/Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules”
	CAN/CSA-A220, “Concrete Roof Tiles”
	CSA O118.1, “Western Red Cedar Shakes and Shingles”
	CSA O118.2, “Eastern White Cedar Shingles”
Eave protection	CSA A123.22, “Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection”
Flashing	ASTM D 4811/D 4811M, “Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing”

Notes to Table 9.26.2.1.-B:
(1) For the purpose of this Subsection, ASTM D 3019 shall only apply to the non-fibered and non-asbestos-fibered types of asphalt roll roofing.

3) Except where otherwise permitted by the Chief Building Official, cedar shingles and shakes shall be certified as to grade by an agency accredited by the Standards Council of Canada.

9.26.2.2. Installation of Materials

1) Materials listed in Tables 9.26.2.1.-A and 9.26.2.1.-B shall be installed in conformance with the manufacturer's written instructions. (See Sentence 1.5.1.2.(1) of Division A.)

9.26.2.3. Nails

1) Nails used for roofing shall be corrosion-resistant roofing or shingle nails conforming to

a) ASTM F 1667, "Driven Fasteners: Nails, Spikes, and Staples," or

b) CSA B111, "Wire Nails, Spikes and Staples."

2) Nails shall have sufficient length to penetrate through, or 12 mm into, roof sheathing.

3) Nails used with asphalt roofing shall have a head diameter of not less than 9.5 mm and a shank thickness of not less than 2.95 mm.

4) Nails used with wood shingles or shakes shall have a head diameter of not less than 4.8 mm and a shank thickness of not less than 2.0 mm and shall be stainless steel, aluminum or hot-dipped galvanized. (See Note A-9.26.2.3.(4).)

9.26.2.4. Staples

1) Staples used to apply asphalt or wood shingles shall be corrosion-resistant and shall be driven with the crown parallel to the eaves.

2) Staples used with asphalt shingles shall be not less than 19 mm long, 1.6 mm diam or thickness, with not less than a 25 mm crown, except that an 11 mm crown may be used as provided in Sentence 9.26.7.4.(2).

3) Staples used with wood shingles shall be not less than 29 mm long, 1.6 mm diam or thickness, with not less than a 9.5 mm crown and shall be stainless steel or aluminum. (See Note A-9.26.2.3.(4).)

9.26.3. Slope of Roofed Surfaces

9.26.3.1. Slope

1) Except as provided in Sentences (2) and (3), the slopes on which roof coverings may be applied shall conform to Table 9.26.3.1.

2) Asphalt and gravel or coal tar and gravel roofs may be constructed with lower slopes than required in Sentence (1) when effective drainage is provided by roof drains located at the lowest points on the roofs.

3) Profiled metal roof cladding systems specifically designed for low-slope applications are permitted to be installed with lower slopes than required by Sentence (1), provided they are installed in conformance with the manufacturer's written recommendations.

4) Except where back-slope will not adversely affect adjacent supported or supporting constructions due to water ingress, roofs and constructions that effectively serve as roofs shall be constructed with sufficient slope away from

a) exterior walls, and

b) guards that are connected to the roof, or to a construction that effectively serves as a roof, by more than pickets or posts.

(See Notes A-9.26.1.1.(1), A-9.26.4.1. and A-9.27.3.8.(4).)

5) The slope required by Sentence (4) shall be sufficient to maintain a positive slope

a) after expected shrinkage of the building frame, where these surfaces are supported by exterior walls and exterior columns (See Note A-9.27.3.8.(4)), and

b) once design loading is taken into consideration, where these surfaces are cantilevered from exterior walls.

Table 9.26.3.1.
Roofing Types and Slope Limits
Forming Part of Sentence 9.26.3.1.(1)*01191212.DOC*

Type of Roofing	Minimum Slope	Maximum Slope
Asbestos-Cement Corrugated Sheets	1 in 4	no limit
Asphalt Shingles		
Low slope application	1 in 6	no limit
Normal application	1 in 3	no limit
Built-up Roofing		
Asphalt base (without gravel)	1 in 25	1 in 2
Asphalt base (gravelled)	1 in 50(1)	1 in 4
Coal-tar base (gravelled)	1 in 50(1)	1 in 25
Cold process	1 in 25	1 in 1.33
Cedar Shakes	1 in 3	no limit
Clay Tile	1 in 2	no limit
Glass Fibre Reinforced Polyester Roofing Panels	1 in 4	no limit
Modified Bituminous Membranes	1 in 50	1 in 4
Profiled Metal Roofing	1 in 4(1)	no limit
Roll Roofing		
480 mm wide selvage asphalt roofing	1 in 6	no limit
Cold application felt	1 in 50	1 in 1.33
Smooth and mineral surfaced	1 in 4	no limit
Sheet Metal Shingles	1 in 4(1)	no limit
Slate Shingles	1 in 2	no limit
Wood Shingles	1 in 4	no limit

Notes to Table 9.26.3.1.:
(1) See Sentence 9.26.3.1.(3).

9.26.4. Flashing at Intersections

9.26.4.1. Required Flashing at Intersections

(See Notes A-9.26.4.1. and A-9.26.1.1.(1).)

1) Except where the omission of flashing will not adversely affect adjacent supported or supporting constructions, flashing shall be installed at junctions between roofs and

a) walls that rise above the roof, and

b) *guards* that are connected to the roof by more than pickets or posts.

2) For the purpose of Sentence (1), roofs shall include platforms that effectively serve as roofs with respect to the accumulation or drainage of precipitation.

9.26.4.2. Materials

1) Sheet metal flashing shall consist of not less than

a) 1.73 mm thick sheet lead,
b) 0.33 mm thick galvanized steel,
c) 0.33 mm thick copper,
d) 0.35 mm thick zinc, or
e) 0.48 mm thick aluminum.

9.26.4.3. Valley Flashing

1) Where sloping surfaces of shingled roofs intersect to form a valley, the valley shall be flashed.

2) Valley flashing shall be installed over continuous sheathing.

3) Closed valleys shall not be used with rigid shingles on slopes of less than 1 in 1.2.

4) Open valleys shall be flashed with at least

a) one layer of sheet metal not less than 600 mm wide, or
b) 2 layers of roll roofing.

5) The bottom layer of roofing required in Sentence (4) shall consist of at least Type S smooth roll roofing or Type M mineral surface roll roofing (mineral surface down) not less than 457 mm wide, centred in the valley and fastened with nails spaced not more than 450 mm o.c. located 25 mm away from the edges.

6) The top layer of roofing required in Sentence (4) shall consist of at least Type M mineral surface roll roofing (mineral surface up), 914 mm wide, centred in the valley, applied over a 100 mm wide strip of cement along each edge of the bottom layer, and fastened with a sufficient number of nails to hold it in place until the shingles are applied.

9.26.4.4. Intersection of Shingle Roofs and Masonry

1) The intersection of shingle roofs and masonry walls or *chimneys* shall be protected with flashing.

2) Counter flashing required in Sentence (1) shall be embedded not less than 25 mm in the masonry and shall extend not less than 150 mm down the masonry and lap the lower flashing not less than 100 mm.

3) Flashing along the slopes of a roof described in Sentence (1) shall be stepped so that there is not less than a 75 mm head lap in both the lower flashing and counter flashing.

4) Where the roof described in Sentence (1) slopes upwards from the masonry, the flashing shall extend up the roof slope to a point equal in height to the flashing on the masonry, but not less than 1.5 times the shingle exposure.

9.26.4.5. Intersection of Shingle Roofs and Walls other than Masonry

1) The intersection of shingle roofs and walls clad with other than masonry shall be protected with flashing.

2) Flashing required in Sentence (1) shall be installed so that it extends up the wall not less than 75 mm behind the sheathing paper, and extends not less than 75 mm horizontally.

3) Along the slope of the roof, the flashing required in Sentence (1) shall be stepped with not less than a 75 mm head lap.

9.26.4.6. Intersection of Built-Up Roofs and Masonry

1) The intersection of built-up roofs with masonry walls or *chimneys* shall have a cant strip at the intersection, and a roofing membrane shall be mopped over the cant strip and not less than 150 mm up the wall.

2) Counter flashing installed over the intersection referred to in Sentence (1) shall be embedded not less than 25 mm in the masonry, and shall be of sufficient length to extend down not less than 150 mm, lapping the membrane on the masonry not less than 100 mm.

9.26.4.7. Intersection of Built-Up Roofs and Walls other than Masonry

1) The intersection of built-up roofs with walls clad with other than masonry shall have a cant strip at the intersection.
2) The roofing membrane shall be mopped over the cant strip referred to in Sentence (1).
3) Flashing plies shall extend not less than 150 mm up the wall referred to in Sentence (1) behind the sheathing paper.

9.26.4.8. Chimney Saddles

1) Except as otherwise permitted in Sentence (5), *chimney* saddles shall be installed where the upper side of a *chimney* on a sloping roof is more than 750 mm wide.
2) *Chimney* saddles shall be covered with sheet metal or roofing material of weight and quality equivalent to the roofing.
3) Saddles shall be flashed where they intersect the roof.
4) The intersection of the saddle and the *chimney* shall be flashed and counterflashed as described in Article 9.26.4.4.
5) A *chimney* saddle need not be installed if the intersection between the *chimney* and roof is protected by sheet metal flashing that extends up the *chimney* to a height equal to at least one sixth the width of the *chimney*, but not less than 150 mm, and up the roof slope to a point equal in height to the flashing on the *chimney*, but not less than 1.5 times the shingle exposure.
6) Flashing described in Sentence (5) at the *chimney* shall be counterflashed as required by Article 9.26.4.4.

9.26.5. Eave Protection for Shingles and Shakes

9.26.5.1. Required Eave Protection

1) Except as provided in Sentence (2), eave protection shall be provided on shingle, shake or tile roofs, extending from the edge of the roof a minimum of 900 mm up the roof slope to a line not less than 300 mm inside the inner face of the exterior wall.
2) Eave protection is not required

- a) over unheated garages, carports and porches,
- b) where the roof overhang exceeds 900 mm measured along the roof slope from the edge of the roof to the inner face of the exterior wall,
- c) on roofs of asphalt shingles installed in accordance with Subsection 9.26.8.,
- d) on roofs with slopes of 1 in 1.5 or greater, or
- e) in regions with 3 500 or fewer degree-days.

9.26.5.2. Materials

1) Eave protection shall be laid beneath the starter strip and shall consist of

- a) No. 15 asphalt-saturated felt laid in two plies lapped 480 mm and cemented together with lap cement,
- b) Type M or S roll roofing laid with not less than 100 mm head and end laps cemented together with lap cement,
- c) glass fibre or polyester fibre coated base sheets, or
- d) self-sealing composite membranes consisting of modified bituminous coated material.

9.26.6. Underlay beneath Shingles

9.26.6.1. Materials

1) Except as required in Sentence (2), when underlay is used beneath shingles, it shall be

- a) asphalt-saturated sheathing paper weighing not less than 0.195 kg/m^2, or
- b) No. 15 plain or perforated asphalt-saturated felt.

2) Underlay used beneath wood shingles shall be breather type.

9.26.6.2. Installation

1) When used with shingles, underlay shall be installed parallel to the eaves with head and end lap of not less than 50 mm.

2) The top edge of each strip of underlay referred to in Sentence (1) shall be fastened with sufficient roofing nails to hold it in place until the shingles are applied.

3) The underlay referred to in Sentence (1) shall overlap the eave protection by not less than 100 mm. (See Article 9.26.10.2. for underlay beneath wood shakes.)

9.26.7. Asphalt Shingles on Slopes of 1 in 3 or Greater

9.26.7.1. Coverage

1) Coverage shall be not less than 2 thicknesses of shingle over the entire roof, disregarding cutouts.

9.26.7.2. Starter Strip

1) A starter strip shall be installed along the lower edge of the roof so that it extends approximately 12 mm beyond the eaves and rake of the roof and fastened along the bottom edge with nails spaced not more than 300 mm o.c.

2) Starter strips shall be

- a) at least Type M mineral-surfaced roll roofing not less than 300 mm wide,
- b) shingles of the same weight and quality as those used as a roof covering with tabs facing up the roof slope, or
- c) pre-manufactured starter strips installed with sealant at the eaves.

3) Starter strips need not be provided where eave protection of not less than Type M mineral-surfaced roll roofing is provided.

9.26.7.3. Head Lap

1) Shingles shall have a head lap of not less than 50 mm.

9.26.7.4. Fasteners

1) Except as provided in Sentence (2), shingles shall be fastened with at least 4 nails or staples for 1 m wide shingles so that no nails or staples are exposed.

2) Where staples with an 11 mm crown are used, shingles shall be fastened with at least 6 staples.

3) Fasteners may be reduced for narrower shingles in proportion to the width of the shingle or when shingles incorporating interlocking devices are used.

4) Fasteners referred to in Sentences (1) and (2) shall be located 25 mm to 40 mm from each end of each strip shingle with other fasteners equally spaced between them.

5) Fasteners referred to in Sentences (1) and (2) shall be located not less than 12 mm above the tops of the cutouts.

9.26.7.5. Securing of Tabs

1) Shingle tabs shall be secured by a spot of plastic cement not exceeding 25 mm diam under the centre of each tab or by interlocking devices or self-sealing strips.

9.26.7.6. Hips and Ridges

1) Shingles on hips and ridges shall be applied so they extend not less than 100 mm on either side of the hip or ridge, and shall be lapped not less than 150 mm.

2) Shingles referred to in Sentence (1) shall be fastened with nails or staples on each side located not more than 25 mm from the edge and 25 mm above the butt of the overlying shingle.

9.26.7.7. Eave Protection

1) Eave protection shall conform to Subsection 9.26.5.

9.26.7.8. Flashing

1) Flashing shall conform to Subsection 9.26.4.

9.26.8. Asphalt Shingles on Slopes of less than 1 in 3

9.26.8.1. Coverage

1) Except for the first 2 courses, coverage shall be not less than 3 thicknesses of shingle over the entire roof, disregarding cutouts.

9.26.8.2. Starter Strip

1) A starter strip shall be installed as in Article 9.26.7.2.

2) Starter strips required in Sentence (1) shall be laid in a continuous band of cement not less than 200 mm wide.

9.26.8.3. Securing of Tabs

1) Shingle tabs shall be secured with cold application cement applied at the rate of not less than 0.5 L/m^2 of cemented area, or hot application asphalt applied at the rate of 1 kg/m^2 of cemented area.

9.26.8.4. Securing of Shingle Courses

1) The first course of shingles shall be secured by a continuous band of cement along the eaves applied so that the width of the band equals the shingle exposure plus 100 mm.

2) The succeeding courses of shingles shall be secured by a continuous band of cement applied so that the width of the band equals the shingle exposure plus 50 mm.

3) The band required in Sentence (2) shall be located not more than 50 mm above the butt of the overlying course of shingles.

9.26.8.5. Hips and Ridges

1) Shingles on hips and ridges shall be not less than 300 mm wide applied to provide triple coverage.

2) Shingles referred to in Sentence (1) shall be cemented to the roof shingles and to each other with a coat of cement and fastened with nails or staples located 40 mm above the butt of the overlying shingle and 50 mm from each edge.

9.26.8.6. Flashing

1) Flashing shall conform to Subsection 9.26.4.

9.26.8.7. Fastening

1) Shingles shall be fastened in accordance with Article 9.26.7.4.

9.26.9. Wood Roof Shingles

9.26.9.1. Decking

1) Except as provided in Sentence 9.23.16.1.(1), decking for wood shingled roofs may be continuous or spaced.

9.26.9.2. Grade

1) Western cedar shingles shall be not less than No. 2 grade.

2) Eastern white cedar shingles shall be not less than B (clear) grade.

9.26.9.3. Size

1) Wood shingles shall be not less than 400 mm long and not less than 75 mm or more than 350 mm wide.

9.26.9.4. Spacing and Joints

1) Shingles shall be spaced approximately 6 mm apart and offset at the joints in adjacent courses not less than 40 mm so that joints in alternate courses are staggered.

9.26.9.5. Fastening

1) Shingles shall be fastened with 2 nails or staples located approximately 20 mm from the sides of the shingle and 40 mm above the exposure line.

9.26.9.6. Exposure

1) The exposure of wood roof shingles shall conform to Table 9.26.9.6.

Table 9.26.9.6.
Exposure of Wood Roof Shingles
Forming Part of Sentence 9.26.9.6.(1)

Roof Slope	Maximum Exposure, mm;l					
	No.1 or A Grade Length of Shingle, mm			No. 2 or B Grade Length of Shingle, mm		
	400	450	600	400	450	600
< 1 in 3	100	115	165	90	100	140
≥ 1 in 3	125	140	190	100	115	165

9.26.9.7. Flashing

1) Flashing shall conform to Subsection 9.26.4.

9.26.9.8. Eave Protection

1) Eave protection shall conform to Subsection 9.26.5.

9.26.10. Cedar Roof Shakes

9.26.10.1. Size and Thickness

1) Shakes shall be not less than 450 mm long and not less than 100 mm nor more than 350 mm wide with a butt thickness of not more than 32 mm and not less than 9 mm.

9.26.10.2. Underlay

1) Where eave protection is not provided, an underlay conforming to the requirements in Article 9.26.6.1. for wood shingles shall be laid as a strip not less than 900 mm wide along the eaves.
2) A strip of material similar to that described in Sentence (1) not less than 450 mm wide shall be interlaid between each course of shakes with the bottom edge of the strip positioned above the butt line at a distance equal to double the exposure of the shakes.
3) Interlaid strips referred to in Sentence (2) shall be lapped not less than 150 mm at hips and ridges in a manner that will prevent water from reaching the roof sheathing.

9.26.10.3. Spacing and Joints

1) Shakes shall be spaced 6 mm to 9 mm apart and the joints in any one course shall be separated not less than 40 mm from joints in adjacent courses.

9.26.10.4.Fastening

1) Shakes shall be fastened with nails located approximately 20 mm from the sides of the shakes and 40 mm above the exposure line.

9.26.10.5.Exposure

1) The exposure of wood shakes shall not exceed

a) 190 mm for shakes not less than 450 mm long, and
b) 250 mm for shakes not less than 600 mm long.

9.26.10.6.Flashing

1) Flashing shall conform to Subsection 9.26.4.

9.26.10.7.Eave Protection

1) Eave protection shall conform to Subsection 9.26.5.

9.26.10.8.Grade

1) Shakes shall be not less than No. 1 or Handsplit grade.

9.26.11. Built-Up Roofs

9.26.11.1.Quantity of Materials

1) The quantities of bituminous materials used on built-up roofs shall conform to Table 9.26.11.1.

Table 9.26.11.1.
Quantities of Bitumen for Built-up Roofs
Forming Part of Sentence 9.26.11.1.(1)

Type of Roof	Amount of Bitumen per Square Metre of Roof Surface	
	Mopping Coats between Layers	Flood Coat
Asphalt and aggregate	1 kg	3 kg
Coal-tar and aggregate	1.2 kg	3.6 kg
Cold process roofing	0.75 L cold process cement	2 L cold process top coating

9.26.11.2.Coal-Tar and Asphalt Products

1) Coal-tar products and asphalt products shall not be used together in built-up roof construction.

9.26.11.3.Roof Felts

1) Bitumen roofing felts shall be at least No. 15 felt.

9.26.11.4.Aggregate Surfacing

1) Aggregate used for surfacing built-up roofs shall be clean, dry and durable and shall consist of particles of gravel, crushed stone or air-cooled blast *furnace* slag having a size of from 6 mm to 15 mm.

2) The minimum amount of aggregate surfacing per square metre of roof surface shall be 15 kg gravel or crushed stone or 10 kg crushed slag.

9.26.11.5.Flashing

1) Flashing for built-up roofs shall conform to Subsection 9.26.4.

9.26.11.6.Number of Layers

1) Built-up roofing shall consist of not less than 3 mopped-down layers of roofing felt flood coated with bitumen.

9.26.11.7.Installation of Layers

1) In hot process applications each layer of bitumen-saturated felt shall be laid while the bitumen is hot, with each layer overlapping the previous one.
2) The full width under each lap referred to in Sentence (1) shall be coated with bitumen so that in no place does felt touch felt.
3) Felt shall be laid free of wrinkles and shall be rolled directly into the hot bitumen and broomed forward and outward from the centre to ensure complete adhesion.

9.26.11.8.Roofing over Wood-Based Sheathing

1) Except as permitted in Sentence (2), built-up roofing applied over wood, plywood, OSB or waferboard roof sheathing shall be laid over an additional base layer of felt laid dry over the entire roof deck with not less than a 50 mm headlap and a 50 mm sidelap between each sheet.
2) Where plywood, OSB or waferboard roof sheathing is used, the dry layer of felt required in Sentence (1) may be omitted when the joints are taped and the sheathing is primed with asphalt.

9.26.11.9.Attachment to Decking

1) Roofing shall be securely attached to the decking or where insulation is applied above the deck, the insulation shall be securely attached to the deck before the first layer of felt is fastened to the insulation.

9.26.11.10.Cant Strips

1) Except as permitted in Sentence (4), a cant strip shall be provided at the edges of roofs.
2) At least 2 plies of the roofing membrane shall be carried over the top of the cant strip.
3) Flashing shall extend over the top of the cant strip and be shaped to form a drip.
4) The cant strip required in Sentence (1) need not be provided where a gravel stop is installed at the edge of roofs.
5) The roofing membranes shall be carried over the edge of the roof before the gravel stop referred to in Sentence (4) is fastened and 2 plies of roofing membrane mopped to the top surface of the gravel stop before the flood coat is applied.
6) The gravel stop referred to in Sentence (4) shall extend over the edge of the roof to form a drip or shall be flashed so that the flashing extends over the edge to form a drip.

9.26.12. Selvage Roofing

9.26.12.1.Coverage

1) Wide selvage asphalt roofing shall provide double coverage over the entire roof surface.

9.26.12.2.Joints

1) Plies of selvage roofing shall be cemented together to ensure a watertight joint.

9.26.13. Sheet Metal Roofing

9.26.13.1.Thickness

1) Sheet metal roofing shall be not less than
a) 0.33 mm thick galvanized steel,
b) 0.46 mm thick copper,
c) 0.46 mm thick zinc, or

d) 0.48 mm thick aluminum.

9.26.13.2. Support

1) Except as provided in Sentence 9.23.16.1.(1), where sheet metal roofing is not supported by roof decking but spans between spaced supports, the panels shall be designed to support the specified *live loads* for roofs.

9.26.14. Glass Reinforced Polyester Roofing

9.26.14.1. Support

1) Except as provided in Sentence 9.23.16.1.(1), where glass-reinforced polyester roofing panels are not supported by roof decking but span between spaced supports, the panels shall be designed to support the specified live roof loads.

9.26.15. Hot Applied Rubberized Asphalt Roofing

9.26.15.1. Installation

1) Hot applied rubberized asphalt roofing shall be installed in accordance with CAN/CGSB-37.51-M, "Application for Hot-Applied Rubberized Asphalt for Roofing and Waterproofing."

9.26.16. Polyvinyl Chloride Sheet Roofing

9.26.16.1. Installation

1) Polyvinyl chloride sheet applied roofing membrane shall be installed in accordance with CGSB 37-GP-55M, "Application of Sheet Applied Flexible Polyvinyl Chloride Roofing Membrane."

9.26.17. Concrete Roof Tiles

9.26.17.1. Installation

1) Except as provided in Sentence 9.23.16.1.(1), concrete roof tiles shall be installed according to CAN/CSA-A220, "Concrete Roof Tiles." (See Note A-9.26.17.1.(1).)

9.26.18. Roof Drains and Downspouts

9.26.18.1. Roof Drains

1) When roof drains are provided they shall conform to Part 7.

9.26.18.2. Downspouts

1) Where downspouts are provided and are not connected to a sewer, extensions shall be provided to carry rainwater away from the *building* in a manner which will prevent *soil* erosion.

9.26.18.3. Roof or Balcony Parapet Walls

1) Where a roof or balcony is entirely enclosed by parapet walls, a secondary means of drainage, such as scuppers or overflow outlets shall be installed in the parapet walls, in addition to drains. (See Note A-9.26.18.3.(1).)

Section 9.27. Cladding

9.27.1. Application

9.27.1.1. General

1) Where lumber, wood shingles, shakes, fibre-cement shingles, planks and sheets, plywood, OSB, waferboard, hardboard, vinyl, aluminum or steel, including trim and soffits, are installed as cladding on wood-frame walls exposed to precipitation, the cladding assembly shall comply with

a) Subsections 9.27.2. to 9.27.12., or
b) Part 5.

2) Where stucco is installed as cladding on wood-frame or masonry walls exposed to precipitation, the cladding assembly shall comply with

a) Subsections 9.27.2. to 9.27.5., and Section 9.28., or
b) Part 5.

3) Where masonry serves as cladding on wood-frame or masonry walls exposed to precipitation, the cladding assembly shall comply with

a) Subsections 9.27.2. to 9.27.4., and Section 9.20., or
b) Part 5.

4) Where asphalt shingles are installed as cladding on wood-frame walls exposed to precipitation, the cladding assembly shall comply with

a) Subsections 9.26.7. and 9.27.2. to 9.27.4., or
b) Part 5.

5) Where an exterior insulation finish system is installed as cladding on wood-frame, masonry, cold-formed steel stud or cast-in-place concrete walls exposed to precipitation, the cladding assembly shall comply with

a) Subsections 9.25.5., 9.27.2. to 9.27.4., and 9.27.13., or
b) Part 5.

(See Note A-9.27.1.1.(5).)

6) Where cladding materials other than those described in Sentences (1) to (5) are installed, or where the cladding materials described in Sentences (1) to (5) are installed on substrates other than those identified in Sentences (1) to (5), the materials and installation shall comply with Part 5.

9.27.2. Required Protection from Precipitation

(See Note A-9.27.2.)

9.27.2.1. Minimizing and Preventing Ingress and Damage

1) Except where exterior walls are protected from precipitation or where it can be shown that precipitation ingress will not adversely affect occupant health or safety, exterior walls shall be designed and constructed to

a) minimize the ingress of precipitation into the assembly, and
b) prevent the ingress of precipitation into interior space.

(See Note A-9.27.2.1.(1).)

2) Except where exterior walls are protected from specific mechanisms of deterioration, such as mechanical impact and ultraviolet radiation, exterior walls shall be designed and constructed to minimize the likelihood of their required performance being reduced to an unacceptable level as a result of those mechanisms.

9.27.2.2. Minimum Protection from Precipitation Ingress

(See Note A-9.27.2.2.)

1) Except as provided in Sentence (2), a cladding assembly is deemed to have a capillary break between the cladding and the backing assembly, where

a) there is a drained and vented air space not less than 9.5 mm deep behind the cladding, over the full height and width of the wall (See also Article 9.27.5.3.),
b) an open drainage material, not less than 9.5 mm thick and with a cross-sectional area that is not less than 80% open, is installed between the cladding and the backing, over the full height and width of the wall,

c) the cladding's components are hollow-backed metal or vinyl and are the cladding is composed of non-insulating type, hollow backed aluminum or vinyl which is horizontally oriented and loosely fastened to the backing substrate,
d) the wall is a masonry *cavity wall* or the cladding is masonry veneer constructed according to Section 9.20., or
e) the cladding conforms to Subsection 9.27.13.

2) The drained and vented air space, and drainage material described in Sentence (1) may be interrupted by
a) penetrations for windows, doors and services,
b) flashing,
c) nominally vertical furring or strapping, provided the furring or strapping does not make up more than 20% of the drained and vented air space, and
d) insect screen, provided the screen allows for drainage and venting of the airspace.

3) Where a construction projects over the top of the drained and vented air space described in Clause (1)(a) or over the drainage material described in Clause (1)(b), the air space or drainage material shall not be contiguous with concealed spaces in the projecting construction.

4) Exterior walls exposed to precipitation shall be protected against precipitation ingress by an exterior cladding assembly consisting of a first plane of protection and a second plane of protection, where such walls enclose spaces of *residential occupancy* or spaces that directly serve spaces of *residential occupancy*.

5) Except as provided in Sentence (6), exterior walls exposed to precipitation shall be protected against precipitation ingress by an exterior cladding assembly consisting of a first plane of protection and a second plane of protection incorporating a capillary break, where
a) the number of degree-days is less than 3 400 and the moisture index is greater than 0.90, or
b) the number of degree-days is 3 400 or more, and the moisture index is greater than 1.00.
(See Sentence 1.1.3.1.(1) and Appendix C for information on the moisture index.)

6) In exterior walls described in Sentence (5), the first and second planes of protection need not incorporate a capillary break, where
a) it can be shown that omitting the capillary break will not adversely affect the performance of the *building* assemblies,
b) the *building* is an accessory *building*, or
c) the wall
i) is constructed of non-moisture-sensitive materials, and intersecting or supported floors are also constructed of non-moisture-sensitive materials, or
ii) is constructed as a mass wall of sufficient thickness to minimize the transfer of moisture to the interior.

9.27.2.3. First and Second Planes of Protection

1) Where walls required to provide protection from precipitation comprise cladding assemblies with first and second planes of protection,
a) the first plane of protection shall
i) consist of cladding with appropriate trim, accessory pieces and fasteners, and
ii) be designed and constructed to minimize the passage of rain and snow into the wall by minimizing holes and managing precipitation ingress caused by the kinetic energy of raindrops, surface tension, capillarity, gravity, and air pressure differences (See Subsection 9.27.4.),
b) the second plane of protection shall be designed and constructed to (See Subsection 9.27.3.)
i) intercept all rain and snow that gets past the first plane of protection, and
ii) effectively dissipate any rain or snow to the exterior, and
c) the protection provided by the first and second planes of protection shall be maintained
i) at wall penetrations created by the installation of components and services such as windows, doors, ventilation ducts, piping, wiring and electrical outlets, and

ii) at the interface with other wall assemblies.

9.27.2.4. Protection of Cladding from Moisture

1) A clearance of not less than 200 mm shall be provided between finished ground and cladding that is adversely affected by moisture, such as untreated wood, plywood, OSB, waferboard and hardboard.
2) A clearance of not less than 50 mm shall be provided between a roof surface and cladding that is adversely affected by moisture, such as untreated wood, plywood, OSB, waferboard and hardboard.

9.27.3. Second Plane of Protection

9.27.3.1. Elements of the Second Plane of Protection

(See Note A-9.27.3.1.)
1) The second plane of protection shall consist of a drainage plane having an appropriate inner boundary and flashing to dissipate rainwater to the exterior.
2) Except for cladding systems conforming to Subsection 9.27.13., the inner boundary of the drainage plane shall comply with Articles 9.27.3.2. to 9.27.3.6.
3) The protection provided by the second plane of protection shall be maintained
a) at wall penetrations created by the installation of components and services such as windows, doors, ventilation ducts, piping, wiring and electrical outlets, and
b) at the interface with other wall assemblies.
4) Flashing material and its installation shall comply with Articles 9.27.3.7. and 9.27.3.8.

9.27.3.2. Sheathing Membrane Material Standard

1) Sheathing membranes shall conform to the performance requirements of CAN/CGSB-51.32-M, "Sheathing, Membrane, Breather Type."

9.27.3.3. Required Sheathing Membrane and Installation

1) Except as provided in Articles 9.27.3.4. to 9.27.3.6., at least one layer of sheathing membrane shall be applied beneath cladding.
2) Sheathing membrane required in Sentence (1) shall be applied so that joints are lapped not less than 100 mm.
3) Where sheathing membrane required in Sentence (1) is applied horizontally, the upper sheets shall overlap the lower sheets.

9.27.3.4. Insulating Sheathing in lieu of Sheathing Membrane

1) Where non-wood-based rigid exterior insulating sheathing, or exterior insulating sheathing with an integral sheathing membrane is installed, a separate sheathing membrane is not required.
2) Where insulating sheathing is installed as provided in Sentence (1),
a) sheathing panels subject to moisture deterioration shall be sealed at all joints, and
b) the joints of sheathing panels not subject to moisture deterioration shall be
i)sealed at all joints, or
ii) lapped or tongue and groove, and detailed to ensure drainage of water to the exterior.
(See Note A-9.27.3.4.(2).)

9.27.3.5. Sheathing Membranes in lieu of Sheathing

1) Except as provided in Article 9.27.3.6., where no sheathing is used, at least 2 layers of sheathing membrane shall be applied beneath the cladding. (See Article 9.23.17.1. and Note A-9.27.3.5.(1).)
2) All joints in the sheathing membrane required in Sentence (1) shall occur over framing, and the membrane shall be fastened to the framing with roofing nails or staples spaced not more than 150 mm along the edges of the outer layer of sheathing membrane.

3) Wall sheathing is permitted to be used in lieu of one layer of sheathing membrane required in Sentence (1), and its thickness need not conform to Table 9.23.17.2.-A.

9.27.3.6. Face Sealed Cladding

(See Note A-9.27.3.6.)

1) Sheathing membrane is permitted to be omitted beneath cladding when the joints in the cladding are formed to effectively prevent the passage of wind and rain in conformance with Sentences (2) or (3), as applicable.

2) Cladding consisting of sheets of plywood, hardboard, OSB, waferboard or fibre cement is considered to meet the requirements of Sentence (1), provided the cladding is applied so that

- a) all edges are directly supported by framing,
- b) the vertical joints between adjacent sheets are sealed and
  - i) covered with battens,
  - ii) shiplapped, or
  - iii) otherwise matched to provide weathertight joints, and
- c) the horizontal joints between adjacent sheets are sealed and
  - i) shiplapped, or
  - ii) otherwise matched to provide weathertight joints.

3) Metal siding consisting of sheets of metal is considered to meet the requirements of Sentence (1) where the joints between sheets are of the locked-seam type.

9.27.3.7. Flashing Materials

1) Flashing shall consist of not less than

- a) 1.73 mm thick sheet lead,
- b) 0.33 mm thick galvanized steel,
- c) 0.46 mm thick copper,
- d) 0.46 mm thick zinc,
- e) 0.48 mm thick aluminum, or
- f) 1.02 mm thick vinyl.

9.27.3.8. Flashing Installation

1) Except as provided in Sentence (2), flashing shall be installed at

- a) every horizontal junction between cladding elements,
- b) every horizontal offset in the cladding, and
- c) every horizontal line where the cladding substrates change and where
  - i) the substrates differ sufficiently for stresses to be concentrated along that line, or
  - ii) the installation of the cladding on the lower substrate may compromise the drainage of moisture from behind the cladding above.

(See Note A-9.27.3.8.(1).)

2) Flashing need not be installed as described in Sentence (1)

- a) where the upper cladding elements overlap the lower cladding elements by not less than 25 mm,
- b) where
  - i) the cladding above and below the joint is installed outboard of a drained and vented air space (See Clause 9.27.2.2.(1)(a)), and
  - ii) the horizontal detail is constructed so as to minimize the ingress of precipitation into the air space, or
- c) at horizontal construction joints in stucco, where
  - i) the joint is finished with an expansion-contraction strip, and
  - ii) the cladding is installed outboard of a drained and vented air space (See Clause 9.27.2.2.(1)(a)).

3) Flashing shall be installed over exterior wall openings where the vertical distance from the bottom of the eave to the top of the trim is more than one-quarter of the horizontal overhang of the eave. (See Note A-9.27.3.8.(3).)

4) Flashing described in Sentences (1) and (3) shall

a) extend not less than 50 mm upward inboard of the sheathing membrane or sheathing installed in lieu of the sheathing membrane (See Article 9.27.3.4.),

b) have a slope of not less than 6% toward the exterior after the expected shrinkage of the *building* frame,

c) terminate at each end with an end-dam

i) with a height in millimetres not less than 25 mm or 1/10 the value of the 1-in-5 driving rain wind pressure in Pa, and

ii) at the height defined in Subclause (c)(i), extending to the face of the adjacent cladding, lap not less than 10 mm vertically over the *building* element below, and

d) terminate in a drip offset not less than 5 mm outward from the outer face of the *building* element below.

(See Note A-9.27.3.8.(4).)

5) Where the sills of windows and doors installed in exterior walls are not self-flashing, flashing shall be installed between the underside of the window or door and the wall construction below. (See Note A-9.27.3.8.(5).)

9.27.4. Sealants

9.27.4.1. Required Sealants

1) Sealant shall be provided where required to prevent the entry of water into the structure.

2) Sealant shall be provided between masonry, siding or stucco and the adjacent door and window frames or trim, including sills, unless such locations are completely protected from the entry of rain.

3) Sealant shall be provided at vertical joints between different cladding materials unless the joint is suitably lapped or flashed to prevent the entry of rain. (See Articles 9.7.6.2., 9.20.13.12. and 9.28.1.5.)

9.27.4.2. Materials

1) Sealants shall be

a) a non-hardening type suitable for exterior use,

b) selected for their ability to resist the effects of weathering, and

c) compatible with and adhere to the substrate to which they are applied.

(See Note A-9.27.4.2.(1).)

2) Sealants shall conform to

a) ASTM C 834, “Latex Sealants,”

b) ASTM C 920, “Elastomeric Joint Sealants,”

c) ASTM C 1184, “Structural Silicone Sealants,” or

d) ASTM C 1311, “Solvent Release Sealants.”

3) Backer rod shall conform to ASTM C 1330, “Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.” (See Note A-9.27.4.2.(1).)

9.27.5. Attachment of Cladding

9.27.5.1. Attachment

1) Except as permitted by Sentences (2) to (6), cladding shall be fastened to the framing members or furring members, or to blocking between the framing members.

2) Vertical lumber and stucco lath or reinforcing are permitted to be attached to sheathing only where the sheathing consists of not less than

a) 14.3 mm lumber,

b) 12.5 mm plywood, or
c) 12.5 mm OSB or waferboard.

3) Vertically applied metal siding and wood shingles and shakes are permitted to be attached to the sheathing only where the sheathing consists of not less than
a) 14.3 mm lumber,
b) 7.5 mm plywood, or
c) 7.5 mm OSB or waferboard.

4) Where wood shingles or shakes are applied to sheathing which is not suitable for attaching the shingles or shakes, the shingles or shakes are permitted to be attached to a wood lath not less than 38 mm by 9.5 mm thick securely nailed to the framing and applied as described in Article 9.27.7.5.

5) Reserved.

6) Reserved.

9.27.5.2. Blocking

1) Blocking for the attachment of cladding shall be not less than 38 mm by 38 mm lumber securely nailed to the framing and spaced not more than 600 mm o.c.

9.27.5.3. Furring

1) Except as permitted in Sentences 9.27.5.1.(4) and (5), furring for the attachment of cladding shall be not less than 19 mm by 38 mm lumber when applied over sheathing.

2) When applied without sheathing, furring referred to in Sentence (1) shall be not less than
a) 19 mm by 64 mm lumber on supports spaced not more than 400 mm o.c., or
b) 19 mm by 89 mm lumber on supports spaced not more than 600 mm o.c.

3) Furring referred to in Sentence (1) shall be
a) securely fastened to the framing, and
b) spaced not more than 600 mm o.c.

9.27.5.4. Size and Spacing of Fasteners

1) Nail or staple size and spacing for the attachment of cladding and trim shall conform to Table 9.27.5.4.

Table 9.27.5.4.
Attachment of Cladding
Forming Part of Sentence 9.27.5.4.(1)

Type of Cladding	Minimum Nail or Staple Length, mm	Minimum Number of Nails or Staples	Maximum Nail or Staple Spacing, mm o.c.
Wood trim	51	–	600
Lumber siding or horizontal siding made from sheet material	51	–	600
Metal cladding	38	–	600 (nailed to framing)
			400 (nailed to sheathing only)
Wood shakes			
up to 200 mm in width	51	2	–
over 200 mm in width	51	3	–

Wood shingles			
200 mm in width	32	2	–
over 200 mm in width	32	3	–
Panel or sheet type cladding			
up to 7 mm thick	38	–	150 (along edges)
more than 7 mm thick	51	–	300 (along intermediate supports)

9.27.5.5. Fastener Materials

1) Nails or staples for the attachment of cladding and wood trim shall be corrosion-resistant and shall be compatible with the cladding material.

9.27.5.6. Expansion and Contraction

1) Fasteners for metal or vinyl cladding shall be positioned to permit expansion and contraction of the cladding.

9.27.5.7. Penetration of Fasteners

1) Fasteners for shakes and shingles shall penetrate through the nail-holding base or not less than 19 mm into the framing.

2) Fasteners for cladding other than that described in Sentence (1) shall penetrate through the nail-holding base or not less than 25 mm into the framing.

9.27.6. Lumber Siding

9.27.6.1. Materials

1) Lumber siding shall be sound, free of knot holes, loose knots, through checks or splits.

9.27.6.2. Thickness and Width

1) Drop, rustic, novelty, lapped board and vertical wood siding shall be not less than 14.3 mm thick and not more than 286 mm wide.

2) Bevel siding shall be

- a) not less than 5 mm thick at the top, and
- b) not less than
  - i) 12 mm thick at the butt for siding 184 mm or less in width, and
  - ii) 14.3 mm thick at the butt for siding wider than 184 mm.

3) Bevel siding shall be not more than 286 mm wide.

9.27.6.3. Joints

1) Lumber siding shall prevent water from entering at the joints by the use of lapped or matched joints or by vertical wood battens.

2) Siding shall overlap not less than 1 mm per 16 mm width of lumber, but not less than

- a) 9.5 mm for matched siding,
- b) 25 mm for lapped bevel siding, or
- c) 12 mm for vertical battens.

9.27.7. Wood Shingles and Shakes

9.27.7.1. Materials

1) Shingles and shakes shall conform to

a) CSA O118.1, "Western Red Cedar Shakes and Shingles," or

b) CSA O118.2, "Eastern White Cedar Shingles."

2) Western cedar shakes shall be not less than No. 1 or Handsplit grade, and western cedar shingles not less than No. 2 grade, except that No. 3 grade may be used for undercoursing.

3) Eastern white cedar shingles shall be at least B (clear) grade, except that C grade may be used for the lower course of double course applications.

9.27.7.2. Width

1) Shingles and shakes shall be not less than 65 mm or more than 350 mm wide.

9.27.7.3. Fasteners

1) Shingles or shakes shall be fastened with nails or staples located approximately 20 mm from each edge and not less than 25 mm above the exposure line for single-course applications, or approximately 50 mm above the butt for double-course applications.

9.27.7.4. Offsetting of Joints

1) In single-course application, joints in succeeding courses shall be offset not less than 40 mm so that joints in any 2 of 3 consecutive courses are staggered.

2) In double-course application, joints in the outer course shall be offset from joints in the under-course by not less than 40 mm, and joints in succeeding courses shall be offset not less than 40 mm.

9.27.7.5. Fastening to Lath

1) When lath is used with double-course application (See Sentence 9.27.5.1.(4)), it shall be spaced according to the exposure and securely fastened to the framing.

2) The butts of the under-course of the application referred to in Sentence (1) shall rest on the top edge of the lath.

3) The outer course of the application referred to in Sentence (1) shall be fastened to the lath with nails of sufficient length to penetrate through the lath.

4) The butts of the shingles or shakes shall be so located that they project not less than 12 mm below the bottom edge of the lath referred to in Sentence (1).

5) If wood lath is not used, the butts of the under-course shingles or shakes of the application referred to in Sentence (1) shall be located 12 mm above the butts of the outer course.

9.27.7.6. Exposure and Thickness

1) The exposure and butt thickness of shingles and shakes shall conform to Table 9.27.7.6.

Table 9.27.7.6.
Exposure and Thickness of Wood Shingles and Shakes
Forming Part of Sentence 9.27.7.6.(1)

Shake or Shingle Length, mm	Maximum Exposure, mm		Minimum Butt Thickness, mm
	Single Coursing	Double Coursing	
400	190	305	10
450	216	356	11
600	292	406	13

9.27.8. Plywood

9.27.8.1. Material Standards

1) Plywood cladding shall be exterior type conforming to
- a) ANSI/HPVA HP-1, "Hardwood and Decorative Plywood,"
- b) CSA O121, "Douglas Fir Plywood,"
- c) CSA O151, "Canadian Softwood Plywood," or
- d) CSA O153, "Poplar Plywood."

9.27.8.2. Thickness

1) Plywood cladding shall be not less than 6 mm thick when applied directly to sheathing.

2) When applied directly to framing or over furring strips, plywood cladding thickness shall conform to Table 9.27.8.2.

Table 9.27.8.2.
Minimum Plywood Cladding Thickness
Forming Part of Sentence 9.27.8.2.(2)

Spacing of Supports, mm	Minimum Thickness, mm	
	Face Grain Parallel to Supports	Face Grain Right Angles to Supports
400	8	6
600	11	8

3) The thickness of grooved or textured plywood cladding shall be measured at the point of least thickness.

9.27.8.3. Edge Treatment

1) The edges of plywood cladding shall be treated with a suitable paint or sealer.

9.27.8.4. Panel Cladding

1) Plywood applied in panels shall have all edges supported.

2) Not less than a 2 mm gap shall be provided between panels referred to in Sentence (1).

3) Vertical joints in cladding referred to in Sentence (1) shall be protected with batten strips or sealant when the plywood joints are not matched.

4) Horizontal joints in cladding referred to in Sentence (1) shall be lapped not less than 25 mm or shall be suitably flashed.

9.27.8.5. Lapped Strip Siding

1) Plywood applied in horizontal lapped strips shall have not less than a 2 mm gap provided at the butted ends, which shall be caulked.

2) The horizontal joints of siding described in Sentence (1) shall be lapped not less than 25 mm.

3) Wedges shall be inserted under all vertical butt joints and at all corners when horizontal lapped plywood is applied without sheathing.

9.27.9. Hardboard

9.27.9.1. Material Standards

1) Factory-finished hardboard cladding shall conform to CAN/CGSB-11.5-M, "Hardboard, Precoated, Factory Finished, for Exterior Cladding."

2) Hardboard cladding that is not factory finished shall conform to Types 1, 2 or 5 in CAN/CGSB-11.3-M, “Hardboard.”

9.27.9.2. Thickness

1) Type 1 or 2 hardboard cladding shall be not less than

a) 6 mm thick when applied over sheathing that provides continuous support, and

b) 7.5 mm thick when applied over furring or framing members not more than 400 mm o.c.

2) Type 5 hardboard cladding shall be not less than 9 mm thick when applied over sheathing that provides continuous support or over furring or framing members spaced not more than 400 mm o.c.

3) Where hardboard cladding is grooved, the grooves shall not extend more than 1.5 mm into the minimum required thickness. (See Note A-9.27.9.2.(3).)

9.27.9.3. Panel Cladding

1) Hardboard cladding applied in panels shall have all edges supported with not less than a 5 mm gap provided between sheets.

2) Vertical joints in cladding described in Sentence (1) shall be protected with batten strips or sealant when the joints are not matched.

3) Horizontal joints in cladding described in Sentence (1) shall be lapped not less than 25 mm or shall be suitably flashed.

9.27.9.4. Lapped Strip Siding

1) Hardboard applied in horizontal lapped strips shall have not less than a 5 mm gap provided at the butted ends, which shall be sealed or otherwise protected with suitable mouldings.

2) The horizontal joints of siding described in Sentence (1) shall overlap not less than 1 mm per 16 mm width of siding board but not less than 9.5 mm for matched joint siding or 25 mm for lapped siding.

9.27.9.5. Clearance

1) Not less than 3 mm clearance shall be provided between hardboard cladding and door or window frames.

9.27.10. OSB and Waferboard

9.27.10.1. Material Standard

1) OSB and waferboard cladding shall conform to CSA O437.0, “OSB and Waferboard.”

9.27.10.2. Thickness

1) OSB conforming to O-2 grade shall be not less than 6.0 mm thick where applied directly to sheathing.

2) OSB conforming to O-2 grade applied directly to framing or over furring strips shall conform to the thickness shown for plywood in Table 9.27.8.2. (See Note A-9.27.10.2.(2).)

3) OSB conforming to O-1 grade and waferboard conforming to R-1 grade shall be not less than 7.9 mm thick where applied directly to sheathing.

4) Where applied directly to framing or over furring strips, OSB conforming to O-1 grade and waferboard conforming to R-1 grade shall be not less than

a) 9.5 mm thick on supports spaced not more than 400 mm o.c., and

b) 12.7 mm thick on supports spaced not more than 600 mm o.c.

9.27.10.3. Panel Cladding

1) OSB and waferboard applied in panels shall have all edges supported and treated with a primer or sealer.

2) Not less than a 3 mm gap shall be provided between sheets in cladding described in Sentence (1).

3) Vertical joints in cladding described in Sentence (1) shall be protected with batten strips or sealant when the OSB and waferboard joints are not matched.

4) Horizontal joints in cladding described in Sentence (1) shall be lapped not less than 25 mm or shall be suitably flashed.

9.27.10.4.Clearance

1) Not less than a 3 mm clearance shall be provided between OSB and waferboard cladding and door or window frames.

9.27.11. Metal

9.27.11.1.Material Standards

1) Horizontal and vertical strip steel siding, including flashing and trim accessories, shall conform to CAN/CGSB-93.4, “Galvanized Steel and Aluminum-Zinc Alloy Coated Steel Siding, Soffits and Fascia, Prefinished, Residential.”
2) Steel sheet cladding shall have a minimum thickness of 0.3 mm and conform to CAN/CGSB-93.3-M, “Prefinished Galvanized and Aluminum-Zinc Alloy Steel Sheet for Residential Use.”
3) Horizontal and vertical strip aluminum siding, including flashing and trim accessories, shall conform to CAN/CGSB-93.2-M, “Prefinished Aluminum Siding, Soffits, and Fascia, for Residential Use.” (See Note A-9.27.11.1.(3) and (4).)
4) Aluminum sheet cladding shall conform to CAN/CGSB-93.1-M, “Sheet, Aluminum Alloy, Prefinished, Residential,” and shall have a thickness of not less than 0.58 mm, except that siding supported by backing or sheathing shall have a thickness of not less than 0.46 mm. (See Note A-9.27.11.1.(3) and (4).)

9.27.12. Vinyl Siding

9.27.12.1.Material Standard

1) Vinyl siding, including flashing and trim accessories, shall conform to CAN/CGSB-41.24, “Rigid Vinyl Siding, Soffits and Fascia.”

9.27.12.2.Attachment

1) The attachment of vinyl siding shall conform to the requirements in Subsection 9.27.5. for metal siding.

9.27.13. Exterior Insulation Finish Systems

9.27.13.1.Application

1) Except as provided in Sentence (2), this Subsection applies to exterior insulation finish systems (EIFS) that

a) are covered in the scope of CAN/ULC-S716.1, “Exterior Insulation and Finish Systems (EIFS) - Materials and Systems,” and
b) have a geometrically defined drainage cavity with a minimum cavity depth of 9.5 mm and an open area equal to not less than 13% of the area of a full-size EIFS panel.

(See Note A-9.27.13.1.(1).)
2) EIFS that are not covered by Sentence (1) shall comply with Part 5.

9.27.13.2.Materials

1) The materials used in EIFS shall conform to CAN/ULC-S716.1, “Exterior Insulation and Finish Systems (EIFS) – Materials and Systems.”
2) The substrate on which the EIFS is installed shall

a) be compatible with that particular system (See Note A-9.27.13.2.(2)(a)), and
b) comply with the structural requirements for sheathing materials stated in Section 9.23.

9.27.13.3.Design and Installation

1) The design and installation of EIFS on the substrate described in Sentence 9.27.13.2.(2) shall comply with

a) CAN/ULC-S716.2, “Exterior Insulation and Finish Systems (EIFS) – Installation of EIFS Components and Water Resistive Barrier,” and

b) CAN/ULC-S716.3, “Exterior Insulation and Finish System (EIFS) – Design Application.”

Section 9.28. Stucco

9.28.1. General

9.28.1.1. Sheathing beneath Stucco

1) Sheathing shall be provided beneath stucco applied over wood-frame walls except as permitted in Article 9.28.4.2.

2) Where applied beneath stucco, sheathing shall conform to Subsection 9.23.17.

9.28.1.2. Lath and Reinforcing

1) Stucco lath or reinforcing shall be used to attach stucco to any substrate other than masonry.

2) Stucco lath or reinforcing shall be used to attach stucco to masonry where

a) the masonry is soft-burned tile or brick of less strength than the stucco, or

b) the masonry surface is not sound, clean and sufficiently rough to provide a good key.

3) Stucco applied over masonry chimneys shall be reinforced.

9.28.1.3. Concrete Masonry Units

1) Stucco finish shall not be applied over concrete masonry units less than one month old unless the units have been cured by the autoclave process.

9.28.1.4. Clearance over Ground Level

1) Stucco shall be not less than 200 mm above finished ground level except when it is applied over concrete or masonry.

9.28.1.5. Flashing and Caulking

1) Flashing and caulking used with stucco shall conform to Subsections 9.27.3. and 9.27.4., except that if aluminum flashing is used, it shall be separated from the stucco by an impervious membrane or coating. (See Article 9.7.6.2. for caulking around window frames.)

9.28.2. Stucco Materials

9.28.2.1. Portland Cement

1) Portland cement shall conform to CSA A3001, “Cementitious Materials for Use in Concrete.”

9.28.2.2. Aggregate

1) Aggregate shall be clean, well-graded natural sand or sand manufactured from crushed stone, gravel or air-cooled blast furnace slag and shall contain no significant amounts of deleterious material.

2) Aggregate grading shall conform to Table 9.28.2.2.

Table 9.28.2.2.
Aggregate Grading for Stucco
Forming Part of Sentence 9.28.2.2.(2)

Sieve Sizes, mm	% Aggregate Passing Sieve

	Maximum	Minimum
4	–	100
2	–	90
1	90	60
0.5	60	45
0.25	30	10
0.125	5	–

9.28.2.3. Water

1) Water shall be clean and free of significant amounts of deleterious material.

9.28.3. Fasteners

9.28.3.1. Materials

1) Fasteners for stucco lath or reinforcing shall be corrosion-resistant and of a material other than aluminum.

9.28.3.2. Nails and Staples

1) Nails for stucco lath or reinforcing shall be not less than 3.2 mm diam with a head diameter of not less than 11.1 mm.
2) Staples for stucco lath or reinforcing shall be not less than 1.5 mm diam or thickness.
3) Staples and nails for attaching stucco lath or reinforcing to vertical surfaces shall be of sufficient length to penetrate 25 mm into framing members or to the full depth of the sheathing where the sheathing is used for attachment.
4) On horizontal surfaces nails for stucco lath or reinforcing shall be not less than 38 mm long.

9.28.4. Stucco Lath

9.28.4.1. Materials

1) Rib lath or expanded metal stucco mesh shall be
- a) copper-alloy steel coated with rust-inhibitive paint after fabrication, or
- b) galvanized.

2) Woven or welded wire mesh shall be galvanized.

9.28.4.2. No Sheathing Required

1) Sheathing need not be provided beneath stucco where not less than 1.19 mm diam galvanized wire is applied horizontally to the framing at vertical intervals of not more than 150 mm, or where paper-backed welded wire metal lath is used.

9.28.4.3. Stucco Lath Specifications

1) Stucco lath shall conform to Table 9.28.4.3.

Table 9.28.4.3.
Stucco Lath
Forming Part of Sentence 9.28.4.3.(1)

<table>
<tr><th>Location</th><th>Type of Lath</th><th>Minimum Diam of Wire, mm</th><th>Maximum Mesh Opening</th><th>Minimum Mass, kg/m²</th></tr>
<tr><td rowspan="4">Vertical surfaces</td><td rowspan="3">Welded or woven wire</td><td>1.15</td><td>25 mm</td><td>–</td></tr>
<tr><td>1.30</td><td>38 mm</td><td>–</td></tr>
<tr><td>1.50</td><td>51 mm</td><td>–</td></tr>
<tr><td>Stucco mesh reinforcing (expanded metal)</td><td>–</td><td>25.8 cm²</td><td>0.98</td></tr>
<tr><td rowspan="2">Horizontal surfaces(1)</td><td>9.5 mm rib lath</td><td>–</td><td>–</td><td>1.84</td></tr>
<tr><td>Cedar lath</td><td>–</td><td>–</td><td>–</td></tr>
</table>

Notes to Table 9.28.4.3.:
(1) See Note A-Table 9.28.4.3.
(2) Wire with other than a circular cross-section is acceptable if its cross-sectional area is equal to or greater than that of the wire listed.

9.28.4.4. Self-Furring Devices

1) Stucco lath shall be held not less than 6 mm away from the backing by means of suitable self-furring devices.

9.28.4.5. Application of Stucco Lath

1) Stucco lath shall be applied with the long dimension horizontal.
2) Horizontal and vertical joints in stucco lath shall be lapped not less than 50 mm.
3) End joints of stucco lath shall be staggered and shall occur over framing members.
4) External corners of stucco lath shall be reinforced with a vertical strip of lath or reinforcing extending not less than 150 mm on both sides of the corner, or the lath or reinforcing shall extend around corners not less than 150 mm.

9.28.4.6. Fastening

1) Stucco lath shall be fastened in conformance with Subsection 9.27.5.
2) Fasteners on vertical surfaces shall be spaced not more than
a) 150 mm o.c. vertically and 400 mm o.c. horizontally, or
b) 100 mm o.c. vertically and 600 mm o.c. horizontally.
3) Nailing patterns other than those required in Sentence (2) are permitted to be used provided there are at least 20 fasteners per square metre of wall surface.
4) Fasteners on horizontal surfaces shall be spaced not more than
a) 150 mm o.c. along the framing members when members are spaced not more than 400 mm o.c., and
b) 100 mm o.c. along members when members are spaced not more than 600 mm o.c.

9.28.5. Stucco Mixes

9.28.5.1. Mixes

1) Stucco mixes shall conform to Table 9.28.5.1.

Table 9.28.5.1.
Stucco Mixes
Forming Part of Sentence 9.28.5.1.(1)

Materials, volume			
Portland Cement	**Masonry Cement**	**Lime**	**Aggregate**
1	–	0.25 to 1	3.25 to 4 parts per part of cementitious material
1	1	–	

9.28.5.2. Pigments

1) Pigment if used shall consist of pure mineral oxides inert to the action of sun, lime and cement.
2) Pigment shall not exceed 6% of the Portland cement by weight.

9.28.5.3. Mixing

1) Materials shall be thoroughly mixed before and after water is added.
2) Stucco shall be applied not later than 3 h after the initial mixing.

9.28.6. Stucco Application

9.28.6.1. Low Temperature Conditions

1) The base for stucco shall be maintained above freezing.
2) Stucco shall be maintained at a temperature of not less than 10°C during application, and for not less than 48 h afterwards.

9.28.6.2. Number of Coats and Total Thickness

1) Stucco shall be applied with at least 2 base coats and one finish coat, providing a total thickness of not less than 15 mm, measured from the face of the lath or the face of the masonry where no lath is used.

9.28.6.3. First Coat

1) The first coat shall be not less than 6 mm thick, measured from the face of the lath or masonry, fully embedding the lath.
2) The surface of the first coat shall be scored to provide a key with the second coat.

9.28.6.4. Second Coat

1) The second coat shall be not less than 6 mm thick.
2) The surface of the second coat shall be lightly roughened to provide a key with the finish coat if the finish coat is other than stone dash.

9.28.6.5. Finish Coat

1) When the finish coat is other than stone dash, the base shall be dampened but not saturated before the finish coat is applied.
2) The thickness of the finish coat shall be not less than 3 mm.
3) When a stone dash finish is used, the stone shall be partially embedded in the second coat before the second coat starts to set or stiffen.

Section 9.29. Interior Wall and Ceiling Finishes

9.29.1. General

9.29.1.1. Fire Protection and Sound Control

1) A wall or ceiling finish shall also conform to the appropriate requirements in Sections 9.10. and 9.11., in addition to the requirements in this Section.

9.29.2. Waterproof Wall Finish

9.29.2.1. Where Required

1) Waterproof finish shall be provided to a height of not less than

a) 1.8 m above the floor in shower stalls,
b) 1.2 m above the rims of bathtubs equipped with showers, and
c) 400 mm above the rims of bathtubs not equipped with showers.

9.29.2.2. Materials

1) Waterproof finish shall consist of ceramic, plastic or metal tile, sheet vinyl, tempered hardboard, laminated thermosetting decorative sheets or linoleum.

9.29.3. Wood Furring

9.29.3.1. Size and Spacing of Furring

1) Wood furring for the attachment of wall and ceiling finishes shall conform to Table 9.29.3.1.

Table 9.29.3.1.
Size and Spacing of Furring
Forming Part of Sentence 9.29.3.1.(1)

Maximum Spacing of Furring, mm	Minimum Size of Furring, mm		
	Maximum Spacing of Furring Supports		
	Continuous Supports	400 mm o.c.	600 mm o.c.
300	19 × 38	19 × 38	19 × 64
400	19 × 38	19 × 38	19 × 64
600	19 × 38	19 × 64	19 × 89

9.29.3.2. Fastening

1) Furring shall be fastened to the framing or to wood blocks with not less than 51 mm nails.

9.29.4. Plastering

9.29.4.1. Application

1) Application of plaster wall and ceiling finishes, including installation of metal or gypsum lath, shall conform to CSA A82.30-M, “Interior Furring, Lathing and Gypsum Plastering.”

9.29.5. Gypsum Board Finish (Taped Joints)

9.29.5.1. Application

1) The requirements for application of gypsum board in this Subsection apply to the single layer application of gypsum board to wood furring or framing using nails or screws.

2) Gypsum board applications not described in this Subsection shall conform to CSA A82.31-M, "Gypsum Board Application."

9.29.5.2. Materials

1) Gypsum products shall conform to

a) ASTM C 1178/C 1178M, "Coated Glass Mat Water-Resistant Gypsum Backing Panel," or

b) ASTM C 1396/C 1396M, "Gypsum Board," except that the flame-spread rating of gypsum board shall be determined in accordance with CAN/ULC-S102, "Test for Surface Burning Characteristics of Building Materials and Assemblies."

9.29.5.3. Maximum Spacing of Supports

1) Maximum spacing of supports for gypsum board applied as a single layer shall conform to Table 9.29.5.3.

Table 9.29.5.3.
Spacing of Supports for Gypsum Board
Forming Part of Sentence 9.29.5.3.(1)

Thickness, mm	Orientation of Board to Framing	Maximum Spacing of Supports, mm o.c.		
		Walls	Ceilings	
			Painted Finish	Water-Based Texture Finish
Gypsum board conforming to Sentence 9.29.5.2.(1) (except Sections 9 and 12 of ASTM C 1396/C 1396M)				
9.5	parallel	–	–	–
	perpendicular	400	400	–
12.7	parallel	600	400	–
	perpendicular	600	600	400
15.9	parallel	600	400	–
	perpendicular	600	600	600
Gypsum ceiling board conforming to Clause 9.29.5.2.(1)(b) (only Section 12 of ASTM C 1396/C 1396M)				
12.7	parallel	600	400	–
	perpendicular	600	600	600

9.29.5.4. Support of Insulation

1) Gypsum board supporting insulation shall be not less than 12.7 mm thick.

9.29.5.5. Length of Fasteners

1) The length of fasteners for gypsum board shall conform to Table 9.29.5.5., except that lesser depths of penetration are permitted for assemblies required to have a fire-resistance rating provided it can be shown, on the basis of fire tests, that such depths are adequate for the required rating.

Table 9.29.5.5.
Fastener Penetration into Wood Supports
Forming Part of Sentence 9.29.5.5.(1)

Required *Fire-Resistance Rating* of Assembly	**Minimum Penetration, mm**			
	Walls		**Ceilings**	
	Nails	**Screws**	**Nails**	**Screws**
Not required	20	15	20	15
45 min	20	20	30	30
1 h	20	20	45	45
1.5 h	20	20	60	60

9.29.5.6. Nails

1) Nails for fastening gypsum board to wood supports shall conform to

a) ASTM F 1667, "Driven Fasteners: Nails, Spikes, and Staples," or
b) CSA B111, "Wire Nails, Spikes and Staples."

9.29.5.7. Screws

1) Screws for fastening gypsum board to wood supports shall conform to ASTM C 1002, "Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs."

9.29.5.8. Spacing of Nails

1) For single-layer application on a ceiling, nails shall be spaced

a) not more than 180 mm o.c. on ceiling supports, or
b) every 300 mm o.c. along ceiling supports, in pairs about 50 mm apart.

2) Where the ceiling sheets are supported by the wall sheets around the perimeter of the ceiling, this support may be considered as equivalent to nailing at this location.

3) Except as required by Sentence (4), for single-layer application on walls, nails shall be spaced

a) not more than 200 mm o.c. on vertical wall supports, or
b) every 300 mm o.c. along vertical wall supports, in pairs about 50 mm apart.

4) For single-layer application on walls, where gypsum board provides required bracing in braced wall panels, lateral support for studs, or fire protection, nails shall be spaced not more than 200 mm o.c. on

a) vertical wall supports, and
b) top and bottom plates.

(See Article 9.23.10.2. and Section 9.10.)

5) The uppermost nails on vertical wall supports shall be not more than 200 mm below the ceiling.

6) Nails shall be located not less than 10 mm from the side or edge of the board.

7) Nails shall be driven so that the heads do not puncture the paper.

9.29.5.9. Spacing of Screws

1) For single-layer application on a ceiling, screws shall be spaced not more than 300 mm o.c. on ceiling supports.

2) Where the ceiling sheets are supported by the wall sheets around the perimeter of the ceiling, this support may be considered as equivalent to screwing at this location.

3) Except as required by Sentence (4), for single-layer application on walls, screws shall be spaced

a) not more than 300 mm o.c. on vertical wall supports where the supports are more than 400 mm o.c., or
b)not more than 400 mm o.c. on vertical wall supports where the supports are not more than 400 mm o.c.

4) Except as provided in Sentence (5), for single-layer application on walls, where gypsum board provides required bracing in braced wall panels, lateral support for studs, or fire protection, screws shall be spaced not more than 300 mm o.c. on
a) vertical wall supports, and
b) top and bottom plates.
(See Article 9.23.10.2. and Section 9.10.)

5) Where a fire-resistance rating is determined based on Table 9.10.3.1.-A, Sentence (4) need not apply for the purpose of fire protection.

6) Screws shall be located not less than 10 mm from the edge of the board.

7) Screws shall be driven so that the heads do not puncture the paper.

9.29.5.10. Low Temperature Conditions

1) In cold weather, heat shall be provided to maintain a temperature not below 10°C for 48 h prior to taping and finishing and maintained for not less than 48 h thereafter.

9.29.6. Plywood Finish

9.29.6.1. Thickness

1) Except as provided in Sentences (2) and (3), the minimum thickness of plywood interior finish shall conform to Table 9.29.6.1.

Table 9.29.6.1.
Thickness of Plywood Interior Finish
Forming Part of Articles 9.29.6.1. and 9.29.6.2.

Maximum Spacing of Supports, mm o.c.	Minimum Thickness, mm(1)	
	On Supports with no Horizontal Blocking	On Supports with Blocking at Vertical Intervals not Exceeding 1.2 m
400	4.7	4.0
600	8.0	4.7

Notes to Table 9.29.6.1.:
(1) Thickness limits shall apply to the net effective thickness (NET) of grooved, striated, textured and/or embossed panels and to the actual thickness of flat panels.

2) A manufacturing tolerance of −0.4 mm may be applied to the thicknesses listed in Table 9.29.6.1.

3) No minimum thickness is required where plywood is applied over continuous backing.

9.29.6.2. Grooved Plywood

1) Except as permitted in Sentence (2), where plywood for interior finish is grooved, the grooves shall not extend through the face ply and into the plies below the face ply unless the groove is supported by framing or furring.

2) If the grain of the face ply is at right angles to the supporting members, the groove is permitted to extend into plies below the face ply provided the thickness of the plywood exceeds the value shown in Table

9.29.6.1. by an amount equal to not less than the depth of penetration of the grooves into the plies below the face ply.

9.29.6.3. Nails and Staples

1) Except as provided in Sentence (2), nails for attaching plywood finishes shall not be less than 38 mm casing or finishing nails spaced not more than 150 mm o.c. along edge supports and 300 mm o.c. along intermediate supports, except that staples providing equivalent lateral resistance may also be used.

2) Where plywood finish provides required bracing in *braced wall panels*, the plywood shall be fastened in accordance with the fastening requirements for sheathing stated in Sentence 9.23.3.5.(2).

9.29.6.4. Edge Support

1) All plywood edges shall be supported by furring, blocking or framing.

9.29.7. Hardboard Finish

9.29.7.1. Material Standard

1) Hardboard shall conform to CAN/CGSB-11.3-M, “Hardboard.”

9.29.7.2. Thickness

1) Hardboard shall be not less than

a) 3 mm thick where applied over continuous backing,
b) 6 mm thick when applied over supports spaced not more than 400 mm o.c., and
c) 9 mm thick when applied over supports spaced not more than 600 mm o.c.

9.29.7.3. Nails

1) Nails for fastening hardboard shall be casing or finishing nails not less than 38 mm long, spaced not more than 150 mm o.c. along edge supports and 300 mm o.c. along intermediate supports.

9.29.7.4. Edge Support

1) All hardboard edges shall be supported by furring, blocking or framing where the backing is not continuous.

9.29.8. Insulating Fibreboard Finish

9.29.8.1. Material Standard

1) Insulating fibreboard shall conform to CAN/ULC-S706, “Wood Fibre Insulating Boards for Buildings.”

9.29.8.2. Thickness

1) Insulating fibreboard sheets shall be not less than 11.1 mm thick on supports not more than 400 mm o.c.

2) Insulating fibreboard tile shall be not less than 12.7 mm thick on supports spaced not more than 400 mm o.c.

9.29.8.3. Nails

1) Nails for fastening fibreboard sheets shall be not less than 2.6 mm shank diameter casing or finishing nails of sufficient length to penetrate not less than 20 mm into the supports.

2) Nails shall be spaced not more than 100 mm o.c. along edge supports and 200 mm o.c. along intermediate supports.

9.29.8.4. Edge Support

1) All fibreboard edges shall be supported by blocking, furring or framing.

9.29.9. Particleboard, OSB or Waferboard Finish

9.29.9.1. Material Standard

1) Particleboard finish shall conform to ANSI A208.1, "Particleboard."
2) OSB or waferboard finish shall conform to
a) CSA O325, "Construction Sheathing," or
b) CSA O437.0, "OSB and Waferboard."

9.29.9.2. Minimum Thickness

1) Except as provided in Sentences (2) and (3), the minimum thickness of O-2 grade OSB used as an interior finish shall conform to that shown for plywood in Table 9.29.6.1.
2) Thicknesses listed in Table 9.29.6.1. shall permit a manufacturing tolerance of −0.4 mm.
3) No minimum thickness is required where O-2 grade OSB is applied over continuous backing.
4) OSB conforming to O-1 grade, waferboard conforming to R-1 grade and particleboard shall be
a) not less than 6.35 mm thick on supports not more than 400 mm o.c.,
b) not less than 9.5 mm thick on supports not more than 600 mm o.c., and
c) not less than 6.35 mm thick on supports not more than 600 mm o.c. in walls where blocking is provided at midwall height.
5) OSB conforming to CSA O325, "Construction Sheathing," shall meet the minimum panel mark of
a) W16, on supports not more than 400 mm o.c.,
b) W24, on supports not more than 600 mm o.c., and
c) W16, on supports not more than 600 mm o.c. where blocking is provided at mid-wall height.

9.29.9.3. Nails

1) Except as provided in Sentence (2), nails for fastening particleboard, OSB or waferboard shall be not less than 38 mm casing or finishing nails spaced not more than 150 mm o.c. along edge supports and 300 mm o.c. along intermediate supports.
2) Where OSB or waferboard provides required bracing in *braced wall panels*, the OSB or waferboard shall be fastened in accordance with the fastening requirements for sheathing stated in Sentence 9.23.3.5.(2).

9.29.9.4. Edge Support

1) All particleboard, OSB or waferboard edges shall be supported by furring, blocking or framing.

9.29.10. Wall Tile Finish

9.29.10.1. Tile Application

1) Ceramic tile shall be set in a mortar base or applied with an adhesive.
2) Plastic tile shall be applied with an adhesive.

9.29.10.2. Mortar Base

1) When ceramic tile is applied to a mortar base the cementitious material shall consist of one part Portland cement to not more than one-quarter part lime by volume.
2) The cementitious material described in Sentence (1) shall be mixed with not less than 3 nor more than 5 parts of aggregate per part of cementitious material by volume.
3) Mortar shall be applied over metal lath or masonry.
4) Ceramic tile applied to a mortar base shall be thoroughly soaked and pressed into place forcing the mortar into the joints while the tile is wet.

9.29.10.3. Adhesives

1) Adhesives to attach ceramic and plastic tile shall be applied to the finish coat or brown coat of plaster that has been steel-trowelled to an even surface or to gypsum board or to masonry provided the masonry has an even surface.

9.29.10.4. Moisture-Resistant Backing

1) Ceramic and plastic tile installed on walls around bathtubs or showers shall be applied over moisture-resistant backing.

9.29.10.5. Joints between Tiles and Bathtub

1) The joints between wall tiles and a bathtub shall be suitably caulked with material conforming to CAN/CGSB-19.22-M, “Mildew-Resistant Sealing Compound for Tubs and Tiles.”

Section 9.30. Flooring

9.30.1. General

9.30.1.1. Required Finished Flooring

1) Finished flooring shall be provided in all *residential occupancies*.

9.30.1.2. Water Resistance

1) Where water permeable finished flooring in bathrooms, kitchens, public entrance halls and laundry areas is supported by a subfloor of a type that would be damaged by water, such flooring shall be installed over a membrane with a water permeance not exceeding 18 ng/(Pa·s·m^2) when tested in accordance with ASTM E 96/E 96M, “Water Vapor Transmission of Materials.” (See Note A-9.30.1.2.(1).)

9.30.1.3. Sleepers

1) Wood sleepers supporting finished flooring over a concrete base supported on the ground shall be not less than 19 mm by 38 mm and shall be treated with a wood preservative.

9.30.1.4. Finish Quality

1) Finished flooring shall have a surface that is smooth, even and free from roughness or open defects.

9.30.2. Panel-Type Underlay

9.30.2.1. Required Underlay

1) A panel-type underlay shall be provided under resilient flooring, parquet flooring, ceramic tile, felted-synthetic-fibre floor coverings or carpeting laid over lumber subflooring. (See Sentence 9.30.3.2.(1).)
2) Panel-type underlay shall be provided under resilient flooring, parquet flooring, felted-synthetic-fibre floor coverings or carpeting on panel-type subflooring whose edges are unsupported. (See Article 9.23.15.3.)
3) Panel-type underlay shall be provided under ceramic tile applied with adhesive.

9.30.2.2. Materials and Thickness

1) Panel-type underlay shall be not less than 6 mm thick and shall conform to

a) ANSI A208.1, “Particleboard,”
b)CAN/CGSB-11.3-M, “Hardboard,”
c) ANSI/HPVA HP-1, “Hardwood and Decorative Plywood,”
d) CSA O121, “Douglas Fir Plywood,”
e) CSA O151, “Canadian Softwood Plywood,”
f) CSA O153, “Poplar Plywood,” or
g) CSA O437.0, “OSB and Waferboard.”

2) Panel-type underlay under ceramic tile applied with adhesive shall be not less than
a) 6 mm thick where the supports are spaced up to 300 mm o.c., and
b) 11 mm thick where the supports are spaced wider than 300 mm o.c.

9.30.2.3. Fastening

1) Panel-type underlay shall be fastened to the subfloor with staples, annular grooved flooring nails or spiral nails, spaced not more than 150 mm o.c. along the edges and 200 mm o.c. both ways at other locations.
2) Nails for panel-type underlay shall be not less than 19 mm long for 6 mm thick underlay and 22 mm long for 7.9 mm thick underlay.
3) Staples for panel-type underlay shall
a) have not less than a 1.2 mm shank diameter or thickness with a 4.7 mm crown, and
b) be not less than
i) 22 mm long for 6 mm underlay, and
ii) 28 mm long for 7.9 mm and 9.5 mm underlay.

9.30.2.4. Joints Offset

1) Where panel-type underlay is required to be installed over plywood, OSB or waferboard, the joints in the underlay shall be offset not less than 200 mm from the joints in the underlying subfloor.

9.30.2.5. Surface Defects

1) Underlay beneath resilient or ceramic floors applied with an adhesive shall have all holes or open defects on the surface patched so that the defects will not be transmitted to the finished surface.

9.30.3. Wood Strip Flooring

9.30.3.1. Thickness

1) The thickness of wood strip flooring shall conform to Table 9.30.3.1.

Table 9.30.3.1.
Thickness of Wood Strip Flooring
Forming Part of Sentence 9.30.3.1.(1)

Type of Flooring	Max. Joist Spacing, mm	Minimum Thickness of Flooring, mm	
		With Subfloor	No Subfloor
Matched hardwood	400	7.9	19.0
(interior use only)	600	7.9	33.3
Matched softwood	400	19.0	19.0
(interior or exterior use)	600	19.0	31.7
Square edge softwood	400	–	25.4
(exterior use only)	600	–	38.1

9.30.3.2. Strip Direction and End Joints

1) Wood strip flooring shall not be laid parallel to lumber subflooring unless a separate underlay is provided.
2) If wood strip flooring is applied without a subfloor, it shall be laid at right angles to the joists so that the end joints are staggered and occur over supports or are end matched.

3) If the flooring is end matched, it shall be laid so that no 2 adjoining strips break joints in the same space between supports and each strip bears on no fewer than 2 supports.

9.30.3.3. Nailing

1) When nails are used, wood strip flooring shall be toe nailed or face nailed with not less than one nail per strip at the spacings shown in Table 9.30.3.3., except that face nailed strips more than 25 mm in width shall have at least 2 nails per strip.

Table 9.30.3.3.
Nailing of Wood Strip Flooring
Forming Part of Sentence 9.30.3.3.(1)

Finish Floor Thickness, mm	Minimum Length of Flooring Nails, mm	Maximum Spacing of Flooring Nails, mm
7.9	38(1)	200
11.1	51	300
19.0	57	400
25.4	63	400
31.7	70	600
38.1	83	600

Notes to Table 9.30.3.3.:
(1) See Article 9.30.3.4.

2) Face nails shall be countersunk.

9.30.3.4. Staples

1) Staples are permitted to be used to fasten wood strip flooring not more than 7.9 mm in thickness provided the staples are not less than 29 mm long with a shank diameter of 1.19 mm and with 4.7 mm crowns.

9.30.4. Parquet Flooring

9.30.4.1. Adhesive

1) Adhesive used to attach parquet block flooring shall be suitable for bonding wood to the applicable subfloor material.

9.30.5. Resilient Flooring

9.30.5.1. Materials

1) Resilient flooring used on concrete slabs supported on ground shall consist of asphalt, rubber, vinyl-asbestos, unbacked vinyl or vinyl with an inorganic type backing.
2) Flooring described in Sentence (1) shall be attached to the base with a suitable waterproof and alkali-resistant adhesive.

9.30.6. Ceramic Tile

9.30.6.1. Substrate

1) Ceramic tile shall be set in a mortar bed or applied to a sound smooth base with a suitable adhesive.
2) Panel-type subfloor to which ceramic tile is to be applied with adhesive shall have its edges supported according to Article 9.23.15.3.

Section 9.31. Plumbing Facilities

9.31.1. Scope

9.31.1.1. Application

1) This Section applies to the plumbing facilities and plumbing systems within dwelling units.
2) In occupancies other than dwelling units, plumbing facilities, grab bars, floor drains, and floor and wall finishes around urinals shall conform to Subsection 3.7.2. (See also Section 3.8. regarding accessible plumbing facilities.)
3) Medical gas piping systems shall conform to Subsection 3.7.3.
4) Systems used for service water heating shall conform to the energy efficiency requirements in Part 10.

9.31.2. General

9.31.2.1. General

1) The construction, extension, alteration, renewal or repair of plumbing systems and sewage disposal systems shall conform to Part 7.

9.31.2.2. Corrosion Protection

1) Metal pipes in contact with cinders or other corrosive material shall be protected by a heavy coating of bitumen or other corrosion protection.

9.31.2.3. Grab Bars

1) When provided, grab bars shall be capable of resisting a load of not less than 1.3 kN applied vertically or horizontally.

9.31.2.4. Site Constructed Fixtures

1) A shower door that swings on a vertical axis shall be capable of opening outwards from a shower stall forming part of a site constructed fixture.

9.31.3. Water Supply and Distribution

9.31.3.1. Required Water Supply

1) Every *dwelling unit* shall be supplied with potable water.

9.31.3.2. Required Connections

1) Where a piped water supply is available, piping for hot and cold water shall be connected to every kitchen sink, lavatory, bathtub, shower, slop sink and laundry area.
2) Piping for cold water shall be run to every water closet.

9.31.4. Required Facilities

9.31.4.1. Required Fixtures

1) A kitchen sink, lavatory, bathtub or shower, and water closet shall be provided for every *dwelling unit* where a piped water supply is available.

9.31.4.2. Hot Water Supply

1) Where a piped water supply is available a hot water supply shall be provided in every *dwelling unit*.

9.31.4.3. Floor Drains

1) Where gravity drainage to a sewer, drainage ditch or dry well is possible, a floor drain shall be installed in a *basement* forming part of a *dwelling unit*.

2) A floor drain shall be provided in a garbage room, incinerator room or *boiler* room serving more than one *dwelling unit*.

9.31.5. Sewage Disposal

9.31.5.1. Building Sewer

1) Wastes from every plumbing fixture shall be piped to the *building* sewer.

9.31.5.2. Discharge of Sewage

1) *Building* sewers shall discharge into a public sewage system where such system is available.

2) Where a public sewage system is not available, the *building* sewer shall discharge into a *private sewage disposal system*.

9.31.6. Service Water Heating Facilities

9.31.6.1. Hot Water Supply

1) Where hot water is required to be supplied in accordance with Article 9.31.4.2., equipment shall

a) provide an adequate supply of hot water, and

b) be installed in conformance with Part 7.

9.31.6.2. Equipment and Installation

1) *Service water heaters* shall conform to appropriate provincial or territorial requirements or, in the absence of such requirements, to the Book II (Plumbing Systems) of this By-law.

2) The installation of *service water heaters*, including provisions for mounting, clearances and air supply, shall conform to

a) the Safety Standards Act and the following of its regulations:

i) the Gas Safety Regulation,

ii) the Electrical Safety Regulation, and

iii) the Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation,

b) CSA B139, "Installation Code for Oil-Burning Equipment," and

c) CSA B365, "Installation Code for Solid-Fuel-Burning Appliances and Equipment."

3) Where the *building* is in a location where the spectral response acceleration, $S_a(0.2)$, is greater than 0.55, *service water heaters* shall be secured to the structure to prevent overturning. (See Note A-9.31.6.2.(3).)

9.31.6.3. Corrosion-Resistant Coating

1) Where storage tanks for *service water heaters* are of steel, they shall be coated with zinc, vitreous enamel (glass lined), hydraulic cement or other corrosion-resistant material.

9.31.6.4. Fuel-Burning Heaters

1) Fuel-burning *service water heaters* shall be connected to a *chimney flue* conforming to Section 9.21.

9.31.6.5. Heating Coils

1) Heating coils of *service water heaters* shall not be installed in a *flue* or in the combustion chamber of a *boiler* or *furnace* heating a *building*.

Section 9.32. Ventilation

9.32.1. General

9.32.1.1. Application

1) This Section applies to the ventilation of rooms and spaces in residential occupancies by natural ventilation and to self-contained mechanical ventilation systems serving only one dwelling unit.
2) Mechanical ventilation systems other than self-contained systems serving a single dwelling unit shall conform to Part 6.
3) A storage garage for more than 5 motor vehicles shall be ventilated in accordance with Part 6.
4) Systems used for ventilation shall conform to the energy efficiency requirements in Part 10.

9.32.1.2. Required Ventilation

1) Every dwelling unit shall incorporate
a) provisions for non-heating-season ventilation in accordance with Subsection 9.32.2., and
b) if supplied with electrical power, provisions for heating-season ventilation in accordance with Subsection 9.32.3.
2) Reserved.
3) Reserved.
4) Reserved.

9.32.1.3. Venting of Laundry-Drying Equipment

1) Exhaust ducts or vents connected to laundry-drying equipment shall discharge directly to the outdoors.
2) Exhaust ducts connected to laundry-drying equipment shall be
a) independent of other exhaust ducts,
b) accessible for cleaning, and
c) constructed of a smooth corrosion-resistant material.
(See Note A-9.32.1.3.(2).)
3) Where collective venting of multiple installations of laundry-drying equipment is used, the ventilation system shall
a) be connected to a common exhaust duct that is vented by one central exhaust fan and incorporates one central lint trap,
b) include an interlock to activate the central exhaust fan when laundry-drying equipment is in use, and
c) where required by Article 9.32.3.8.4.1., be provided with make-up air.

9.32.2. Non-Heating-Season Ventilation

9.32.2.1. Required Ventilation

1) Rooms or spaces in dwelling units shall be ventilated during the non-heating season by
a) natural ventilation in accordance with Article 9.32.2.2., or
b) a mechanical ventilation system conforming to Subsection 9.32.3.
2) Where a habitable room or space is not provided with natural ventilation as described in Clause (1)(a), mechanical ventilation shall be provided to exhaust inside air from, or to introduce outside air to, that room or space at the rate of
a) one-half air change per hour if the room or space is mechanically cooled during the non-heating season, or
b) one air change per hour if the room or space is not mechanically cooled during the non-heating season.

9.32.2.2. Non-Heating-Season Natural Ventilation

1) The unobstructed openable ventilation area to the outdoors for rooms and spaces in residential buildings ventilated by natural means shall conform to Table 9.32.2.2.

Table 9.32.2.2.
Natural Ventilation Area
Forming Part of Sentence 9.32.2.2.(1)

Location		Minimum Unobstructed Area
Within a *dwelling unit*	Bathrooms or water-closet rooms	0.09 m^2
	Unfinished *basement space*	0.2% of the *floor area*
	Dining rooms, living rooms, bedrooms, kitchens, combination rooms, dens, recreation rooms and all other finished rooms	0.28 m^2 per room or combination room
Other than within a *dwelling unit*	Bathrooms or water-closet rooms	0.09 m^2 per water closet
	Sleeping areas	0.14 m^2 per occupant
	Laundry rooms, kitchens, recreation rooms	4% of the *floor area*
	Corridors, storage rooms and other similar public rooms or spaces	2% of the *floor area*
	Unfinished *basement* space not used on a shared basis	0.2% of the *floor area*

2) Where a vestibule opens directly off a living or dining room within a *dwelling unit*, ventilation to the outdoors for such rooms may be through the vestibule.
3) Openings for natural ventilation other than windows shall provide protection from the weather and insects.
4) Screening shall be of corrosion-resistant material.

9.32.2.3. Reserved

9.32.3. Heating-Season Mechanical Ventilation

(See Note A-9.32.3.)

9.32.3.1. Required Ventilation

1) Every *dwelling unit* that is supplied with electrical power shall be provided with a mechanical ventilation system that conforms to

a) CAN/CSA-F326-M, “Residential Mechanical Ventilation Systems,” or
b) this Subsection, or
c) **reserved**.

9.32.3.2. Design and Installation

1) Aspects of mechanical ventilation systems not specifically addressed in this Subsection shall be designed, constructed and installed in accordance with good practice such as that described in the ASHRAE Handbooks and Standards, the HRAI Digest, the HRAI Residential Mechanical Ventilation Manual, the TECA Ventilation Guidelines, the Hydronics Institute Manuals and the SMACNA manuals.

2) Exhaust fans and supply fans shall be installed in accordance with this Subsection and the manufacturer's instructions.
3) The mechanical components of a mechanical ventilation system shall be installed so as to be accessible for inspection, maintenance, repair, and cleaning.

9.32.3.3. Mechanical Ventilation System Components
1) A mechanical ventilation system shall include:
a) a principal ventilation fan system that
i) provides supply air in accordance with Article 9.32.3.4., and
ii) includes an exhaust fan that conforms with Article 9.32.3.5.,
b) the kitchen and bathroom exhaust fans that are required by Article 9.32.3.6., and
c) if the *building* includes a heated crawl space, the components that are required by Article 9.32.3.7.

9.32.3.4. Ventilation System Supply Air
(See Note A-9.32.3.4.)
1) Except as provided in Sentence (6), a principal ventilation system shall mechanically provide supply air in accordance with Sentence (2), (3), (4) or (5).
2) Where the principal ventilation system is a ducted forced-air heating system, the ducted forced-air heating system shall
a) provide supply air through the ducting to
i) each bedroom, and
ii) each floor level without a bedroom,
b) draw supply air from an outdoor inlet that is connected to the cabinet containing the furnace air circulating fan required by Clause (d) by ducting that measures, from that cabinet to the point at which the ducting intersects the return air plenum,
i) between 3 m and 4.5 m in length, or
ii) if a flow control device is used, not more than 4.5 m in length,
c) draw supply air through ducting that is
i) rigid ducting with an equivalent diameter of at least 100 mm, or
ii) flexible ducting with an equivalent diameter of at least 125 mm, and
d) have a furnace air circulating fan set to run continuously.
3) Where the principal ventilation system is a ducted forced-air heating system used in combination with a heat-recovery ventilator,
a) the ducted forced-air heating system shall conform to Clauses (2)(a),(c) and (d),
b) the heat-recovery ventilator shall draw supply air from an outdoor inlet into the return air plenum of the ducted forced-air heating system, and
c) the heat-recovery ventilator shall draw exhaust air, through dedicated ducting,
i) from one or more indoor inlets, at least one of which is located at least 2 m above the floor of the uppermost floor level, and
ii) at the capacity rating of the heat-recovery ventilator, which shall be no less than the air-flow rate specified in Table 9.32.3.5.
4) Where the principal ventilation system is a heat-recovery ventilator, the heat-recovery ventilator shall
a) provide supply air through dedicated ducting to
i) each bedroom, and
ii) each floor level without a bedroom, and
b) draw exhaust air, through dedicated ducting,
i) from one or more indoor inlets, at least one of which is located at least 2 m above the floor of the uppermost floor level, and
ii) at the capacity rating of the heat-recovery ventilator, which shall be no less than the air-flow rate specified in Table 9.32.3.5.

5) Where the principal ventilation system is a ducted central-recirculation ventilation system, the ducted central-recirculation ventilation system shall
- a) draw supply air from an outdoor inlet connected upstream of the fan, and
- b) draw air from
  - i) each bedroom and deliver it to a common area, or
  - ii) a common area and deliver it to each bedroom.

6) A principal ventilation system need not conform to Sentence (1) if the principal ventilation system
- a) services a *dwelling unit* that
  - i) is located where the January design temperature, on a 2.5% basis determined in conformance with Article 1.1.3.1., is greater than −20°C,
  - ii) has only 1 *storey* and a *floor area* of less than 168 m^2 within the *building* envelope (See Note A-9.32.3.4.(6)(a)(ii)),
  - iii) does not have a ducted forced-air heating system, and
  - iv) except for a *secondary suite*, is not located in a *building* conforming to Subsection 9.36.6. or 10.2.3., and
- b) provides supply air passively from outdoors through dedicated inlets that
  - i) are located in each bedroom and at least one common area,
  - ii) are located at least 1 800 mm above the floor, and
  - iii) have an unobstructed vent area of not less than 25 cm^2.

9.32.3.5. Principal Ventilation System Exhaust Fan

1) A principal ventilation system exhaust fan shall
- a) run continuously, and
- b) provide at least the air-flow rate specified in Table 9.32.3.5.

Table 9.32.3.5.
Principal Ventilation System Exhaust Fan Minimum Air-flow Rate
Forming Part of Clause 9.32.3.5.(1)

Floor Area, m^2	Minimum Air-Flow Rate, L/s				
	Number of Bedrooms				
	0-1	2-3	4-5	6-7	> 7
< 140	14	21	28	35	42
140-280	21	28	35	42	49
281-420	28	35	42	49	56
421-560	35	42	49	56	64
561-700	42	49	56	64	71
> 700	49	56	64	71	78

2) For the purposes of Sentence (1), the capacity rating of the principal ventilation system exhaust fan shall be determined, based on air-flow performance at 50 Pa of external static pressure, in accordance with
- a) HVI Publication 916, “Airflow Test Procedure,” or
- b) CAN/CSA-C260-M, “Rating the Performance of Residential Mechanical Ventilating Equipment.”

3) The principal ventilation system exhaust fan shall be

a) designed to run continuously, and
b) controlled by a dedicated switch that
i) has 2 settings, on and off,
ii) is located where it will be accessible for the purposes of servicing the exhaust fan but not likely to be turned off inadvertently, and
iii) is clearly marked "PRINCIPAL VENTILATION EXHAUST FAN."

4) If the principal ventilation system exhaust fan is designed to run at multiple air-flow rates,
a) the air-flow rate of the fan shall be controlled by a switch other than the switch described in Clause (3)(b), and
b) the lowest air-flow rate shall not be less than the air-flow rate specified in Table 9.32.3.5.

5) The sound rating of the principal ventilation system exhaust fan shall not exceed 1.0 sone when running continuously at the air-flow rate specified in Table 9.32.3.5. as determined in accordance with
a) HVI Publication 915, "Loudness Testing and Rating Procedure," or
b) CAN/CSA-C260-M, "Rating the Performance of Residential Mechanical Ventilating Equipment."

9.32.3.6. Exhaust-Only Ventilation Systems Kitchen and Bathroom Exhaust Fans

1) An exhaust fan that provides at least the air-flow rate specified in Table 9.32.3.6. shall be installed in
a) every kitchen, and
b) every bathroom or water-closet room, unless the bathroom or water-closet room is served by the principal ventilation system exhaust fan that complies with Article 9.32.3.5.

2) For the purposes of Sentence (1), the capacity rating of the exhaust fan shall be determined, based on air-flow performance at 50 Pa of external static pressure, in accordance with
a) HVI Publication 916, "Airflow Test Procedure," or
b) CAN/CSA-C260-M, "Rating the Performance of Residential Mechanical Ventilating Equipment."

Table 9.32.3.6.
Kitchen/Bathroom Exhaust Fan Minimum Air-Flow Rate
Forming Part of Sentence 9.32.3.6.(1)

Room	Minimum Exhaust Fan Air-Flow Rate, L/s	
	Intermittent	Continuous
Kitchen	47	N/A
Bathroom or water-closet room	23	9

9.32.3.7. Heated Crawl Space Ventilation

1) Where a crawl space is heated by a ducted forced-air heating system that does not draw air from the crawl space to the furnace through the return air plenum, the crawl space shall be connected to the floor space above the crawl space by at least one air-transfer grille.

2) Where a crawl space is heated other than by a ducted forced-air heating system, the crawl space shall
a) be connected to
i) the floor space above the crawl space by at least one air-transfer grille, and
ii) the principal ventilation system by a supply air outlet or an exhaust air inlet,
b) be connected to the floor space above the crawl space by at least 2 air-transfer grilles for every 30 m^2 of crawl space area, or
c) be connected to
i) the floor space above the crawl space by at least one air-transfer grille, and
ii) the outdoors by a dedicated exhaust fan that complies with Sentence (4).

3) An air-transfer grille required by Sentence (1) or (2) shall have an unobstructed vent area of the greater of
a) 25 cm^2, and

b) 0.83 cm^2 for every m^2 of crawl space area.

4) Where a dedicated exhaust fan is installed in accordance with Subclause (2)(c)(ii), the dedicated exhaust fan shall

a) provide an air-flow rate of at least 23 L/s, and

b) be controlled by

i) a humidity control device, or

ii) an adjustable time control device that is capable of providing not less than 8 total hours of ventilation per 24 hour period.

5) Where a crawl space is divided into 2 or more compartments, each heated compartment shall conform to Sentence (1) or (2).

9.32.3.8. Air Ducts

1) Except as required by Sentence (3), this Article applies to air ducts other than those described in Article 9.32.1.3.

2) Exhaust ducts shall discharge to the outdoors.

3) Exhaust ducts that are downstream of an exhaust fan shall have no connections to other fans or ducts.

4) Exhaust ducts, and supply ducts that conduct heated or cooled air, shall

a) be sized in accordance with the requirements of the manufacturer of the fans to which they are connected, and

b) have an equivalent diameter not less than that specified by Table 9.32.3.8.(3).

Table 9.32.3.8.(3)
Maximum Equivalent Duct Length[1], m
Forming Part of Sentence 9.32.3.8.(3)

Flexible Duct						
Equivalent Diameter, mm (Cross Section Area for Rectangular Ducts, cm^2)	Fan Capacity, L/s					
	25	40	50	60	70	80
125 (123)	32	15	--	--	--	--
150 (177)	46	40	28	18	13	--
175 (240)	46	46	46	46	46	24
200 (314)	46	46	46	46	46	46
Rigid Duct						
Equivalent Diameter, mm (Cross Section Area for Rectangular Ducts, cm^2)	Fan Capacity, L/s					
	25	40	50	60	70	80
100 (79)	32	15	--	--	--	--
125 (123)	46	40	28	18	13	--
150 (177)	46	46	46	42	34	24
175 (240)	46	46	46	46	46	46

Notes to Table 9.32.3.8.(3):

(1) The equivalent length of a duct is the length of the duct plus 10 m for the exterior hood and 3 m for each 90° elbow.

5) Where an *exhaust duct* passes through or is located adjacent to a space that is not *conditioned space*, the duct shall conform to Article 9.36.3.2., except that in no case shall such a duct be insulated to less than RSI 0.75.

6) Where a principal ventilation system *supply duct* passes through or is located adjacent to a *conditioned space*, the duct shall be

a) insulated to not less than RSI 0.75, and

b) provided with an effective vapour barrier.

7) Where a kitchen exhaust fan grille is installed within 1.2 m horizontally of a *cooktop*, the exhaust fan duct shall

a) be constructed of a material that is noncombustible, corrosion-resistant, and cleanable, and

b) be equipped with a grease filter at the intake end.

8) Except for a supply air system described in Sentence 9.32.3.4.(2) or (3), all joints in *exhaust ducts*, and in *supply ducts* that conduct conditioned air, shall be sealed against air leakage with

a) sealants or gaskets made from liquids, mastics or heat-applied materials,

b) mastic with embedded fabric,

c) foil-faced butyl tape, or

d) aluminum foil tape.

9) *Supply ducts* for a mechanical ventilation system shall not be used to provide combustion or dilution air to fuel-burning appliances.

9.32.3.9. Outdoor Inlets and Outlets

1) Outdoor air inlets and exhaust outlets shall be shielded from the weather, birds and rodents by using hoods incorporating a screen of corrosion-resistant material with openings of 6 to 12 mm.

9.32.3.10. Interior Distribution

1) Interior doors shall be undercut by a minimum of 12 mm above the finished floor or the rooms shall be provided with an air-transfer grille with an unobstructed vent area that is not less than 100 cm^2.

9.32.4. Additional Protection Against Depressurization

9.32.4.1. Protection Requirements

1) Additional make-up air for the actual *appliance* exhaust rate shall be provided for any *appliance* that discharges air to the exterior at an installed rate exceeding 0.5 air changes per hour when it is located within a *dwelling unit* that contains a vented *appliance* that is subject to back drafting (Naturally Aspirating Fuel Fired Vented Appliance). (See Note A-9.32.4.1.)

2) Where additional make-up air is required for *appliances* described in Sentence (1), it shall be provided by a supply fan rated to deliver outdoor air at the rate of the installed exhaust *appliance*.

3) The supply fan as required in Sentence (2) shall be interconnected with the exhaust fan for which make-up air is required.

4) The outdoor air required by Sentence (3) shall be

a) tempered to at least 1°C before being introduced to a normally unoccupied area of the *dwelling unit*, or

b) tempered to at least 12°C before being introduced to occupied areas either by passive transfer grille or directly from outside.

9.32.4.2. Carbon Monoxide Alarms

(See Note A-9.32.4.2.)

1) This Article applies to every *building* that contains a *residential occupancy* and that also contains

a) a fuel-burning *appliance*, or

b) a *storage garage*.

2) Carbon monoxide (CO) alarms required by this Article shall

a) conform to CAN/CSA-6.19, “Residential Carbon Monoxide Alarming Devices,”
b) be equipped with an integral alarm that satisfies the audibility requirements of CAN/CSA-6.19, “Residential Carbon Monoxide Alarming Devices,”
c) have no disconnect switch between the overcurrent device and the CO alarm, where the CO alarm is powered by the *dwelling unit*’s electrical system, and
d) be mechanically fixed at a height recommended by the manufacturer.

3) Where a room contains a solid-fuel-burning *appliance*, a CO alarm conforming to CAN/CSA-6.19, “Residential Carbon Monoxide Alarming Devices,” shall be mechanically fixed
a) at the manufacturer’s recommended height where these instructions specifically mention solid-fuel-burning *appliances*, or
b) in the absence of specific instructions related to solid-fuel-burning *appliances*, on or near the ceiling.

4) Where a fuel-burning *appliance* is installed in a *suite* of *residential occupancy*, a CO alarm shall be installed
a) inside each bedroom, or
b) outside each bedroom, within 5 m of each bedroom door, measured following corridors and doorways.

5) Where a fuel-burning *appliance* is installed in a *service room* that is not in a *suite* of *residential occupancy*, a CO alarm shall be installed
a) either inside each bedroom, or if outside, within 5 m of each bedroom door, measured following corridors and doorways, in every *suite* of *residential occupancy* that shares a wall or floor/ceiling assembly with the *service room*, and
b) in the *service room*.

6) For each *suite* of *residential occupancy* that shares a wall or floor/ceiling assembly with a *storage garage* or that is adjacent to an attic or crawl space to which the *storage garage* is also adjacent, a CO alarm shall be installed
a) inside each bedroom, or
b) outside each bedroom, within 5 m of each bedroom door, measured following corridors and doorways.

7) Reserved.

Section 9.33. Heating and Air-conditioning

9.33.1. General

9.33.1.1. Application

1) This Section applies to the design and installation of heating systems, including requirements for combustion air, and air-conditioning systems serving only one *dwelling unit*.

2) The design and installation of heating systems, including requirements for combustion air, and air-conditioning systems other than those described in Sentence (1) shall conform to Part 6. (See Article 9.33.4.1. and Subsection 9.10.10.)

3) Reserved.

4) Systems used for heating and air-conditioning shall conform to the energy efficiency requirements in Section 9.36.

9.33.2. Required Heating Systems

9.33.2.1. Required Heating Systems

1) Residential *buildings* intended for use in the winter months on a continuing basis shall be equipped with heating facilities conforming to this Section.

9.33.3. Design Temperatures

9.33.3.1. Indoor Design Temperatures

1) At the outside winter design temperature, required heating facilities shall be capable of maintaining an indoor air temperature of not less than

a) 22°C in all living spaces,
b) 18°C in unfinished *basements*,
c) **reserved**, and
d) 15°C in heated crawl spaces.

9.33.3.2. Outdoor Design Temperatures

1) The outdoor conditions to be used in designing heating and air-conditioning systems shall be determined in conformance with Article 1.1.3.1.

9.33.4. General Requirements for Heating and Air-conditioning Systems

9.33.4.1. Design of Heating and Air-conditioning Systems

1) Aspects of heating and air-conditioning systems not specifically addressed in this Subsection, including ducting, and mechanical heating and refrigeration equipment, shall be designed, constructed and installed in accordance with good practice such as that described in the ASHRAE Handbooks and Standards, the HRAI Digest, the CHC Handbook on Hydronic Heating Systems, the Hydronics Institute Manuals, the SMACNA Manuals and the TECA Quality First Manuals. (See also Subsection 9.32.3. for the design of systems that also provide ventilation.)

9.33.4.2. Installation of Hydronic Heating Systems

1) The installation of a hydronic heating system shall conform to CSA B214, “Installation Code for Hydronic Heating Systems.”

9.33.4.3. Reserved

9.33.4.4. Access

1) Equipment forming part of a heating or air-conditioning system, with the exception of embedded pipes or ducts, shall be installed with provision for access for inspection, maintenance, repair and cleaning.

9.33.4.5. Protection from Freezing

1) Equipment forming part of a heating or air-conditioning system that may be adversely affected by freezing temperatures and that is located in an unheated area shall be protected from freezing.

9.33.4.6. Expansion, Contraction and System Pressure

1) Heating and cooling systems shall be designed to allow for expansion and contraction of the heat transfer fluid and to maintain the system pressure within the rated working pressure limits of all components of the system.

9.33.4.7. Structural Movement

1) Mechanical systems and equipment shall be designed and installed to accommodate the maximum amount of structural movement provided for in the construction of the *building*.

2) Where the *building* is in a location where the spectral response acceleration, $S_a(0.2)$, is greater than 0.55, heating and air-conditioning equipment with fuel or power connections shall be secured to the structure to resist overturning and displacement. (See Note A-9.31.6.2.(3).)

9.33.4.8. Asbestos

1) Asbestos shall not be used in air distribution systems or equipment.

9.33.4.9. Contaminant Transfer

1) Systems serving garages, and systems serving other occupied parts of a *dwelling unit* but located in or running through a garage, shall be designed and constructed in a manner such that means are not provided for the transfer of contaminants from the garage into other spaces in the *dwelling unit*.

9.33.4.10. Noise Control

1) Heating and air-conditioning equipment shall be installed and located so that the noise generated by this equipment conforms with the Vancouver Noise Control By-law.

9.33.5. Heating and Air-conditioning Appliances and Equipment

9.33.5.1. Capacity of Heating Appliances

1) The required capacity of heating *appliances* located in a *dwelling unit* and serving only that *dwelling unit*, shall be determined in accordance with CSA F280, "Determining the Required Capacity of Residential Space Heating and Cooling Appliances," except that the design temperatures shall conform to Subsection 9.33.3.

9.33.5.2. Installation Standards

1) Except as provided in Articles 9.33.5.3. and 9.33.5.4., the installation of heating and air-conditioning equipment, including mechanical refrigeration equipment, and including provisions for mounting, clearances and air supply, shall conform to

a) the Safety Standards Act and the following of its regulations:

i) the Gas Safety Regulation,

ii) the Electrical Safety Regulation, and

iii) the Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation,

b) CSA B139, "Installation Code for Oil-Burning Equipment," and

c) CSA C448 Series, "Design and Installation of Earth Energy Systems."

(See also Sentence 9.33.5.3.(1).)

9.33.5.3. Design, Construction and Installation Standard for Solid-Fuel-Burning Appliances

(See Note A-9.33.5.3.)

1) The design, construction and installation, including the provision of combustion air, of solid-fuel-burning *appliances* and equipment, including *stoves*, *cooktops*, ovens and *space heaters*, shall conform to CSA B365, "Installation Code for Solid-Fuel-Burning Appliances and Equipment."

2) For the purposes of Sentence (1), solid-fuel-burning boiler appliances that are approved for use under section 10 of the Safety Standards Act satisfy section 3.1 of CAN/CSA-B365 "Installation Code for Solid-Fuel-Burning Appliances and Equipment."

(See also Subclause 9.33.5.2.(1)(a)(ii).)

9.33.5.4. Fireplaces

1) Fireplaces shall conform to Section 9.22.

9.33.6. Air Duct Systems

9.33.6.1. Application

1) The design, construction and installation of air duct distribution systems serving heating systems in which the rated heat input does not exceed 120 kW shall conform to this Subsection.

2) Air duct distribution systems in which the rated heat input exceeds 120 kW shall conform to Part 6 and Subsection 3.6.5.

9.33.6.2. Materials in Air Duct Systems

1) Except as provided in Sentences (2) to (6) and in Article 3.6.4.3., all ducts, duct connectors, associated fittings and *plenums* used in air duct systems shall be constructed of steel, aluminum alloy, copper, clay or similar *noncombustible* material.

2) Ducts, associated fittings and *plenums* are permitted to contain *combustible* material provided they

a) conform to the appropriate requirements for Class 1 duct materials in CAN/ULC-S110, "Test for Air Ducts,"

b) conform to Article 3.1.5.18. and Subsection 3.1.9.,

c) are not used in vertical runs serving more than 2 *storeys*, and

d) are not used in air duct systems in which the air temperature may exceed 120°C.

3) Duct sealants shall have a *flame-spread rating* of not more than 25 and a smoke developed classification of not more than 50.

4) Duct connectors that contain *combustible* materials and that are used between ducts and air outlet units shall

a) conform to the appropriate requirements for Class 1 air duct materials in CAN/ULC-S110, "Test for Air Ducts,"

b) be limited to 4 m in length,

c) be used only in horizontal runs, and

d) not penetrate required *fire separations*.

5) *Combustible* ducts that are part of a duct system carrying only ventilation air and that are contained entirely within a *dwelling unit* need not comply with the requirements of Sentences (1) to (4).

6) Except as provided in Sentences 9.33.6.13.(2) and (3), ducts that are part of a return-air duct system and that are contained entirely within a *dwelling unit* need not comply with the requirements of Sentences (1) to (4).

7) Materials referred to in Sentences (1) to (6), when used in a location where they may be subjected to excessive moisture, shall

a) have no appreciable loss of strength when wet, and

b) be corrosion-resistant.

9.33.6.3. Tape

1) Tape used for sealing duct joints in air ducts, *plenums* and other parts of air duct systems shall meet the flame-resistance requirements for fabric in CAN/ULC-S109, "Flame Tests of Flame-Resistant Fabrics and Films."

9.33.6.4. Coverings, Linings, Adhesives and Insulation

1) Coverings, linings and associated adhesives and insulation of air ducts, *plenums* and other parts of air duct systems shall be of *noncombustible* material when exposed to heated air or radiation from heat sources that would result in the exposed surface exceeding a temperature of 120°C.

2) Except as provided in Sentence (3), when *combustible* coverings and linings, including associated adhesives and insulation, are used, they shall have

a) a *flame-spread rating* of not more than 25 on any exposed surface or any surface that would be exposed by cutting through the material in any direction, and

b) a smoke developed classification of not more than 50.

3) The outer covering of ducts, *plenums* and other parts of air duct systems used within an assembly of *combustible construction* are permitted to have

a) an exposed surface *flame-spread rating* of not more than 75, and

b) a smoke developed classification greater than 50.

4) *Combustible* coverings and linings described in Sentences (2), (3) and (6) shall not flame, glow, smoulder or smoke when tested in accordance with the method of test in ASTM C 411, "Hot-Surface Performance of High-Temperature Thermal Insulation," at the maximum temperature to which the coverings and linings are to be exposed in service.
5) Except as provided in Sentences (6) and (7), foamed plastic insulation shall not be used as part of an air duct or for insulating an air duct.
6) Foamed plastic insulation conforming to Article 9.25.2.2. is permitted to be used to insulate a galvanized steel, stainless steel or aluminum air duct, provided

a) the foamed plastic insulation applied to supply ductwork is not less than 3 m from the *furnace* bonnet,
b) the temperature within the ductwork where the insulation is installed is not greater than 50°C,
c) duct joints are taped with a product conforming to Sentence 9.33.6.3.(1),
d) return air *plenums* are separated from the foamed plastic insulation, and
e) the foamed plastic insulation is protected

i) by one of the interior finishes described in Subsections 9.29.4. to 9.29.9.,
ii) provided the *building* does not contain a Group C *major occupancy*, by sheet metal that is mechanically fastened to the supporting assembly independent of the insulation, is not less than 0.38 mm thick and has a melting point of 650°C or more, or
iii) by any thermal barrier that meets the requirements of Clause 3.1.5.15.(2)(e).

7) Foamed plastic insulation is permitted to be used in a ceiling space that acts as a return air *plenum* provided the foamed plastic insulation is protected from exposure to the *plenum* in accordance with Sentence 3.1.5.14.(4).
8) *Combustible* coverings and linings of ducts, including associated adhesives and insulation, shall be interrupted

a) at the immediate area of operation of heat sources in a duct system, such as electric resistance heaters or fuel-burning heaters or *furnaces*, and
b) where the duct penetrates a *fire separation*.

9) Linings of ducts shall be installed so that they will not interfere with the operation of volume or balancing dampers or of *fire dampers*, *fire stop flaps* and other closures.

9.33.6.5. Galvanized Steel or Aluminum Supply Ducts

1) Galvanized steel or aluminum *supply ducts* shall conform to Table 9.33.6.5.
2) The design of fittings for ducts shall conform to ANSI/SMACNA 006, "HVAC Duct Construction Standards – Metal and Flexible," except that metal thicknesses shall conform to Table 9.33.6.5.

Table 9.33.6.5.
Minimum Metal Thickness of Ducts
Forming Part of Article 9.33.6.5.

Type of Duct	Maximum Diameter, mm	Maximum Width or Depth, mm	Minimum metal thickness, mm — Duct Material: Galvanized Steel	Minimum metal thickness, mm — Duct Material: Aluminum
Round ducts serving single *dwelling units*	125 or less	–	0.254	0.30
Round	350	–	0.33	0.30
	Over 350	–	0.41	0.41
Rectangular, enclosed	–	350	0.33	0.30

	–	Over 350	0.41	0.41
Rectangular, not enclosed, for single *dwelling units*, with required clearance up to 12 mm	–	350	0.33	0.41
	–	Over 350	0.41	0.48
Rectangular, not enclosed, with required clearance of more than 12 mm	–	350	0.41	0.41
	–	Over 350	0.48	0.48

9.33.6.6. Construction of Ducts and Plenums

1) Where the installation of heating *supply ducts* in walls and floors creates a space between the duct and construction material, the space shall be fire stopped with *noncombustible* material at each end.
2) Ducts shall be securely supported by metal hangers, straps, lugs or brackets, except that, where zero clearance is permitted, wooden brackets are permitted to be used.
3) All round duct joints shall be tight-fitting and lapped not less than 25 mm.
4) Rectangular duct connections shall be made with S and drive cleats or equivalent mechanical connections.
5) Duct systems shall have no openings other than those required for the proper operation and maintenance of the system.

9.33.6.7. Installation of Ducts and Plenums

1) Air duct systems serving garages shall not be interconnected with other parts of the *dwelling unit*.
2) Trunk *supply ducts* shall not be nailed directly to wood members.
3) Branch ducts shall be supported at suitable spacings to maintain alignment and prevent sagging.
4) Ducts passing through unheated spaces shall have all joints taped or otherwise sealed to ensure that the ducts are airtight throughout their length.
5) *Combustible* ducts in concrete slabs-on-ground that are connected to a *furnace* supply *plenum* shall be located not closer than 600 mm to that *plenum* and not less than 600 mm from its connection to a riser or register.
6) Ducts in or beneath concrete slabs-on-ground shall be watertight and corrosion-, decay-, and mildew-resistant.
7) Underground ducts shall
a) be constructed to provide interior drainage from and access to all low points, and
b) not be connected directly to a sewer.

9.33.6.8. Clearances of Ducts and Plenums

1) The clearance of *furnace plenums* from *combustible* material shall conform to the appropriate standards in Sentence 9.33.5.2.(1).
2) Where the *plenum* clearance required in Sentence (1) is 75 mm or less, the clearance between a *supply duct* and *combustible* material shall
a) be equal to the required *plenum* clearance within 450 mm of the *plenum*, and
b) be not less than 12 mm at a distance of 450 mm or more from the *plenum*, except that this clearance may be reduced to zero beyond a bend or offset in the duct sufficiently large to shield the remainder of the *supply duct* from direct radiation from the *furnace* heat exchanger. (See Note A-3.6.5.6.(2).)
3) Where the *plenum* clearance required in Sentence (1) is more than 75 mm but not more than 150 mm, the clearance between a *supply duct* and *combustible* material shall be
a) equal to the required *plenum* clearance within a horizontal distance of 1.8 m of the *plenum*, and
b) not less than 12 mm at a horizontal distance of 1.8 m or more from the *plenum*, except that this distance may be reduced to zero beyond a bend or offset in the duct sufficiently large to shield the

remainder of the duct from direct radiation from the *furnace* heat exchanger. (See Note A-3.6.5.6.(3).)

4) Where the *plenum* clearance required in Sentence (1) is more than 150 mm, the clearance between a *supply duct* and *combustible* material shall be

a) equal to the required *plenum* clearance within a horizontal distance of 1 m of the *plenum*,
b) not less than 150 mm within a horizontal distance between 1 m and 1.8 m from the *plenum*, and
c) not less than 25 mm at a horizontal distance of 1.8 m or more from the *plenum*, except that this distance may be reduced to 8 mm beyond a bend or offset in the duct sufficiently large to shield the remainder of the *supply duct* from direct radiation from the *furnace* heat exchanger. (See Note A-3.6.5.6.(4).)

5) Where a register is installed in a floor directly over a pipeless *furnace*, a double-walled register box with not less than 100 mm between walls, or a register box with the warm-air passage completely surrounded by the cold-air passage, shall be permitted in lieu of the clearances listed in Sentences (2), (3) and (4).

9.33.6.9. Adjustable Dampers and Balance Stops

1) All branch *supply ducts* that are not fitted with diffusers with adjustable balance stops shall be supplied with adjustable dampers and fitted with devices to indicate the positions of the dampers.

9.33.6.10. Warm-Air Supply Outlets and Return Inlets – General

1) Supply outlets and return openings in the *dwelling unit*, when located less than 2 m above the floor, shall be protected by grilles having openings of a size that will not allow the passage of a 15 mm diam sphere.

2) *Combustible* grilles, diffusers and other devices for the supply and return air openings installed in walls and ceilings shall have a *flame-spread rating* of

a) not more than 200 in bathrooms, and
b) not more than 150 in rooms or spaces other than bathrooms.

9.33.6.11. Warm-Air Supply Outlets

1) In a *dwelling unit*, a warm-air supply outlet shall be provided in each finished room that is located adjacent to unheated space.

2) Except as provided in Sentence (3), when a room described in Sentence (1) is located adjacent to exterior walls, such outlet shall be located so as to bathe at least one exterior wall or window with warm air, except in bathrooms, utility rooms or kitchens, where this may not be practical.

3) Where the heating system is also designed to provide ventilation air, ceiling outlets or outlets located high on interior walls are permitted to be installed, provided the outlets are designed for this purpose and are installed with diffusers.

4) At least one warm-air supply outlet shall be provided for each 40 m^2 of floor surface area in unfinished *basements* serving *dwelling units*, and it shall be located so as to provide adequate distribution of warm air throughout the *basement*.

5) At least one warm-air supply outlet shall be provided for each 80 m^2 of floor surface area in heated crawl spaces serving *dwelling units*, and it shall be located so as to provide adequate distribution of warm air throughout the crawl space.

6) Except for pipeless *furnaces*, the capacity of warm-air supply outlets serving *dwelling units* shall be not less than the design heat loss from the area served and shall not exceed 3 kW per outlet.

7) In *basements* and heated crawl spaces, the calculated heat gain from the *supply ducts* and *plenum* surfaces is permitted to be considered in calculating the design heat loss.

8) The temperature of supply air at warm-air supply outlets shall not exceed 70°C.

9) Warm-air supply outlets located in finished areas shall be provided with diffusers and adjustable openings and shall not be located on a *furnace plenum*.

9.33.6.12. Return-Air Inlets

1) Return-air inlets shall not be installed in an enclosed room or crawl space that provides combustion air to a *furnace*.
2) Except for unfinished areas and floor levels which are less than 900 mm above or below an adjacent floor level which is provided with a return-air inlet, at least one return-air inlet shall be provided in each floor level in a *dwelling unit*.
3) Provision shall be made for the return of air from all rooms by leaving gaps beneath doors, using louvred doors or installing *return duct* inlets.

9.33.6.13. Return-Air System

(See Note A-9.33.6.13.)
1) The return-air system shall be designed to handle the entire air supply.
2) Where any part of a *return duct* will be exposed to radiation from the *furnace* heat exchanger or other radiating part within the *furnace*, such part of a *return duct* directly above or within 600 mm of the outside *furnace* casing shall be *noncombustible*.
3) *Return ducts* serving solid-fuel-burning *furnaces* shall be constructed of *noncombustible* material.
4) *Combustible return ducts* shall be lined with *noncombustible* material
- a) below floor registers,
- b) at the bottom of vertical ducts, and
- c) under *furnaces* having a bottom return.

5) Spaces between studs or joists used as *return ducts* shall be separated from the unused portions of such spaces by tight-fitting metal stops or wood blocking.
6) A vertical *return duct* shall have openings to return air on not more than one floor.
7) The return-air system shall be designed so that the negative pressure from the circulating fan cannot
- a) affect the *furnace* combustion air supply, nor
- b) draw combustion products from joints or openings in the *furnace* or *flue pipe*.

9.33.6.14. Filters and Odour Removal Equipment

1) Air filters for air duct systems shall conform to the requirements for Class 2 air filter units as described in CAN/ULC-S111, “Fire Tests for Air Filter Units.”
2) When electrostatic-type filters are used, they shall be installed so as to ensure that the electric circuit is automatically de-energized when filter access doors are opened or, in *dwelling units*, when the *furnace* circulation fan is not operating.
3) When odour removal equipment of the adsorption type is used it shall be
- a) installed to provide access so that adsorption material can be reactivated or renewed, and
- b) protected from dust accumulation by air filters installed on the inlet side.

9.33.7. Radiators and Convectors

9.33.7.1. Recessed Radiators and Convectors

1) Every steam or hot water radiator and convector located in a recess or concealed space or attached to the face of a wall of *combustible construction* shall be provided with a *noncombustible* lining or backing.

9.33.7.2. Surface Temperature

1) The exposed surface temperature of a steam or hot water radiator shall not exceed 70°C unless precautions are taken to prevent human contact.

9.33.8. Piping for Heating and Cooling Systems

9.33.8.1. Piping Materials and Installation

1) Piping shall be made from materials designed to withstand the effects of temperatures and pressures that may occur in the system. (See Articles 3.1.5.19., 3.1.9.1. and 9.10.9.6. for fire safety requirements.)

2) Every pipe used in a heating or air-conditioning system shall be installed to allow for expansion and contraction due to temperature changes.
3) Supports and anchors for piping in a heating or air-conditioning system shall be designed and installed to ensure that undue stress is not placed on the supporting structure.

9.33.8.2. Insulation and Coverings

1) Insulation and coverings on pipes shall be composed of material suitable for the operating temperature of the system to withstand deterioration from softening, melting, mildew and mould.
2) Insulation and coverings on pipes in which the temperature of the fluid exceeds 120°C
- a) shall be made of *noncombustible* material, or
- b) shall not flame, glow, smoulder or smoke when tested in accordance with ASTM C 411, "Hot-Surface Performance of High-Temperature Thermal Insulation," at the maximum temperature to which such insulation or covering is to be exposed in service.

3) Except as provided in Sentence (6), where *combustible* insulation is used on piping in a horizontal or *vertical service space*, the insulation and coverings on such pipes shall have a *flame-spread rating* throughout the material of not more than
- a) 25 in *buildings* of *noncombustible construction*, and
- b) 75 in *buildings* of *combustible construction*.

4) Except as provided in Sentence (6), insulation and coverings on piping located in rooms and spaces other than the *service spaces* described in Sentence (3) shall have a *flame-spread rating* not more than that required for the interior finish for the ceiling of the room or space.
5) Pipes that are exposed to human contact shall be insulated so that the exposed surface does not exceed 70°C. (See Note A-6.5.1.1.(3).)
6) No *flame-spread rating* or smoke developed classification limitations are required where *combustible* insulation and coverings are used on piping when such piping is
- a) located within a concealed space in a wall,
- b) located in a floor slab, or
- c) enclosed in a *noncombustible* raceway or conduit.

9.33.8.3. Clearances

1) Clearances between *combustible* material and bare pipes carrying steam or hot water shall conform to Table 9.33.8.3.

Table 9.33.8.3.
Clearance between Steam or Hot Water Pipes and Combustible Material
Forming Part of Sentence 9.33.8.3.(1)

Steam or Water Temperature (T), °C	Minimum Clearance, mm
T ≤ 95	no clearance required
95 < T ≤ 120	15
T > 120	25

9.33.8.4. Protection

1) Where a pipe carrying steam or hot water at a temperature above 120°C passes through a combustible floor, ceiling or wall, the construction shall be protected by a sleeve of metal or other noncombustible material not less than 50 mm larger in diameter than the pipe.
2) Unprotected steam or hot water pipes that pass through a storage space shall be covered with not less than 25 mm thickness of noncombustible insulation to prevent direct contact with the material stored.

9.33.9. Refrigerating Systems and Equipment for Air-conditioning

9.33.9.1. Cooling Units

1) Where a cooling unit is combined with a fuel-fired furnace in the same duct system, the cooling unit shall be installed

a) in parallel with the heating furnace,

b) upstream of the furnace, provided the furnace is designed for such application, or

c) downstream of the furnace, provided the cooling unit is designed to prevent excessive temperature or pressure in the refrigeration system.

9.33.10. Chimneys and Venting Equipment

9.33.10.1. Requirement for Venting

1) Except as provided in Articles 9.33.10.2. and 9.33.10.3., the products of combustion from oil-, gas- and solid-fuel-burning appliances, including stoves, cooktops, ovens and space heaters, shall be vented in conformance with the applicable appliance installation standard listed in Sentences 9.33.5.2.(1) and 9.33.5.3.(1).

9.33.10.2. Factory-Built Chimneys

1) Factory-built chimneys serving solid-fuel-burning appliances, and their installation, shall conform to CAN/ULC-S629-M, "650°C Factory-Built Chimneys." (See Note A-9.33.10.2.(1).)

9.33.10.3. Masonry or Concrete Chimneys

1) Masonry or concrete chimneys shall conform to Section 9.21.

9.33.10.4. Location of Exhaust Vents Serving Buildings Containing Not More than Two Principal Dwelling Units

1) Exhaust Vents from heating and air conditioning equipment and similar appliances, other than direct vented fireplaces, shall be directed

a) vertically through the roof of a *building*, with the discharge located at least 1.5 m away from any property line, or

b) horizontally through an exterior wall which faces a *street* or a *lane*, with the discharge located at least 3 m away
from any property line.

Section 9.34. Electrical Facilities

9.34.1. General

9.34.1.1. Standard for Electrical Installations

1) Electrical installations, including the service capacity of the installation and the number and distribution of circuits and receptacles, shall conform to the Electrical Safety Regulation."

2) In addition to the requirements of Sentence (1), electrical installations in a principal *dwelling unit* containing an *ancillary residential unit* in a residential *suite* in an apartment building required to conform to Section 9.37 shall also comply with the following:

a) the electrical service size shall be based on the demand load calculated on the total area of the principal *dwelling unit* including any associated *ancillary residential unit*, provided that

i) for each electrical range additional to the first range, 6 kW demand shall be added for a rating of 12 kW or less, plus 40% of the amount by which the rating of the range exceeds 12 kW, and

ii) except for the first electrical range referred to in Subclause (2)(a)(i), any electrical equipment loads provided for shall be calculated in conformance with Sentence (1), and

b) a single panel board may supply electrical loads of the *dwelling units* referred to in Clause (2)(a) except for the *residential suite* containing an *ancillary residential unit* in an apartment building, provided that it is located within the *building* in a common area accessible to all occupants of the *building*.

3) Circuit breakers of panel boards installed in the dwelling units

a) shall be positioned not less than 600 mm above the finished floor level, and

b) notwithstanding the requirements of Sentence (1) and 3.8.5.7.(2), shall be positioned as high as feasible with the branch circuit breakers not more than 1500 mm above the finished floor level.

9.34.1.2. Required Facilities

1) Where electrical services are available, electrical facilities shall be provided for every *building* in conformance with this Section.

9.34.1.3. Location of Equipment in Public Areas

1) Entrance switches, meters, panel boxes, splitter boxes, time clocks and other similar equipment shall not be located in any public area unless adequate precautions are taken to prevent interference with the equipment.

9.34.1.4. Recessed Lighting Fixtures

1) Recessed lighting fixtures shall not be located in insulated ceilings unless the fixtures are designed for such installations.

9.34.1.5. Wiring and Cables

1) Except as required in Sentence (2), optical fibre cables and electrical wires and cables installed in *buildings* permitted to be of *combustible construction* shall

a) not convey flame or continue to burn for more than 1 min when tested in conformance with the Vertical Flame Test (FT1 rating) in CSA C22.2 No. 0.3, “Test Methods for Electrical Wires and Cables,” or

b) be located in

i) totally enclosed *noncombustible* raceways (See Note A-3.1.4.3.(1)(b)(i)),

ii) masonry walls,

iii) concrete slabs, or

iv) totally enclosed non-metallic raceways conforming to Clause 3.1.5.23.(1)(b).

2) Except as permitted in Sentence (3), where a concealed space in a floor or ceiling assembly is used as a *plenum*, electrical wires and cables with *combustible* insulation, jackets or sheathes that are used for the transmission of voice, sound or data and optical fibre cables installed within the *plenum* shall conform to Clause 3.6.4.3.(1)(a).

3) Wires or cables within *plenum* spaces that are used for the transmission of signals in fire alarm, security, radio, and television broadcasting, closed circuit television or community television systems need not meet the requirements of Sentence (2).

9.34.2. Lighting Outlets

(See Note A-9.34.2.)

9.34.2.1. Lighting of Entrances

1) An exterior lighting outlet with fixture controlled by a wall switch located within the *building* shall be provided at every entrance to *buildings* of *residential occupancy*.

9.34.2.2. Outlets in Dwelling Units

1) Except as provided in Sentence (2), a lighting outlet with fixture controlled by a wall switch shall be provided in kitchens, bedrooms, living rooms, utility rooms, laundry rooms, dining rooms, bathrooms, water-closet rooms, vestibules and hallways in *dwelling units*.

2) Where a receptacle controlled by a wall switch is provided in bedrooms or living rooms, such rooms need not conform to the requirements in Sentence (1).

9.34.2.3. Stairways

1) Every stairway shall be lighted.

2) Except as provided in Sentence (3), 3-way wall switches located at the head and foot of every stairway shall be provided to control at least one lighting outlet with fixture for stairways with 4 or more risers in *dwelling units*.

3) The stairway lighting for *basements* that do not contain finished space or lead to an outside entrance or built-in garage and which serve not more than one *dwelling unit* is permitted to be controlled by a single switch located at the head of the stairs.

9.34.2.4. Basements

1) A lighting outlet with fixture shall be provided for each 30 m^2 or fraction thereof of *floor area* in unfinished *basements*.

2) The outlet required in Sentence (1) nearest the stairs shall be controlled by a wall switch located at the head of the stairs.

9.34.2.5. Storage Rooms

1) A lighting outlet with fixture shall be provided in storage rooms.

9.34.2.6. Garages and Carports

1) A lighting outlet with fixture shall be provided for an attached, built-in or detached garage or carport.

2) Except as provided in Sentence (3), outlets required in Sentence (1) shall be controlled by a wall switch near the doorway.

3) Where the outlet and fixture required in Sentence (1) are ceiling mounted above an area not normally occupied by a parked car, or are wall mounted, a fixture with a built-in switch accessible to an adult of average height is permitted to be used.

4) Where a carport is lighted by a light at the entrance to a *dwelling unit*, additional carport lighting is not required.

9.34.2.7. Public and Service Areas

1) Every public or service area in *buildings* shall be provided with lighting outlets with fixtures controlled by a wall switch or panel to illuminate every portion of such areas.

2) When provided by incandescent lighting, illumination required in Sentence (1) shall conform to Table 9.34.2.7. (See Article 9.9.12.2. for lighting in *means of egress*.)

3) When other types of lighting are used, illumination equivalent to that shown in Table 9.34.2.7. shall be provided.

Table 9.34.2.7.
Lighting for Public Areas
Forming Part of Sentences 9.34.2.7.(2) and (3)

Room or Space	Minimum Illumination, lx	Minimum Lighting Power Density, W/m^2 of *floor area* (incandescent lighting)
Storage rooms	50	5
Service rooms and laundry areas	200	20
Garages	50	5
Public water closet rooms	100	10
Service hallways and stairways	50	5
Recreation rooms	100	10

9.34.3. Emergency Lighting

9.34.3.1. Criteria for Emergency Lighting

1) Emergency lighting shall conform to Subsection 9.9.12.

Section 9.35. Garages and Carports

9.35.1. Scope

9.35.1.1. Application

1) This Section applies to garages and carports serving not more than one *dwelling unit*.

9.35.1.2. Construction Requirements

1) The construction of a garage or carport shall conform to the requirements for other *buildings* in this Part except as provided in this Section.

9.35.2. General

9.35.2.1. Carport Considered to be Garage

1) Where a roofed enclosure used for the storage or parking of motor vehicles has more than 60% of the total perimeter enclosed by walls, doors or windows, the enclosure shall be considered a garage.

9.35.2.2. Garage Floor

1) Where an attached or built-in garage is provided and where adjacent spaces in the *building* are less than 50 mm above the garage floor,

a) the garage floor shall be sloped to the outdoors, or

b) where the garage can accommodate not more than 3 vehicles, an airtight curb or *partition* not less than 50 mm high shall be installed at the edges of the garage floor adjacent to interior space.

(See Note A-9.35.2.2.(1).)

9.35.3. Foundations

9.35.3.1. Foundation Required

1) Except as permitted in this Subsection, *foundations* conforming to Sections 9.12. and 9.15. shall be provided for the support of carport and garage super-structures, including that portion beneath garage doors.

2) Detached garages of less than 55 m² *floor area* and not more than 1 *storey* in height that are not of masonry or masonry veneer construction are permitted to be supported on

a) wood mud sills, or

b) a 100 mm thick concrete floor slab.

9.35.3.2. Protection from Damage due to Soil Movement

1) In clay-type *soils* subject to significant movement with a change in *soil* moisture content, the *foundation* depth of carports or garages connected to a *dwelling unit* directly or by a breezeway shall be approximately the same depth as the main *building foundation*.

2) Where slab-on-ground construction is used, a construction joint shall be provided between the main *building* slab and a slab serving an attached garage, breezeway or carport.

3) Except as provided in Section 9.12., *foundations* for attached unheated garages or carports shall be below frost level.

9.35.3.3. Drainage

1) Detached garages of less than 55 m² *floor area* and not more than 1 *storey* in height that are not of masonry or masonry veneer construction need not conform with the *foundation* drainage requirements stated in Section 9.14., where the finished ground level is at or near the elevation of the garage's floor and where the ground slopes away from the *building*.

9.35.3.4. Column Piers

1) Piers for the support of carport columns shall extend not less than 150 mm above ground level.

2) Piers referred to in Sentence (1) shall project not less than 25 mm beyond the base of the column but in no case be less than 190 mm by 190 mm in size.

9.35.4. Walls and Columns

9.35.4.1. Interior Finish

1) Interior finish need not be applied to garage and carport walls.

9.35.4.2. Columns

1) Columns for garages and carports shall conform to Section 9.17., except that 89 mm by 89 mm wood columns may be used.

9.35.4.3. Anchorage

1) Garage or carport walls and columns shall be anchored to the *foundation* to resist wind uplift in conformance with Subsection 9.23.6., except that where a garage is supported on the surface of the ground, ground anchors shall be provided to resist wind uplift.

Section 9.36. Energy Efficiency

9.36.1. General

9.36.1.1. Application

1) All Part 9 buildings shall conform to the energy requirements of Part 10.

Section 9.37 Ancillary Residential Units

9.37.1. General

9.37.1.1. Application

(See Note 9.37.1.1)

1) This Section applies to the construction of an *ancillary residential unit* in a *building* containing not more than 2 principal *dwelling units* or *a row house*. (See Note A-9.37.1.1.(1).)

9.37.1.2. Construction Requirements

1) An *ancillary residential unit,* and those parts of a *building* serving only the principal *dwelling unit* and its *ancillary residential unit,* shall conform to the requirements in this Part except as provided in this Section. (See Note A-9.37.1.2.)

9.37.2. Specific Requirements

9.37.2.1. Heights of Rooms or Spaces

1) The minimum height of rooms or spaces in an *ancillary residential unit* over the required minimum area as indicated in Table 9.5.3.1. shall be not less than 2.0 m.

2) It shall be possible to travel from the required area of one room to the required areas of all other rooms within an *ancillary residential unit* without reduction of the room height as required in Sentence (1).

9.37.2.2. Deleted.

9.37.2.3. Exit Stairs

1) *Exit* stairs serving a principal *dwelling unit* and its *ancillary residential unit* shall have a minimum width, measured between wall faces or guards, of not less than 860 mm. (See Note A-9.37.2.3.(1).)

9.37.2.4. Dimensions of Landings

1) Landings for exterior stairs serving an *ancillary residential unit* need not exceed 900 mm in length.

9.37.2.5. Handrails and Guards

1) Handrails and *guards* shall conform to the requirements of Subsections 9.8.7. and 9.8.8. as if serving only one *dwelling unit*.

9.37.2.6. Means of Egress

1) The width of every *public corridor* and *exit* corridor that serves a principal *dwelling unit* and its *ancillary residential unit* shall be not less than 860 mm. (See Note A-9.37.2.6.(1).)

9.37.2.7. Fire Separations for Exits

1) Except as permitted by Sentence (2), every *exit* other than an *exit* doorway shall be separated from adjacent *floor areas* by a *fire separation*

a) having a *fire-resistance rating* of 45 min, or

b) having a *fire-resistance rating* of not less than 30 min where the *dwelling units* are equipped with *smoke alarms* as referenced in Article 9.37.2.19.

2) A *fire-resistance rating* is not required for a *fire separation* that separates an *exit* from adjacent *floor areas* where the *building* is *sprinklered*.

9.37.2.8. Openings Near Unenclosed Exit Stairs and Ramps

1) Where an unenclosed exterior *exit* stair or ramp provides the only *means of egress* from a *dwelling unit* in a *building* that contains an *ancillary residential unit* and the stair is exposed to the hazards of fire from *unprotected openings* in the exterior wall of another *fire compartment*, the openings shall be protected in conformance with Articles 9.10.13.5. to 9.10.13.7. and 3.2.5.13.(5) (See Note A-9.37.2.8.(1).)

9.37.2.9. Doors in a Means of Egress

1) Every *exit* door or door that opens into or is located within a *public corridor* or other facility that provides *access to exit* from a principal *dwelling unit* and its *ancillary residential unit* shall

a) be not less than 1980 mm high,
b) have a clear opening width of not less than 800 mm, and
c) be permitted to swing inward.

9.37.2.10. Travel Limit to Exits or Egress Doors

1) In an *ancillary residential unit*, the travel limit from a floor level in the *dwelling unit* to an *exit* or egress door may exceed 1 *storey* provided the floor level within the *dwelling unit* is served by an operable window conforming to Article 9.9.10.1. and is located so that the window could provide egress from the *ancillary residential unit* if the other *dwelling unit* becomes inaccessible to the occupants due to a fire which originates in the *dwelling unit*.

9.37.2.11. Shared Egress Facilities

1) Except as provided in Article 9.9.7.3., where an egress door from a *dwelling unit* opens onto a *public corridor* or exterior passageway, it shall be possible from the location where the egress door opens onto the *public corridor* or exterior passageway to go in opposite directions to 2 separate *exits* unless the *dwelling unit* is served by a second and separate *means of egress* or an opening window conforming to Article 9.9.10.1.

2) Each *dwelling unit* shall be provided with a second and separate *means of egress* or an opening window conforming to Article 9.9.10.1. where the egress door from either *dwelling unit* opens onto

a) an *exit* stairway that serves both *suites*,
b) a *public corridor* serving both *suites* and served by a single *exit* stairway,
c) an exterior passageway serving both *suites* and served by a single *exit* stairway, or
d) a balcony serving both *suites* and served by a single *exit* stairway.

9.37.2.12. Exit Signs

1) *Exit* signs are not required within an *ancillary residential suite*.

9.37.2.13. Structural Fire Resistance

1) Table 9.10.8.1., Fire-Resistance Ratings for Structural Members and Assemblies, does not apply to an *ancillary residential unit*. (See Note A-9.37.2.13.)

9.37.2.14. Combustible Drain, Waste and Vent Piping

(See Note A-9.37.2.14.)

1) *Combustible* drain, waste and vent piping is permitted to be located within or penetrate a *fire separation* required to have a *fire-resistance rating* provided

a) except for the permitted penetration in Clause (b), the *combustible* piping is located within an assembly protected by a membrane of a minimum 12.7 mm gypsum board,
b) piping and tubing is tightly fitted, cast in place, or firestopped to ensure the integrity of the fire separation, and
c) the *combustible* piping does not penetrate the gypsum board protection membrane on the underside of a horizontal assembly.

2) *Combustible* drain, waste and vent piping enclosed in an assembly or protected as described in Sentence (1) is permitted on both sides of a *fire separation*.

9.37.2.15. Separation of Ancillary Residential Units

(See Note A-9.37.2.15.)

1) A principal *dwelling unit* and its *ancillary residential unit* shall be separated from each other by

- a) wall or partition assemblies consisting of
  - i) not less than one layer of 1/2” type C or 5/8” type X wall board on wood or steel studs on each side,
  - ii) resilient channel installed on at least one side, and
  - iii) *noncombustible* insulation of at least 3-1/2” depth throughout, and
- b) floor assemblies consisting of
  - i) not less than one layer of 1/2” type C or 5/8” type X wall board,
  - ii) with resilient channel, and
  - iii) at least 3-1/2” of *noncombustible* insulation.

2) Openings in a *fire separation* required by Sentence (1) shall be protected by *closures* with a minimum 20 min *fire-protection rating*, or 45 mm thick solid core wood doors in accordance with 9.10.13.2.

9.37.2.16. Separation of Public Corridors

1) A *public corridor* serving only a principal *dwelling unit* and its *ancillary residential unit* shall be separated from the *dwelling units* by

- a) wall or partition assemblies consisting of
  - i) not less than one layer of 1/2” type C or 5/8” type X wall board on wood or steel studs on each side, and
  - ii) *noncombustible* insulation of at least 3-1/2” depth throughout, and
- b) floor assemblies consisting of
  - i) not less than one layer of 1/2” type C or 5/8” type X wall board, and
  - ii) at least 3-1/2” of *noncombustible* insulation.

2) Openings in a *fire separation* required by Sentence (1) shall be protected by *closures* with a minimum 20 min *fire-protection rating*, or 45 mm thick solid core wood doors in accordance with 9.10.13.2.

9.37.2.17. Air Ducts and Fire Dampers

(See Note A-9.37.2.17.)

1) Except as provided in Sentences (2) and (3), and notwithstanding Sentences 9.32.1.1.(1) and 9.33.1.1.(1), Sections 9.32 and 9.33 applies to a *building* that contains an *ancillary residential suite*.

2) Where a heating or ventilation duct system serves more than one *dwelling unit*, the system shall be designed and installed to prevent the circulation of smoke to adjacent *dwelling units* upon a signal from a duct-type *smoke detector* or *smoke alarm*.

3) Ducts penetrating *fire separations* need not be equipped with *fire dampers* in conformance with Article 3.1.8.9. provided they are *noncombustible* with all openings in the duct system serving only one *fire compartment*.

9.37.2.18. Spatial Separation

1) Spatial separation shall conform to the applicable requirements of Subsection 9.10.14 or 9.10.15.

9.37.2.19. Smoke Alarms

(See Note A-9.37.2.19.)

1) The installation of *smoke alarms* shall conform to Subsection 9.10.19.

2) *Smoke alarms* shall be installed in each principal *dwelling unit* and each *ancillary residential unit,* and shall be of the photo-electric type hard-wired so that the activation of any smoke alarm will cause the smoke alarms in the principal *dwelling unit* and its *ancillary residential unit* to sound.

9.37.2.20. Sound Control

1) The assemblies separating the primary *dwelling unit* and its contained *ancillary residential suites* need not comply with the sound control requirements of Section 9.11. (See Note A-9.37.2.20.(1).)

9.37.2.21. Attic Space Access

1) An *attic space* access hatchway not less than 0.32 m^2 in an area with no dimension less than 500 mm may serve a principle dwelling unit and its contained ancillary residential suites.

9.37.2.22. Garages and Carports

1) Section 9.35 is applicable to garages and carports serving a *building* that contains an *ancillary residential suite.*

9.37.2.23. Accessibility and Adaptability

1) *Ancillary residential units* shall be designed in conformance with Section 3.8.

9.37.2.24. Fire Sprinklers

1) Where the *building* is permitted to be sprinklered to NFPA 13D by Article 3.2.5.12., the sprinkler system serving an *ancillary residential unit* is permitted to be designed in accordance with NFPA 13D.
2) The sprinkler system referred to in Sentence (1) shall be supplied from the *Principal Dwelling Unit*.

Section 9.38. Objectives and Functional Statements

9.38.1. Objectives and Functional Statements

9.38.1.1. Attributions to Acceptable Solutions

1) For the purpose of compliance with this By-law as required in Clause 1.2.1.1.(1)(b) of Division A, the objectives and functional statements attributed to the acceptable solutions in this Part shall be the objectives and functional statements listed in Table 9.38.1.1. (See Note A-1.1.2.1.(1).)

Table 9.38.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 9
Forming Part of Sentence 9.38.1.1.(1)

Functional Statements and Objectives[1]	
9.1.2.1. Floor Area Limits for Secondary Suites	
(1)	[F05-OS1.5]
	[F05-OS3.7]
9.3.1.1. General	
(1)	[F20-OS2.1] [F20,F21,F80-OS2.3]
	[F20-OP2.1,OP2.4] [F21-OP2.3,OP2.4]

	[F20,F80-OP2.3]
	[F20,F21,F80-OH1.1] Applies where concrete supports or is used in the walls of *chimneys* or fireplaces. [F20,F21,F55,F61,F80-OH1.1,OH1.2] [F20,F21,F61,F80-OH1.3] Applies where concrete supports or is used in an environmental separator.
	[F20,F21,F80-OH4] Applies where concrete elements support wood-frame floors.
	[F20,F21,F80-OS3.1,OS3.7] Applies to concrete floors or steps, concrete that supports wood-frame floors or steps, and concrete steps that support *guards* or handrails. [F20,F21,F80-OS3.4] Applies where concrete supports or is used in *chimneys* or fireplaces.
	[F20,F21,F80-OS1.1] Applies where concrete supports or is used in *chimneys* or fireplaces.
(4)	[F20-OS2.1] [F80-OS2.3] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F21,F80-OP2.3,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21,F80-OH1.1] Applies where concrete supports or is used in the walls of *chimneys* or fireplaces. [F20,F21,F80,F61,F55-OH1.1,OH1.2] [F20,F21,F80,F61-OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21,F80-OH4] Applies to elements that support floors.
	[F20,F80-OS3.1] Applies to concrete that supports wood-frame floors or steps. [F20,F80-OS3.4,OS3.7] Applies where concrete supports or is used in *chimneys* or fireplaces.
	[F20,F80-OS1.1] Applies where concrete supports or is used in *chimneys* or fireplaces.
9.3.1.2. Cement	
(1)	[F20-OS2.1] [F80-OS2.3] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F80-OP2.3,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OH1.1] Applies where concrete supports or is used in the walls of *chimneys* or fireplaces. [F20,F80,F61,F55-OH1.1,OH1.2] [F20,F80,F61-OH1.3] Applies where concrete supports or is used in an environmental separator.
	[F20,F80-OH4] Applies where concrete elements support wood-frame floors.
	[F20,F80-OS3.1] Applies to concrete floors or steps, concrete that supports wood-frame floors or steps, and concrete steps that support *guards* or handrails.

	[F20,F80-OS3.4,OS3.7] Applies where concrete supports or is used in *chimneys* or fireplaces.
	[F20,F80-OS1.1] Applies where concrete supports or is used in *chimneys* or fireplaces.
9.3.1.3. Concrete in Contact with Sulphate Soil	
(1)	[F20-OS2.1] [F80-OS2.3] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F80-OP2.3,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F80-OH1.1] Applies where concrete supports or is used in the walls of *chimneys* or fireplaces. [F80-OH1.1,OH1.2,OH1.3] Applies where concrete supports or is used in an environmental separator.
	[F80-OH4] Applies where concrete elements support wood-frame floors.
	[F80-OS3.1] Applies to concrete floors or steps, concrete that supports wood-frame floors or steps, and concrete steps that support *guards* or handrails. [F80-OS3.4,OS3.7] Applies where concrete supports or is used in *chimneys* or fireplaces.
	[F80-OS1.1] Applies where concrete is used in footings for *chimneys* or fireplaces.
9.3.1.4. Aggregates	
(1)	[F20-OS2.1] [F80-OS2.3] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F80-OP2.3,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80,F61,F55-OH1.1,OH1.2] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces. [F20,F80,F61-OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.
	[F20,F80-OS1.1] Applies to concrete used in *chimneys* or fireplaces.
	[F20,F80-OS3.1] Applies to floors and elements that support floors. [F20,F80-OS3.4] Applies to concrete used in *chimneys* or fireplaces.
	[F20,F80-OH4] Applies to floors and elements that support floors.
9.3.1.5. Water	
(1)	[F20-OS2.1] [F80-OS2.3] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.

	[F20-OP2.1,OP2.4] [F80-OP2.3,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80,F61,F55-OH1.1,OH1.2] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces. [F20,F80,F61-OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.
	[F20,F80-OH4] Applies where concrete elements support wood-frame floors.
	[F20,F80-OS3.1] Applies to concrete floors or steps, concrete that supports wood-frame floors or steps, and concrete steps that support *guards* or handrails. [F20,F80-OS3.4,OS3.7] Applies where concrete supports or is used in *chimneys* or fireplaces.
	[F20,F80-OS1.1] Applies where concrete supports or is used in *chimneys* or fireplaces.
9.3.1.6. Compressive Strength	
(1)	(a) [F20-OS2.1] (a) [F21,F80-OS2.3] (a) [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	(a) [F20-OP2.1,OP2.4] (a) [F21-OP2.3,OP2.4] (a) [F80-OP2.3] (a) [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	(a) [F20,F80-OH1.1] Applies where concrete supports or is used in the walls of *chimneys* or fireplaces. (a) [F20,F80,F61,F55-OH1.1,OH1.2] [F20,F80,F61-OH1.3] Applies where concrete supports or is used in an environmental separator.
	(a) [F20,F21,F80-OH4] Applies to elements that support floors.
	(a) [F20,F80-OS3.1] Applies to elements that support floors or steps. (a) [F20,F80-OS3.4,OS3.7] Applies where concrete supports or is used in *chimneys* or fireplaces.
	(a) [F20,F21,F80-OS1.1] Applies where concrete supports or is used in *chimneys* or fireplaces.
	(b) [F20-OS2.1] (b) [F21,F80-OS2.3] (b) [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	(b) [F20-OP2.1,OP2.4] (b) [F21-OP2.3,OP2.4] (b) [F80-OP2.3] (b) [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	(b) [F20,F21,F80,F61,F55-OH1.1,OH1.2] [F20,F21,F80,F61-OH1.3]
	(b) [F20,F21,F80-OS3.1]

	(c) [F20-OS2.1] [F20,F21,F80-OS2.3]
	(c) [F20-OP2.1] [F20,F21,F80-OP2.3,OP2.4]
	(c) [F20,F21,F80-OS3.1]
(2)	[F80-OS3.1]
9.3.1.7. Concrete Mixes	
(1)	(a) [F20-OS2.1] (a) [F21-OS2.3] (a) [F20,F61,F55-OS2.3] Applies to elements that support or are part of an environmental separator.
	(a) [F20-OP2.1,OP2.4] (a) [F21-OP2.3,OP2.4] (a) [F20,F55,F61-OP2.3] Applies to elements that support or are part of an environmental separator.
	(a) [F20,F21,F80-OH1.1] Applies where concrete supports or is used in the walls of *chimneys* or fireplaces. (a) [F20,F21,F80,F61,F55-OH1.1,OH1.2] [F20,F21,F80,F61-OH1.3] Applies where concrete supports or is used in an environmental separator.
	(a) [F20,F21,F61-OH4] Applies to elements that support floors.
	(a) [F20,F21,F61-OS3.1] Applies to concrete floors or steps, concrete that supports wood-frame floors or steps, and concrete steps that support *guards* or handrails. (a) [F20,F21,F61-OS3.4,OS3.7] Applies where concrete supports or is used in *chimneys* or fireplaces.
	(a) [F20,F21,F61-OS1.1] Applies where concrete supports or is used in *chimneys* or fireplaces.
	(b) [F20-OS2.1] (b) [F21,F80-OS2.3] (b) [F20-OS2.3] Applies where concrete is used in an environmental separator.
	(b) [F20-OP2.1,OP2.4] (b) [F21-OP2.3,OP2.4] (b) [F80-OP2.3] (b) [F20-OP2.3] Applies where concrete is used in an environmental separator.
	(b) [F20,F21,F80,F61,F55-OH1.1,OH1.2] [F20,F21,F80,F61-OH1.3]
	(b) [F20,F21,F80-OS3.1]
	(c) [F20,F21-OS2.1] [F20,F21,F80-OS2.3]
	(c) [F20,F21,F80-OS3.1]
	(c) [F20,F21,F80-OP2.3,OP2.4]
(2)	[F20-OS2.1] [F21-OS2.3]

	[F20,F61,F55-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F21-OP2.3,OP2.4] [F20,F61,F55-OP2.3] Applies where concrete supports or is used in an environmental separator.
	[F20,F21,F61,F55-OH1.1] Applies where concrete supports or is used in the walls of *chimneys* or fireplaces. [F20,F21-OH1.2,OH1.3] Applies where concrete supports or is used in an environmental separator.
	[F20,F21,F61,F55-OH4] Applies where concrete elements support wood-frame floors.
	[F20,F80-OS3.1] Applies to concrete floors or steps, concrete that supports wood-frame floors or steps, and concrete steps that support *guards* or handrails. [F20,F80-OS3.4,OS3.7] Applies where concrete supports or is used in *chimneys* or fireplaces.
	[F20,F21-OS1.1] Applies where concrete supports or is used in *chimneys* or fireplaces.
9.3.1.8. Admixtures	
(1)	[F20-OS2.1] [F21-OS2.3] [F20,F61,F55-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F21-OP2.3,OP2.4] [F80-OP2.3,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OH1.1] Applies where concrete supports or is used in the walls of *chimneys* or fireplaces. [F20,F80,F61,F55-OH1.1,OH1.2] [F20,F80,F61-OH1.3] Applies where concrete supports or is used in an environmental separator.
	[F20,F21,F80-OH4] Applies where concrete elements support wood-frame floors.
	[F20,F80-OS3.1] Applies to concrete floors or steps, concrete that supports wood-frame floors or steps, and concrete steps that support *guards* or handrails. [F20,F80-OS3.4,OS3.7] Applies where concrete supports or is used in *chimneys* or fireplaces.
	[F20,F21,F80-OS1.1] Applies where concrete supports or is used in *chimneys* or fireplaces.
9.3.1.9. Cold Weather Requirements	
(1)	[F20-OS2.1] [F21-OS2.3] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F21,F80-OP2.3,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OH1.1] Applies where concrete supports or is used in the walls of *chimneys* or fireplaces. [F20,F80,F61,F55-OH1.1,OH1.2] [F20,F80,F61-OH1.3] Applies where concrete supports or is used in an

	environmental separator.
	[F20,F21,F80-OH4] Applies where concrete elements support wood-frame floors.
	[F20,F80-OS3.1] Applies to concrete floors or steps, concrete that supports wood-frame floors or steps, and concrete steps that support *guards* or handrails. [F20,F80-OS3.4,OS3.7] Applies where concrete supports or is used in *chimneys* or fireplaces.
	[F20,F21,F80-OS1.1] Applies where concrete supports or is used in *chimneys* or fireplaces.
(2)	[F20-OH1.1] Applies where concrete supports or is used in the walls of *chimneys* or fireplaces. [F20,F61,F55-OH1.1,OH1.2] [F20,F61-OH1.3] Applies where concrete supports or is used in an environmental separator.
	[F20-OS2.1] [F20,F61,F55-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20,F61,F55-OP2.3] [F61,F55-OP2.4] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.1] Applies to concrete that supports or is used in *chimneys* or fireplaces.
	[F20,F61,F55-OS3.1] Applies to floors and elements that support floors. [F20,F61,F55-OS3.4] Applies to concrete that supports or is used in *chimneys* or fireplaces.
	[F20,F61,F55-OH4] Applies to elements that support floors.
9.3.2.2. Lumber Grades	
(1)	[F20-OS2.1] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, or elements that support walls, that contain doors or windows required for emergency egress.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
9.3.2.5. Moisture Content	
(1)	[F21,F80-OS2.3]
	[F21,F80-OP2.3,OP2.4]

	[F21,F80-OS3.1] Applies to floors and elements that support floors.
	[F21,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F21,F80-OS1.2] Applies to assemblies required to provide fire resistance.
	[F21,F80-OH4] Applies to floors and elements that support floors.
9.3.2.8. Undersized Lumber	
(1)	[F20-OS2.1] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.3.2.9. Termite and Decay Protection	
(1)	[F82,F80-OS2.3]
	[F82,F80-OP2.3,OP2.4]
	[F82,F80,F61,F55-OH1.1,OH1.2] [F82,F80,F61-OH1.3] Applies where structural wood elements support or are used in an environmental separator.
	[F82,F80-OH4] Applies where structural wood elements support or are used in floors.
	[F82,F80-OS3.1] Applies where structural wood elements support or are used in floors.
	[F82,F80-OS1.2] Applies where structural wood elements support or are used in assemblies that are required to provide fire resistance.
(2)	[F80,F82-OS2.3]
	[F80,F82-OP2.3,OP2.4]
	[F82,F80,F61,F55-OH1.1,OH1.2] [F82,F80,F61-OH1.3] Applies where structural wood elements support or are used in an environmental separator.
	[F82,F80-OH4] Applies where structural wood elements support or are used in floors.
	[F82,F80-OS3.1] Applies where structural wood elements support or are used in floors.

	[F82,F80-OS1.2] Applies where structural wood elements support or are used in assemblies that are required to provide fire resistance.
(3)	[F80-OS2.3]
	[F80-OP2.3,OP2.4]
	[F82,F80,F61,F55-OH1.1,OH1.2] [F82,F80,F61-OH1.3] Applies where structural wood elements support or are used in an environmental separator.
	[F80-OH4] Applies where structural wood elements support or are used in floors.
	[F80-OS3.1] Applies where structural wood elements support or are used in floors.
	[F80-OS1.2] Applies where structural wood elements support or are used in assemblies that are required to provide fire resistance.
(4)	[F80-OS2.3,OS2.5]
	[F80-OP2.3,OP2.4,OP2.5]
	[F80,F61,F55-OH1.1,OH1.2] [F80,F61-OH1.3] Applies where cribbing or retaining walls support an environmental separator.
	[F80-OH4] Applies to floors and elements that support floors.
	[F80-OS3.1] Applies where cribbing or retaining walls support floors.
	[F80-OS1.2] Applies where cribbing or retaining walls support assemblies that are required to provide fire resistance.
(5)	[F80,F81-OS2.3,OS2.4]
	[F80,F81-OP2.3,OP2.4]
	[F55,F61,F80,F81-OH1.1,OH1.2] [F61,F80,F81-OH1.3] Applies where structural wood elements support or are used in an environmental separator.
	[F80,F81-OH4] Applies where structural wood elements support wood-frame floors.
	[F80,F81-OS3.1] Applies where structural wood elements support or are used in floors.
	[F80,F81-OS1.2] Applies where structural wood elements support or are used in assemblies that are required to provide fire resistance.
(6)	[F20,F60-OS2.3]
	[F20,F61-OP2.3,OP2.4]
	[F20,F55,F61-OH1.1,OH1.2] [F20,F61-OH1.3] Applies where structural wood elements support or are used in an environmental separator.

	[F61,F80-OH4] Applies to floors and elements that support floors.
	[F20,F61-OS3.1] Applies where structural wood elements support or are used in floors.
	[F80,F81-OS1.2] Applies where structural wood elements support or are used in assemblies that are required to provide fire resistance.
9.3.3.2. Galvanized Sheet Steel	
(1)	[F80-OS2.3]
	[F80-OP2.3,OP2.4]
	[F80-OH1.1,OH1.2,OH1.3] Applies where sheet metal is used in an environmental separator.
	[F80-OS3.1] Applies where sheet metal is used in assemblies that support floors.
	[F80-OH4] Applies where sheet metal is used in assemblies that support floors.
(2)	[F80-OS2.3]
	[F80-OP2.3]
	[F80-OH1.1,OH1.2,OH1.3]
9.4.2.2. Specified Snow Loads	
(1)	[F20-OS2.1,OS2.3] [F22-OS2.3]
	[F20-OP2.1,OP2.3] [F22-OP2.3]
	[F22-OH1.1,OH1.2,OH1.3]
(2)	[F20-OS2.1]
	[F20-OP2.1]
9.4.2.3. Platforms Subject to Snow and Occupancy Loads	
(1)	[F20-OS2.1]
	[F20-OP2.1]
9.4.2.4. Attics and Roof Spaces	
(1)	[F20-OS2.1]
	[F20-OP2.1]
9.4.3.1. Deflections	
(1)	[F22-OS2.3] Applies to elements that support or are part of an environmental separator.

	[F22-OP2.1,OP2.4] [F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
9.4.4.1. Allowable Bearing Pressures	
(1)	[F20-OS2.2] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.2,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to footings that support an environmental separator.
	[F20-OH4] Applies to footings that support floors and other elements that support floors.
	[F20-OS3.1] Applies to footings that support floors and other elements that support floors. [F20-OS3.7] Applies to footings that support walls that contain doors or windows required for emergency egress.
9.4.4.2. Foundation Capacity in Weaker Soil and Rock	
(1)	[F20-OS2.2] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.2,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OS2.2] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.2,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.

9.4.4.3. High Water Table	
(1)	[F20-OS2.2] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.2,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
9.4.4.4. Soil Movement	
(1)	[F21-OS2.1] [F21-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F21-OP2.1,OP2.4] [F21-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F21-OH1.1,OH1.2,OH1.3] Applies to walls that support or are part of an environmental separator.
	[F21-OH4] Applies to *foundations* that support floors and other elements that support floors.
	[F21-OS3.1] Applies to footings that support floors and other elements that support floors. [F21-OS3.7] Applies to footings that support walls that contain doors or windows required for emergency egress.
9.4.4.5. Retaining Walls	
(1)	[F20-OS2.1,OS2.3]
	[F20-OP2.1,OP2.3,OP2.4]
	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
9.4.4.6. Walls Supporting Drained Earth	
(1)	[F20-OS2.1,OS2.3]
	[F20-OP2.1,OP2.3,OP2.4]
	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OH4] Applies to floors and elements that support floors.

	[F20-OS3.1] Applies to floors and elements that support floors. [F20-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F20-OS2.1,OS2.3]
	[F20-OP2.1,OP2.3,OP2.4]
	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors. [F20-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.5.1.2. Combination Rooms	
(2)	[F10-OS3.7]
9.5.3.1. Ceiling Heights of Rooms or Spaces	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7]
(4)	[F30-OS3.1] [F10-OS3.7]
9.5.3.2. Mezzanines	
(1)	[F30-OS3.1] [F10-OS3.7]
9.5.3.3. Storage Garages	
(1)	[F30-OS3.1] [F10-OS3.7]
9.5.4.1. Hallway Width	
(1)	[F10-OS3.7]
9.5.5.1. Doorway Opening Sizes	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F10-OS3.7] [F30-OS3.1]
9.5.5.2. Doorways to Public Water-Closet Rooms	
(1)	[F30-OS3.1] [F10-OS3.7]

9.5.5.3. Doorways to Rooms with a Bathtub, Shower or Water Closet	
(2)	[F74-OA2]
9.6.1.2. Material Standards for Glass	
(1)	[F20-OS2.1] [F63-OS2.3]
	(e),(h) [F63-OH1.1] [F51,F63-OH1.2]
	(g) [F03-OS1.2]
(2)	[F30-OS3.1] [F10-OS3.7]
9.6.1.3. Structural Sufficiency of Glass	
(1)	[F20-OS2.1]
(2)	Reserved
(3)	[F30-OS3.1] [F10-OS3.7]
9.6.1.4. Types of Glass and Protection of Glass	
(1)	[F30-OS3.1] [F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7]
(4)	[F30-OS3.1] [F10-OS3.7] Applies to portion of Code text: "… except that such *partitions* shall be suitably marked to indicate their existence and position."
(5)	[F30-OS3.1] [F10-OS3.7]
(6)	[F20,F30-OS3.1]
(7)	[F20, F21, F23, F30-OS2.1, OS2.2, OS2.4, OS3.1]
9.7.2.1. Entrance Doors	
(1)	[F42-OH2.5]
	[F51,F54-OH1.2] [F40,F61,F42-OH1.1]
	[F61,F42-OS2.3]
(2)	[F35-OS4.2]
9.7.3.1. General	
(1)	[F20-OS2.1,OS2.3]
9.7.3.2. Heat Transfer Performance	

(1)	[F51,F63-OH1.1,OH1.2]
	[F63-OS2.3]
9.7.3.3. Thermal Characteristics of Windows, Doors and Skylights	
(1)	[F63-OH1.1,OH1.2,OH1.3]
	[F63-OS2.3]
(4)	[F63-OH1.1,OH1.2,OH1.3]
	[F63-OS2.3]
	[F63-OS3.1]
9.7.4.2. General	
(1)	[F20,F55,F61,F62,F63-OH1.1] [F81-OH1.1] Applies to windows that provide required non-heating season ventilation. [F54,F55,F61,F62,F63-OH1.2] [F20,F61,F62,F63-OH1.3]
	[F20,F21,F61-OS2.3]
	[F10-OS1.5] Applies where windows, doors or skylights serve bedrooms, except bedrooms that have direct access to the exterior through an *exit* door or bedrooms that are in *sprinklered suites*.
9.7.4.3. Performance Requirements	
(1)	[F20,F55,F61-OH1.1] [F55-OH1.2] [F20,F61,F62-OH1.3]
9.7.5.2. Resistance to Forced Entry for Swinging Doors	
(2)	[F34-OS4.1]
(3)	[F20-OS4.1]
(4)	[F34-OS4.1]
(5)	[F34-OS4.1]
(6)	[F20-OS4.1]
(7)	[F20-OS4.1]
(8)	[F34-OS4.1]
(9)	[F20-OS4.1]
(10)	[F34-OS4.1]

(11)	[F34-OS4.1]
9.7.5.3. Resistance to Forced Entry for Windows	
(1)	[F34-OS4.1]
9.7.5.4. Resistance to Forced Entry	
(1)	[F34-OS4.1]
9.7.6.1. Installation of Windows, Doors and Skylights	
(1)	[F20,F54,F55,F61,F63-OH1.1,OH1.2,OH1.3]
	[F20,F61,F63-OS2.3]
(3)	[F55,F61,F63-OS2.3]
	[F55,F61,F63-OH1.1,OH1.2,OH1.3]
9.7.6.2. Sealants, Trim and Flashing	
(1)	[F61,F63-OH1.1,OH1.3] [F51,F54,F61,F63-OH1.2]
	[F61,F63-OS2.3]
(4)	[F80-OS2.1,OS2.3]
	[F80-OP2.1,OP2.3]
	[F80-OH1.1,OH1.2,OH1.3]
9.8.2.1. Stair Width	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7]
(4)	[F30-OS3.1] [F10-OS3.7]
9.8.2.2. Height over Stairs	
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7]
(4)	[F30-OS3.1] [F10-OS3.7]
9.8.3.1. Permitted Configurations	

(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7]
(4)	[F30-OS3.1] [F10-OS3.7]
(5)	[F30-OS3.1] [F10-OS3.7]
9.8.3.2. Minimum Number of Risers	
(1)	[F30-OS3.1] [F10-OS3.7]
9.8.3.3. Maximum Height of Stairs	
(1)	[F30-OS3.1]
9.8.4.1. Dimensions for Risers	
(1)	[F30-OS3.1] [F10-OS3.7]
9.8.4.2. Dimensions for Rectangular Treads	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
9.8.4.3. Dimensions of Tapered Treads	
(1)	[F30-OS3.1] [F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7]
9.8.4.4. Uniformity and Tolerances for Risers, Runs and Treads	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7]
(4)	[F30-OS3.1] [F10-OS3.7]
(5)	[F30-OS3.1] [F10-OS3.7]
9.8.4.6. Winders	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]

9.8.4.8. Tread Nosings	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
9.8.5.2. Ramp Width	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
9.8.5.3. Height over Ramps	
(1)	[F30-OS3.1] [F10-OS3.7]
9.8.5.4. Ramp Slope	
(1)	[F30-OS3.1] [F10-OS3.7]
9.8.5.5. Maximum Rise	
(1)	[F30-OS3.1]
9.8.6.2. Required Landings	
(1)	[F30-OS3.1] [F10-OS3.7]
9.8.6.3. Dimensions of Landings	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
(4)	[F30-OS3.1] [F10-OS3.7]
(5)	[F30-OS3.1] [F10-OS3.7]
(6)	[F30-OS3.1] [F10-OS3.7]
(7)	[F30-OS3.1] [F10-OS3.7]
9.8.6.4. Height over Landings	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
9.8.6.5. Tactile Warning	
(1)	[F30-OS3.1]

9.8.7.1. Required Handrails	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F10-OS3.7] [F30-OS3.1]
(5)	[F30-OS3.1] [F10-OS3.7]
9.8.7.2. Continuity of Handrails	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
	[F73-OA1]
9.8.7.3. Termination of Handrails	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
9.8.7.4. Height of Handrails	
(2)	[F30-OS3.1] [F10-OS3.7]
9.8.7.5. Ergonomic Design	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
9.8.7.6. Projections into Stairs and Ramps	
(1)	[F30-OS3.1] [F10-OS3.7]
9.8.7.7. Design and Attachment of Handrails	
(1)	[F20-OS2.1]
	[F20-OS3.1,OS3.7]
(2)	[F20-OS2.1]
	[F20-OS3.1,OS3.7]
9.8.8.1. Required Guards	
(1)	[F30-OS3.1] [F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7]

(4)	[F30-OS3.1]
(6)	[F30-OS3.1] [F10-OS3.7]
(7)	[F30-OS3.1] [F10-OS3.7]
(8)	[F30-OS3.1]
(10)	[F30-OS3.1]
(11)	[F30-OS3.1]
9.8.8.2. Loads on Guards	
(1)	[F20-OS2.1]
9.8.8.3. Height of Guards	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7]
(4)	[F30-OS3.1] [F10-OS3.7]
9.8.8.4. Guards for Floors and Ramps in Garages	
(1)	[F10-OS3.1]
(2)	[F20-OS2.1]
9.8.8.5. Openings in Guards	
(1)	[F30-OS3.1]
(2)	[F30-OS3.1]
(3)	[F30-OS3.1]
9.8.8.6. Design of Guards to Not Facilitate Climbing	
(1)	[F30-OS3.1]
9.8.8.7. Glass in Guards	
(1)	[F20-OS3.1,OS3.7]
	[F20-OS2.1]
9.8.8.8. Glass Guards	

(1)	[F30-OS3.1]
9.8.9.1. Loads on Stairs and Ramps	
(1)	[F20-OS2.1]
	[F22-OH4]
9.8.9.2. Exterior Concrete Stairs	
(1)	[F22-OS3.1,OS3.7]
9.8.9.3. Exterior Wood Steps	
(1)	[F80-OS3.1,OS3.7]
	[F80-OS2.3]
9.8.9.4. Wooden Stair Stringers	
(1)	[F20-OS2.1]
	[F22-OH4]
(2)	[F22-OH4]
	[F20-OS2.1]
9.8.9.5. Treads	
(1)	[F22-OH4]
	[F20-OS2.1]
(2)	[F22-OH4]
	[F20-OS2.1]
9.8.9.6. Finish for Treads and Landings	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
9.8.10.1. Design	
(1)	[F22-OS3.1,OS3.7]
	[F20-OS2.1]
9.8.10.2. Anchorage	

(1)	[F20-OS2.1]
	[F22-OS3.1,OS3.7]
	[F20-OH1.1,OH1.2,OH1.3]
9.8.10.3. Prevention of Damage Due to Frost	
(1)	[F21-OS3.1]
	[F21-OS2.1]
	[F21-OH1.1,OH1.2,OH1.3]
9.9.1.3. Occupant Load	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
9.9.2.2. Purpose of Exits	
(1)	[F10-OS3.7] Applies to "An *exit* shall be designed for no purpose other than for exiting …"
9.9.2.3. Elevators, Slide Escapes and Windows as Means of Egress	
(1)	[F10-OS3.7]
9.9.2.4. Principal Entrances	
(1)	[F10-OS3.7]
9.9.3.2. Exit Width	
(1)	[F10-OS3.7]
9.9.3.3. Width of Corridors	
(1)	[F30-OS3.1] [F10-OS3.7]
9.9.3.4. Clear Height	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
9.9.4.2. Fire Separations for Exits	
(1)	[F05-OS1.5] [F03-OS1.2]
	[F03-OP1.2]

(3)	[F05-OS1.5]
(4)	[F05-OS1.5] [F03-OS1.2]
	[F03-OP1.2]
9.9.4.3. Wired Glass or Glass Block	
(2)	[F05-OS1.5]
9.9.4.4. Openings Near Unenclosed Exterior Exit Stairs and Ramps	
(1)	[F05-OS1.5]
9.9.4.5. Openings in Exterior Walls of Exits	
(1)	[F05-OS1.5]
9.9.4.6. Openings Near Exit Doors	
(1)	[F05-OS1.5]
9.9.4.7. Stairways in 2 Storey, Group D or E Buildings	
(1)	[F05-OS1.5]
9.9.5.2. Occupancies in Corridors	
(1)	[F10-OS3.7]
9.9.5.3. Obstructions in Public Corridors	
(1)	[F30-OS3.1]
9.9.5.4. Obstructions in Exits	
(1)	[F10-OS3.7]
9.9.5.5. Obstructions in Means of Egress	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
9.9.5.6. Mirrors or Draperies	
(1)	[F10-OS3.7] [F30-OS3.1]
9.9.5.7. Fuel-Fired Appliances	
(1)	[F10-OS1.5]

	[F10-OS3.7]
9.9.5.8. Service Rooms	
(1)	[F10-OS3.7] [F30-OS3.1]
9.9.5.9. Ancillary Rooms	
(1)	[F05,F06-OS1.5]
	[F10-OS3.7]
9.9.6.1. Obstructions by Doors	
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7]
9.9.6.2. Clear Opening Height at Doorways	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
9.9.6.3. Clear Opening Width at Doorways	
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7]
9.9.6.4. Door Action	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
9.9.6.5. Direction of Door Swing	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10-OS3.7]
(4)	[F10-OS3.7]
(5)	[F10-OS3.7]
9.9.6.6. Nearness of Doors to Stairs	
(1)	[F30-OS3.1] [F10-OS3.7]

(2)	[F10-OS3.7]
9.9.6.7. Door Latching, Locking and Opening Mechanisms	
(1)	(a) [F10-OS3.7]
	(b) [F10,F81-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10-OS3.7]
	[F73-OA1]
(4)	[F10-OS3.7]
9.9.6.8. Effort Required to Open	
(1)	[F10-OS3.7]
9.9.7.1. Egress from Roof Area, Podiums, Terraces, Platforms and Contained Open Spaces	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
9.9.7.2. Means of Egress from Suites	
(1)	[F10-OS1.5]
(2)	[F10-OS3.7]
9.9.7.3. Dead-End Corridors	
(1)	[F10-OS3.7]
9.9.7.4. Number and Spacing of Egress Doors	
(1)	[F10-OS3.7]
(2)	[F10-OS1.5]
9.9.7.5. Independent Access to Exit	
(1)	[F10-OS3.7]
9.9.8.2. Number of Required Exits	
(1)	[F10-OS3.7]
9.9.8.3. Contribution of Each Exit	

(1)	[F10-OS3.7]
9.9.8.4. Location of Exits	
(1)	[F10-OS1.5]
9.9.8.5. Exiting through a Lobby	
(1)	[F10-OS1.5]
(2)	[F10-OS1.5]
(3)	[F10-OS1.5]
(4)	[F10-OS1.5]
(5)	[F05-OS1.5]
9.9.8.6. Mezzanine Means of Egress	
(1)	[F05-OS1.5]
(4)	[F05-OS1.5]
9.9.9.1. Travel Limit to Exits or Egress Doors	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10-OS3.7]
9.9.9.2. Two Separate Exits	
(1)	[F10-OS3.7]
9.9.9.3. Shared Egress Facilities	
(1)	[F10-OS3.7]
9.9.10.1. Egress Windows or Doors for Bedrooms	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10-OS3.7]
(4)	[F10-OS3.7]
(5)	[F10-OS3.7]

9.9.11.2. Visibility of Exits	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
9.9.11.3. Exit Signs	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10,F81-OS3.7]
(4)	[F10,F81-OS3.7]
(5)	[F10-OS3.7]
(6)	[F10-OS3.7]
9.9.11.4. Signs for Stairs and Ramps at Exit Level	
(1)	[F10-OS3.7]
9.9.11.5. Floor Numbering	
(1)	[F10-OS3.7]
	[F73-OA1]
9.9.12.2. Required Lighting in Egress Facilities	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
9.9.12.3. Emergency Lighting	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7]
(4)	[F30-OS3.1] [F10-OS3.7]
(5)	[F30-OS3.1] [F10-OS3.7]
(7)	[F30-OS3.1] [F10-OS3.7]
9.10.1.2. Testing of Integrated Fire Protection and Life Safety Systems	

(1)	[F02,F81,F82-OS1.2,OS1.5]
	[F02,F81,F82-OP1.2]
9.10.1.3. Items under Part 3 Jurisdiction	
(5)	[F01-OS1.1] Applies to portion of Code text: " ... facilities for the dispensing of fuel shall not be installed in any *building*."
9.10.3.4. Suspended Membrane Ceilings	
(1)	[F04-OS1.3]
	[F04-OP1.3]
9.10.4.3. Basement Storage Garages	
(1)	[F03-OS1.2]
	[F03-OP1.2]
9.10.5.1. Permitted Openings in Wall and Ceiling Membranes	
(1)	[F03-OS1.2] [F04-OS1.3]
	[F03-OP1.2] [F04-OP1.3]
(2)	[F04-OS1.3]
	[F04-OP1.3]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F04-OS1.2,OS1.3]
	[F04-OP1.3]
9.10.7.1. Protection of Steel Members	
(1)	[F03-OS1.2] [F04-OS1.3]
	[F03-OP1.2] [F04-OP1.3]
9.10.8.1. Fire-Resistance Ratings for Floors and Roofs	
(1)	[F03-OS1.2] [F04-OS1.2,OS1.3] Applies to portion of Code text: "Except as otherwise provided in this Subsection, the *fire-resistance ratings* of floors and roofs shall conform to Table 9.10.8.1."
	[F03-OP1.2] [F04-OP1.2,OP1.3] Applies to portion of Code text: "Except as otherwise provided in this Subsection, the *fire-resistance ratings* of floors and roofs shall conform to Table 9.10.8.1."

9.10.8.2. Fire-Resistance Ratings in Sprinklered Buildings	
(1)	(a),(b) [F02,F82-OS1.3] [F13-OS1.5,OS1.2]
	(a),(b) [F02,F82-OP1.3] [F13-OP1.2]
9.10.8.3. Fire-Resistance Ratings for Walls, Columns and Arches	
(1)	[F04-OS1.2,OS1.3]
	[F04-OP1.2,OP1.3]
(2)	[F04-OS1.2,OS1.3]
	[F04-OP1.2,OP1.3]
9.10.8.4. Support of Noncombustible Construction	
(1)	[F04-OS1.3]
	[F04-OP1.3]
9.10.8.7. Roofs Supporting an Occupancy	
(1)	[F03-OS1.2]
	[F03-OP1.2]
9.10.8.8. Floors of Exterior Passageways	
(1)	[F05-OS1.5] [F06-OS1.5,OS1.2]
	[F04-OP1.3] [F06-OP1.2]
9.10.9.2. Continuous Barrier	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
9.10.9.3. Openings to be Protected with Closures	
(1)	[F03-OS1.2]

	[F03-OP1.2]
9.10.9.4. Floor Assemblies	
(1)	[F03-OS1.2]
	[F03-OP1.2]
9.10.9.6. Penetration of Fire Separations	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OP1.2] [F04-OP1.3] Applies to portion of Code text: “Except as provided in Sentences (4) to (12) and Article 9.10.9.7., pipes, ducts, electrical boxes, totally enclosed raceways or other similar service equipment that partly or wholly penetrate an assembly required to have a *fire-resistance rating* shall be *noncombustible*...”
	[F03-OS1.2] [F04-OS1.3] Applies to portion of Code text: “Except as provided in Sentences (4) to (12) and Article 9.10.9.7., pipes, ducts, electrical boxes, totally enclosed raceways or other similar service equipment that partly or wholly penetrate an assembly required to have a *fire-resistance rating* shall be *noncombustible*...”
9.10.9.7. Combustible Drain, Waste and Vent Piping	
(1)	[F03-OS1.2] [F04-OS1.3]
	[F03-OP1.2] [F04-OP1.3]
9.10.9.8. Collapse of Combustible Construction	
(1)	[F03-OS1.2]
	[F03-OP1.2]
9.10.9.9. Reduction in Thickness of Fire Separation by Beams and Joists	
(1)	[F03-OS1.2]
	[F03-OP1.2]
9.10.9.10. Concealed Spaces above Fire Separations	
(1)	[F03-OS1.2]
	[F03-OP1.2]

(2)	[F03-OS1.2]
	[F03-OP1.2]
9.10.9.11. Separation of Residential Occupancies	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
9.10.9.12. Residential Suites in Industrial Buildings	
(1)	[F02-OS1.2]
9.10.9.13. Separation of Suites	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F02-OS1.2]
	[F02-OP1.2]
9.10.9.14. Separation of Residential Suites	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
9.10.9.15. Separation of Public Corridors	
(1)	[F05,F03-OS1.5] [F06-OS1.5,OS1.2]
	[F03,F06-OP1.2]
(2)	[F03-OS1.2] [F06,F05-OS1.5]
	[F03,F06-OP1.2]
(3)	[F03-OS1.2] [F06,F05-OS1.5]

	[F03,F06-OP1.2]
9.10.9.16. Separation of Storage Garages	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F44-OS3.4]
	[F01-OS1.1]
(5)	[F44-OS3.4]
	[F01-OS1.1]
9.10.9.17. Separation of Repair Garages	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F44-OS3.4]
	[F44-OS1.1]
	[F44-OH1.1]
(5)	[F44-OS3.4]
	[F44-OS1.1]
	[F44-OH1.1]
9.10.9.18. Exhaust Ducts Serving More Than One Fire Compartment	
(1)	[F03-OS1.2]
(2)	[F03-OS1.2]
9.10.9.19. Central Vacuum Systems	
(1)	[F03-OS1.2]

9.10.10.3. Separation of Service Rooms	
(1)	[F03-OS1.2] [F03,F81-OS1.4]
	[F03-OP1.2] [F03,F81-OP1.4]
9.10.10.4. Location of Fuel-Fired Appliances	
(1)	[F03-OS1.2] [F03,F81-OS1.4]
	[F03-OP1.2] [F03,F81-OP1.4]
9.10.10.5. Incinerators	
(1)	[F03-OS1.2] [F03,F81-OS1.4]
	[F03-OP1.2] [F03,F81-OP1.4]
(2)	[F01-OS1.1]
(3)	[F01-OS1.1]
	[F40,F61-OH1.1,OH1.3]
	[F20-OP2.1] [F80-OP2.3]
	[F20-OS2.1] [F80-OS2.3]
	[F01-OP1.1]
(4)	[F01,F02-OS1.2]
9.10.10.6. Storage Rooms	
(1)	[F03-OS1.2]
	[F03-OP1.2]
9.10.11.1. Required Firewalls	
(1)	[F03-OS1.2]
	[F03-OP3.1]
	[F03-OP1.2]
9.10.11.2. Firewalls Not Required	
(1)	[F03-OS1.2]
	[F03-OP3.1]

(3)	[F03-OS1.2]
	[F03-OP3.1]
(4)	[F03-OS1.2]
	[F03-OP3.1]
9.10.12.1. Termination of Floors or Mezzanines	
(1)	[F03-OS1.5]
	[F03-OP1.2,OP1.4]
9.10.12.2. Location of Skylights	
(1)	[F03-OS1.2]
	[F03-OP1.2]
9.10.12.3. Exterior Walls Meeting at an Angle	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
9.10.12.4. Protection of Soffits	
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
9.10.13.1. Closures	
(1)	[F03-OS1.2]
	[F03-OP1.2]
9.10.13.2. Solid Core Wood Door as a Closure	
(2)	[F03-OS1.2]
	[F03-OP1.2]

9.10.13.5. Wired Glass as a Closure	
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
9.10.13.6. Steel Door Frames	
(1)	[F03-OS1.2]
	[F03-OP1.2]
9.10.13.8. Maximum Size of Opening	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
9.10.13.9. Door Latch	
(1)	[F03-OS1.2]
	[F03-OP1.2]
9.10.13.10. Self-closing Device	
(1)	[F03-OS1.2]
	[F03-OP1.2]
9.10.13.12. Service Room Doors	
(1)	[F30-OS3.1] Applies to portion of Code text: "Swing-type doors shall open into *service rooms* containing fuel-fired equipment where such doors lead to *public corridors* or rooms used for assembly…"
	[F10-OS1.5] Applies to portion of Code text: "... but shall swing outward from such rooms in all other cases."
9.10.13.13. Fire Dampers	
(1)	[F03-OS1.2]
	[F03-OP1.2]
9.10.13.14. Fire Stop Flaps	

(1)	[F03-OS1.2,OS1.3]
	[F03-OP1.2,OP1.3]
9.10.13.15. Doors between Garages and Dwelling Units	
(1)	[F44-OS3.4]
	[F01-OS1.1]
(2)	[F44-OS3.4]
	[F01-OS1.1]
9.10.13.16. Door Stops	
(1)	[F81-OS1.4]
	[F81-OP1.4]
9.10.14.3. Limiting Distance and Fire Department Response	
(1)	[F03-OP3.1]
9.10.14.4. Openings in Exposing Building Face	
(1)	[F03-OP3.1]
(2)	[F03-OP3.1]
(3)	[F03-OP3.1]
(4)	[F03-OP3.1]
(6)	[F03-OP3.1]
(7)	[F03-OP3.1]
(12)	[F03-OP3.1]
9.10.14.5. Construction of Exposing Building Face and Walls above Exposing Building Face	
(1)	[F02,F03-OP3.1]
(2)	[F03-OP3.1]
(3)	[F02,F03-OP3.1]
(4)	[F03-OP3.1]
(6)	[F03-OP3.1]

(7)	[F03-OP3.1]
(8)	[F02,F03-OP3.1]
(9)	[F03-OP3.1]
(10)	[F03-OP3.1]
(12)	[F03-OP3.1]
(14)	[F03-OP3.1]
9.10.15.3. Limiting Distance and Firefighting Services	
(1)	[F03-OP3.1]
9.10.15.4. Glazed Openings in Exposing Building Face	
(1)	[F03-OP3.1]
(3)	[F03-OP3.1]
(4)	[F03-OP3.1]
(8)	[F03-OP3.1]
9.10.15.5. Construction of Exposing Building Face of Houses	
(2)	[F02,F03-OP3.1]
(3)	[F02,F03-OP3.1]
(5)	[F03-OP3.1]
(7)	[F02,F03-OP3.1]
(8)	[F03-OP3.1]
(9)	[F03-OP3.1]
(11)	[F03-OP3.1]
(13)	[F02, F03-OP3.1]
9.10.16.1. Required Fire Blocks in Concealed Spaces	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]

	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
(5)	[F03-OS1.2]
	[F03-OP1.2]
(6)	[F02,F03-OS1.2]
	[F02,F03-OP1.2]
(7)	[F02,F03-OS1.2]
	[F02,F03-OP1.2]
9.10.16.2. Required Fire Blocks in Wall Assemblies	
(1)	[F03-OS1.2]
	[F03-OP1.2]
9.10.16.3. Fire Block Materials	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F04-OS1.2]
	[F04-OP1.2]
9.10.16.4. Penetration of Fire Blocks	
(1)	[F03-OS1.2]
	[F03-OP1.2]
9.10.17.1. Flame-Spread Rating of Interior Surfaces	
(1)	[F02-OS1.2]

9.10.17.2. Ceilings in Exits or Public Corridors	
(1)	[F05-OS1.5]
9.10.17.3. Walls in Exits	
(1)	[F05-OS1.5]
(2)	[F05-OS1.5]
9.10.17.4. Exterior Exit Passageways	
(1)	[F05-OS1.5]
9.10.17.5. Walls in Public Corridors	
(1)	[F05-OS1.5]
9.10.17.9. Combustible Skylights	
(1)	[F02,F05-OS1.5]
9.10.17.10. Protection of Foamed Plastics	
(1)	(a),(b),(c) [F01,F02,F05-OS1.5]
(2)	[F01-OS1.1] [F02-OS1.2]
	[F01-OP1.1] [F02-OP1.2]
(3)	[F01,F02-OS1.2]
9.10.18.1. Access Provided through a Firewall	
(1)	[F11-OS1.5]
9.10.18.2. Fire Alarm System Required	
(1)	[F11-OS1.5] [F13-OS1.2,OS1.5] [F03-OS1.2]
	[F13-OP1.2]
(2)	[F11-OS1.5]
9.10.18.4. Rooms and Spaces Requiring Heat Detectors or Smoke Detectors	
(1)	[F11-OS1.5]
(2)	[F11-OS1.5]
(3)	[F02-OS1.2] Applies to *sprinklered buildings*. [F11-OS1.5] Applies to the supervision of the system and the flow alarm.

(4)	[F11-OS1.5]
9.10.18.5. Smoke Detectors in Recirculating Air-Handling Systems	
(1)	[F03-OS1.2]
9.10.18.6. Portions of Buildings Considered as Separate Buildings	
(1)	[F03-OS1.2]
(2)	[F11-OS1.2]
9.10.18.7. Central Vacuum Systems	
(1)	[F03-OS1.2]
9.10.19.1. Required Smoke Alarms	
(1)	[F81,F11-OS1.5]
(2)	[F11-OS1.5]
9.10.19.2. Sound Patterns of Smoke Alarms	
(1)	[F11-OS1.5]
9.10.19.3. Location of Smoke Alarms	
(1)	[F11-OS1.5]
(2)	[F81,F11-OS1.5]
(3)	[F11-OS1.5]
9.10.19.4. Power Supply	
(1)	[F11,F81-OS1.5]
(3)	[F11,F81-OS1.5]
9.10.19.5. Interconnection of Smoke Alarms	
(1)	[F11-OS1.5]
(2)	[F11-OS1.5]
9.10.19.6. Silencing of Smoke Alarms	
(1)	[F11,F81-OS1.5]
9.10.19.7. Instructions for Maintenance and Care	

(1)	[F82-OS1.5]
9.10.19.8. Residential Fire Warning Systems	
(1)	[F81,F11-OS1.5]
9.10.20.1. Windows or Access Panels Required	
(1)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(2)	[F12-OS1.5,OS1.2]
	[F12-OP1.2]
9.10.20.2. Access to Basements	
(1)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(2)	[F12-OS1.2,OS1.5] Applies to portion of Code text: “Access required in Sentence (1) …provides an opening not less than 1 100 mm high and 550 mm wide, the sill height of which shall not be more than 900 mm above the floor.”
	[F12-OP1.2] Applies to portion of Code text: “Access required in Sentence (1) …provides an opening not less than 1 100 mm high and 550 mm wide, the sill height of which shall not be more than 900 mm above the floor.”
9.10.20.3. Fire Department Access to Buildings	
(1)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(2)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(5)	[F12-OP1.2]
	[F12-OS1.2,OS1.3]
(6)	[F12-OP1.2]
	[F12-OS1.2,OS1.3]
9.10.20.4. Portable Extinguishers	
(1)	[F81,F02,F12-OS1.2]

	[F81,F02,F12-OP1.2]
9.10.20.5. Freeze Protection of Fire Protection Systems	
(1)	[F81,F02-OS1.2]
	[F81,F02-OP1.2]
9.10.21.2. Separation of Sleeping Rooms	
(1)	[F03-OS1.2]
	[F03-OP1.2]
9.10.21.3. Floor Assemblies between the First and Second Storey	
(1)	[F03-OS1.2,OS1.5]
	[F03-OP1.2]
9.10.21.4. Walkways Connecting Buildings	
(1)	[F03,F06-OS1.2,OS1.5]
	[F03-OP1.2]
	[F03-OP3.1]
9.10.21.5. Spatial Separations	
(1)	[F03-OP3.1]
9.10.21.6. Flame-Spread Ratings	
(1)	[F05-OS1.5,OS1.2]
9.10.21.7. Smoke Detectors	
(1)	[F11-OS1.5]
9.10.21.8. Portable Fire Extinguishers	
(1)	[F81,F12,F02-OP1.2]
	[F81,F12,F02-OS1.2]
9.10.21.9. Hose Stations	
(1)	[F81,F12,F02-OP1.2]
	[F81,F12,F02-OS1.2]

(2)	[F12-OP1.2]
	[F12-OS1.2]
(3)	[F12-OP1.2]
	[F12-OS1.2]
9.10.22.1. Installation of Cooktops and Ovens	
(1)	[F81,F43,F01-OS1.1]
	[F81,F43-OS3.4]
9.10.22.2. Vertical Clearances above Cooktops	
(1)	[F01-OS1.1,OS1.2]
(2)	[F01-OS1.1,OS1.2]
9.10.22.3. Protection around Cooktops	
(1)	[F01-OS1.1,OS1.2]
(3)	[F01-OS1.1,OS1.2]
9.11.1.1. Required Protection	
(1)	[F56-OH3.1]
(3)	[F56-OH3.1]
9.11.1.2. Determination of Sound Transmission Ratings	
(1)	[F56-OH3.1]
(2)	[F56-OH3.1]
9.11.1.4. Adjoining Constructions	
(2)	[F56-OH3.1]
(3)	[F56-OH3.1]
(4)	[F56-OH3.1]
9.12.1.1. Removal of Topsoil and Organic Matter	
(1)	[F40,F41,F20-OH1.1]
(2)	[F81-OS2.3]

	[F81-OP2.3,OP2.4]
	[F81-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F81-OS1.2] Applies to assemblies required to provide fire resistance.
	[F81-OS3.1] Applies to floors and elements that support floors.
(3)	[F20,F21,F40,F41-OH1.1] [F20,F21-OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.2,OS2.3] [F21-OS2.3]
	[F20-OP2.2] [F20,F21-OP2.3,OP2.4]
	[F20,F21-OH4] Applies to floors and elements that support floors.
	[F20,F21-OS3.1] Applies to floors and elements that support floors.
9.12.1.2. Standing Water	
(1)	[F60-OS2.2,OS2.3]
	[F60-OP2.2,OP2.3,OP2.4]
	[F60-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F60-OH4] Applies to floors and elements that support floors.
	[F60-OS3.1] Applies to floors and elements that support floors.
9.12.1.3. Protection from Freezing	
(1)	[F21-OS2.3]
	[F21-OP2.3,OP2.4]
	[F21-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F21-OH4] Applies to floors and elements that support floors.
	[F21-OS3.1] Applies to floors and elements that support floors.
9.12.2.1. Excavation to Undisturbed Soil	
(1)	[F20-OS2.2,OS2.3]
	[F20-OP2.2,OP2.3,OP2.4]
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH4] Applies to floors and elements that support floors.

	[F20-OS3.1] Applies to floors and elements that support floors.
9.12.2.2. Minimum Depth of Foundations	
(1)	[F21-OS2.3]
	[F21-OP2.3,OP2.4]
	[F21-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F21-OS3.1] Applies to floors, elements that support floors, and concrete steps with more than 2 risers.
	[F21-OH4] Applies to floors and elements that support floors.
(8)	[F21-OS2.3]
	[F21-OP2.3,OP2.4]
	[F21-OS3.1]
	[F21-OH4]
9.12.3.1. Placement of Backfill	
(1)	[F81-OS2.1] [F81-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F81-OP2.1] [F22-OP2.4] [F81-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F81-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.12.3.2. Grading of Backfill	
(1)	[F60,F61-OH1.1,OH1.2,OH1.3]
	[F60,F61-OS2.3]
	[F60,F61-OP2.3]
9.12.3.3. Deleterious Debris and Boulders	
(1)	[F81-OS2.3]
	[F81-OP2.3]

	[F81-OH1.1,OH1.2,OH1.3]
	[F81-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OS2.1,OS2.3]
	[F20-OP2.1,OP2.3]
	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS3.1] Applies to floors and elements that support floors.
(3)	[F20-OS2.1,OS2.3]
	[F20-OP2.1,OP2.3]
	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS3.1] Applies to floors and elements that support floors.
9.12.4.1. Support of Footings	
(1)	[F21-OH1.1,OH1.2,OH1.3]
	[F21-OS2.1] [F21-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F21-OP2.2] [F21-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F21-OH2.1] Applies to sewer-line locations beneath footings.
	[F21-OS3.1] Applies to floors and elements that support floors.
9.13.2.1. Required Dampproofing	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.13.2.2. Dampproofing Materials	
(1)	[F40-OH1.1] [F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F40-OH1.1] Applies to materials installed to control the ingress of soil gas.

	[F61-OH1.1,OH1.2,OH1.3] Applies to materials installed to control the ingress of moisture.
	[F61-OS2.3]
9.13.2.3. Preparation of Surface	
(1)	[F40-OH1.1] [F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F40-OH1.1] [F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(3)	[F40-OH1.1] [F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(4)	[F40-OH1.1] Applies to dampproofing installed to control the ingress of soil gas. [F61-OH1.1,OH1.2,OH1.3] Applies to dampproofing installed to control the ingress of moisture.
	[F61-OS2.3]
(5)	[F40-OH1.1] Applies to *foundation* walls where the dampproofing serves to control the ingress of *soil* gas. [F61-OH1.1,OH1.2,OH1.3] Applies where the dampproofing serves to control the ingress of moisture.
	[F61-OS2.3]
(6)	[F61-OH1.1,OH1.2,OH1.3] [F40-OH1.1] Applies where dampproofing materials are installed to control the infiltration of soil gas.
	[F61-OS2.3]
9.13.2.4. Application of Dampproofing Material	
(1)	[F40-OH1.1] Applies to dampproofing installed to control the ingress of soil gas. [F61-OH1.1,OH1.2,OH1.3] Applies to dampproofing installed to control the ingress of moisture.
	[F61-OS2.3]
(2)	[F40-OH1.1] [F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(3)	[F40-OH1.1] [F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]

9.13.2.5. Moisture Protection for Interior Finishes	
(1)	[F61-OH1.1,OH1.2]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(3)	[F61,F80-OH1.1,OH1.2,OH1.3]
	[F61,F80-OS2.3]
9.13.2.6. Dampproofing of Floors-on-Ground	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.13.3.1. Required Waterproofing	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.13.3.2. Waterproofing Materials	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.13.3.3. Preparation of Surface	
(1)	[F40-OH1.1] [F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F40-OH1.1]

	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(3)	[F61-OH1.1,OH1.2,OH1.3] [F40-OH1.1] Applies where waterproofing materials are installed to control the infiltration of soil gas.
	[F61-OS2.3]
(4)	[F61-OH1.1,OH1.2,OH1.3] [F40-OH1.1] Applies where waterproofing materials are installed to control the infiltration of soil gas.
	[F61-OS2.3]
(5)	[F61-OH1.1,OH1.2,OH1.3] [F40-OH1.1] Applies where waterproofing materials are installed to control the infiltration of soil gas.
	[F61-OS2.3]
9.13.3.4. Application of Waterproofing Membranes	
(1)	[F40-OH1.1] [F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F40-OH1.1] [F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(3)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(4)	[F40-OH1.1] [F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.13.3.5. Floor Waterproofing System	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.13.4.2. Protection from Soil Gas Ingress	
(1)	[F40-OH1.1]
(2)	[F40-OH1.1]

(3)	[F40-OH1.1]
9.13.4.3. Providing for the Rough-in for a Subfloor Depressurization System	
(1)	[F40-OH1.1]
(2)	[F40-OH1.1]
(3)	[F40-OH1.1]
9.14.2.1. Foundation Wall Drainage	
(1)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.1,OS2.2,OS2.3]
	[F60-OP2.1,OP2.2,OP2.3]
(2)	(a) [F60-OH1.1,OH1.2,OH1.3] Applies where *foundations* serve as or support an environmental separator.
	(a) [F60-OS2.1] (a) [F60-OS2.3] Applies where *foundations* serve as or support an environmental separator.
	(b) [F21-OS2.1] (b) [F21-OS2.3] Applies where *foundations* serve as or support an environmental separator.
	(b) [F21-OP2.1] (b) [F21-OP2.3] Applies where *foundations* serve as or support an environmental separator. (b) [F21-OP2.4] Applies where *foundations* support walls or floors.
	(b) [F21-OH1.1,OH1.2,OH1.3] Applies where *foundations* serve as or support an environmental separator.
	(b) [F21-OH4] Applies where *foundations* support floors or elements supporting floors.
	(b) [F21-OS3.1] Applies where *foundations* support floors or elements supporting floors. (b) [F21-OS3.7] Applies where *foundations* support walls that contain windows or doors required for emergency egress.
9.14.3.1. Material Standards	
(1)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.1,OS2.3]
	[F60-OP2.1,OP2.3]
9.14.3.2. Minimum Size	
(1)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.1,OS2.2,OS2.3]

	[F60-OP2.1,OP2.2,OP2.3]
9.14.3.3. Installation	
(1)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.1,OS2.2,OS2.3]
	[F60-OP2.1,OP2.2,OP2.3]
(2)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.1,OS2.2,OS2.3]
	[F60-OP2.1,OP2.2,OP2.3]
(3)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.1,OS2.2,OS2.3]
	[F60-OP2.1,OP2.2,OP2.3]
(4)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.1,OS2.2,OS2.3]
	[F60-OP2.1,OP2.2,OP2.3]
9.14.4.1. Type of Granular Material	
(1)	(a) [F60-OS2.3] [F21-OS2.2]
	(a) [F60-OP2.3] [F21-OP2.6]
	(a) [F60-OH1.1,OH1.2,OH1.3]
	(b) [F21-OS2.1] (b) [F21-OS2.3] Applies to elements that support or are part of an environmental separator.
	(b) [F21-OP2.1,OP2.4] (b) [F21-OP2.3] Applies to elements that support or are part of an environmental separator.
	(b) [F21-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	(b) [F21-OH4] Applies to floors and elements that support floors.
	(b) [F21-OS3.1] Applies to floors and elements that support floors.
9.14.4.2. Installation	
(1)	[F60-OH1.1,OH1.2,OH1.3]

	[F60-OS2.1,OS2.2,OS2.3]
	[F60-OP2.1,OP2.2,OP2.3]
9.14.4.3. Grading	
(1)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.1,OS2.2,OS2.3]
	[F60-OP2.1,OP2.2,OP2.3]
9.14.4.4. Wet Site Conditions	
(1)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.1,OS2.2,OS2.3]
	[F60-OP2.1,OP2.2,OP2.3]
9.14.5.1. Drainage Disposal	
(1)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.1,OS2.2,OS2.3]
	[F60-OP2.1,OP2.2,OP2.3]
9.14.5.2. Sump Pits	
(1)	(a),(b) [F60,F61-OH1.1,OH1.3] (c) [F40-OH1.1] [F52-OH1.2]
	(a),(b) [F60,F61-OS2.1,OS2.3] (c) [F52-OS2.3]
	(a),(b) [F60,F61-OP2.3,OP2.4] (c) [F52-OP2.3]
	(c) [F30-OS3.1]
(2)	(a) [F30-OS3.1]
	(b) [F40-OH1.1]
(3)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.1,OS2.2,OS2.3]
	[F60-OP2.1,OP2.2,OP2.3]
9.14.5.3. Dry Wells	

(1)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.1,OS2.2,OS2.3]
	[F60-OP2.1,OP2.2,OP2.3]
(2)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.1,OS2.2,OS2.3]
	[F60-OP2.1,OP2.2,OP2.3]
9.14.6.1. Surface Drainage	
(1)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.1,OS2.2,OS2.3]
	[F60-OP2.1,OP2.2,OP2.3]
9.14.6.2. Drainage away from Wells or Septic Disposal Beds	
(1)	[F46-OH2.2] Applies to directing drainage away from the location of a water supply. [F44-OH2.1] Applies to directing drainage away from a septic tank disposal system.
9.14.6.3. Window Wells	
(1)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.1,OS2.3]
	[F60-OP2.1,OP2.3]
9.14.6.4. Catch Basin	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
	[F61-OP2.3]
	[F61-OS3.1]
9.15.1.3. Foundations for Deformation-Resistant Buildings	
(1)	[F20-OS2.2] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.2] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.

	[F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.15.2.2. Unit Masonry Construction	
(1)	[F20-OS2.1] [F20,F21,F61-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21,F61-OS3.1] Applies to floors and elements that support floors.
	[F20,F21,F61-OH4] Applies to floors and elements that support floors.
	[F20,F21,F61-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F21,F61-OP2.4] [F20,F21,F61-OP2.3] Applies to elements that support or are part of an environmental separator.
(3)	(a) [F20-OS2.1] (a) [F20,F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	(a) [F20-OP2.1] (a) [F80-OP2.4] (a) [F20,F80-OP2.3] Applies to elements that support or are part of an environmental separator.
	(a) [F20,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	(a) [F20,F80-OH4] Applies to floors and elements that support floors.
	(a) [F20,F80-OS3.1] Applies to floors and elements that support floors.
	(b) [F20-OS2.1] (b) [F20,F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	(b) [F20-OP2.1] (b) [F80-OP2.4] (b) [F20,F80-OP2.3] Applies to elements that support or are part of an environmental separator.
	(b) [F20,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	(b) [F20,F80-OH4] Applies to floors and elements that support floors.
	(b) [F20,F80-OS3.1] Applies to floors and elements that support floors.
	(c) [F20-OS2.1] (c) [F20,F61-OS2.3] Applies to elements that support or are part of an environmental separator.

	(c) [F20-OP2.1] (c) [F61-OP2.4] (c) [F20,F61-OP2.3] Applies to elements that support or are part of an environmental separator.
	(c) [F20,F61-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	(c) [F20,F61-OH4] Applies to floors and elements that support floors.
	(c) [F20,F61-OS3.1] Applies to floors and elements that support floors.
9.15.2.3. Pier-Type Foundations	
(1)	[F20-OS2.1,OS2.2] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.2] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OS2.1,OS2.2] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.2] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(3)	[F20-OS2.1,OS2.4] [F22-OS2.4,OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.

9.15.2.4. Wood-Frame Foundations	
(1)	(a) [F20-OS2.1,OS2.2] (a) [F20,F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	(a) [F20-OP2.1,OP2.2] (a) [F20,F80-OP2.3] Applies to elements that support or are part of an environmental separator.
	(a) [F20,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	(a) [F20,F80-OH4] Applies to floors and elements that support floors.
	(a) [F20,F80-OS3.1] Applies to floors and elements that support floors.
9.15.3.1. Footings Required	
(1)	[F20-OS2.2] [F20,F21-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.2] [F20,F21-OP2.4] [F20,F21-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21-OH4] Applies to floors and elements that support floors.
	[F20,F21-OS3.1] Applies to floors and elements that support floors.
9.15.3.2. Support of Footings	
(1)	[F21-OS2.4] [F21-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F21-OP2.4] [F21-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F21-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F21-OH4] Applies to floors and elements that support floors.
	[F21-OS3.1] Applies to floors and elements that support floors.
(2)	[F21-OS2.1] [F21-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F21-OP2.1,OP2.4] [F21-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F21-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F21-OH4] Applies to floors and elements that support floors.

	[F21-OS3.1] Applies to floors and elements that support floors.
9.15.3.4. Basic Footing Widths and Areas	
(1)	[F20-OS2.2] [F20,F21-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F21-OP2.4] [F20,F21-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21-OH4] Applies to floors and elements that support floors.
	[F20,F21-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OS2.2] [F20,F21-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.2] [F21-OP2.4] [F20,F21-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21-OH4] Applies to floors and elements that support floors.
	[F20,F21-OS3.1] Applies to floors and elements that support floors.
(3)	[F20-OS2.2] [F20,F21-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.2] [F21-OP2.4] [F20,F21-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21-OH4] Applies to floors and elements that support floors.
	[F20,F21-OS3.1] Applies to floors and elements that support floors.
9.15.3.5. Adjustments to Footing Widths for Exterior Walls	
(1)	[F20-OS2.2,OS2.3] [F21-OS2.3]
	[F20-OP2.2,OP2.3] [F21-OP2.3,OP2.4]
	[F20,F21-OH1.1,OH1.2,OH1.3]
	[F20,F21-OH4] Applies to floors and elements that support floors.

	[F20,F21-OS3.1] Applies to floors and elements that support floors.
9.15.3.6. Adjustments to Footing Widths for Interior Walls	
(1)	[F20-OS2.2] [F20,F21-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.2] [F21-OP2.4] [F20,F21-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21-OH4] Applies to floors and elements that support floors.
	[F20,F21-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OS2.2]
	[F20-OP2.2]
9.15.3.7. Adjustments to Footing Area for Columns	
(1)	[F20-OS2.2] [F20,F21-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.2] [F21-OP2.4] [F20,F21-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21-OH4] Applies to floors and elements that support floors.
	[F20,F21-OS3.1] Applies to floors and elements that support floors.
9.15.3.8. Footing Thickness	
(1)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
9.15.3.9. Step Footings	

(1)	[F20,F22-OS2.3,OS2.4]
	[F20,F22-OP2.3,OP2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies where the *foundation* supports or is part of an environmental separator.
	[F20,F22-OH4] Applies to *foundations* that support floors.
	[F20,F22-OS3.1] Applies to *foundations* that support floors.
9.15.4.1. Permanent Form Material	
(1)	[F22,F63,F55-OH1.1,OH1.2,OH1.3]
9.15.4.2. Foundation Wall Thickness and Required Lateral Support	
(1)	[F20-OS2.1,OS2.3] [F22-OS2.3]
	[F20-OP2.1,OP2.3] [F22-OP2.3,OP2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OS2.1,OS2.3] [F22-OS2.3]
	[F20-OP2.1,OP2.3] [F22-OP2.3,OP2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(3)	[F20-OS2.1,OS2.3] [F22-OS2.3,OS2.4]
	[F20-OP2.1,OP2.3] [F22-OP2.3,OP2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(4)	[F20-OS2.1,OS2.3] [F22-OS2.3]
	[F20-OP2.1,OP2.3] [F22-OP2.3,OP2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]

	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(5)	[F20-OS2.1,OS2.3] [F22-OS2.3,OS2.4]
	[F20-OP2.1,OP2.3] [F22-OP2.3,OP2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(6)	[F20-OS2.1,OS2.3] [F22-OS2.3,OS2.4]
	[F20-OP2.1,OP2.3] [F22-OP2.3,OP2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(7)	[F20-OS2.1,OS2.3] [F22-OS2.3,OS2.4]
	[F20-OP2.1,OP2.3] [F22-OP2.3,OP2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(8)	[F20-OS2.1,OS2.3] [F22-OS2.3,OS2.4]
	[F20-OP2.1,OP2.3] [F22-OP2.3,OP2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.15.4.5. Reinforcement for Flat Insulating Concrete Form Foundation Walls	
(1)	[F20-OS2.1,OS2.3] [F22-OS2.3,OS2.4]
	[F20-OP2.1,OP2.3] [F22-OP2.3,OP2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]

	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OS2.1,OS2.3] [F22-OS2.3,OS2.4]
	[F20-OP2.1,OP2.3] [F22-OP2.3,OP2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(3)	[F20-OS2.1,OS2.3] [F22-OS2.3,OS2.4]
	[F20-OP2.1,OP2.3] [F22-OP2.3,OP2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(4)	[F20-OS2.1,OS2.3] [F22-OS2.3,OS2.4]
	[F20-OP2.1,OP2.3] [F22-OP2.3,OP2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.15.4.6. Extension above Ground Level	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
	[F61-OP2.3]
9.15.4.7. Reduction in Thickness	
(1)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.

	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(3)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
9.15.4.9. Crack Control Joints	
(1)	[F21-OS2.3]
	[F21-OP2.3]
	[F21-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
(2)	[F61-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20,F61-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20,F61-OP2.3] Applies to elements that support or are part of an environmental separator.
9.15.5.1. Support of Floor Joists	
(1)	[F20-OS2.1] [F40,F61-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] [F40,F61-OP2.3,OP2.4] Applies to elements that support or are part of an environmental separator.

	[F20,F40,F61-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F40,F61-OH4] Applies to floors and elements that support floors.
	[F20,F40,F61-OS3.1] Applies to floors and elements that support floors.
9.15.5.2. Support of Beams	
(1)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(2)	[F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F80-OP2.3,OP2.4] Applies to elements that support or are part of an environmental separator.
	[F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F80-OH4] Applies to floors and elements that support floors.
	[F80-OS3.1] Applies to floors and elements that support floors.
9.15.5.3. Pilasters	
(1)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.

	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(3)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
9.15.6.2. Foundation Walls above Ground	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
	[F61-OP2.3]
9.15.6.3. Form Ties	
(1)	[F61-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F30-OS3.1]
	[F61-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F61-OP2.3] Applies to elements that support or are part of an environmental separator.
9.16.1.3. Required Floors-on-Ground	
(1)	(a),(b) [F30-OS3.1]
	(a),(b) [F40-OH2.4]
9.16.2.1. Required Installation of Granular Material	
(1)	[F40,F61-OH1.1] [F60,F61-OH1.2,OH1.3]
	[F60-OS2.3]
9.16.2.2. Support of Floors	
(1)	[F21-OS2.1,OS2.3]
	[F21-OP2.1,OP2.3,OP2.4]

	[F21-OH1.1,OH1.2,OH1.3]
	[F21-OS3.1]
(2)	[F21-OS2.1,OS2.3]
	[F21-OP2.1,OP2.3,OP2.4]
	[F21-OH1.1,OH1.2,OH1.3]
	[F21-OS3.1]
(3)	[F22-OS3.1]
9.16.3.1. Control of Water Ingress	
(1)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.3]
	[F60-OS3.1]
9.16.3.2. Hydrostatic Pressure	
(1)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1] [F61-OS2.3]
	[F20-OP2.1] [F61-OP2.3]
	[F20-OS3.1]
9.16.3.3. Floor Drains	
(1)	[F62-OH1.1,OH1.2,OH1.3]
	[F62-OS2.3]
	[F62-OS3.1]
9.16.4.1. Surface Finish	
(1)	[F40-OH2.4]
	[F30,F80-OS3.1]
	[F62-OH1.1,OH1.2,OH1.3]
(2)	[F41-OH1.1]
	[F20,F80-OS3.1]

9.16.4.2. Topping Course	
(1)	[F20,F80-OS3.1]
(2)	[F20,F80-OS3.1]
9.16.4.3. Thickness	
(1)	[F20-OS2.1,OS2.3]
	[F20-OS3.1]
	[F20-OP2.1,OP2.3]
	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OH4]
9.16.4.4. Bond Break	
(1)	[F21-OS3.1]
9.16.5.1. Wood-Frame Floors	
(1)	[F20-OS2.1] [F20-OS2.3] Applies where wood-frame floors-on-ground serve as an environmental separator.
	[F20-OS3.1]
	[F20-OP2.1] [F20-OP2.3] Applies where wood-frame floors-on-ground serve as an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies where wood-frame floors-on-ground serve as an environmental separator.
	[F20-OH4]
9.17.2.1. Location	
(1)	[F20-OS2.2] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.2,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
9.17.2.2. Lateral Support	

(1)	[F22-OS2.4,OS2.5] [F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F22-OP2.4,OP2.5] [F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F22-OS2.4,OS2.5] [F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F22-OP2.4,OP2.5] [F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.17.3.1. Size and Thickness	
(1)	[F20-OS2.1] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20,F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OS2.1] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20,F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.

	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.17.3.2. End Bearing Plates	
(1)	[F20-OS2.1] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20,F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.17.3.3. Paint	
(1)	[F80-OS3.1] Applies to floors and elements that support floors.
	[F80-OS2.3]
	[F80-OP2.3,OP2.4]
	[F80-OH1.1,OH1.2,OH1.3]
	[F80-OH4] Applies to floors and elements that support floors.
9.17.3.4. Design of Steel Columns	
(1)	[F20-OS2.1] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors. [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.17.4.1. Column Sizes	
(1)	[F20-OS2.1]

	[F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20,F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OS2.1] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20,F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.17.4.2. Materials	
(1)	[F20-OS2.1] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20,F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OS2.1] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20,F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.

9.17.4.3. Columns in Contact with Concrete	
(1)	[F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F80-OP2.4] [F80-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F80-OH4] Applies to floors and elements that support floors.
	[F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F80-OS3.1] Applies to floors and elements that support floors.
9.17.5.1. Materials	
(1)	[F20-OS2.1] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20,F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.17.5.2. Sizes	
(1)	[F20-OS2.1] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20,F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.17.6.2. Sizes	
(1)	[F20-OS2.1] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20,F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.

	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.18.2.1. Access Openings	
(1)	[F82-OH1.1,OH1.2]
(2)	[F51,F63-OS2.3] Applies where crawl spaces are unheated and access is from the interior. [F42,F61-OS2.3] Applies where crawl spaces are heated or unheated and access is from the exterior.
	[F63-OS2.3] Applies where crawl spaces are unheated and access is from the interior. [F42,F61-OS2.3] Applies where crawl spaces are heated or unheated and access is from the exterior.
	[F42-OH2.4,OH2.5] Applies where crawl spaces are heated or unheated and access is from the exterior.
9.18.3.1. Ventilation of Unheated Crawl Spaces	
(1)	[F62-OH1.1]
	[F62-OS2.3]
(2)	[F62-OH1.1]
	[F62-OS2.3]
(3)	(a) [F62-OH1.1,OH1.2] (b) [F61,F42-OH1.1,OH1.2]
	(a),(b) [F61,F62,F42-OS2.3]
	(b) [F42-OH2.3,OH2.5]
9.18.4.1. Access Way to Services	
(1)	[F82-OH1.1,OH1.2]
	[F82-OH2.1]
9.18.5.1. Drainage	
(1)	[F60-OH1.1,OH1.2]
	[F60-OS2.3]
9.18.6.1. Ground Cover in Unheated Crawl Spaces	
(1)	[F61-OH1.1,OH1.2]
	[F61-OS2.3]

(2)	[F61-OH1.1,OH1.2]
	[F61-OS2.3]
9.18.6.2. Ground Cover in Heated Crawl Spaces	
(1)	[F40,F61-OH1.1] [F61-OH1.2]
	[F61-OS2.3]
(2)	[F40,F61-OH1.1] [F61-OH1.2]
	[F61-OS2.3]
(3)	[F40-OH1.1]
(4)	[F40,F61-OH1.1,OH1.2]
	[F61-OS2.3]
9.18.7.1. Crawl Spaces as Warm Air Plenums	
(1)	[F51-OH1.1,OH1.2]
	[F51-OS2.3]
(2)	[F02-OS1.2]
(3)	[F01-OS1.1]
(4)	(a),(b) [F01-OS1.1]
9.19.1.1. Required Venting	
(1)	[F51,F62-OH1.1,OH1.2] [F51-OH1.3] Applies to sloped roof assemblies that may be subject to ice damming.
	[F62,F51-OS2.3]
9.19.1.2. Vent Requirements	
(1)	[F51,F62-OH1.1,OH1.2] [F51-OH1.3] Applies to sloped roof assemblies that may be subject to ice damming.
	[F62,F51-OS2.3]
(2)	[F51,F62-OH1.1,OH1.2] [F51-OH1.3] Applies to sloped roof assemblies that may be subject to ice damming.
	[F62,F51-OS2.3]
(3)	[F51,F62-OH1.1,OH1.2]

	[F51-OH1.3] Applies to sloped roof assemblies that may be subject to ice damming.
	[F62,F51-OS2.3]
(4)	[F51,F62-OH1.1,OH1.2] [F51-OH1.3] Applies to sloped roof assemblies that may be subject to ice damming.
	[F62,F51-OS2.3]
(5)	[F42,F51,F61,F62-OS2.3]
	[F42-OH1.1] Applies to resistance to the entry of insects. [F51,F61,F62-OH1.1,OH1.2,OH1.3]
	[F42-OH2.5] Applies to resistance to the entry of insects.
9.19.1.3. Clearances	
(1)	[F62,F51-OH1.1,OH1.2,OH1.3]
	[F62,F51-OS2.3]
(2)	[F62,F51-OH1.1,OH1.2,OH1.3]
	[F62,F51-OS2.3]
(3)	[F51,F62-OH1.1,OH1.2,OH1.3]
	[F51,F62-OS2.3]
9.19.2.1. Access	
(1)	[F82-OS2.3]
	[F82-OH1.1,OH1.2,OH1.3]
(2)	[F82-OH1.1,OH1.2]
	[F82-OS2.3]
(3)	[F42-OH1.1] [F61-OH1.1,OH1.2,OH1.3] Applies where access is from the exterior. [F42-OH1.1] Applies where access is from an unheated enclosed space. [F51-OH1.2] Applies where access is from an interior heated space.
	[F61,F42-OS2.3] Applies where access is from the exterior or an unheated enclosed space.
	[F42-OH2.5] Applies where access is from the exterior or an unheated enclosed space.
9.20.2.1. Masonry Unit Standards	
(1)	[F20,F80-OS2.1] [F20,F80-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to

	moisture.
	[F20,F80-OP2.1,OP2.4] [F20,F80-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.
	[F20,F80-OS3.1] Applies to floors and elements that support floors. [F20,F80-OS3.4] Applies to masonry used in *chimneys* and fireplaces.
	[F20,F80-OS1.2] Applies to assemblies required to provide fire resistance. [F01-OS1.1,OS1.2] Applies to masonry used in *chimneys* and fireplaces.
	[F20,F80-OH4] Applies to floors and elements that support floors.
	[F20,F80-OP1.2] Applies to assemblies required to provide fire resistance. [F01,F20,F80-OP1.2] Applies to masonry used in *chimneys* and fireplaces.
9.20.2.2. Used Brick	
(1)	[F20,F80-OS2.1] [F20,F80-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F80-OP2.1,OP2.4] [F20,F80-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.
	[F20,F80-OS1.2] Applies to assemblies required to provide fire resistance. [F01-OS1.1,OS1.2] Applies to masonry used in *chimneys* and fireplaces.
	[F20,F80-OS3.1] Applies to floors and elements that support floors. [F20,F80-OS3.4] Applies to masonry used in *chimneys* and fireplaces.
	[F20,F80-OH4] Applies to floors and elements that support floors.
	[F20,F80-OP1.2] Applies to assemblies required to provide fire resistance. [F01-OP1.2] Applies to masonry used in *chimneys* and fireplaces.
9.20.2.3. Glass Blocks	
(1)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to

	moisture.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors. [F01,F20-OS3.4] Applies to masonry used in *chimneys* and fireplaces.
	[F01,F20-OS1.1] [F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F01,F20-OP1.1] [F20-OP1.2] Applies to assemblies required to provide fire resistance.
9.20.2.4. Cellular Concrete	
(1)	[F80-OS2.1] [F80-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F80-OP2.1,OP2.4] [F80-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.
	[F80-OH4] Applies to floors and elements that support floors.
	[F80-OS3.1] Applies to floors and elements that support floors. [F80-OS3.4] Applies to masonry used in *chimneys* and fireplaces.
	[F80-OP1.2] Applies to masonry used in *chimneys* and fireplaces.
	[F80-OS1.2] Applies to masonry used in *chimneys* and fireplaces.
9.20.2.5. Stone	
(1)	[F20,F80-OS2.1] [F20,F80-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F80-OP2.1,OP2.4] [F20,F80-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.
	[F20,F80-OS1.2] Applies to assemblies required to provide fire resistance. [F01-OS1.1,OS1.2] Applies to masonry used in *chimneys* and fireplaces.

	[F20,F80-OH4] Applies to floors and elements that support floors.
	[F20,F80-OP1.2] Applies to assemblies required to provide fire resistance. [F01,F20,F80-OP1.2] Applies to masonry used in *chimneys* and fireplaces.
9.20.2.6. Concrete Blocks Exposed to the Weather	
(1)	[F80-OS2.1,OS2.3] [F61-OS2.3]
	[F80-OP2.1,OP2.3] [F61-OP2.3]
	[F61,F80-OH1.1,OH1.2,OH1.3]
	[F80-OH4] Applies to floors and elements that support floors.
	[F80-OS3.1] Applies to elements that support floors. [F80-OS3.4] Applies to masonry used in *chimneys* and fireplaces.
	[F80-OP1.2] Applies to concrete blocks in *chimneys* and fireplaces.
9.20.2.7. Compressive Strength	
(1)	[F20,F80-OS2.1] [F20,F80-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F80-OP2.1,OP2.4] [F20,F80-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.
	[F20,F80-OS1.2] Applies to assemblies required to provide fire resistance. [F01-OS1.1,OS1.2] Applies to masonry used in *chimneys* and fireplaces.
	[F20,F80-OH4] Applies to floors and elements that support floors.
	[F20,F80-OS3.1] Applies to floors and elements that support floors. [F20,F80-OS3.4] Applies to masonry used in *chimneys* and fireplaces.
	[F20,F80-OP1.2] Applies to assemblies required to provide fire resistance. [F01,F20,F80-OP1.2] Applies to masonry used in *chimneys* and fireplaces.
9.20.3.1. Mortar Materials	
(1)	[F20,F80-OS2.1] [F20,F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OP2.1,OP2.4] [F20,F80-OP2.3] Applies to elements that support or are part of an environmental separator.

	[F20,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.
	[F20,F80-OH4] Applies to floors and elements that support floors.
	[F20,F80-OS3.1] Applies to floors and elements that support floors.
	[F20,F80-OS1.2] Applies to assemblies required to provide fire resistance.
(2)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(3)	[F21-OS2.1] [F21-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F21-OP2.1,OP2.4] [F21-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F21-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.
	[F21-OS1.2] Applies to assemblies required to provide fire resistance.
	[F21-OH4] Applies to floors and elements that support floors.
	[F21-OS3.1] Applies to floors and elements that support floors.
(4)	[F21-OS2.1] [F21-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F21-OP2.1,OP2.4] [F21-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F21-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator and to

	masonry used in *chimneys* and fireplaces.
	[F21-OS1.2] Applies to assemblies required to provide fire resistance.
	[F21-OH4] Applies to floors and elements that support floors.
	[F21-OS3.1] Applies to floors and elements that support floors.
9.20.3.2. Mortar and Grout Mixes	
(1)	[F20,F21,F61-OS2.1] [F20,F21,F61-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21,F61-OP2.1,OP2.4] [F20,F21,F61-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21,F61-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.
	[F20,F21,F61-OH4] Applies to floors and elements that support floors.
	[F20,F21,F61-OS3.1] Applies to floors and elements that support floors.
	[F20,F21-OS1.2] Applies to assemblies required to provide fire resistance.
(2)	(a) [F21,F61,F55-OS2.1,OS2.3]
	(a) [F21,F61,F55-OP2.1,OP2.3]
	(a) [F21,F61,F55-OH1.1,OH1.2,OH1.3]
	(b) [F21-OS2.1]
	(b) [F21-OP2.1]
	(b) [F21,F44-OS1.2] Applies to assemblies required to provide fire resistance.
(3)	[F20,F21,F61-OS2.1] [F20,F21,F61-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21,F61-OP2.1,OP2.4] [F20,F21,F61-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21,F61-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.
	[F20,F21,F61-OH4] Applies to floors and elements that support floors.
	[F20,F21,F61-OS3.1] Applies to floors and elements that support floors.
	[F20,F21-OS1.2] Applies to assemblies required to provide fire resistance.

(4)	[F20,F21-OS2.1] [F20,F21-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21-OP2.1,OP2.4] [F20,F21-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.
	[F20,F21-OH4] Applies to floors and elements that support floors.
	[F20,F21-OS3.1] Applies to floors and elements that support floors.
	[F20,F21-OS1.2] Applies to assemblies required to provide fire resistance.
(5)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
(6)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
(7)	[F20,F21,F61-OS2.1] [F20,F21,F61-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21,F61-OP2.1,OP2.4] [F20,F21,F61-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21,F61-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental

	separator and to masonry used in *chimneys* and fireplaces.
	[F20,F21,F61-OH4] Applies to floors and elements that support floors.
	[F20,F21,F61-OS3.1] Applies to floors and elements that support floors.
	[F20,F21,F61-OS1.2] Applies to assemblies required to provide fire resistance.
9.20.4.1. Thickness	
(1)	[F20,F61-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F61-OS2.1] [F20,F61-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F61-OP2.1,OP2.4] [F20,F61-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F61-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F61-OH4] Applies to floors and elements that support floors.
	[F20,F61-OS3.1] Applies to floors and elements that support floors.
(2)	[F20,F61-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F61-OS2.1] [F20,F61-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F61-OP2.1,OP2.4] [F20,F61-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F61-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F61-OH4] Applies to floors and elements that support floors.
	[F20,F61-OS3.1] Applies to floors and elements that support floors.
9.20.4.2. Solid Masonry Units	
(1)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20-OP2.1,OP2.4]

	[F20-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
9.20.4.3. Laying of Masonry Units	
(1)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
(3)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in *chimneys* and fireplaces.

	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
9.20.5.1. Masonry Support	
(1)	[F20,F21-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F21-OS2.1] [F20,F21-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F21-OP2.1,OP2.4] [F20,F21-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F21-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F21-OH4] Applies to floors and elements that support floors.
	[F20,F21-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
9.20.5.2. Lintels or Arches	
(1)	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS2.1] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F22-OP2.1,OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.

	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(2)	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS2.1] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OP2.1,OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
(4)	[F80-OS2.1] [F80-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F80-OP2.1,OP2.4] [F80-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F80-OS1.2] Applies to assemblies required to provide fire resistance.
	[F80-OH4] Applies to floors and elements that support floors.
	[F80-OS3.1] Applies to floors and elements that support floors. [F80-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.20.6.1. Thickness of Exterior Walls	
(1)	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(2)	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.

	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(3)	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.20.6.2. Cavity Walls	
(1)	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20-OP2.1,OP2.4,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(2)	[F20,F22,F61-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1,OS2.5]

	[F22-OS2.5] [F20,F22,F61-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4,OP2.5] [F22-OP2.4,OP2.5] [F20,F22,F61-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
	[F61-OS1.2] Applies to assemblies required to provide fire resistance.
(3)	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20-OP2.1,OP2.4,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.20.6.3. Thickness of Interior Walls	
(2)	(b) [F20-OS2.1,OS2.3,OS2.5] [F22-OS2.5]
	(b) [F20-OP2.1,OP2.3,OP2.5] [F22-OP2.5]
9.20.6.4. Masonry Veneer	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.5] [F20,F22-OP2.3] Applies to elements that are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
(2)	[F61-OS2.3]
	[F61-OH1.1,OH1.2,OH1.3]

	[F61-OP2.3]
	[F61-OS1.2] Applies to assemblies required to provide fire resistance.
(3)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.20.6.5. Parapet Walls	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
(2)	[F61-OS2.3]
	[F61-OP2.3]
	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS1.2]
9.20.7.1. Maximum Dimensions	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.20.7.2. Minimum Wall Thickness	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.

	[F20-OP2.1,OP2.4,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.20.7.3. Separation of Chases or Recesses	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.20.7.4. Non-Conforming Chases or Recesses	
(1)	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OS2.1,OS2.5] [F22-OS2.5]

	[F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.20.7.5. Chases or Recesses Cut into Walls	
(1)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
9.20.8.1. Capping of Hollow Masonry Walls	
(1)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.

	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
9.20.8.2. Cavity Walls Supporting Framing Members	
(1)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(2)	[F80-OS2.3]
	[F80-OP2.3]
(3)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
9.20.8.3. Bearing of Beams and Joists	
(1)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
(2)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1]

	[F20-OP2.3] Applies to elements that support or are part of an environmental separator.
(3)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
9.20.8.4. Support of Beams and Columns	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(3)	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.

	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(4)	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(5)	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.20.8.5. Projection of Masonry Veneer Beyond Supporting Members	
(1)	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.20.9.1. Joints to be Offset or Reinforced	

(1)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
9.20.9.2. Bonding or Tying of Other than Masonry Veneer	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors. [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.20.9.3. Bonding	
(1)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.

	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(3)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
9.20.9.4. Tying	
(2)	[F20,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OS2.1] [F20,F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OP2.1,OP2.4] [F20,F80-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OS1.2] Applies to assemblies required to provide fire resistance.

	[F20,F80-OH4] Applies to floors and elements that support floors.
	[F20,F80-OS3.1] Applies to floors and elements that support floors. [F20,F80-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(3)	[F20,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OS2.1] [F20,F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OP2.1,OP2.4] [F20,F80-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F80-OH4] Applies to floors and elements that support floors.
	[F20,F80-OS3.1] Applies to floors and elements that support floors. [F20,F80-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(4)	[F20,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OS2.1] [F20,F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OP2.1,OP2.4] [F20,F80-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F80-OH4] Applies to floors and elements that support floors.
	[F20,F80-OS3.1] Applies to floors and elements that support floors. [F20,F80-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(5)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.

(6)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(7)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(8)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS3.1] Applies to floors and elements that support floors.
(9)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.

	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
9.20.9.5. Ties for Masonry Veneer	
(1)	[F20,F22,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OS2.1] [F20,F22,F80-OS2.5] [F20,F22,F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OP2.1] [F20,F22,F80-OP2.5] [F20,F22,F80-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22,F80-OS1.2] Applies to assemblies required to provide fire resistance.
(2)	[F20,F80-OS2.1] [F20,F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OP2.1] [F20,F80-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OS1.2] Applies to assemblies required to provide fire resistance.
9.20.9.6. Reinforcing for Glass Block	
(1)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that are part of an environmental separator.
	[F20-OP2.1] [F20-OP2.3] Applies to elements that are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
(2)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that are part of an environmental separator.
	[F20-OP2.1] [F20-OP2.3] Applies to elements that are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
9.20.10.1. Lateral Support Required	

(1)	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20,F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(2)	(a) [F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20,F22-OS2.5] (a) [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20,F22-OP2.5] (a) [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	(a) [F20,F22-OH4] Applies to floors and elements that support floors.
	(a) [F20,F22-OS3.1] Applies to floors and elements that support floors.
(4)	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20-OP2.1] [F20,F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.20.11.1. Anchorage to Floor or Roof Assemblies where Masonry Walls Require Lateral Support	

(1)	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20,F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(2)	[F20,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OS2.1] [F20,F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OP2.1,OP2.4] [F20,F80-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F80-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F80-OH4] Applies to floors and elements that support floors.
	[F20,F80-OS3.1] Applies to floors and elements that support floors. [F20,F80-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(3)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(4)	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20,F22-OS2.5]

	[F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20,F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.20.11.2. Bonding and Tying Intersecting Masonry Walls where Walls Require Lateral Support	
(1)	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20,F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(3)	[F20,F80-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F80-OS2.1] [F20,F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OP2.1,OP2.4]

	[F20,F80-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OH4] Applies to floors and elements that support floors.
	[F20,F80-OS3.1] Applies to floors and elements that support floors. [F20,F80-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.20.11.3. Anchoring Intersecting Wood-Frame Walls to Masonry Walls	
(1)	[F20,F22,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OS2.1] [F20,F22,F80-OS2.5] [F20,F22,F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OP2.1] [F20,F22,F80-OP2.4,OP2.5] [F20,F22,F80-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22,F80-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22,F80-OH4] Applies to floors and elements that support floors.
	[F20,F22,F80-OS3.1] Applies to floors and elements that support floors. [F20,F22,F80-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
9.20.11.4. Anchoring Wood-Frame Roof Systems to Masonry Walls	
(1)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3]
	[F20-OP2.1,OP2.3]

(2)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3]
	[F20-OP2.1,OP2.3]
9.20.11.5. Anchoring Masonry Cornices, Sills and Trim to Masonry Walls	
(1)	[F20,F80-OS2.1,OS2.3,OS2.5] [F22-OS2.5]
9.20.11.6. Anchoring to Masonry Piers	
(1)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
9.20.12.1. Corbelling	
(1)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.

	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
9.20.12.2. Corbelling for Cavity Walls	
(1)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
9.20.12.3. Corbelling for Masonry Veneer	
(1)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
(2)	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
9.20.13.1. Materials for Flashing	
(1)	[F80-OS2.1,OS2.3]

	[F80-OP2.1,OP2.3]
	[F80-OH1.1,OH1.2,OH1.3]
	[F80-OS1.2] Applies to assemblies required to provide fire resistance.
(2)	[F80-OS2.1,OS2.3]
	[F80-OP2.1,OP2.3]
	[F80-OH1.1,OH1.2,OH1.3]
	[F80-OS1.2] Applies to assemblies required to provide fire resistance.
9.20.13.2. Fastening of Flashing	
(1)	[F80-OH1.1,OH1.2,OH1.3]
	[F80-OS2.1,OS2.3]
	[F80-OP2.1,OP2.3]
	[F80-OS1.2] Applies to assemblies required to provide fire resistance.
9.20.13.3. Location of Flashing	
(1)	[F61,F62-OS2.1,OS2.3]
	[F61,F62-OP2.1,OP2.3]
	[F61,F62-OH1.1,OH1.2,OH1.3]
9.20.13.4. Extension of Flashing	
(1)	[F61-OS2.1,OS2.3]
	[F61-OP2.1,OP2.3]
	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS1.2] Applies to assemblies required to provide fire resistance.
9.20.13.5. Flashing for Weep Holes in Masonry/Masonry Walls	
(1)	[F61,F62-OH1.1,OH1.2,OH1.3]
	[F61,F62-OS2.1,OS2.3]
	[F61,F62-OP2.1,OP2.3]
	[F61,F62-OS1.2] Applies to assemblies required to provide fire resistance.

9.20.13.6. Flashing for Weep Holes in Masonry Veneer	
(2)	[F61,F62-OS2.1,OS2.3]
	[F61,F62-OP2.1,OP2.3]
	[F61,F62-OH1.1,OH1.2,OH1.3]
	[F61,F62-OS1.2] Applies to assemblies required to provide fire resistance.
(3)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.1,OS2.3]
	[F61-OP2.1,OP2.3]
	[F61-OS1.2] Applies to assemblies required to provide fire resistance.
9.20.13.7. Flashing Joints	
(1)	[F61,F62-OH1.1,OH1.2,OH1.3]
	[F61,F62-OS2.1,OS2.3]
	[F61,F62-OP2.1,OP2.3]
	[F61,F62-OS1.2] Applies to assemblies required to provide fire resistance.
9.20.13.8. Required Weep Holes	
(1)	[F62-OS2.1,OS2.3]
	[F62-OP2.1,OP2.3]
	[F62-OH1.1,OH1.2,OH1.3]
	[F62-OS1.2] Applies to assemblies required to provide fire resistance.
9.20.13.9. Protection of Interior Finish	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.1,OS2.3]
	[F61-OP2.1,OP2.3]
(2)	[F61,F62-OS2.1,OS2.3]
	[F61,F62-OP2.1,OP2.3]
	[F61,F62-OH1.1,OH1.2,OH1.3]

9.20.13.10. Mortar Droppings	
(1)	[F61,F62-OH1.1,OH1.2,OH1.3]
	[F61,F62-OS2.1,OS2.3]
	[F61,F62-OP2.1,OP2.3]
	[F61,F62-OS1.2] Applies to assemblies required to provide fire resistance.
9.20.13.12. Drips beneath Window Sills	
(1)	[F61,F62-OH1.1,OH1.2,OH1.3]
	[F61,F62-OS2.1,OS2.3]
	[F61,F62-OP2.1,OP2.3]
	[F61,F62-OS1.2] Applies to assemblies required to provide fire resistance.
9.20.14.1. Laying Temperature of Mortar and Masonry	
(1)	[F20,F80-OS2.1] [F20,F80-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F80-OP2.1,OP2.4] [F20,F80-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F80-OH4] Applies to floors and elements that support floors.
	[F20,F80-OS3.1] Applies to floors and elements that support floors. [F20,F80-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F20,F80-OS2.1] [F20,F80-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F80-OP2.1,OP2.4] [F20,F80-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F20,F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F80-OS1.2] Applies to assemblies required to provide fire resistance.

	[F20,F80-OH4] Applies to floors and elements that support floors.
	[F20,F80-OS3.1] Applies to floors and elements that support floors. [F20,F80-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.20.14.2. Protection from Weather	
(1)	[F80-OS2.1,OS2.3]
	[F80-OP2.1,OP2.3]
9.20.15.1. Amount of Reinforcement	
(1)	[F20-OS2.1,OS2.3]
	[F20-OP2.1,OP2.3]
9.20.15.2. Installation Standard	
(1)	[F20-OS2.1,OS2.3]
	[F20-OP2.1,OP2.3]
9.20.16.1. Corrosion Resistance of Connectors	
(1)	[F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F80-OS2.1] [F80-OS2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F80-OP2.1,OP2.4] [F80-OP2.3] Applies to elements that support or are part of an environmental separator or are exposed to moisture.
	[F80-OS1.2] Applies to assemblies required to provide fire resistance.
	[F80-OH4] Applies to floors and elements that support floors.
	[F80-OS3.1] Applies to floors and elements that support floors. [F80-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.20.17.1. Thickness of Flat Insulating Concrete Form Walls	
(1)	[F20-OS2.1] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F22-OP2.4]

	[F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors. [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.20.17.2. Reinforcement for Flat Insulating Concrete Form Walls	
(1)	[F20-OS2.1] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors. [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F20-OS2.1] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors. [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(3)	[F20-OS2.1] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.

	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors. [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.20.17.3. Openings in Non-Loadbearing Flat Insulating Concrete Form Walls	
(1)	[F20-OS2.1,OS2.3] [F22-OS2.3,OS2.4]
	[F20-OP2.1,OP2.3] [F22-OP2.3,OP2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors. [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F20-OS2.1] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors. [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(3)	[F20-OS2.1] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors. [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for

	emergency egress.
(4)	[F20-OS2.1] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors. [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(5)	[F20-OS2.1] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors. [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(6)	[F20-OS2.1] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors. [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.20.17.4. Openings in Loadbearing Flat Insulating Concrete Form Walls	

(1)	[F20-OS2.1] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors. [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F20-OS2.1] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors. [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(3)	[F20-OS2.1] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors. [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(4)	[F20-OS2.1] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.

	[F20-OP2.1] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
9.20.17.5. Framing Supported on Flat Insulating Concrete Form Walls	
(1)	[F20-OS2.1] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4]
	[F20,F22-OS3.1]
(2)	[F20-OS2.1] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4]
	[F20,F22-OS3.1]
(3)	[F20-OS2.1] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4]
	[F20,F22-OS3.1]
9.20.17.6. Anchoring of Roof Framing to the Top of Flat Insulating Concrete Form Walls	
(1)	[F20-OS2.1,OS2.3] [F22-OS2.3,OS2.4]
	[F20-OP2.1,OP2.3] [F22-OP2.3,OP2.4]

	[F20,F22-OH1.1,OH1.2,OH1.3]
(2)	[F20-OS2.1,OS2.3] [F22-OS2.3,OS2.4]
	[F20-OP2.1,OP2.3] [F22-OP2.3,OP2.4]
	[F20-OH1.1,OH1.2,OH1.3]
9.21.1.2. Chimney or Flue Pipe Walls	
(1)	[F01-OS1.1] Applies to the walls of any *chimney* or *flue pipe*, which are required to be constructed to be flame-tight.
	[F44-OH1.1] Applies to the walls of any *chimney* or *flue pipe*, which are required to be constructed to be smoke-tight.
	[F01-OP1.1] Applies to the walls of any *chimney* or *flue pipe*, which are required to be constructed to be flame-tight.
9.21.2.1. Chimney Flue Limitations	
(1)	[F44-OH1.1]
	[F44-OS3.4]
(2)	[F44-OH1.1]
	[F44-OS3.4]
(3)	[F44-OS3.4]
	[F44-OH1.1]
9.21.2.2. Connections of More Than One Appliance	
(1)	[F44-OH1.1]
	[F44-OS3.4]
(2)	[F44-OS3.4]
(3)	[F44-OH1.1]
	[F44-OS3.4]
(4)	[F44-OH1.1]
	[F44-OS3.4]
9.21.2.3. Inclined Chimney Flues	
(1)	[F44-OH1.1]

	[F44-OS3.4]
9.21.2.4. Size of Chimney Flues	
(2)	[F44-OH1.1]
	[F44-OS3.4]
9.21.2.5. Fireplace Chimneys	
(1)	[F44-OH1.1]
	[F44-OS3.4]
9.21.2.6. Oval Chimney Flues	
(1)	[F44-OH1.1]
	[F44-OS3.4]
9.21.3.1. Lining Materials	
(1)	[F20-OS2.3]
	[F20-OH1.1]
	[F01-OS1.1]
	[F44-OS3.4]
	[F44,F01,F20-OP1.1]
9.21.3.2. Joints in Chimney Liners	
(1)	[F44-OH1.1]
	[F44,F20-OS2.3]
	[F01-OS1.1]
	[F01-OP1.1]
	[F01-OS3.4]
(2)	[F01-OS1.1]
	[F44-OS3.4]
	[F01-OP1.1]
	[F44-OH1.1]

9.21.3.3. Clay Liners	
(1)	[F20-OS2.2]
	[F01-OS1.1]
	[F20,F44-OS3.4]
	[F20,F44-OH1.1]
	[F20,F01-OP1.1]
(2)	[F44-OH1.1]
	[F01,F20-OP1.1]
	[F44-OS3.4]
	[F01,F20-OS1.1]
	[F20-OS2.3] Applies to the liners referred to in Sentence 9.21.3.3.(1), which are required to be not less than 15.9 mm thick.
9.21.3.4. Firebrick Liners	
(1)	[F20,F44-OS3.4]
	[F44-OH1.1]
	[F01-OS1.1]
	[F01-OP1.1]
(2)	[F20-OH1.1]
	[F20,F01-OS1.1]
	[F20-OS2.2]
	[F20,F44-OS3.4]
	[F01,F20-OP1.1]
9.21.3.5. Concrete Liners	
(1)	[F01,F20-OS1.1]
	[F44-OH1.1]
	[F20,F44-OS3.4]
	[F01-OP1.1]

	[F20-OS2.3]
9.21.3.6. Metal Liners	
(1)	[F20,F44-OH1.1]
	[F01,F20-OP1.1]
	[F20,F44-OS3.4]
	[F20,F01-OS1.1]
	[F20-OS2.3]
(2)	[F44-OH1.1]
	[F20-OS2.3]
	[F20-OP1.1]
	[F20,F44-OS3.4]
	[F20,F01-OS1.1]
9.21.3.7. Installation of Chimney Liners	
(1)	[F44-OH1.1]
	[F01-OP1.1]
	[F44-OS3.4]
	[F01-OS1.1]
	[F20-OS2.3]
9.21.3.8. Spaces between Liners and Surrounding Masonry	
(1)	[F01-OP1.1]
	[F20-OS2.3]
	[F01-OS1.1]
(2)	[F20-OS1.1]
	[F44-OH1.1]
	[F44-OS3.4]
	[F01-OP1.1]

	[F20-OS2.3]
9.21.3.9. Mortar for Chimney Liners	
(1)	(b) [F20-OS2.3]
	(a),(b) [F01,F20-OP1.1]
	[F20,F44-OH1.1]
	[F20,F44-OS3.4]
	(a),(b) [F01,F20-OS1.1]
(2)	[F20,F01-OP1.1]
	[F20,F44-OH1.1]
	[F20-OS2.3]
	[F44-OS3.4]
	[F20,F01-OS1.1]
9.21.3.10. Extension of Chimney Liners	
(1)	[F20-OS2.3]
	[F44,F20-OH1.1]
	[F44-OS3.4]
	[F01-OS1.1]
	[F01-OP1.1]
9.21.4.4. Height of Chimney Flues	
(1)	(a),(b) [F44-OH1.1]
	(a),(b) [F44-OS3.4]
9.21.4.6. Chimney Caps	
(1)	[F20-OS2.3]
	[F01-OS1.1]
	[F01-OP1.1]
	[F20,F44-OH1.1]

	[F44-OS3.4]
(2)	[F20-OS2.3]
(3)	[F20-OS2.3]
	[F20,F01-OS1.1]
	[F20,F01-OP1.1]
	[F20,F44-OS3.4]
(4)	[F20-OS2.3]
	[F20,F01-OS1.1]
	[F20,F01-OP1.1]
	[F20,F44-OH1.1]
	[F20,F44-OS3.4]
9.21.4.7. Cleanout	
(1)	[F01-OP1.1]
	[F01-OS1.1]
9.21.4.8. Wall Thickness	
(1)	[F20,F22-OS2.1]
	[F01-OP1.1]
	[F01-OS1.1]
	[F22-OP2.1]
9.21.4.9. Separation of Flue Liners	
(1)	[F20,F44-OH1.1]
	[F20,F01-OP1.1]
	[F20,F22-OS2.3]
	[F44-OS3.4]
	[F01-OS1.1]
(2)	[F20,F22-OS2.3]

	[F20,F44-OH1.1]
	[F20,F44-OS3.4]
	[F01-OS1.1]
9.21.4.10. Flashing	
(1)	[F20,F61-OS2.3]
9.21.5.1. Clearance from Combustible Materials	
(1)	(a),(b) [F01-OP1.1]
	(a),(b) [F01-OS1.1]
(2)	[F01-OP1.1]
	[F01-OS1.1]
(3)	[F01-OP1.1]
	[F01-OS1.1]
9.21.5.2. Sealing of Spaces	
(1)	[F01-OP1.1]
	[F01-OS1.1]
9.21.5.3. Support of Joists or Beams	
(1)	[F01-OP1.1]
	[F01-OS1.1]
9.22.1.2. Masonry and Concrete	
(2)	[F22,F20-OS2.3]
9.22.1.4. Combustion Air	
(1)	[F01-OS1.1]
	[F01-OP1.1]
9.22.2.1. Brick or Steel Liners	
(1)	[F20,F01-OS1.1]
	[F20,F01-OP1.1]

9.22.2.2. Firebrick Liners	
(1)	(a),(b) [F01-OS1.1]
	(a),(b) [F01-OP1.1]
(2)	[F01-OS1.1]
	[F01-OP1.1]
(3)	[F01-OS1.1]
	[F01-OP1.1]
9.22.2.3. Steel Liners	
(1)	[F44-OH1.1]
	[F01-OS1.1]
	[F44-OS3.4]
	[F01-OP1.1]
9.22.3.1. Thickness of Walls	
(1)	[F01-OS1.1]
	[F01-OP1.1]
(2)	(a),(b) [F01-OS1.1]
	(a),(b) [F01-OP1.1]
9.22.4.1. Fire Chamber Dimensions	
(1)	[F44-OH1.1]
	[F44-OS3.4]
9.22.5.1. Hearth Extension	
(1)	[F01-OS1.1]
	[F01-OP1.1]
(2)	(a),(b) [F01-OS1.1]
	(a),(b) [F01-OP1.1]
9.22.5.2. Support of Hearth	

(1)	[F01-OS1.1]
	[F20-OS2.3]
	[F20,F01-OP1.1]
(2)	[F01-OS1.1]
	[F01-OP1.1]
9.22.6.1. Required Damper and Size	
(1)	[F01-OS1.1]
	[F54-OH1.2]
	[F01-OP1.1]
9.22.7.1. Slope of Smoke Chamber	
(1)	[F44-OH1.1]
	[F44-OS3.4]
9.22.7.2. Wall Thickness	
(1)	[F01-OS1.1]
	[F01-OP1.1]
9.22.8.1. Conformance to Standard	
(1)	[F01-OS1.1]
	[F44-OH1.1]
	[F01-OP1.1]
	[F44-OS3.4]
9.22.9.1. Clearance to the Fireplace Opening	
(1)	[F01-OS1.1]
	[F01-OP1.1]
9.22.9.2. Metal Exposed to the Interior	
(1)	[F01-OS1.1]
	[F01-OP1.1]

9.22.9.3. Clearance to Combustible Framing	
(1)	[F01-OS1.1]
	[F01-OP1.1]
(2)	[F01-OS1.1]
	[F01-OP1.1]
9.22.9.4. Heat-Circulating Duct Outlets	
(1)	(a),(b) [F01-OS1.1]
	(a),(b) [F01-OP1.1]
9.22.10.1. Appliance Standard	
(1)	[F44-OH1.1]
	[F01-OS1.1]
	[F44-OS3.4]
	[F01-OP1.1]
9.22.10.2. Installation	
(1)	[F01-OS1.1]
	[F44-OH1.1]
	[F01-OP1.1]
	[F44-OS3.4]
9.23.2.1. Strength and Rigidity	
(1)	[F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20,F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for

	emergency egress.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
9.23.2.2. Protection from Decay	
(1)	[F80-OS2.3]
	[F80-OP2.3,OP2.4]
	[F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F80-OS1.2] Applies to assemblies required to provide fire resistance.
	[F80-OH4] Applies to floors and elements that support floors.
	[F80-OS3.1] Applies to floors and elements that support floors. [F80-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F81-OS2.3]
	[F81-OP2.3]
	[F81-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F81-OS1.2] Applies to assemblies required to provide fire resistance.
	[F81-OH4] Applies to floors and elements that support floors.
	[F81-OS3.1] Applies to floors and elements that support floors.
9.23.2.3. Protection from Dampness	
(1)	[F80-OS2.1,OS2.3]
	[F80-OP2.1,OP2.3,OP2.4]
	[F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F80-OS1.2] Applies to assemblies required to provide fire resistance.
	[F80-OH4] Applies to floors and elements that support floors.
	[F80-OS3.1] Applies to floors and elements that support floors.
9.23.3.1. Standards for Nails and Screws	
(1)	[F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.

	[F20-OP2.1] [F20,F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1] [F20,F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(3)	[F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OH4] Applies to floors and elements that support floors.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.3.2. Length of Nails	

(1)	[F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OH4] Applies to floors and elements that support floors.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.3.3. Prevention of Splitting	
(1)	[F80-OS2.1] [F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F80-OP2.1,OP2.4] [F80-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F80-OS1.2] Applies to assemblies required to provide fire resistance.
	[F80-OH4] Applies to floors and elements that support floors.
	[F80-OS3.1] Applies to floors and elements that support floors.
9.23.3.4. Nailing of Framing	
(1)	[F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for

	emergency egress.
(2)	[F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OH4] Applies to floors and elements that support floors.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(3)	[F20-OS2.1] [F20,F22-OS2.3] [F20,F22-OS2.5]
	[F20-OP2.1,OP2.5] [F20,F22-OP2.3] [F22-OP2.4,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
(4)	[F20-OS2.1] [F20,F22-OS2.3] [F20,F22-OS2.5]
	[F20-OP2.1,OP2.5] [F20,F22-OP2.3] [F22-OP2.4,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.23.3.5. Fasteners for Sheathing or Subflooring	
(1)	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5]

	[F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
(2)	[F22-OH4] Applies to floors and elements that support floors.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
(3)	[F22-OH4] Applies to floors and elements that support floors.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
(5)	[F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(6)	[F20-OS2.1] [F20,F22-OS2.5]

	[F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(7)	[F20,F22-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4] Applies to floors and elements that support floors.
	[F22-OS3.1] Applies to floors and elements that support floors.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
(8)	[F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
9.23.4.2. Spans for Joists, Rafters and Beams	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.4,OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for

	emergency egress.
(2)	[F20-OS2.1,OS2.5] [F22-OS2.4,OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(3)	[F20-OS2.1,OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5]
(4)	[F20-OS2.1,OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5]
9.23.4.3. Steel Beams	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.4,OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F22-OH4] Applies to floors and elements that support floors.
(2)	[F20-OS2.1,OS2.5] [F22-OS2.4,OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.

	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F22-OH4] Applies to floors and elements that support floors.
9.23.4.4. Concrete Topping	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.4,OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F20-OS2.1,OS2.5] [F22-OS2.4,OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.

(3)	[F20-OS2.1,OS2.5] [F22-OS2.4,OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to elements that support walls that contain doors or windows required for emergency egress.
9.23.4.5. Heavy Roofing Materials	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.4,OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.5.1. Holes Drilled in Framing Members	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors.

	[F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F22-OH4] Applies to floors and elements that support floors.
9.23.5.2. Notching of Framing Members	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F22-OH4] Applies to floors and elements that support floors.
9.23.5.3. Wall Studs	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.5.4. Top Plates	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5]

	[F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.5.5. Roof Trusses	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.23.6.1. Anchorage of Building Frames	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.

	[F22-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(3)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(4)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20-OS3.1] Applies to floors and elements that support floors.
(5)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(6)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.

	[F20-OS3.1] Applies to floors and elements that support floors.
9.23.6.2. Anchorage of Columns and Posts	
(1)	[F22-OS2.4,OS2.5] [F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F22-OP2.4,OP2.5] [F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F22-OS2.4,OS2.5] [F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F22-OP2.4,OP2.5] [F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F22-OS3.1] Applies to floors and elements that support floors.
	[F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
9.23.6.3. Anchorage of Smaller Buildings	
(1)	[F22-OS2.3,OS2.5]
9.23.7.1. Size of Sill Plates	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.

	[F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.23.7.2. Levelling and Sealing of Sill Plates	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.4,OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.23.8.1. Bearing for Beams	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors. [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.23.8.2. Priming of Steel Beams	
(1)	[F80-OS2.1] [F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F80-OP2.1,OP2.4] [F80-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F80-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F80-OS1.2] Applies to assemblies required to provide fire resistance.
	[F80-OS3.1] Applies to floors and elements that support floors.

	[F80-OH4] Applies to floors and elements that support floors.
9.23.8.3. Built-up Wood Beams	
(1)	[F20-OS2.1]
	[F20-OP2.1]
(2)	[F20-OS2.1]
	[F20-OP2.1]
(3)	[F20-OS2.1]
	[F20-OP2.1]
(4)	[F20-OS2.1]
	[F20-OP2.1]
(5)	[F20-OS2.1]
	[F20-OP2.1]
(6)	[F20-OS2.1]
	[F20-OP2.1]
(7)	[F20-OS2.1]
	[F20-OP2.1]
(8)	[F20-OS2.1]
	[F20-OP2.1]
9.23.9.1. End Bearing for Joists	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.

	[F22-OS3.1]
(2)	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1]
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
9.23.9.2. Joists Supported by Beams	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.

	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(3)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(4)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(5)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]

	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.9.3. Restraint of Joist Bottoms	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.9.4. Strapping, Bridging, Furring and Ceilings in Span Tables 9.23.4.2.-A and -B	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5]

	[F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(3)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(4)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(5)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.

	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(6)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.9.5. Header Joists	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.

9.23.9.6. Trimmer Joists	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.9.7. Support of Tail and Header Joists	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.9.8. Support of Walls	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.

	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(4)	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
(5)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.

	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(6)	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
9.23.9.9. Cantilevered Floor Joists	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5]

	[F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(3)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.10.1. Stud Size and Spacing	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.10.2. Bracing and Lateral Support	

(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to walls that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to walls that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to walls that support or are part of an environmental separator.
	[F22-OH4] Applies to walls that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to walls that support floors. [F22-OS3.7] Applies to walls that contain doors or windows required for emergency egress.
9.23.10.3. Orientation of Studs	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(3)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for

	emergency egress.
9.23.10.4. Continuity of Studs	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.10.5. Support for Cladding, Sheathing and Finishing Materials	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.

	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OH4] Applies to floors and elements that support floors.
9.23.10.6. Studs at Sides of Openings	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors. [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
(2)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors. [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
(3)	[F20-OS2.1] (b) [F20,F22-OS2.5] (b) [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1]

	(b) [F20-OP2.5] (b) [F22-OP2.4,OP2.5] (b) [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	(b) [F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	(b) [F20,F22-OH4] Applies to floors and elements that support floors.
	(b) [F20,F22-OS3.1] Applies to floors and elements that support floors. (b) [F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	(b) [F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.23.11.1. Size of Wall Plates	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
(2)	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.

9.23.11.2. Bottom Wall Plates	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.11.3. Top Plates	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for

	emergency egress.
(2)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(3)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OH4] Applies to floors and elements that support floors.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(4)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.

	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.11.4. Joints in Top Plates	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(3)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.

	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(4)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(5)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.12.1. Openings in Non-Loadbearing Walls	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5]

	[F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F20,F22-OS1.2]
9.23.12.2. Openings in Loadbearing Walls	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.12.3. Lintel Spans and Sizes	
(1)	[F20-OS2.1,OS2.5]

	[F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(3)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.

9.23.13.1. Requirements for Low to Moderate Wind and Seismic Forces	
(2)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to walls that support floors. [F22-OS3.7] Applies to walls that contain doors or windows required for emergency egress.
	[F20,F22-OH4] Applies to walls that support floors.
9.23.13.4. Braced Wall Bands	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to walls that support floors. [F22-OS3.7] Applies to walls that contain doors or windows required for emergency egress.
	[F20,F22-OH4] Applies to walls that support floors.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
(2)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to walls that support floors. [F22-OS3.7] Applies to walls that contain doors or windows required for emergency egress.
	[F20,F22-OH4] Applies to walls that support floors.
(3)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to walls that support floors. [F22-OS3.7] Applies to walls that contain doors or windows required for emergency egress.

	[F20,F22-OH4] Applies to walls that support floors.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
9.23.13.5. Braced Wall Panels in Braced Wall Bands	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to walls that support floors. [F22-OS3.7] Applies to walls that contain doors or windows required for emergency egress.
	[F20,F22-OH4] Applies to walls that support floors.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
(2)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to walls that support floors. [F22-OS3.7] Applies to walls that contain doors or windows required for emergency egress.
	[F20,F22-OH4] Applies to walls that support floors.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
9.23.13.6. Materials in Braced Wall Panels	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to walls that support floors. [F22-OS3.7] Applies to walls that contain doors or windows required for emergency egress.
	[F20,F22-OH4] Applies to walls that support floors.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
(2)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.

	[F22-OS3.1] Applies to walls that support floors.
	[F20,F22-OH4] Applies to walls that support floors.
(4)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to walls that support floors. [F22-OS3.7] Applies to walls that contain doors or windows required for emergency egress.
	[F20,F22-OH4] Applies to walls that support floors.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
(5)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to walls that support floors. [F22-OS3.7] Applies to walls that contain doors or windows required for emergency egress.
	[F20,F22-OH4] Applies to walls that support floors.
	[F20,F22-OH1.1,OH1.2,OH1.3]
(6)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to walls that support floors. [F22-OS3.7] Applies to walls that contain doors or windows required for emergency egress.
	[F20,F22-OH4] Applies to walls that support floors.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
9.23.13.7. Additional System Considerations	
(7)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to walls that support floors.

	[F22-OS3.7] Applies to walls that contain doors or windows required for emergency egress.
	[F20,F22-OH4] Applies to walls that support floors.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
9.23.14.1. Continuity of Rafters and Joists	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.23.14.2. Framing around Openings	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.23.14.3. End Bearing Length	
(1)	[F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.5] [F22-OP2.5] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
9.23.14.4. Location and Attachment of Rafters	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]

	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
(2)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
(3)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.23.14.5. Shaping of Rafters	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.23.14.6. Hip and Valley Rafters	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
9.23.14.7. Intermediate Support for Rafters and Joists	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
(2)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]

	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
(4)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
(5)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
(6)	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F22-OH4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.14.8. Ridge Support	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(3)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.

	[F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(4)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(5)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(6)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(7)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.23.14.9. Restraint of Joist Bottoms	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]

	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.23.14.10. Ceiling Joists Supporting Roof Load	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
(2)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.23.14.11. Roof Trusses	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	(b) [F20,F22-OH1.1,OH1.2,OH1.3]
	(b) [F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
(3)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
(4)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
(5)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
(6)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]

	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.23.15.1. Subflooring Required	
(1)	[F20-OS2.1]
9.23.15.2. Material Standards	
(1)	[F22-OS3.1]
	[F22-OP2.4]
	[F22-OH4]
	[F20-OS2.1]
(2)	[F80-OS3.1]
	[F80-OP2.4]
	[F80-OH4]
	[F80-OS2.1]
(3)	[F22-OS3.1]
	[F22-OP2.4]
	[F22-OH4]
	[F20-OS2.1]
(4)	[F80-OS3.1]
	[F80-OP2.4]
	[F80-OH4]
	[F80-OH1.1]
9.23.15.3. Edge Support	
(1)	[F22-OS3.1]
	[F22-OP2.4]
	[F22-OH4]
9.23.15.4. Direction of Installation	

(1)	[F22-OS3.1]
	[F22-OP2.4]
	[F22-OH4]
(2)	[F22-OS3.1]
	[F22-OP2.4]
	[F22-OH4]
9.23.15.5. Subfloor Thickness or Rating	
(1)	[F22-OS3.1]
	[F22-OP2.4]
	[F22-OH4]
	[F20-OS2.1]
(2)	[F20-OS2.1]
	[F22-OS3.1]
	[F22-OH4]
	[F22-OP2.4]
(3)	[F20-OS2.1]
	[F22-OH4]
	[F22-OS3.1]
	[F22-OP2.4]
9.23.15.6. Annular Grooved Nails	
(1)	[F81-OS2.3]
	[F81-OP2.3]
	[F81-OH1.1]
9.23.15.7. Lumber Subflooring	
(1)	[F22-OS3.1]
	[F22-OP2.4]

	[F22-OH4]
(2)	[F22-OS3.1]
	[F22-OP2.4]
	[F22-OH4]
(3)	[F22-OS3.1]
	[F22-OP2.4]
9.23.16.1. Required Roof Sheathing	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
9.23.16.2. Material Standards	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.23.16.3. Direction of Installation	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
(2)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.23.16.4. Joints in Panel-Type Sheathing	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]

	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
(2)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.23.16.5. Lumber Roof Sheathing	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
(2)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH1.1,OH1.2,OH1.3]
9.23.16.6. Edge Support	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.23.16.7. Thickness or Rating	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F22-OH4]

	[F22-OS3.1]
(2)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
(3)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
(4)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
9.23.17.1. Required Sheathing	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F20,F22-OH4] Applies to floors and elements that support floors.
9.23.17.2. Thickness, Rating and Material Standards	
(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
9.23.17.4. Lumber Sheathing	

(1)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.
(2)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to floors and elements that support floors. [F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F20,F22-OH4] Applies to floors and elements that support floors.
9.23.17.5. Joints in Panel-Type Sheathing	
(1)	[F80,F81-OS2.3]
	[F80,F81-OP2.3,OP2.4]
	[F80,F81-OH1.1,OH1.2,OH1.3]
	[F80,F81-OH4] Applies to floors and elements that support floors.
	[F80,F81-OS3.1] Applies to floors and elements that support floors.
9.24.1.2. Material Standards	
(1)	[F20-OP2.1,OP2.4] [F22,F80-OP2.4] [F20,F22,F80-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS2.1,OS2.4] [F22,F80-OS2.4] [F20,F22,F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22,F80-OH1.1,OH1.2,OH1.3]
	[F20,F22,F80-OS1.2] Applies to assemblies required to provide fire resistance.

	[F22,F80-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.24.1.4. Screws	
(1)	[F20-OP2.1,OP2.4] [F22,F80-OP2.4] [F20,F22,F80-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22,F80-OS2.1] [F20,F22,F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22,F80-OH1.1,OH1.2,OH1.3]
	[F20,F22,F80-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22,F80-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.24.1.5. Cladding, Sheathing and Interior Finish Required	
(1)	[F20,F22,F80-OH1.1,OH1.2,OH1.3]
	[F20,F22,F80-OS2.1] [F20,F22,F80-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22,F80-OP2.1,OP2.4] [F20,F22,F80-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22,F80-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22,F80-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.24.2.1. Size and Spacing of Studs in Interior Walls	
(1)	[F20-OP2.1,OP2.4] [F22-OP2.4]
	[F20-OS2.1,OS2.4] [F22-OS2.4]
	[F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.24.2.2. Thickness of Studs	
(1)	[F20-OP2.1,OP2.4] [F22-OP2.4]
	[F20-OS2.1,OS2.4] [F22-OS2.4]
	[F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.

9.24.2.3. Runners	
(1)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.4] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.24.2.4. Openings in Fire Separations	
(1)	[F20-OS1.2]
(2)	[F20-OS1.2]
(3)	[F20-OS1.2]
(4)	[F20-OS1.2]
9.24.2.5. Size and Spacing of Studs in Exterior Walls	
(1)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4]
	[F20-OP2.1,OP2.3,OP2.4] [F22-OP2.3,OP2.4]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22,F80-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.24.3.1. Installation of Runners	
(1)	[F20-OP2.1,OP2.4] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.4] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22,F80-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for

	emergency egress.
(2)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.4] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(3)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS2.1,OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OP2.1,OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(4)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.4] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
9.24.3.2. Fire-Rated Walls	
(1)	[F21-OS1.2]
(2)	[F21-OS1.2]
(3)	[F20-OS1.2]

(4)	[F20-OS1.2]
(5)	[F03-OS1.2]
9.24.3.3. Orientation of Studs	
(1)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.4] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.24.3.4. Support for Cladding Materials	
(1)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.4] [F20-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F20-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.24.3.5. Framing around Openings	
(1)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.4] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.

(2)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.4] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
9.24.3.6. Attachment of Studs to Runners	
(1)	[F20-OS2.1,OS2.4] [F22-OS2.4] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F22-OP2.4] [F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(2)	[F21-OS1.2]
9.24.3.7. Openings for Fire Dampers	
(1)	[F20-OS1.2]
(2)	[F20-OS1.2]
(3)	[F03-OS1.2]
9.25.1.1. Scope and Application	
(2)	[F51,F63-OH1.1,OH1.2] [F55-OH1.1,OH1.2,OH1.3]
	[F55,F63-OS2.3]
9.25.2.1. Required Insulation	
(1)	[F51,F63-OH1.1,OH1.2]

	[F63-OS2.3]
9.25.2.2. Insulation Materials	
(1)	[F51,F63,F80-OH1.1,OH1.2]
	[F63,F80-OS2.3]
(3)	[F51,F63-OH1.1,OH1.2]
	[F63-OS2.3]
9.25.2.3. Installation of Thermal Insulation	
(1)	[F51,F63-OH1.1,OH1.2]
	[F63-OS2.3]
(2)	[F51,F63-OH1.1,OH1.2]
	[F63-OS2.3]
(3)	[F55-OH1.1,OH1.2]
	[F55-OS2.3]
(4)	[F51,F63,F80-OH1.1,OH1.2]
	[F63,F80-OS2.3]
(5)	[F21-OH1.1,OH1.2,OH1.3]
	[F21-OS2.2,OS2.3]
(6)	[F80-OH1.1,OH1.2]
	[F80-OS2.3]
(7)	[F80-OH1.1,OH1.2]
	[F80-OS2.3]
(8)	[F21-OH1.1,OH1.2]
	[F21-OS2.3]
9.25.2.4. Installation of Loose-Fill Insulation	
(1)	[F51,F63-OH1.1,OH1.2]
	[F63-OS2.3]

(2)	[F51-OH1.1,OH1.2,OH1.3]
	[F51-OS2.3]
(4)	(a) [F21,F51-OS2.3]
	(a) [F21,F51-OH1.1,OH1.2]
	(c) [F81-OS2.1,OS2.3] (c) [F81-OS2.1,OS2.3,OS2.4,OS2.5] Applies where the interior finish provides the required bracing.
	(c) [F81-OH1.1,OH1.2] (c) [F81-OH1.1,OH1.2,OH1.3] Applies where the interior finish provides the required bracing.
	(c) [F81-OP2.1,OP2.3,OP2.4,OP2.5] Applies where the interior finish provides to the required bracing.
	(c) [F81-OP3.1] Applies where the interior finish contributes to the required fire resistance of the wall.
	(c) [F81-OS3.7] Applies where the interior finish provides the required bracing. (c) [F81-OS3.1] Applies where the interior finish provides the required bracing of walls that support floors.
	(c) [F81-OH4] Applies where the interior finish provides the required bracing of walls that support floors.
	(d) [F80-OS2.3]
	(d) [F80-OH1.1,OH1.2,OH1.3]
(5)	[F51,F63-OH1.1,OH1.2]
	[F63-OS2.3]
(6)	(a) [F51,F62-OH1.1,OH1.2,OH1.3] (b) [F51,F63-OH1.1,OH1.2]
	(a) [F62,F51-OS2.3] (b) [F51,F63-OS2.3]
9.25.2.5. Installation of Spray-Applied Polyurethane	
(1)	[F51,F41,F63-OH1.1] [F51,F63-OH1.2]
	[F63-OS2.3]
9.25.3.1. Required Barrier to Air Leakage	
(1)	[F55-OH1.1,OH1.2,OH1.3] [F40-OH1.1]
	[F55-OS2.3]
	[F44-OS1.1] Applies where the *air barrier system* separates a garage, or *suite* containing a garage, from residential space.

	[F44-OS3.4] Applies where the *air barrier system* separates a garage, or *suite* containing a garage, from residential space.
9.25.3.2. Air Barrier System Properties	
(1)	[F20,F55-OH1.1,OH1.2,OH1.3] [F40-OH1.1]
	[F20,F55-OS2.3]
	[F20,F44-OS1.1] Applies where the *air barrier system* separates a garage, or *suite* containing a garage, from residential space.
	[F20,F44-OS3.4] Applies where the *air barrier system* separates a garage, or *suite* containing a garage, from residential space.
(2)	[F20,F80,F55-OH1.1,OH1.2,OH1.3] [F40-OH1.1]
	[F20,F80,F55-OS2.3]
	[F20,F80,F44-OS1.1] Applies where the *air barrier system* separates a garage, or *suite* containing a garage, from residential space.
	[F20,F80,F44-OS3.4] Applies where the *air barrier system* separates a garage, or *suite* containing a garage, from residential space.
9.25.3.3. Continuity of the Air Barrier System	
(1)	[F55-OH1.1,OH1.2,OH1.3] [F40-OH1.1]
	[F55-OS2.3]
	[F44-OS1.1] Applies where the *air barrier system* separates a garage, or *suite* containing a garage, from residential space.
	[F44-OS3.4] Applies where the *air barrier system* separates a garage, or *suite* containing a garage, from residential space.
(2)	[F55-OH1.1,OH1.2,OH1.3] [F40-OH1.1]
	(a) [F44-OS3.4] Applies where the *air barrier system* separates a garage, or *suite* containing a garage, from residential space.
	[F55-OS2.3]
	(a) [F44-OS1.1] Applies where the *air barrier system* separates a garage, or *suite* containing a garage, from residential space.
(6)	[F55-OH1.1,OH1.2,OH1.3] [F40-OH1.1]
	[F55-OS2.3]
	[F44-OS1.1] Applies where the *air barrier system* separates a garage, or *suite* containing a garage, from

	residential space.
	[F44-OS3.4] Applies where the *air barrier system* separates a garage, or *suite* containing a garage, from residential space.
(7)	[F55-OH1.1,OH1.2,OH1.3] [F40-OH1.1]
	[F55-OS2.3]
(8)	[F01-OS1.1]
9.25.3.4. Air Leakage Control in Masonry Walls	
(1)	[F40-OH1.1]
(2)	[F40-OH1.1]
9.25.3.5. Air Leakage Control in Underground Roofs	
(1)	[F40-OH1.1]
9.25.3.6. Air Barrier Systems in Floors-on-ground	
(1)	[F40-OH1.1]
(2)	[F40-OH1.1]
(3)	[F40-OH1.1]
(5)	[F40-OH1.1]
(6)	[F40-OH1.1]
9.25.4.1. Required Barrier to Vapour Diffusion	
(1)	[F63-OH1.1,OH1.2]
	[F63-OS2.3]
9.25.4.2. Vapour Barrier Materials	
(1)	[F63-OS2.3]
	[F63-OH1.1,OH1.2]
(2)	[F62,F63-OS2.3]
	[F62,F63-OH1.1,OH1.2,OH1.3]
(3)	[F63,F80-OS2.3]
	[F63,F80-OH1.1,OH1.2]

(4)	[F63,F80-OS2.3]
	[F63,F80-OH1.1,OH1.2]
(5)	[F63-OS2.3]
	[F63-OH1.1,OH1.2]
(6)	[F63-OS2.3]
	[F63-OH1.1,OH1.2]
9.25.4.3. Installation of Vapour Barriers	
(1)	[F63-OH1.1,OH1.2]
	[F63-OS2.3]
(2)	[F63-OH1.1,OH1.2]
	[F63-OS2.3]
(3)	[F63-OS2.3]
	[F63-OH1.1,OH1.2]
9.25.5.1. General	
(2)	[F62,F63-OS2.3]
	[F62,F63-OH1.1,OH1.2,OH1.3]
9.25.5.2. Position of Low Permeance Materials	
(1)	[F62,F63-OS2.3]
	[F62,F63-OH1.1,OH1.2]
9.26.1.2. Required Protection	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.1.3. Alternative Installation Methods	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.2.1. Material Standards	

(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.2.2. Installation of Materials	
(1)	[F61-OH1.2,OH1.3,OH1.1]
	[F61-OS2.3]
9.26.2.3. Nails	
(1)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
(2)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
(3)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
(4)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
9.26.2.4. Staples	
(1)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
(2)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
(3)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
9.26.3.1. Slope	
(1)	[F20-OS2.1,OS2.3] [F61,F80-OS2.3]
	[F20,F61,F80-OH1.1,OH1.2,OH1.3]

(2)	[F20,F61,F80-OS2.3]
	[F20,F61,F80-OH1.1,OH1.2,OH1.3]
(3)	[F61,F80-OS2.3]
	[F61,F80-OH1.1,OH1.2,OH1.3]
(4)	[F61,F80-OS2.3]
	[F61,F80-OH1.1,OH1.2,OH1.3]
(5)	[F21-OS2.3]
	[F21-OH1.1,OH1.2,OH1.3]
9.26.4.1. Required Flashing at Intersections	
(1)	[F61-OS2.3]
	[F61-OH1.1,OH1.2,OH1.3]
9.26.4.2. Materials	
(1)	[F61,F62,F80-OH1.1,OH1.2,OH1.3]
	[F61,F62,F80-OS2.3]
9.26.4.3. Valley Flashing	
(1)	[F61-OS2.3]
	[F61-OH1.1,OH1.2,OH1.3]
(2)	[F20-OS2.1,OS2.3] [F22-OS2.3,OS2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]
(3)	[F61-OS2.3]
	[F61-OH1.1,OH1.2,OH1.3]
(4)	[F20,F61,F80-OH1.1,OH1.2,OH1.3]
	[F20,F61,F80-OS2.3]
(5)	[F20,F61,F80-OH1.1,OH1.2,OH1.3]
	[F20,F61,F80-OS2.3]
(6)	[F20,F61,F80-OH1.1,OH1.2,OH1.3]

	[F20,F61,F80-OS2.3]
9.26.4.4. Intersection of Shingle Roofs and Masonry	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
	[F61-OS1.1] Applies where a shingle roof intersects with a masonry *chimney*.
	[F61-OP1.1] Applies where a shingle roof intersects with a masonry *chimney*.
	[F61-OS3.4] Applies where a shingle roof intersects with a masonry *chimney*.
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
	[F61-OS1.1] Applies where counter flashing is installed between a shingle roof and a masonry *chimney*.
	[F61-OP1.1] Applies where counter flashing is installed between a shingle roof and a masonry *chimney*.
	[F61-OS3.4] Applies where counter flashing is installed between a shingle roof and a masonry *chimney*.
(3)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
	[F61-OS1.1] Applies where flashing is installed between a shingle roof and a masonry *chimney*.
	[F61-OP1.1] Applies where flashing is installed between a shingle roof and a masonry *chimney*.
	[F61-OS3.4] Applies where flashing is installed between a shingle roof and a masonry *chimney*.
(4)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
	[F61-OS1.1] Applies where a shingle roof slopes upward from a masonry *chimney*.
	[F61-OP1.1] Applies where a shingle roof slopes upward from a masonry *chimney*.
	[F61-OS3.4] Applies where a shingle roof slopes upward from a masonry *chimney*.
9.26.4.5. Intersection of Shingle Roofs and Walls other than Masonry	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]

	[F61-OS2.3]
(3)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.4.6. Intersection of Built-Up Roofs and Masonry	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
	[F61-OS1.1] Applies where a built-up roof intersects with a masonry *chimney*.
	[F61-OP1.1] Applies where a built-up roof intersects with a masonry *chimney*.
	[F61-OS3.4] Applies where a built-up roof intersects with a masonry c*himney*.
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
	[F61-OS1.1] Applies where counter flashing is installed between a built-up roof and a masonry *chimney*.
	[F61-OP1.1] Applies where counter flashing is installed between a built-up roof and a masonry *chimney*.
	[F61-OS3.4] Applies where counter flashing is installed between a built-up roof and a masonry *chimney*.
9.26.4.7. Intersection of Built-Up Roofs and Walls other than Masonry	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(3)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.4.8. Chimney Saddles	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
	[F61-OS1.1]
	[F61-OP1.1]

	[F61-OS3.4]
(2)	[F20,F81-OH1.1,OH1.2,OH1.3]
	[F20,F81-OS2.3]
	[F20,F81-OS1.1]
	[F20,F81-OP1.1]
	[F20,F81-OS3.4]
(3)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(5)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
	[F61-OS1.1]
	[F61-OP1.1]
	[F61-OS3.4]
9.26.5.1. Required Eave Protection	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.5.2. Materials	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.6.1. Materials	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F62-OH1.1,OH1.2,OH1.3]
	[F62-OS2.3]
9.26.6.2. Installation	
(1)	[F61-OH1.1,OH1.2,OH1.3]

	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(3)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.7.1. Coverage	
(1)	[F61,F80-OH1.1,OH1.2,OH1.3]
	[F61,F80-OS2.1]
9.26.7.2. Starter Strip	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61,F80-OH1.1,OH1.2,OH1.3]
	[F61,F80-OS2.3]
(3)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.7.3. Head Lap	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.7.4. Fasteners	
(1)	[F20,F61-OH1.1,OH1.2,OH1.3]
	[F20,F61-OS2.3]
(2)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
(3)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
(4)	[F20-OH1.1,OH1.2,OH1.3]

	[F20-OS2.3]
(5)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
9.26.7.5. Securing of Tabs	
(1)	[F20,F61-OH1.1,OH1.2,OH1.3]
	[F20,F61-OS2.3]
9.26.7.6. Hips and Ridges	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
9.26.8.1. Coverage	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.8.2. Starter Strip	
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.8.3. Securing of Tabs	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.8.4. Securing of Shingle Courses	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(3)	[F61-OS2.3]

	[F61-OH1.1,OH1.2,OH1.3]
9.26.8.5. Hips and Ridges	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61,F80-OS2.3]
	[F61,F80-OH1.1,OH1.2,OH1.3]
9.26.9.2. Grade	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.9.3. Size	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.9.4. Spacing and Joints	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.9.5. Fastening	
(1)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
9.26.9.6. Exposure	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.10.1. Size and Thickness	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]

9.26.10.2. Underlay	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(3)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.10.3. Spacing and Joints	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.10.4. Fastening	
(1)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
9.26.10.5. Exposure	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.10.8. Grade	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.11.1. Quantity of Materials	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.11.2. Coal-Tar and Asphalt Products	
(1)	[F61,F80-OH1.1,OH1.2,OH1.3]
	[F61,F80-OS2.3]
9.26.11.3. Roof Felts	

(1)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
9.26.11.4. Aggregate Surfacing	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.11.6. Number of Layers	
(1)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
9.26.11.7. Installation of Layers	
(1)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
(2)	[F61,F81-OH1.1,OH1.2,OH1.3]
	[F61,F81-OS2.3]
(3)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
9.26.11.8. Roofing over Wood-Based Sheathing	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.11.9. Attachment to Decking	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.11.10. Cant Strips	

(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
	[F61-OS3.1]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(3)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(4)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
	[F61-OS3.1]
(5)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(6)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.12.1. Coverage	
(1)	[F61,F80-OH1.1,OH1.2,OH1.3]
	[F61,F80-OS2.3]
9.26.12.2. Joints	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.13.1. Thickness	
(1)	[F61,F80-OH1.1,OH1.2,OH1.3]
	[F61,F80-OS2.3]
9.26.13.2. Support	
(1)	[F20-OS2.1,OS2.3] [F22-OS2.3,OS2.4]
	[F20-OP2.1,OP2.3] [F22-OP2.3,OP2.4]

	[F20,F22-OH1.1,OH1.2,OH1.3]
9.26.14.1. Support	
(1)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3] [F22-OS2.3,OS2.4]
	[F20-OP2.1,OP2.3] [F22-OP2.3,OP2.4]
9.26.15.1. Installation	
(1)	[F61,F80-OH1.1,OH1.2,OH1.3]
	[F61,F80-OS2.3]
9.26.16.1. Installation	
(1)	[F61,F80-OH1.1,OH1.2,OH1.3]
	[F61,F80-OS2.3]
9.26.17.1. Installation	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.18.2. Downspouts	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.26.18.3. Roof or Balcony Parapet Walls	
(1)	[F81-OS2.1, OS2.2, OS2.3]
9.27.2.1. Minimizing and Preventing Ingress and Damage	
(1)	[F61-OS2.3]
	[F61-OH1.1,OH1.2,OH1.3]
(2)	[F80,F81-OS2.3]
	[F80,F81-OH1.1,OH1.2,OH1.3]
9.27.2.2. Minimum Protection from Precipitation Ingress	
(3)	[F62-OS2.3]

	[F62-OH1.1,OH1.2,OH1.3]
(4)	[F61,F62-OS2.3]
	[F61,F62-OH1.1,OH1.2,OH1.3]
(5)	[F61,F62-OS2.3]
	[F61,F62-OH1.1,OH1.2,OH1.3]
9.27.2.3. First and Second Planes of Protection	
(1)	[F61,F62-OS2.3]
	[F61,F62-OH1.1,OH1.2,OH1.3]
9.27.2.4. Protection of Cladding from Moisture	
(1)	[F61,F80-OS2.3]
	[F61,F80-OH1.1,OH1.2,OH1.3]
(2)	[F61,F80-OS2.3]
	[F61-OH1.1,OH1.2,OH1.3]
9.27.3.1. Elements of the Second Plane of Protection	
(1)	[F61,F62-OS2.3]
	[F61,F62-OH1.1,OH1.2,OH1.3]
(3)	[F61,F62-OS2.3]
	[F61,F62-OH1.1,OH1.2,OH1.3]
9.27.3.2. Sheathing Membrane Material Standard	
(1)	[F20,F61,F62,F55-OS2.3]
	[F20,F61,F62,F55-OH1.1,OH1.2,OH1.3]
9.27.3.3. Required Sheathing Membrane and Installation	
(1)	[F61,F55-OS2.3]
	[F61,F55-OH1.1,OH1.2,OH1.3]
(2)	[F61,F55-OS2.3]
	[F61,F55-OH1.1,OH1.2,OH1.3]

(3)	[F61-OS2.3]
	[F61-OH1.1,OH1.2,OH1.3]
9.27.3.4. Insulating Sheathing in lieu of Sheathing Membrane	
(2)	[F61,F55-OS2.3]
	[F61,F55-OH1.1,OH1.2,OH1.3]
9.27.3.5. Sheathing Membranes in lieu of Sheathing	
(1)	[F61,F55-OS2.3]
	[F61,F55-OH1.1,OH1.2,OH1.3]
(2)	[F61,F55-OS2.3]
	[F61,F55-OH1.1,OH1.2,OH1.3]
9.27.3.6. Face Sealed Cladding	
(2)	[F20,F61,F55-OS2.3]
	[F20,F61,F55-OH1.1,OH1.2,OH1.3]
(3)	[F61,F55-OS2.3]
	[F61,F55-OH1.1,OH1.2,OH1.3]
9.27.3.7. Flashing Materials	
(1)	[F61,F62,F80-OS2.3]
	[F61,F62,F80-OH1.1,OH1.2,OH1.3]
9.27.3.8. Flashing Installation	
(1)	(a),(b),(c)(i) [F61-OS2.3]
	(a),(b),(c)(i) [F61-OH1.1,OH1.2,OH1.3]
	(c)(ii) [F61,F62-OS2.3]
	(c)(ii) [F61,F62-OH1.1,OH1.2,OH1.3]
(2)	(a),(b)(ii),(c)(i) [F61-OS2.3] Applies to detailing of horizontal joints.
	(a),(b)(ii),(c)(i) [F61-OH1.1,OH1.2,OH1.3] Applies to detailing of horizontal joints.
	(b)(i),(c)(ii) [F61,F62-OS2.3] Applies to cladding installed outboard of a drained and vented air space.

	(b)(i), (c)(ii) [F61,F62-OH1.1,OH1.2,OH1.3] Applies to cladding installed outboard of a drained and vented air space.
(3)	[F61,F62-OS2.3]
	[F61,F62-OH1.1,OH1.2,OH1.3]
(4)	[F61,F62-OS2.3]
	[F61,F62-OH1.1,OH1.2,OH1.3]
(5)	[F61,F62-OS2.3]
	[F61,F62-OH1.1,OH1.2,OH1.3]
9.27.4.1. Required Sealants	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(3)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.27.4.2. Materials	
(1)	[F80-OH1.1,OH1.2,OH1.3]
	[F80-OS2.3]
(2)	[F80-OH1.1,OH1.2,OH1.3]
	[F80-OS2.3]
(3)	[F80-OH1.1,OH1.2,OH1.3]
	[F80-OS2.3]
9.27.5.1. Attachment	
(1)	[F20-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
	[F20-OP2.1,OP2.3,OP2.4] [F22-OP2.3,OP2.4,OP2.5] Applies where panel-type cladding is installed to provide the required bracing.

	[F20-OH1.1,OH1.2,OH1.3] [F20,F22-OH1.1,OH1.2,OH1.3] Applies where panel-type cladding is installed to provide the required bracing.
	[F20,F22-OH4] Applies where panel-type cladding is installed to provide the required bracing of walls that support floors.
	[F20,F22-OS3.1] Applies where panel-type cladding is installed to provide the required bracing of walls that support floors. [F20,F22-OS3.7] Applies where panel-type cladding is installed to provide required bracing of walls that contain doors or windows required for emergency egress.
(2)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3]
(3)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
(4)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3]
(5)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3]
(6)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3]
9.27.5.2. Blocking	
(1)	[F20-OH1.1,OH1.2,OH1.3] [F20,F22-OH1.1,OH1.2,OH1.3] Applies where panel-type cladding is installed to provide the required bracing.
	[F20-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
	[F20-OP2.1,OP2.3,OP2.4] [F22-OP2.3,OP2.4,OP2.5] Applies where panel-type cladding is installed to provide the required bracing.
9.27.5.3. Furring	
(1)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where furring is used for the attachment of panel-type cladding installed to provide the required bracing.
(2)	[F20-OH1.1,OH1.2,OH1.3]

	[F20,F22-OH1.1,OH1.2,OH1.3] Applies where furring is used for the attachment of panel-type cladding installed to provide the required bracing.
	[F20-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where furring is used for the attachment of panel-type cladding installed to provide the required bracing.
(3)	[F20-OH1.1,OH1.2,OH1.3] [F20,F22-OH1.1,OH1.2,OH1.3] Applies where furring is used for the attachment of panel-type cladding installed to provide the required bracing.
	[F20-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where furring is used for the attachment of panel-type cladding installed to provide the required bracing.
9.27.5.4. Size and Spacing of Fasteners	
(1)	[F20-OH1.1,OH1.2,OH1.3] [F20,F22-OH1.1,OH1.2,OH1.3] Applies to the attachment of panel-type cladding installed to provide the required bracing.
	[F20-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
9.27.5.5. Fastener Materials	
(1)	[F80-OH1.1,OH1.2,OH1.3]
	[F80-OS2.3] [F80-OS2.3,OS2.4] Applies where panel-type cladding is installed to provide the required bracing.
	[F80-OP2.1,OP2.3,OP2.4,OP2.5] Applies where panel-type cladding is installed to provide the required bracing.
9.27.5.6. Expansion and Contraction	
(1)	[F21-OH1.1,OH1.2,OH1.3]
	[F21-OS2.3]
9.27.5.7. Penetration of Fasteners	
(1)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3]
(2)	[F20-OH1.1,OH1.2,OH1.3] [F20,F22-OH1.1,OH1.2,OH1.3] Applies where panel-type cladding is installed to provide the required bracing.
	[F20-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide

	the required bracing.
	[F20-OP2.1,OP2.3,OP2.4] [F22-OP2.3,OP2.4,OP2.5] Applies where panel-type cladding is installed to provide the required bracing.
9.27.6.1. Materials	
(1)	[F61,F20-OH1.1,OH1.2,OH1.3]
	[F62,F20-OS2.3]
9.27.6.2. Thickness and Width	
(1)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
(2)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
(3)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
9.27.6.3. Joints	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F21,F61-OH1.1,OH1.2,OH1.3]
	[F21,F61-OS2.3]
9.27.7.1. Materials	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61,F20-OH1.1,OH1.2,OH1.3]
	[F61,F20-OS2.3]
(3)	[F61,F20-OH1.1,OH1.2,OH1.3]
	[F61,F20-OS2.3]
9.27.7.2. Width	
(1)	[F61,F20-OH1.1,OH1.2,OH1.3]

	[F61,F20-OS2.3]
9.27.7.3. Fasteners	
(1)	[F61,F20-OH1.1,OH1.2,OH1.3]
	[F61,F20-OS2.3]
9.27.7.4. Offsetting of Joints	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.27.7.5. Fastening to Lath	
(1)	[F81-OH1.1,OH1.2,OH1.3]
	[F81-OS2.3]
(2)	[F62-OH1.1,OH1.2,OH1.3]
	[F62-OS2.3]
(3)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
(4)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
(5)	[F62-OH1.1,OH1.2,OH1.3]
	[F62-OS2.3]
9.27.7.6. Exposure and Thickness	
(1)	[F62,F20-OH1.1,OH1.2,OH1.3]
	[F62,F20-OS2.3]
9.27.8.1. Material Standards	
(1)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide

	the required bracing.
	[F20-OP2.1,OP2.3,OP2.4] [F22-OP2.3,OP2.4,OP2.5] Applies where panel-type cladding is installed to provide the required bracing.
9.27.8.2. Thickness	
(1)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
(2)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
	[F20-OP2.1,OP2.3] [F22-OP2.3,OP2.4,OP2.5] Applies where panel-type cladding is installed to provide the required bracing.
9.27.8.3. Edge Treatment	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3] [F61-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
	[F61-OP2.3,OP2.4,OP2.5] Applies where panel-type cladding is installed to provide the required bracing.
9.27.8.4. Panel Cladding	
(1)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
	[F20-OP2.1,OP2.3,OP2.4] [F22-OP2.3,OP2.4,OP2.5] Applies where panel-type cladding is installed to provide the required bracing.
(2)	[F21-OH1.1,OH1.2,OH1.3]
	[F21-OS2.3]
(3)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(4)	[F61-OH1.1,OH1.2,OH1.3]

	[F61-OS2.3]
9.27.8.5. Lapped Strip Siding	
(1)	[F21,F61-OH1.1,OH1.2,OH1.3]
	[F21,F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(3)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.27.9.1. Material Standards	
(1)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
(2)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
9.27.9.2. Thickness	
(1)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
	[F20-OP2.1,OP2.3,OP2.4] [F22-OP2.3,OP2.4,OP2.5] Applies where panel-type cladding is installed to provide the required bracing.
(2)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
(3)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.

	[F20-OP2.1,OP2.3,OP2.4] [F22-OP2.3,OP2.4,OP2.5] Applies where panel-type cladding is installed to provide the required bracing.
9.27.9.3. Panel Cladding	
(1)	[F20,F21,F22-OH1.1,OH1.2,OH1.3]
	[F20,F21,F22-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
	[F20-OP2.1,OP2.3,OP2.4] [F22-OP2.3,OP2.4,OP2.5] Applies where panel-type cladding is installed to provide the required bracing.
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(3)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.27.9.4. Lapped Strip Siding	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.27.9.5. Clearance	
(1)	[F21-OH1.1,OH1.2,OH1.3]
	[F21-OS2.1,OS2.3] [F21-OS2.1,OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
	[F21-OP2.1,OP2.3,OP2.4,OP2.5] Applies where panel-type cladding is installed to provide the required bracing.
9.27.10.1. Material Standard	
(1)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
9.27.10.2. Thickness	

(1)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
(2)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
	[F20-OP2.1,OP2.3,OP2.4] [F22-OP2.3,OP2.4,OP2.5] Applies where panel-type cladding is installed to provide the required bracing.
(3)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
(4)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS2.1,OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
	[F20-OP2.1,OP2.3,OP2.4] [F22-OP2.3,OP2.4,OP2.5] Applies where panel-type cladding is installed to provide the required bracing.
9.27.10.3. Panel Cladding	
(1)	[F20,F22,F80-OH1.1,OH1.2,OH1.3]
	[F20,F22,F80-OS2.1,OS2.3] [F20,F80-OS2.1,OS2.3,OS2.4] [F22,F80-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
(2)	[F21-OH1.1,OH1.2,OH1.3]
	[F21-OS2.3]
(3)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(4)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.27.10.4. Clearance	

(1)	[F21-OH1.1,OH1.2,OH1.3]
	[F21-OS2.1,OS2.3] [F21-OS2.1,OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
	[F21-OP2.1,OP2.3,OP2.4,OP2.5] Applies where panel-type cladding is installed to provide the required bracing.
9.27.11.1. Material Standards	
(1)	[F20,F22,F61,F62-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3] [F22,F61,F62-OS2.3]
(2)	[F20,F22,F61-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3] [F22,F61-OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
(3)	[F20,F22,F61-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3] [F22,F61-OS2.3]
(4)	[F20,F22,F61-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3] [F22,F61-OS2.3] [F20-OS2.1,OS2.3,OS2.4] [F22-OS2.3,OS2.4,OS2.5] Applies where panel-type cladding is installed to provide the required bracing.
9.27.12.1. Material Standard	
(1)	[F62,F61,F20-OH1.1,OH1.2,OH1.3]
	[F62,F61,F20-OS2.3]
9.27.13.1. Application	
(1)	[F61,F62-OH1.1,OH1.2,OH1.3]
	[F61,F62-OS2.3]
9.27.13.2. Materials	
(1)	[F20,F61,F62-OH1.1,OH1.2,OH1.3]
	[F20,F61,F62-OS2.3]
(2)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS2.3]

9.27.13.3. Design and Installation	
(1)	[F20,F61,F62-OH1.1,OH1.2,OH1.3]
	[F20,F61,F62-OS2.3]
9.28.1.1. Sheathing beneath Stucco	
(1)	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OS2.3]
9.28.1.2. Lath and Reinforcing	
(1)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
(2)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
(3)	[F20,F21-OS1.1]
	[F20,F21-OS2.3]
	[F20,F21-OS3.4]
	[F20,F21-OP1.1]
	[F20,F21-OH1.1]
9.28.1.3. Concrete Masonry Units	
(1)	[F80-OH1.1,OH1.2,OH1.3]
	[F80-OS2.3]
	[F80-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F80-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F80-OP1.1] Applies where stucco is applied to masonry *chimneys*.
9.28.1.4. Clearance over Ground Level	
(1)	[F80-OH1.1,OH1.2,OH1.3]
	[F80-OS2.3]
9.28.1.5. Flashing and Caulking	

(1)	[F80-OH1.1,OH1.2,OH1.3] Applies to the separation of aluminum flashing from stucco.
	[F80-OS2.3] Applies to the separation of aluminum flashing from stucco.
9.28.2.1. Portland Cement	
(1)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20-OP1.1] Applies where stucco is applied to masonry *chimneys*.
9.28.2.2. Aggregate	
(1)	[F80-OH1.1,OH1.2,OH1.3]
	[F80-OS2.3]
	[F80-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F80-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F80-OP1.1] Applies where stucco is applied to masonry *chimneys*.
(2)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
	[F20,F80-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20,F80-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20,F80-OP1.1] Applies where stucco is applied to masonry *chimneys*.
9.28.2.3. Water	
(1)	[F80-OH1.1,OH1.2,OH1.3]
	[F80-OS2.3]
	[F80-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F80-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F80-OP1.1] Applies where stucco is applied to masonry *chimneys*.
9.28.3.1. Materials	

(1)	[F80-OH1.1,OH1.2,OH1.3]
	[F80-OS2.3]
	[F80-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F80-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F80-OP1.1] Applies where stucco is applied to masonry *chimneys*.
9.28.3.2. Nails and Staples	
(1)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20-OP1.1] Applies where stucco is applied to masonry *chimneys*.
(2)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
(3)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20-OP1.1] Applies where stucco is applied to masonry *chimneys*.
(4)	[F20-OS2.1]
9.28.4.1. Materials	
(1)	[F80-OH1.1,OH1.2,OH1.3]
	[F80-OS2.3]
	[F80-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F80-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F80-OP1.1] Applies where stucco is applied to masonry *chimneys*.
(2)	[F80-OH1.1,OH1.2,OH1.3]

	[F80-OS2.3]
	[F80-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F80-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F80-OP1.1] Applies where stucco is applied to masonry *chimneys*.
9.28.4.2. No Sheathing Required	
(1)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
9.28.4.3. Stucco Lath Specifications	
(1)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20-OP1.1] Applies where stucco is applied to masonry *chimneys*.
9.28.4.4. Self-Furring Devices	
(1)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
	[F20,F80-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20,F80-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20,F80-OP1.1] Applies where stucco is applied to masonry *chimneys*.
9.28.4.5. Application of Stucco Lath	
(1)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20-OP1.1] Applies where stucco is applied to masonry *chimneys*.
(2)	[F20-OH1.1,OH1.2,OH1.3]

	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20-OP1.1] Applies where stucco is applied to masonry *chimneys*.
(3)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
(4)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20-OP1.1] Applies where stucco is applied to masonry *chimneys*.
9.28.4.6. Fastening	
(2)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20-OP1.1] Applies where stucco is applied to masonry *chimneys*.
(3)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20-OP1.1] Applies where stucco is applied to masonry *chimneys*.
(4)	[F20-OS2.1]
9.28.5.1. Mixes	
(1)	[F20,F61,F80-OH1.1,OH1.2,OH1.3]
	[F20,F61,F80-OS2.3]

	[F20,F61,F80-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20,F61,F80-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20,F61,F80-OP1.1] Applies where stucco is applied to masonry *chimneys*.
9.28.5.2. Pigments	
(1)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
	[F20,F80-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20,F80-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20,F80-OP1.1] Applies where stucco is applied to masonry *chimneys*.
(2)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
9.28.5.3. Mixing	
(1)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
	[F20,F80-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20,F80-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20,F80-OP1.1] Applies where stucco is applied to masonry *chimneys*.
(2)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
	[F20,F80-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20,F80-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20,F80-OP1.1] Applies where stucco is applied to masonry *chimneys*.
9.28.6.1. Low Temperature Conditions	
(1)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
	[F20,F80-OS1.1] Applies where stucco is applied to masonry *chimneys*.

	[F20,F80-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20,F80-OP1.1] Applies where stucco is applied to masonry *chimneys*.
(2)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
	[F20,F80-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20,F80-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20,F80-OP1.1] Applies where stucco is applied to masonry *chimneys*.
9.28.6.2. Number of Coats and Total Thickness	
(1)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20-OP1.1] Applies where stucco is applied to masonry *chimneys*.
9.28.6.3. First Coat	
(1)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
	[F20,F80-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20,F80-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20,F80-OP1.1] Applies where stucco is applied to masonry *chimneys*.
(2)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20-OP1.1] Applies where stucco is applied to masonry *chimneys*.
9.28.6.4. Second Coat	
(1)	[F20-OH1.1,OH1.2,OH1.3]

	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20-OP1.1] Applies where stucco is applied to masonry *chimneys*.
(2)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20-OP1.1] Applies where stucco is applied to masonry *chimneys*.
9.28.6.5. Finish Coat	
(1)	[F80-OH1.1,OH1.2,OH1.3]
	[F80-OS2.3]
	[F80-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F80-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F80-OP1.1] Applies where stucco is applied to masonry *chimneys*.
(2)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F20-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F20-OP1.1] Applies where stucco is applied to masonry *chimneys*.
(3)	[F80-OH1.1,OH1.2,OH1.3]
	[F80-OS2.3]
	[F80-OS1.1] Applies where stucco is applied to masonry *chimneys*.
	[F80-OS3.4] Applies where stucco is applied to masonry *chimneys*.
	[F80-OP1.1] Applies where stucco is applied to masonry *chimneys*.
9.29.2.1. Where Required	

(1)	[F80,F81-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F80,F81-OS2.3]
	[F80,F81-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F80,F81-OP2.3,OP2.4]
9.29.2.2. Materials	
(1)	[F80,F81-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F80-OS2.3]
	[F80-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F80-OP2.3,OP2.4]
9.29.3.1. Size and Spacing of Furring	
(1)	[F20,F22-OS2.1]
	[F20,F22-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22-OP2.1,OP2.4]
9.29.3.2. Fastening	
(1)	[F20-OS2.1]
	[F20-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1,OP2.4]
9.29.4.1. Application	
(1)	[F20,F80-OS2.1,OS2.3]
	[F20,F22,F80,F81-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.

	[F20,F80-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F80-OP2.1,OP2.3] [F22,F80-OP2.4]
9.29.5.1. Application	
(2)	[F20,F80-OS2.1,OS2.3]
	[F20,F22,F80,F81-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20,F22,F80-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F80-OP2.1,OP2.3] [F22,F80-OP2.4]
9.29.5.2. Materials	
(1)	[F20,F80-OP2.1,OP2.3] [F22,F80-OP2.4]
	[F20,F80-OS2.1,OS2.3]
	[F20,F22,F80-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22,F80,F81-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
9.29.5.3. Maximum Spacing of Supports	
(1)	[F20-OS2.1]
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20,F22-OP2.4]
9.29.5.4. Support of Insulation	
(1)	[F20-OS2.1]
	[F20,F22-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OP2.1] [F20,F22-OP2.4]

9.29.5.5. Length of Fasteners	
(1)	[F20-OS2.1]
	[F20-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1,OP2.4]
9.29.5.6. Nails	
(1)	[F20-OS2.1]
	[F20-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1,OP2.4]
9.29.5.7. Screws	
(1)	[F20-OS2.1]
	[F20-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1,OP2.4]
9.29.5.8. Spacing of Nails	
(1)	[F20-OP2.1] [F20-OP2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OS2.1] [F20-OS2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OP1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.

(3)	[F20-OS2.1] [F20-OS2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20-OP2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
(4)	[F20-OS2.1] [F20-OS2.5] [F22-OS2.4,OS2.5] Applies where interior finishes contribute to the required bracing or lateral support for studs. [F20,F22-OS2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20-OP2.5] [F22-OP2.4,OP2.5] Applies where interior finishes contribute to the required bracing or lateral support for studs. [F20,F22-OP2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies where interior finishes contribute to the required bracing or lateral support for studs, or where interior finishes support or serve as required environmental separation elements.
	[F20-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or contribute to the required fire resistance of assemblies.
	[F20,F22-OH4] Applies where walls support floors and where interior finishes contribute to the required bracing or lateral support for studs or where interior finishes support or serve as required environmental separation elements.
	[F20,F22-OS3.1,OS3.7] Applies where walls support floors and where interior finishes contribute to the required bracing or lateral support for studs or where interior finishes support or serve as required environmental separation elements.
	[F20-OP3.1] Applies where interior finishes are installed to contribute to the required fire resistance of exterior walls.
	[F20-OP1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or contribute to the required fire resistance of assemblies.
(5)	[F20-OS2.1] [F20-OS2.5] [F22-OS2.4,OS2.5] Applies where interior finishes contribute to the required bracing or lateral support for studs. [F20,F22-OS2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20-OP2.5] [F22-OP2.4,OP2.5] Applies where interior finishes contribute to the required bracing or lateral support for studs. [F20,F22-OP2.3] Applies where interior finishes support or serve as required environmental separation

	elements.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies where interior finishes contribute to the required bracing or lateral support for studs, or where interior finishes support or serve as required environmental separation elements.
	[F20-OH4] Applies where walls support floors and where interior finishes contribute to the required bracing or lateral support for studs or where interior finishes support or serve as required environmental separation elements.
	[F20-OS3.1,OS3.7] Applies where walls support floors and where interior finishes contribute to the required bracing or lateral support for studs or where interior finishes support or serve as required environmental separation elements.
	[F20-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OP1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OP3.1] Applies where interior finishes are installed to contribute to the required fire resistance of exterior walls.
(6)	[F20-OS2.1] [F20-OS2.5] [F22-OS2.4,OS2.5] Applies where interior finishes contribute to the required bracing or lateral support for studs. [F20,F22-OS2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20-OP2.5] [F22-OP2.4,OP2.5] Applies where interior finishes contribute to the required bracing or lateral support for studs. [F20,F22-OP2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OH4] Applies where walls support floors and where interior finishes contribute to the required bracing or lateral support for studs or where interior finishes support or serve as required environmental separation elements.
	[F20-OP1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OS3.1,OS3.7] Applies where walls support floors and where interior finishes contribute to the required bracing or lateral support for studs or where interior finishes support or serve as required environmental separation elements.

(7)	[F20-OS2.1] [F20-OS2.5] [F22-OS2.4,OS2.5] Applies where interior finishes contribute to the required bracing or lateral support for studs. [F20,F22-OS2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20-OP2.5] [F22-OP2.4,OP2.5] Applies where interior finishes contribute to the required bracing or lateral support for studs. [F20,F22-OP2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies where interior finishes contribute to the required bracing or lateral support for studs, or where interior finishes support or serve as required environmental separation elements.
	[F20-OH4] Applies where walls support floors and where interior finishes contribute to the required bracing or lateral support for studs or where interior finishes support or serve as required environmental separation elements.
	[F20-OS3.1,OS3.7] Applies where walls support floors and where interior finishes contribute to the required bracing or lateral support for studs or where interior finishes support or serve as required environmental separation elements.
	[F20-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OP1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OP3.1] Applies where interior finishes are installed to contribute to the required fire resistance of exterior walls.
9.29.5.9. Spacing of Screws	
(1)	[F20-OS2.1] [F20-OS2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20-OP2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OP1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
(3)	[F20-OS2.1] [F20-OS2.3] Applies where interior finishes support or serve as required environmental separation elements.

	[F20-OP2.1] [F20-OP2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OH1.1,OH1.2,OH1.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OS1.2] Applies where gypsum board is required to provide the fire resistance and the rating of the assembly is determined according to Table 9.10.3.1.-A.
	[F20-OP1.2] Applies where gypsum board is required to provide the fire resistance and the rating of the assembly is determined according to Table �9.10.3.1.-A.
	[F20-OP3.1] Applies where interior finishes are installed to contribute to the required fire resistance of exterior walls.
(4)	[F20-OS2.1] [F20-OS2.5] [F22-OS2.4,OS2.5] Applies where interior finishes contribute to the required bracing or lateral support for studs. [F20,F22-OS2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20-OP2.5] [F22-OP2.4,OP2.5] Applies where interior finishes contribute to the required bracing or lateral support for studs. [F20,F22-OP2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies where interior finishes contribute to the required bracing or lateral support for studs, or where interior finishes support or serve as required environmental separation elements.
	[F20-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or contribute to the required fire resistance of assemblies.
	[F20,F22-OS3.1,OS3.7] Applies where the walls support floors and where interior finishes contribute to the required bracing or lateral support for studs or where interior finishes support or serve as required environmental separation elements.
	[F20,F22-OH4] Applies where the walls support floors and where interior finishes contribute to the required bracing or lateral support for studs or where interior finishes support or serve as required environmental separation elements.
	[F20-OP3.1] Applies where interior finishes are installed to contribute to the required fire resistance of exterior walls.
	[F20-OP1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
(6)	[F20-OS2.1] [F20-OS2.5] [F22-OS2.4,OS2.5] Applies where interior finishes contribute to the required bracing or lateral support for studs. [F20,F22-OS2.3] Applies where interior finishes support or serve as required environmental separation

	elements.
	[F20-OP2.1] [F20-OP2.5] [F22-OP2.4,OP2.5] Applies where interior finishes contribute to the required bracing or lateral support for studs. [F20,F22-OP2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies where interior finishes contribute to the required bracing or lateral support for studs, or where interior finishes support or serve as required environmental separation elements.
	[F20-OH4] Applies where walls support floors and where interior finishes contribute to the required bracing or lateral support for studs or where interior finishes support or serve as required environmental separation elements.
	[F20-OS3.1,OS3.7] Applies where walls support floors and where interior finishes contribute to the required bracing or lateral support for studs or where interior finishes support or serve as required environmental separation elements.
	[F20-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OP1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OP3.1] Applies where interior finishes are installed to contribute to the required fire resistance of exterior walls.
(7)	[F20-OS2.1] [F20-OS2.5] [F22-OS2.4,OS2.5] Applies where interior finishes contribute to the required bracing or lateral support for studs. [F20,F22-OS2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20-OP2.5] [F22-OP2.4,OP2.5] Applies where interior finishes contribute to the required bracing or lateral support for studs. [F20,F22-OP2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies where interior finishes contribute to the required bracing or lateral support for studs, or where interior finishes support or serve as required environmental separation elements.
	[F20-OS3.1,OS3.7] Applies where walls support floors and where interior finishes contribute to the required bracing or lateral support for studs or where interior finishes support or serve as required environmental separation elements.
	[F20-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OH4] Applies where walls support floors and where interior finishes contribute to the required bracing or

	lateral support for studs or where interior finishes support or serve as required environmental separation elements.
	[F20-OP1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OP3.1] Applies where interior finishes are installed to contribute to the required fire resistance of exterior walls.
9.29.5.10. Low Temperature Conditions	
(1)	[F81-OS1.2] Applies where the finishing of joints is required to maintain required *fire-resistance ratings*.
9.29.6.1. Thickness	
(1)	[F20-OS2.1]
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20,F22-OP2.4]
9.29.6.2. Grooved Plywood	
(1)	[F20-OS2.1]
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20,F22-OP2.4]
9.29.6.3. Nails and Staples	
(1)	[F20-OS2.1]
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20,F22-OP2.4]
(2)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]

	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to walls that support floors. [F22-OS3.7] Applies to walls that contain doors or windows required for emergency egress.
	[F20,F22-OH4] Applies to walls that support floors.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
9.29.6.4. Edge Support	
(1)	[F20-OS2.1]
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20,F22-OP2.4]
9.29.7.1. Material Standard	
(1)	[F20,F80-OS2.1,OS2.3]
	[F20,F22,F80-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22,F80,F81-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20,F80-OP2.1,OP2.3] [F22,F80-OP2.4]
9.29.7.2. Thickness	
(1)	[F20-OS2.1]
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20,F22-OP2.4]
9.29.7.3. Nails	
(1)	[F20-OS2.1]
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.

	[F20,F22-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20,F22-OP2.4]
9.29.7.4. Edge Support	
(1)	[F20-OS2.1]
	[F20,F22-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OP2.1] [F20,F22-OP2.4]
9.29.8.1. Material Standard	
(1)	[F20,F80-OS2.1,OS2.3]
	[F20,F22,F80-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22,F80,F81-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20,F80-OP2.1,OP2.3]
9.29.8.2. Thickness	
(1)	[F20-OS2.1]
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20,F22-OP2.4]
(2)	[F20-OS2.1]
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20,F22-OP2.4]
9.29.8.3. Nails	

(1)	[F20-OS2.1]
	[F20-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20-OP2.4]
(2)	[F20-OS2.1]
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20,F22-OP2.4]
9.29.8.4. Edge Support	
(1)	[F20-OS2.1]
	[F20,F22-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OP2.1] [F20,F22-OP2.4]
9.29.9.1. Material Standard	
(1)	[F20,F80-OS2.1,OS2.3]
	[F20,F22,F80-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22,F80,F81-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20,F80-OP2.1,OP2.3] [F22,F80-OP2.4]
(2)	[F20,F80-OP2.1,OP2.3] [F22,F80-OP2.4]
	[F20,F80-OS2.1,OS2.3]
	[F20,F22,F80-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22,F80,F81-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental

	separation elements.
9.29.9.2. Minimum Thickness	
(1)	[F20-OS2.1]
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20,F22-OP2.4]
(4)	[F20-OS2.1]
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20,F22-OP2.4]
(5)	[F20-OS2.1] [F20,F22-OS2.4,OS2.5] Applies where interior finishes contribute to the required bracing or lateral support for studs. [F20,F22-OS2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20-OP2.5] [F22-OP2.4,OP2.5] Applies where interior finishes contribute to the required bracing or lateral support for studs. [F20,F22-OP2.3] Applies where interior finishes support or serve as required environmental separation elements.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies where interior finishes support or serve as required environmental separation elements, or where interior finishes contribute to the required bracing of exterior walls.
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics.
9.29.9.3. Nails	
(1)	[F20-OS2.1]
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F22-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20-OP2.1] [F20,F22-OP2.4]

(2)	[F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]
	[F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]
	[F20,F22-OS1.2] Applies to assemblies required to provide fire resistance.
	[F22-OS3.1] Applies to walls that support floors. [F22-OS3.7] Applies to walls that contain doors or windows required for emergency egress.
	[F20,F22-OH4] Applies to walls that support floors.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
9.29.9.4. Edge Support	
(1)	[F20-OS2.1]
	[F20,F22-OH1.1,OH1.2] Applies where interior finishes support or serve as required environmental separation elements.
	[F20,F22-OS1.2] Applies where interior finishes are required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OP2.1] [F20,F22-OP2.4]
9.29.10.1. Tile Application	
(1)	[F20,F81-OH1.1,OH1.2] Applies where the substrate serves as a required environmental separation element.
	[F20-OS2.1] [F20-OS2.5] [F22-OS2.4,OS2.5] Applies where the substrate for the tile contributes to the required bracing or lateral support for studs. [F20-OS2.3] Applies where the substrate for the tile serves as a required environmental separation element or where the tile is installed to provide the required waterproof wall finish.
	[F20-OS1.2] Applies where the substrate is required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OP2.1] [F20-OP2.5] [F22-OP2.4,OP2.5] Applies where the substrate for the tile contributes to the required bracing or lateral support for studs. [F20-OP2.3] Applies where the substrate for the tile serves as a required environmental separation element or where the tile is installed to provide the required waterproof wall finish.
(2)	[F20,F81-OH1.1,OH1.2] Applies where the substrate serves as a required environmental separation element.
	[F20-OS2.1] [F20-OS2.5] [F22-OS2.4,OS2.5] Applies where the substrate for the tile contributes to the required bracing or lateral support for studs. [F20-OS2.3] Applies where the substrate for the tile serves as a required environmental separation element or where the tile is installed to provide the required waterproof wall finish.

	[F20-OS1.2] Applies where the substrate is required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OP2.1] [F20-OP2.5] [F22-OP2.4,OP2.5] Applies where the substrate for the tile contributes to the required bracing or lateral support for studs. [F20-OP2.3] Applies where the substrate for the tile serves as a required environmental separation element or where the tile is installed to provide the required waterproof wall finish.
9.29.10.2. Mortar Base	
(1)	[F20-OS2.1] [F20-OS2.5] [F22-OS2.4,OS2.5] Applies where the substrate for the tile contributes to the required bracing or lateral support for studs. [F20,F80-OS2.3] Applies where the substrate for the tile serves as a required environmental separation element or where the tile is installed to provide the required waterproof wall finish.
	[F20,F80-OS1.2] Applies where the substrate is required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F80,F81-OH1.1,OH1.2] Applies where the substrate serves as a required environmental separation element.
	[F20-OP2.1] [F20-OP2.5] [F22-OP2.4,OP2.5] Applies where the substrate for the tile contributes to the required bracing or lateral support for studs. [F20-OP2.3] Applies where the substrate for the tile serves as a required environmental separation element or where the tile is installed to provide the required waterproof wall finish.
(2)	[F20-OS2.1] [F20-OS2.5] [F22-OS2.4,OS2.5] Applies where the substrate for the tile contributes to the required bracing or lateral support for studs. [F20,F80-OS2.3] Applies where the substrate for the tile serves as a required environmental separation element or where the tile is installed to provide the required waterproof wall finish.
	[F20,F80-OS1.2] Applies where the substrate is required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F80,F81-OH1.1,OH1.2] Applies where the substrate serves as a required environmental separation element.
	[F20-OP2.1] [F20-OP2.5] [F22-OP2.4,OP2.5] Applies where the substrate for the tile contributes to the required bracing or lateral support for studs. [F20-OP2.3] Applies where the substrate for the tile serves as a required environmental separation element or where the tile is installed to provide the required waterproof wall finish.
(3)	[F20-OS2.1] [F20-OS2.5] [F22-OS2.4,OS2.5] Applies where the substrate for the tile contributes to the required bracing or lateral support for studs. [F20-OS2.3] Applies where the substrate for the tile serves as a required environmental separation element.

	[F20-OS1.2] Applies where the substrate is required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20,F81-OH1.1,OH1.2] Applies where the substrate serves as a required environmental separation element.
	[F20-OP2.1] [F20-OP2.5] [F22-OP2.4,OP2.5] Applies where the substrate for the tile contributes to the required bracing or lateral support for studs. [F20-OP2.3] Applies where the substrate for the tile serves as a required environmental separation element or where the tile is installed to provide the required waterproof wall finish.
(4)	[F20-OS2.1] [F20-OS2.5] [F22-OS2.4,OS2.5] Applies where the substrate for the tile contributes to the required bracing or lateral support for studs. [F20-OS2.3] Applies where the substrate for the tile serves as a required environmental separation element or where the tile is installed to provide the required waterproof wall finish.
	[F20-OH1.1,OH1.2] Applies where the substrate serves as a required environmental separation element.
	[F20-OS1.2] Applies where the substrate is required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OP2.1] [F20-OP2.5] [F22-OP2.4,OP2.5] Applies where the substrate for the tile contributes to the required bracing or lateral support for studs. [F20-OP2.3] Applies where the substrate for the tile serves as a required environmental separation element or where the tile is installed to provide the required waterproof wall finish.
9.29.10.3. Adhesives	
(1)	[F20-OH1.1,OH1.2] Applies where the substrate serves as a required environmental separation element.
	[F20-OS2.3]
	[F20-OS1.2] Applies where the substrate is required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F20-OP2.3,OP2.4]
9.29.10.4. Moisture-Resistant Backing	
(1)	[F81-OH1.1,OH1.2] Applies where the substrate supports or serves as a required environmental separation element.
	[F20-OS2.3]
	[F20-OS1.2] Applies where the substrate is required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F81-OP2.3,OP2.4]

9.29.10.5. Joints between Tiles and Bathtub	
(1)	[F81-OH1.1,OH1.2] Applies where the substrate serves as a required environmental separation element.
	[F81-OS2.3]
	[F81-OS1.2] Applies where the substrate is required to act as fire protection for foamed plastics or to contribute to the required fire resistance of assemblies.
	[F81-OP2.3,OP2.4]
9.30.1.1. Required Finished Flooring	
(1)	[F30-OS3.1]
	[F40,F41-OH2.4]
9.30.1.2. Water Resistance	
(1)	[F80-OS2.3] Applies where finished flooring is required to provide water resistance.
	[F41,F81-OH1.1] Applies where finished flooring is required to provide water resistance.
9.30.1.3. Sleepers	
(1)	[F20,F80-OS3.1]
	[F80-OH1.1] Applies to portion of Code text: "Wood sleepers supporting finished flooring over a concrete base supported on the ground ... shall be treated with a wood preservative."
9.30.2.1. Required Underlay	
(1)	[F81-OS3.1]
	[F81-OS2.3] Applies where finished flooring is required to provide water resistance.
	[F81-OH1.1] Applies where finished flooring is required to provide water resistance.
(2)	[F81-OS3.1]
	[F81-OS2.3] Applies where finished flooring is required to provide water resistance.
	[F81-OH1.1] Applies where finished flooring is required to provide water resistance.
(3)	[F81-OS3.1]
	[F81-OH1.1] Applies where finished flooring is required to provide water resistance.
	[F81-OS2.3] Applies where finished flooring is required to provide water resistance.
9.30.2.2. Materials and Thickness	

(1)	[F81-OS3.1]
	[F81-OS2.3] Applies where finished flooring is required to provide water resistance.
	[F81-OH1.1] Applies where finished flooring is required to provide water resistance.
(2)	[F81-OS2.3] Applies where finished flooring is required to provide water resistance.
	[F81-OS3.1]
	[F81-OH1.1] Applies where finished flooring is required to provide water resistance.
9.30.2.3. Fastening	
(1)	[F81-OS3.1]
	[F81-OS2.3] Applies where finished flooring is required to provide water resistance.
	[F81-OH1.1] Applies where finished flooring is required to provide water resistance.
(2)	[F81-OS3.1]
	[F81-OS2.3] Applies where finished flooring is required to provide water resistance.
	[F81-OH1.1] Applies where finished flooring is required to provide water resistance.
(3)	[F81-OS3.1]
	[F81-OS2.3] Applies where finished flooring is required to provide water resistance.
	[F81-OH1.1] Applies where finished flooring is required to provide water resistance.
9.30.2.4. Joints Offset	
(1)	[F81-OS3.1]
	[F81-OS2.3] Applies where finished flooring is required to provide water resistance.
	[F81-OH1.1] Applies where finished flooring is required to provide water resistance.
9.30.2.5. Surface Defects	
(1)	[F81-OS3.1]
	[F81-OS2.3] Applies where finished flooring is required to provide water resistance.
	[F81-OH1.1] Applies where finished flooring is required to provide water resistance.
9.30.3.1. Thickness	
(1)	[F30-OS3.1]

	[F20-OS2.1]
9.30.3.2. Strip Direction and End Joints	
(1)	[F30-OS3.1]
(2)	[F20-OS2.1]
(3)	[F20-OS2.1]
9.30.3.3. Nailing	
(1)	[F30-OS3.1]
(2)	[F30-OS3.1]
9.30.3.4. Staples	
(1)	[F30-OS3.1]
9.30.4.1. Adhesive	
(1)	[F81-OS3.1]
9.30.5.1. Materials	
(1)	[F41,F80-OH1.1]
	[F80-OS3.1]
(2)	[F81,F80-OS3.1]
	[F41-OH1.1]
9.30.6.1. Substrate	
(1)	[F81-OS3.1]
	[F81-OH1.1] Applies where finished flooring is required to provide water resistance.
	[F81-OS2.3] Applies where finished flooring is required to provide water resistance.
(2)	[F81-OH1.1] Applies where finished flooring is required to provide water resistance.
	[F81-OS3.1]
	[F81-OS2.3] Applies where finished flooring is required to provide water resistance.
9.31.2.2. Corrosion Protection	
(1)	[F80-OH2.1]

	[F80-OS2.3]
9.31.2.3. Grab Bars	
(1)	[F20-OS3.1]
9.31.3.1. Required Water Supply	
(1)	[F70,F71-OH2.2,OH2.3]
9.31.3.2. Required Connections	
(1)	[F71-OH2.3]
(2)	[F71,F70-OH2.3]
9.31.4.1. Required Fixtures	
(1)	[F71,F70,F72-OH2.1,OH2.3]
9.31.4.2. Hot Water Supply	
(1)	[F71-OH2.3]
9.31.4.3. Floor Drains	
(1)	[F62,F40,F41-OH1.2,OH1.3] [F62-OH1.1]
(2)	[F62,F52-OH1.2,OH1.3] [F62-OH1.1]
9.31.5.1. Building Sewer	
(1)	[F72-OH2.1]
9.31.5.2. Discharge of Sewage	
(1)	[F72-OH2.1]
(2)	[F72-OH2.1]
9.31.6.1. Hot Water Supply	
(1)	(a) [F40-OH2.1,OH2.4] [F71-OH2.3]
9.31.6.2. Equipment and Installation	
(1)	[F31,F30,F81-OS3.2] [F44-OS3.4]
(2)	[F44-OH1.1]
	[F01-OS1.1]

(3)	[F23-OS3.4]
	[F01-OS1.1]
9.31.6.3. Corrosion-Resistant Coating	
(1)	[F81,F80-OH2.3]
9.31.6.4. Fuel-Burning Heaters	
(1)	[F41-OH1.1]
	[F01-OS1.1]
9.31.6.5. Heating Coils	
(1)	[F31-OS3.2]
	[F71-OH2.3]
9.32.1.2. Required Ventilation	
(1)	[F40,F50-OH1.1] [F51,F52-OH1.2] [F51,F52,F62,F63-OH1.3]
	[F52,F62,F63,F80-OP2.3]
(2)	[F40,F50,F52-OH1.1] [F51,F52-OH1.2]
9.32.1.3. Venting of Laundry-Drying Equipment	
(1)	[F50,F44,F40-OH1.1]
	[F52,F50-OH1.1]
	[F44-OS3.4]
	[F01-OS1.1]
	[F01-OP1.1]
(2)	[F81-OS1.1]
(3)	[F44,F50,F40-OH1.1]
	[F52,F50-OH1.1]
	[F44-OS3.4]
	[F01-OS1.1]
	[F01-OP1.1]

9.32.2.1. Required Ventilation	
(1)	[F40,F50-OH1.1] [F51,F52-OH1.2] [F51,F52,F62,F63-OH1.3]
	[F52,F62,F63,F80-OP2.3]
(2)	[F40,F50-OH1.1] [F51,F52-OH1.2] [F51,F52,F62,F63-OH1.3]
	[F52,F62,F63,F80-OP2.3]
9.32.2.2. Non-Heating-Season Natural Ventilation	
(1)	[F40,F50-OH1.1] [F51,F52-OH1.2] [F51,F52,F62,F63-OH1.3]
	[F52,F62,F63,F80-OP2.3]
(3)	[F42-OH2.5]
	[F61,F42-OP2.3]
	Reserved
(4)	[F80-OH2.5]
	[F80-OP2.3]
9.32.2.3. Non-Heating-Season Mechanical Ventilation	
(1)	[F40,F50,F52-OH1.1]
(3)	[F40,F50,F52-OH1.1] [F51,F52-OH1.2]
(4)	[F40,F50,F52-OH1.1] [F51,F52-OH1.2]
9.32.3.1. Required Ventilation	
(1)	[F40,F50,F52-OH1.1] [F51,F52-OH1.2] [F51,F52,F62,F63-OH1.3]
	[F52,F62,F63,F80-OP2.3]
(2)	(a),(b) [F40,F50,F52-OH1.1] (a),(b) [F51,F52-OH1.2] (c) [F53-OH1.1]
	(c) [F53-OS3.4]
9.32.3.2. Design and Installation	
(1)	[F81-OH1.1,OH1.2,OH1.3]
	[F81-OP2.3]

(2)	[F82-OH1.1,OH1.2,OH1.3]
(3)	[F82-OH1.1,OH1.2,OH1.3]
	[F82-OP2.3]
(4)	[F40,F43,F50,F53-OH1.1]
	[F43,F53,F82-OS3.4]
(5)	[F82-OH1.1]
(6)	[F63,F81-OH1.1]
9.32.3.3. Mechanical Ventilation System Components	
(1)	(a) [F40,F41,F50-OH1.1]
	(a), (b) [F52-OH1.2]
	(a), (b) [F40,F52,F62,F63,F80-OH1.3]
	(a), (b) [F40,F52,F62,F63,F80-OP2.3]
(2)	[F40,F50,F52-OH1.1] [F51,F52-OH1.2]
(4)	[F80,F81-OH1.1]
(5)	[F81-OH1.1]
(6)	[F81-OH1.1]
(7)	[F81-OH1.1]
(8)	[F81-OH1.1]
(9)	[F40,F50,F52-OH1.1]
(10)	[F40-OH1.1]
9.32.3.4. Principal Ventilation System Supply Air	
(2)	[F40,F41,F50-OH1.1]
	Reserved
(3)	[F40,F41,F50-OH1.1]
	Reserved
(4)	[F40,F41,F50-OH1.1]

	Reserved
	Reserved
(5)	[F40,F41,F50-OH1.1]
	Reserved
(6)	[F40,F41,F50-OH1.1]
	Reserved
9.32.3.5. Principal Ventilation System Exhaust Fan	
(1)	[F40,F41,F50-OH1.1] [F52-OH1.2] [F52,F62,F63-OH1.3]
	[F52,F62,F63,F80-OP2.3]
(2)	[F81-OH1.1,OH1.2,OH1.3]
	[F81-OP2.3]
	Reserved
(3)	(a) [F40,F41,F50-OH1.1] [F52-OH1.2] [F52,F62,F63-OH1.3]
	(a) [F52,F62,F63,F80-OP2.3]
	(b) [F81-OH1.1,OH1.2,OH1.3]
	(b) [F81-OP2.3]
(4)	[F81-OH1.1,OH1.2,OH1.3]
	[F81-OP2.3]
	Reserved
(5)	[F56-OH3.1]
	Reserved
	Reserved
9.32.3.6. Kitchen and Bathroom Exhaust Fans	
(1)	[F52,F62,F63-OH1.3]
	[F52,F62,F63,F80-OP2.3]
(2)	[F81-OH1.1,OH1.2,OH1.3]

	[F81-OP2.3]
9.32.3.7. Heated Crawl Space Ventilation	
(1)	[F40,F41,F52,F62,F63,F80-OP2.3]
(2)	[F40,F41,F52,F62,F63,F80-OP2.3]
(3)	[F40,F41,F52,F62,F63,F80-OP2.3]
(4)	[F40,F41,F52,F62,F63,F80-OP2.3]
(5)	[F40,F41,F52,F62,F63,F80-OP2.3]
9.32.3.8. Air Ducts	
(1)	[F40,F41,F50-OH1.1]
	[F52,F62,F63-OH1.3]
	[F52,F62,F63,F80-OP2.3]
(2)	[F62-OH1.3]
	[F62-OP2.3]
(3)	[F40,F41,F50-OH1.1] [F52,F62,F63-OH1.3]
	[F52,F62,F63,F80-OP2.3]
	Table 9.32.3.8.(3), Note (1) [F81-OH1.1,OH1.3]
	Table 9.32.3.8.(3), Note (1) [F81-OP2.3]
(4)	[F51,F63-OH1.3]
	[F63,F80-OP2.3]
	Reserved
(5)	[F51,F63-OH1.3]
	[F63,F80-OP2.3]
(6)	(a) [F01,F02-OS1.1,OS1.2]
	(a) [F80,F82-OP2.3]
	(b) [F40,F80-OP2.3]
(7)	[F50,F81-OH1.1]

	[F81-OH1.3]
	[F81-OP2.3]
(8)	[F40,F81-OH1.1]
9.32.3.9. Outdoor Inlets and Outlets	
(1)	[F42-OH2.5]
	[F61,F81-OP2.3]
9.32.3.10. Interior Distribution	
(1)	[F40,F50-OH1.1] [F52-OH1.2]
	Reserved
9.32.4.1. Protection Requirements	
(1)	(a) [F40,F81-OH1.1]
	(b) [F40,F50,F53-OH1.1]
	(b) [F43-OS3.4]
(2)	[F40,F50,F53-OH1.1]
(3)	[F40,F50,F53,F81-OH1.1]
(4)	[F51-OH1.2]
9.32.4.2. Carbon Monoxide Alarms	
(2)	[F11,F81-OS3.4]
(3)	[F11,F81-OS3.4]
(4)	[F11-OS3.4]
(5)	[F11-OS3.4]
(6)	[F11-OS3.4]
9.33.2.1. Required Heating Systems	
(1)	[F51,F52-OH1.2] [F63-OH1.1]
	[F63-OS2.3]
9.33.3.1. Indoor Design Temperatures	

(1)	[F51-OH1.2]
9.33.4.1. Design of Heating and Air-conditioning Systems	
(1)	[F41,F63-OH1.1] [F51,F52-OH1.2]
	[F63-OS2.3] Applies only to heating systems.
	[F44-OS3.4] Applies only to heating systems.
9.33.4.2. Installation of Hydronic Heating Systems	
(1)	[F01-OS1.1]
	[F01-OP1.1]
	[F63-OH1.1] [F51,F52-OH1.2]
	[F63-OS2.3]
	[F44-OS3.4] Applies to heating equipment.
9.33.4.4. Access	
(1)	[F82-OH1.1,OH1.2]
	[F82-OS2.3] Applies only to heating systems.
	[F82-OS1.1]
	[F82-OP1.1]
9.33.4.5. Protection from Freezing	
(1)	[F81-OH1.1,OH1.2]
	[F81-OS2.3] Applies only to heating systems.
9.33.4.6. Expansion, Contraction and System Pressure	
(1)	[F20-OH1.1,OH1.2]
	[F20-OS3.2]
	[F20-OS2.3] Applies only to heating systems.
9.33.4.7. Structural Movement	
(1)	[F23-OS3.4]
	[F23-OH1.1,OH1.2]

	[F23-OS1.1]
	[F23-OP1.1]
(2)	[F20-OS3.3,OS3.4]
	[F20-OS1.1]
9.33.4.8. Asbestos	
(1)	[F43-OH1.1]
9.33.4.9. Contaminant Transfer	
(1)	[F44-OH1.1]
	[F44-OS3.4]
9.33.4.10. Noise Control	
(1)	[F56-OH3.1]
9.33.5.1. Capacity of Heating Appliances	
(1)	[F63-OH1.1] [F51-OH1.2]
	[F63-OS2.3]
9.33.5.2. Installation Standards	
(1)	[F01-OP1.1] Applies to heating equipment.
	[F41,F63,F50-OH1.1] [F51,F52-OH1.2]
	[F63-OS2.3] Applies to heating equipment.
	[F44-OS3.4] Applies to heating equipment.
	[F01-OS1.1] Applies to heating equipment.
9.33.5.3. Design, Construction and Installation Standard for Solid-Fuel-Burning Appliances	
(1)	[F41,F43-OH1.1] [F51-OH1.2]
	[F51-OS2.3]
	[F43-OS3.4]
	[F01-OS1.1]
	[F01-OP1.1]

9.33.6.2. Materials in Air Duct Systems	
(1)	[F01-OS1.1]
	[F01-OP1.1]
(2)	(a),(b),(c),(d) [F01-OS1.1]
	(a),(b),(c),(d) [F01-OP1.1]
(3)	[F01-OS1.1]
	[F01-OP1.1]
(4)	(a),(b),(c),(d) [F01-OS1.1]
	(a),(b),(c),(d) [F01-OP1.1]
(7)	(a),(b) [F41,F63-OH1.1] [F50,F51,F52-OH1.2]
	(a),(b) [F63-OS2.3]
9.33.6.3. Tape	
(1)	[F01-OS1.1]
	[F01-OP1.1]
9.33.6.4. Coverings, Linings, Adhesives and Insulation	
(1)	[F01-OS1.1]
	[F01-OP1.1]
(2)	(a),(b) [F01-OS1.1]
	(a),(b) [F01-OP1.1]
(3)	(a),(b) [F01-OS1.1]
	(a),(b) [F01-OP1.1]
(4)	[F01-OS1.1]
	[F01-OP1.1]
(5)	[F01-OS1.1]
	[F01-OP1.1]
(6)	[F01-OS1.1]

	(c) [F01,F02,F05-OS1.5]
	[F01-OP1.1]
(7)	[F01-OS1.1]
	[F01-OP1.1]
(8)	(a),(b) [F01,F03-OS1.1]
	(a),(b) [F01,F03-OP1.1]
(9)	[F63-OH1.1] Applies to ventilation ducts and their fittings. [F51,F52-OH1.2] Applies to air duct distribution systems serving heating systems.
	[F03-OS1.1] Applies to air duct distribution systems.
	[F03-OP1.1] Applies to air duct distribution systems.
	[F63-OS2.3] Applies to air duct distribution systems.
9.33.6.5. Galvanized Steel or Aluminum Supply Ducts	
(1)	[F20-OH1.1,OH1.2]
	[F01-OS1.1]
	[F01-OP1.1]
(2)	[F20,F63-OH1.1] [F20,F51,F52-OH1.2]
	[F20,F63-OS2.3]
9.33.6.6. Construction of Ducts and Plenums	
(1)	[F03-OS1.1]
	[F03-OP1.1]
(2)	[F01-OS1.1]
	[F20-OS3.1]
	[F63-OH1.1] [F51,F52-OH1.2]
	[F20,F63-OS2.3]
(3)	[F43,F63-OH1.1] [F51,F52-OH1.2]
	[F01-OS1.1]
	[F63-OS2.3]

	[F01-OP1.1]
(4)	[F43,F63-OH1.1] [F51,F52-OH1.2]
	[F63-OS2.3]
	[F01-OS1.1]
	[F01-OP1.1]
(5)	[F63-OH1.1] [F51,F52-OH1.2]
	[F63-OS2.3]
	[F01-OS1.1]
	[F01-OP1.1]
9.33.6.7. Installation of Ducts and Plenums	
(1)	[F40-OH1.1]
	[F40-OS3.4]
(2)	[F63-OH1.1] [F51,F52-OH1.2]
	[F63-OS2.3]
	[F01-OS1.1]
	[F01-OP1.1]
(3)	[F63-OH1.1] [F51,F52-OH1.2]
	[F63-OS2.3]
	[F20-OS3.1]
(4)	[F51,F52-OH1.2] [F63,F50-OH1.1]
	[F63,F80-OS2.3]
(5)	[F01-OS1.1]
	[F01-OP1.1]
(6)	[F80-OH1.1,OH1.2]
	[F80-OS2.3]
(7)	(a),(b) [F40,F62-OH1.1,OH1.2]

	(a),(b) [F40,F62-OS2.3]
	(b) [F44-OS3.4]
9.33.6.8. Clearances of Ducts and Plenums	
(2)	(a),(b) [F01-OS1.1]
	(a),(b) [F01-OP1.1]
(3)	(a),(b) [F01-OS1.1]
	(a),(b) [F01-OP1.1]
(4)	(a),(b),(c) [F01-OS1.1]
	(a),(b),(c) [F01-OP1.1]
(5)	[F01-OS1.1]
	[F01-OP1.1]
9.33.6.9. Adjustable Dampers and Balance Stops	
(1)	[F40,F63-OH1.1] [F51,F52-OH1.2]
	[F63-OS2.3] Applies to branch *supply ducts* that are not fitted with diffusers with adjustable balance stops.
9.33.6.10. Warm-Air Supply Outlets and Return Inlets – General	
(1)	[F81-OS1.1]
	[F81-OH1.1,OH1.2]
	[F81-OS2.3]
(2)	(a),(b) [F01,F02-OS1.1]
	(a),(b) [F01,F02-OP1.1]
9.33.6.11. Warm-Air Supply Outlets	
(1)	[F40,F63-OH1.1] [F51,F52-OH1.2]
	[F63-OS2.3]
(2)	[F63-OH1.1] [F51-OH1.2]
	[F63-OS2.3]
(3)	[F40,F63-OH1.1] [F51-OH1.2]

(4)	[F40,F63-OH1.1] [F51-OH1.2]
	[F63-OS2.3]
(5)	[F40,F63-OH1.1] [F51-OH1.2]
	[F63-OS2.3]
(6)	[F40,F63-OH1.1] [F51-OH1.2]
	[F63-OS2.3]
(8)	[F31-OS3.2]
(9)	[F40,F63-OH1.1] [F51-OH1.2]
	[F63-OS2.3] Applies to warm-air supply outlets located in finished areas.
9.33.6.12. Return-Air Inlets	
(1)	[F44,F40-OH1.1]
	[F44,F40-OS3.4]
(2)	[F63-OH1.1] [F51-OH1.2]
(3)	[F63-OH1.1] [F51-OH1.2]
	[F63-OS2.3]
9.33.6.13. Return-Air System	
(1)	[F63-OH1.1] [F51-OH1.2]
	[F63-OS2.3]
(2)	[F01-OS1.1]
	[F01-OP1.1]
(3)	[F01-OS1.1]
	[F01-OP1.1]
(4)	(a),(b),(c) [F01-OS1.1]
	(a),(b),(c) [F01-OP1.1]
(5)	[F51,F52-OH1.1,OH1.2]
	[F51,F52-OS2.3]

(6)	[F63-OH1.1] [F51-OH1.2]
	[F63-OS2.3]
(7)	(a),(b) [F44-OH1.1]
	(a),(b) [F44-OS3.4]
9.33.6.14. Filters and Odour Removal Equipment	
(1)	[F01-OS1.1]
	[F01-OP1.1]
(2)	[F32-OS3.3]
	[F41-OH1.1]
(3)	(a),(b) [F81-OH1.1]
9.33.7.1. Recessed Radiators and Convectors	
(1)	[F01-OS1.1]
	[F01-OP1.1]
9.33.7.2. Surface Temperature	
(1)	[F31-OS3.2]
9.33.8.1. Piping Materials and Installation	
(1)	[F20-OS3.2]
	[F20-OH1.1,OH1.2]
(2)	[F21,F40-OH1.1] [F21,F51-OH1.2]
(3)	[F20-OS2.2]
9.33.8.2. Insulation and Coverings	
(1)	[F80-OH1.2]
	[F80-OS3.2]
(2)	(a),(b) [F01-OS1.1]
	(a),(b) [F01-OP1.1]
(3)	(a),(b) [F01,F02-OS1.1,OS1.2]

	(a),(b) [F01,F02-OP1.1,OP1.2]
(4)	[F01,F02-OS1.1,OS1.2]
	[F01,F02-OP1.1]
(5)	[F31-OS3.2]
9.33.8.3. Clearances	
(1)	[F01-OS1.1]
	[F01-OP1.1]
9.33.8.4. Protection	
(1)	[F01-OS1.1]
	[F01-OP1.1]
(2)	[F01-OS1.1]
	[F01-OP1.1]
9.33.9.1. Cooling Units	
(1)	(a),(b),(c) [F43-OH1.1] [F51-OH1.2]
9.33.10.2. Factory-Built Chimneys	
(1)	[F01-OS1.1]
	[F44-OS3.4]
	[F44,F41-OH1.1]
	[F01-OP1.1]
9.33.10.3. Factory-Built Chimneys	
(1)	[F50-OH5]
	[F56-OH3.1]
9.33.10.4. Location of Exhaust Vents Serving a Building containing not more than 2 Principal Dwelling Units	
(1)	[F50-OH5]
	[F56-OH3.1]
9.34.1.1. Standard for Electrical Installations	

(1)	[F32-OS3.3]
	[F01-OS1.1]
	[F01-OP1.1]
(2)	[F01-OP1.1] [F01-OS1.1] [F32-OS3.3]
9.34.1.3. Location of Equipment in Public Areas	
(1)	[F10-OS3.1] [F32-OS3.3]
9.34.1.4. Recessed Lighting Fixtures	
(1)	[F01-OS1.1]
9.34.1.5. Wiring and Cables	
(1)	[F02-OS1.2]
	[F02-OP1.2]
9.34.2.1. Lighting of Entrances	
(1)	[F30-OS3.1]
	[F34-OS4.2]
9.34.2.2. Outlets in Dwelling Units	
(1)	[F30-OS3.1]
(2)	[F30-OS3.1]
9.34.2.3. Stairways	
(1)	[F30-OS3.1]
(2)	[F30-OS3.1]
9.34.2.4. Basements	
(1)	[F30-OS3.1]
(2)	[F30-OS3.1]
9.34.2.5. Storage Rooms	
(1)	[F30-OS3.1]
9.34.2.6. Garages and Carports	

(1)	[F30-OS3.1]
(2)	[F30-OS3.1]
(3)	[F30-OS3.1]
9.34.2.7. Public and Service Areas	
(1)	[F30-OS3.1]
(2)	[F30-OS3.1]
(3)	[F30-OS3.1]
9.35.2.2. Garage Floor	
(1)	[F40-OS1.1]
9.35.3.2. Protection from Damage due to Soil Movement	
(1)	[F21-OS2.3]
	[F21-OH1.1,OH1.2,OH1.3]
	[F21-OP2.3,OP2.4]
	[F21-OH4] Applies to floors and elements that support floors.
	[F21-OS3.1] Applies to floors and elements that support floors.
(2)	[F21-OS2.3]
	[F21-OH1.1,OH1.2,OH1.3]
	[F21-OP2.3,OP2.4]
	[F21-OH4] Applies to floors and elements that support floors.
	[F21-OS3.1] Applies to floors and elements that support floors.
9.35.3.4. Column Piers	
(1)	[F80-OS2.3]
	[F80-OP2.3]
(2)	[F20-OS2.1,OS2.2]
	[F20-OP2.1,OP2.2]
9.35.4.2. Columns	

(1)	[F20-OS2.1]
	[F20-OP2.1]
9.35.4.3. Anchorage	
(1)	[F22-OS2.4,OS2.5]
	[F22-OP2.4,OP2.5]
9.36.2.2. Determination of Thermal Characteristics of Materials, Components and Assemblies	
(1)	[F92-OE1.1]
(2)	[F92-OE1.1]
(3)	[F92-OE1.1]
(4)	[F92-OE1.1]
(5)	[F92-OE1.1]
9.36.2.4. Calculation of Effective Thermal Resistance of Assemblies	
(1)	[F92-OE1.1]
(3)	[F92-OE1.1]
9.36.2.5. Continuity of Insulation	
(1)	[F92-OE1.1]
(2)	[F92-OE1.1]
(3)	[F92-OE1.1]
(4)	[F92-OE1.1]
(5)	[F92-OE1.1]
(6)	[F92-OE1.1]
(7)	[F92-OE1.1]
(8)	[F92-OE1.1]
9.36.2.6. Thermal Characteristics of Above-ground Opaque Building Assemblies	
(1)	[F92-OE1.1]
(2)	[F92-OE1.1]

(3)	[F92-OE1.1]
(4)	[F92-OE1.1]
9.36.2.7. Thermal Characteristics of Fenestration, Doors and Skylights	
(1)	[F92-OE1.1]
(2)	[F92-OE1.1]
(3)	[F92-OE1.1]
(4)	[F92-OE1.1]
(7)	[F92-OE1.1]
(8)	[F92-OE1.1]
9.36.2.8. Thermal Characteristics of Building Assemblies Below-Grade or in Contact with the Ground	
(1)	[F92-OE1.1]
(3)	[F92-OE1.1]
(4)	[F92-OE1.1]
(5)	[F92-OE1.1]
(6)	[F92-OE1.1]
(7)	[F92-OE1.1]
(8)	[F92-OE1.1]
(9)	[F92-OE1.1]
9.36.2.9. Airtightness	
(1)	[F90-OE1.1]
(2)	[F90-OE1.1]
(3)	[F90-OE1.1]
(4)	[F90-OE1.1]
(5)	[F90-OE1.1]
(6)	[F90-OE1.1]
9.36.2.10. Construction of Air Barrier Details	

(1)	[F90-OE1.1]
(2)	[F90-OE1.1]
(3)	[F90-OE1.1]
(4)	[F90-OE1.1]
(5)	[F90-OE1.1]
(6)	[F90-OE1.1]
(17)	[F90-OE1.1]
9.36.2.11. Trade-off Options for Above-ground Building Envelope Components and Assemblies	
(2)	[F92-OE1.1]
(3)	[F92-OE1.1]
(4)	[F92-OE1.1]
(5)	[F92-OE1.1]
(6)	[F92-OE1.1]
(7)	[F92-OE1.1]
(8)	[F92-OE1.1]
9.36.3.2. Equipment and Ducts	
(1)	[F95-OE1.1]
(3)	[F91,F93-OE1.1]
(4)	[F91,F93-OE1.1]
(5)	[F91,F93-OE1.1]
9.36.3.3. Air Intake and Outlet Dampers	
(1)	[F91,F95-OE1.1]
(2)	[F91,F95-OE1.1]
9.36.3.4. Piping for Heating and Cooling Systems	
(2)	[F93-OE1.1]
9.36.3.5. Equipment for Heating and Air-conditioning Systems	

(1)	[F98-OE1.1]
9.36.3.6. Temperature Controls	
(1)	[F92-OE1.1]
(2)	[F95,F98-OE1.1]
(3)	[F95-OE1.1]
(4)	[F95-OE1.1]
(5)	[F95-OE1.1]
(6)	[F95-OE1.1]
(7)	[F95-OE1.1]
9.36.3.7. Humidification	
(1)	[F95-OE1.1]
9.36.3.8. Heat Recovery from Dehumidification in Spaces with an Indoor Pool or Hot Tub	
(1)	[F95,F100-OE1.1]
(3)	[F95-OE1.1]
(4)	[F98,F100-OE1.1]
(5)	[F98,F100-OE1.1]
9.36.3.9. Heat Recovery from Ventilation Systems	
(2)	[F95,F100-OE1.1]
(3)	[F95,F100-OE1.1]
(4)	[F95,F98,F100-OE1.1]
9.36.3.10. Equipment Efficiency	
(1)	[F95,F98,F99-OE1.1]
(2)	[F95,F98,F99-OE1.1]
9.36.3.11. Solar Thermal Systems	
(1)	[F95,F98,F99-OE1.1]
(3)	[F93,F96-OE1.1]

9.36.4.2. Equipment Efficiency	
(1)	[F96,F98-OE1.1]
(2)	[F93,F96-OE1.1]
(3)	[F98-OE1.1]
9.36.4.3. Solar Domestic Hot Water Systems	
(1)	[F96,F98-OE1.1]
(3)	[F93,F96-OE1.1]
9.36.4.4. Piping	
(1)	[F93,F96-OE1.1]
(2)	[F93,F96-OE1.1]
(3)	[F93,F96-OE1.1]
9.36.4.5. Controls	
(1)	[F96-OE1.1]
9.36.4.6. Indoor Swimming Pool Equipment Controls	
(1)	[F96-OE1.1]
(2)	[F96-OE1.1]
9.36.5.3. Compliance	
(1)	[F99-OE1.1]
(2)	[F92,F93,F95,F96,F98,F99,F100-OE1.1]
(3)	[F92,F93,F95,F96,F98,F99,F100-OE1.1]
(4)	[F92,F93,F95,F96,F98,F99,F100-OE1.1]
(5)	[F92,F93,F95,F96,F98,F99,F100-OE1.1]
(6)	[F99-OE1.1]
9.36.5.4. Calculation Methods	
(1)	[F99-OE1.1]
(3)	[F99-OE1.1]

(4)	[F99-OE1.1]
(5)	[F95,F99-OE1.1]
(6)	[F95,F99-OE1.1]
(7)	[F95,F99-OE1.1]
(8)	[F99-OE1.1]
(9)	[F99-OE1.1]
(10)	[F90,F99-OE1.1]
(11)	[F90,F99-OE1.1]
9.36.5.5. Climatic Data	
(1)	[F99-OE1.1]
(2)	[F99-OE1.1]
(3)	[F99-OE1.1]
9.36.5.6. Building Envelope Calculations	
(1)	[F92,F99-OE1.1]
(2)	[F92,F99-OE1.1]
(3)	[F92,F99-OE1.1]
(4)	[F92,F99-OE1.1]
(5)	[F92,F99-OE1.1]
(6)	[F92,F99-OE1.1]
(7)	[F92,F93,F95,F96,F99-OE1.1]
(8)	[F92,F99-OE1.1]
(9)	[F92,F99-OE1.1]
(10)	[F92,F99-OE1.1]
(11)	[F92,F99-OE1.1]
9.36.5.7. HVAC System Calculations	
(1)	[F95,F99-OE1.1]

(2)	[F95,F99-OE1.1]
(3)	[F95,F99-OE1.1]
(4)	[F95,F99-OE1.1]
(5)	[F95,F99-OE1.1]
(6)	[F95,F99-OE1.1]
(7)	[F95,F99-OE1.1]
(8)	[F95,F99-OE1.1]
(9)	[F95,F99-OE1.1]
9.36.5.8. Service Water Heating System Calculations	
(1)	[F96,F99-OE1.1]
(2)	[F96,F99-OE1.1]
(3)	[F96,F99-OE1.1]
(4)	[F96,F99-OE1.1]
(5)	[F96,F99-OE1.1]
(6)	[F96,F99-OE1.1]
9.36.5.9. General Requirements for Modeling the Proposed House	
(1)	[F99-OE1.1]
9.36.5.10. Modeling Building Envelope of Proposed House	
(1)	[F92,F95,F99-OE1.1]
(4)	[F92,F95,F99-OE1.1]
(5)	[F92,F95,F99-OE1.1]
(6)	[F92,F95,F99-OE1.1]
(7)	[F92,F95,F99-OE1.1]
(9)	[F90,F91,F92,F95,F99-OE1.1]
(10)	[F90,F99-OE1.1]
(11)	[F90,F99-OE1.1]

(13)	[F90,F99-OE1.1]
9.36.5.11. Modeling HVAC System of Proposed House	
(1)	[F95,F99-OE1.1]
(2)	[F95,F99-OE1.1]
(3)	[F92,F95,F99-OE1.1]
(4)	[F95,F99,F100-OE1.1]
(5)	[F95,F99-OE1.1]
(6)	[F95,F99-OE1.1]
(7)	[F99-OE1.1]
(8)	[F95,F99-OE1.1]
(9)	[F95,F99-OE1.1]
(10)	[F95,F99,F100-OE1.1]
(11)	[F95,F99-OE1.1]
(12)	[F95,F99,F100-OE1.1]
(13)	[F95,F99-OE1.1]
(14)	[F95,F99,F100-OE1.1]
(15)	[F95,F99-OE1.1]
(16)	[F95,F99-OE1.1]
(17)	[F95,F99-OE1.1]
(18)	[F95,F99-OE1.1]
(19)	[F95,F99-OE1.1]
(20)	[F95,F99-OE1.1]
9.36.5.12. Modeling Service Water Heating System of Proposed House	
(1)	[F96,F99-OE1.1]
(2)	[F99-OE1.1]
9.36.5.13. General Requirements for Modeling the Reference House	

(1)	[F99-OE1.1]
(2)	[F99-OE1.1]
9.36.5.14. Modeling Building Envelope of Reference House	
(1)	[F92,F95,F99-OE1.1]
(2)	[F90,F91,F92,F95,F99-OE1.1]
(3)	[F92,F95,F99-OE1.1]
(4)	[F92,F95,F99-OE1.1]
(5)	[F92,F99-OE1.1]
(6)	[F92,F95,F99-OE1.1]
(7)	[F92,F99-OE1.1]
(8)	[F92,F99-OE1.1]
(9)	[F92,F99,F95-OE1.1]
(10)	[F92,F99-OE1.1]
9.36.5.15. Modeling HVAC System of Reference House	
(1)	[F95,F99-OE1.1]
(2)	[F95,F99-OE1.1]
(3)	[F95,F99,F100-OE1.1]
(4)	[F95,F99-OE1.1]
(5)	[F95,F99-OE1.1]
(6)	[F95,F99-OE1.1]
(7)	[F95,F99-OE1.1]
(8)	[F95,F99,F100-OE1.1]
(9)	[F95,F99-OE1.1]
(10)	[F95,F99-OE1.1]
(11)	[F95,F99-OE1.1]
(12)	[F95,F99,F100-OE1.1]

(13)	[F95,F99,F100-OE1.1]
(14)	[F95,F99-OE1.1]
(15)	[F95,F99-OE1.1]
(16)	[F95,F99-OE1.1]
9.36.5.16. Modeling Service Water Heating System of Reference House	
(1)	[F95,F99-OE1.1]
(2)	[F95,F99-OE1.1]
(3)	[F95,F99-OE1.1]
9.36.6.3. Compliance Requirements	
(1)	[F85,F86, F90, F91, F92, F93, F95, F96, F98, F99-OE1.1]
9.36.6.5. Building Envelope Airtightness Testing	
(1)	[F90-OE1.1]
9.37.2.1. Heights of Rooms or Spaces	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
9.37.2.2. Solid Blocking	
(1)	[F20-OS4.1]
9.37.2.3. Exit Stairs	
(1)	[F30-OS3.1] [F10-OS3.7]
9.37.2.4. Dimensions of Landings	
(1)	[F30-OS3.1] [F10-OS3.7]
9.37.2.5. Handrails and Guards	
(1)	[F30-OS3.1] [F10-OS3.7]
9.37.2.6. Means of Egress	
(1)	[F30-OS3.1] [F10-OS3.7]
9.37.2.7. Fire Separations for Exits	

(1)	[F03-OP1.2]
(2)	[F05-OS1.5] [F03-OS1.2]
9.37.2.8. Openings Near Unenclosed Exit Stairs and Ramps	
(1)	[F05-OS1.5]
9.37.2.9. Doors in a Means of Egress	
(1)	[F30-OS3.1] [F10-OS3.7]
9.37.2.10. Travel Limit to Exits or Egress Doors	
(1)	[F10-OS3.7]
9.37.2.11. Shared Egress Facilities	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
9.37.2.12. Exit Signs	
(1)	[F10-OS3.7]
9.37.2.14. Combustible Drain, Waste and Vent Piping	
(1)	[F03-OP1.2] [F04-OP1.3]
	[F03-OS1.2] [F04-OS1.3]
(2)	[F03-OP1.2] [F04-OP1.3]
	[F03-OS1.2] [F04-OS1.3]
9.37.2.15. Separation of Ancillary Residential Suites	
(1)	[F03-OP1.2] [F04-OP1.3]
	[F03-OS1.2] [F04-OS1.3]
9.37.2.16. Separation of Public Corridors	
(1)	[F03-OP1.2]
9.37.2.17. Air Ducts and Fire Dampers	
(2)	[F03,F06-OP1.2]
	[F03,F06-OS1.5] [F03-OS1.2]

9.37.2.18. Spatial Separation	
(1)	[F03-OP1.2]
	[F03-OS1.2]
9.37.2.19. Smoke Alarms	
(1)	[F02,F03-OP3.7]
(2)	[F02,F03-OP3.7]
(3)	[F02,F03-OP3.7]
9.37.2.24 Fire Sprinklers	
(2)	[F81-OS1.4,OP1.4]
9.37.2.21. Sound Control	
(1)	[F81,F11-OS1.5]
9.37.2.22. Attic Space Access	
(1)	[F56-OH3.1]
9.37.2.23. Garages and Carports	
(1)	[F82-OH1.1, OH1.2, OH1.3]
	[F82-OS2.3]
9.37.3.1 Specific Requirements	
(1)	[F03-OS1.2] [F11-OS1.2, OS3.7]
9.37.4.1. Specific Requirements	
(1)	[F03-OS1.2]
(2)	[F03-OS1.2]
(3)	[F03-OS1.2]

Notes to Table 9.38.1.1.:
(1)See Parts 2 and 3 of Division A.

(4)	[F20-OS2.1,OS2.4] [F22-OS2.4,OS2.5] [F20,F22-OS2.3] Applies to elements that support or are part of an environmental separator.
	[F20-OP2.1,OP2.4] [F22-OP2.4,OP2.5]

	[F20,F22-OP2.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH1.1,OH1.2,OH1.3] Applies to elements that support or are part of an environmental separator.
	[F20,F22-OH4] Applies to floors and elements that support floors.
	[F20,F22-OS3.1] Applies to floors and elements that support floors.

Notes to Part 9
Housing and Small Buildings

A-9.1.1.1.(1) Application of Part 9 to Seasonally and Intermittently Occupied Buildings. The Building By-law does not provide separate requirements which would apply to seasonally or intermittently occupied buildings. Without compromising the basic health and safety provisions, however, various requirements in Part 9 recognize that leniency may be appropriate in some circumstances. With greater use of "cottages" through the winter months, the proliferation of seasonally occupied multiple-dwelling buildings and the increasing installation of modern conveniences in these buildings, the number and extent of possible exceptions is reduced.

Thermal Insulation
Article 9.25.2.1. specifies that insulation is to be installed in walls, ceilings and floors which separate heated space from unheated space. Cottages intended for use only in the summer and which, therefore, have no space heating appliances, would not be required to be insulated. Should a heating system be installed at some later date, insulation should also be installed at that time in accordance with Article 9.25.1.1. and the insulation requirements of Part 10. However, if the building were not intended for continuous or regular winter use, it may still be exempted from the remainder of the energy efficiency requirements in Part 10.

Air Barrier Systems and Vapour Barriers
Articles 9.25.3.1. and 9.25.4.1. require the installation of air barrier systems and vapour barriers only where insulation is installed. Dwellings with no heating system would thus be exempt from these requirements. In some cases, seasonally occupied buildings that are conditioned may be required to conform to the air and vapour barrier requirements of Section 9.25, but not to the air barrier and other requirements of Part 10.

Interior Wall and Ceiling Finishes
The choice of interior wall and ceiling finishes has implications for fire safety. Where a dwelling is a detached building, there are no fire resistance requirements for the walls or ceilings within the dwelling. The exposed surfaces of walls and ceilings are required to have a flame-spread rating not greater than 150 (Subsection 9.10.17.). There is, therefore, considerable flexibility, even in continuously occupied dwellings, with respect to the materials used to finish these walls. Except where waterproof finishes are required (Subsection 9.29.2.), ceilings and walls may be left unfinished. Where two units adjoin, however, additional fire resistance requirements may apply to interior loadbearing walls, floors and the shared wall (Article 9.10.8.3., and Subsections 9.10.9. and 9.10.11.).

Plumbing and Electrical Facilities
Plumbing fixtures are required only where a piped water supply is available (Subsection 9.31.4.), and electrical facilities only where electrical services are available (Article 9.34.1.2.).

A-9.3.1.7. Ratio of Water to Cementing Material. While adding water to concrete on site may facilitate its distribution through formwork, this practice can have several undesirable results, such as reduced strength, greater porosity, and more propensity to shrinkage cracking. The ratio of water to cementing material is determined according to weight. For example, using Table 9.3.1.7., the maximum water-cement ratio of 0.45 for a 20 mm coarse aggregate would require 18 kg (or 18 L) of water (1 L of water weighs 1 kg).

A-9.3.2.1.(1) Grade Marking of Lumber. Lumber is generally grouped for marketing into the species combinations contained in Table A-9.3.2.1.(1)-A. The maximum allowable spans for those combinations are listed in the span tables for joists, rafters and beams. Some species of lumber are also marketed individually. Since the allowable span for the northern species combination is based on the weakest species in the combination, the use of the span for this combination is permitted for any individual species not included in the Spruce-Pine-Fir, Douglas Fir-Larch and Hemlock-Fir combinations.

Facsimiles of typical grade marks of lumber associations and grading agencies accredited by the Canadian Lumber Standards (CLS) Accreditation Board to grade mark lumber in Canada are shown in Table A-9.3.2.1.(1)-B. Accreditation by the CLS Accreditation Board applies to the inspection, grading and grade marking of lumber, including mill supervisory service, in accordance with CSA O141, "Softwood Lumber."

The grade mark of a CLS accredited agency on a piece of lumber indicates its assigned grade, species or species combination, moisture condition at the time of surfacing, the responsible grader or mill of origin and the CLS accredited agency under whose supervision the grading and marking was done.

Table A-9.3.2.1.(1)-A
Species Designations and Abbreviations
Forming Part of Note A-9.3.2.1.(1)

Commercial Designation of Species or Species Combination	Abbreviation Permitted on Grade Stamps	Species Included
Douglas Fir – Larch	D Fir – L (N)	Douglas Fir, Western Larch
Hemlock – Fir	Hem – Fir (N)	Western Hemlock, Amabilis Fir
Spruce – Pine – Fir	S – P – F or Spruce – Pine – Fir	White Spruce, Engelmann Spruce, Black Spruce, Red Spruce, Lodgepole Pine, Jack Pine, Alpine Fir, Balsam Fir
Northern Species	North Species	Any Canadian softwood covered by the "Standard Grading Rules for Canadian Lumber"

Canadian lumber is graded to the "Standard Grading Rules for Canadian Lumber," published by the National Lumber Grades Authority. These rules specify standard grade names and grade name abbreviations for use in grade marks to provide positive identification of lumber grades. In a similar fashion, standard species names or standard species abbreviations, symbols or marks are provided in the rules for use in grade marks.

Grade marks denote the moisture content of lumber at the time of surfacing. "S-Dry" in the mark indicates the lumber was surfaced at a moisture content not exceeding 19%. "MC 15" indicates a moisture content not exceeding 15%. "S-GRN" in the grade mark signifies that the lumber was surfaced at a moisture content higher than 19% at a size to allow for natural shrinkage during seasoning.

Each mill or grader is assigned a permanent number. The point of origin of lumber is identified in the grade mark by use of a mill or grader number or by the mill name or abbreviation. The CLS certified agency under whose supervision the lumber was grade marked is identified in the mark by the registered symbol of the agency.

Table A-9.3.2.1.(1)-B
Facsimiles of Grade Marks Used by Canadian Lumber Manufacturing Associations and Agencies Authorized to Grade Mark Lumber in Canada
Forming Part of Note A-9.3.2.1.(1)

Facsimiles of Grade Mark	Association or Agency
A.F.P.A.® 00 S-P-F NLGA KD-HT 1 GG00056B	Alberta Forest Products Association www.albertaforestproducts.ca
CMSA® No 1 KD-HT NLGA 100 S – P – F GG00062B	Canadian Mill Services Association www.canserve.org
CSI® No.1 00 KD-HT NLGA D FIR-L (N) GG00008A	Canadian Softwood Inspection Agency Inc. www.canadiansoftwood.com
CFPA® 26 S-P-F KD-HT 2 NLGA GG00058B	Central Forest Products Association Inc. c/o Alberta Forest Products Association www.albertaforestproducts.ca
COFI® KD-HT 91 1 NLGA S-P-F ILMA® KD-HT 25 1 NLGA D FIR - L(N) GG00057B	Council of Forest Industries www.cofi.org
5® No. 2 KD-HT S-P-F NLGA GG00064B	Macdonald Inspection Services Ltd. www.gradestamp.com
M L® B S-P-F No.1 KD-HT 99 NLGA GG00065B	Maritime Lumber Bureau www.mlb.ca

N L P A® NLGA S-P-F NO.1 000 KD HT	Newfoundland & Labrador Lumber Producers' Association www3.nf.sympatico.ca/nllpa
NWT 10 CONST S-P-F S-GRN NLGA	Northwest Territories Forest Industries Association
CL®A 100 1 NLGA S-P-F KD-HT	Ontario Forest Industries Association www.ofia.com
O.L.M.A.® 09 1 KD-HT NLGA S—P—F	Ontario Lumber Manufacturers' Association (Home of CLA Grading and Inspection) www.olma.ca
PLIB® NO. 1 KD - HT S-P-F 0 0 NLGA RULES	Pacific Lumber Inspection Bureau www.plib.org
® S-P-F KD-HT 1 477 NLGA	Quebec Forest Industry Council (Conseil de l'industrie forestière du Québec) www.qfic.gc.ca

A-Table 9.3.2.1. Lumber Grading. To identify board grades, the paragraph number of the NLGA "Standard Grading Rules for Canadian Lumber" under which the lumber is graded must be shown in the grade mark. Paragraph 113 is equivalent to the WWPA "Western Lumber Grading Rules" and paragraph 114 is equivalent to the WCLIB "Standard Grading Rules." When graded in accordance with WWPA or WCLIB rules, the grade mark will not contain a paragraph number.

A-9.3.2.8.(1) Non-Standard Lumber. NLGA 2014, "Standard Grading Rules for Canadian Lumber," permits lumber to be dressed to sizes below the standard sizes (38 × 89, 38 × 140, 38 × 184, etc.) provided the grade stamp shows the reduced size. This Sentence permits the use of the span tables for such lumber, provided the size indicated on the stamp is not less than 95% of the corresponding standard size. Allowable spans in the tables must be reduced a full 5% even if the undersize is less than the 5% permitted.

A-9.3.2.9.(1) Protection from Termites

Figure A-9.3.2.9.(1)-A
Known termite locations

Note to Figure A-9.3.2.9.(1)-A:
(1) Reference: J.K. Mauldin (1982), N.Y. Su (1995), T. Myles (1997).

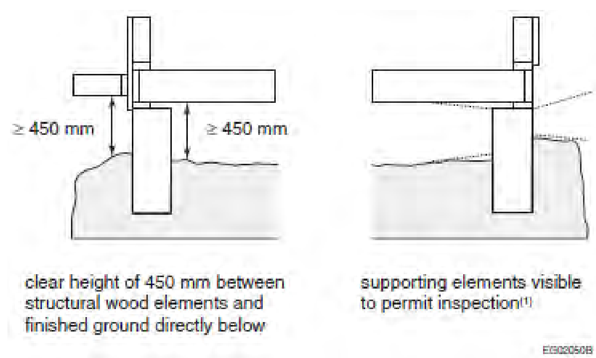


Figure A-9.3.2.9.(1)-B
Clearances under structural wood elements and visibility of supporting elements where required to permit inspection for termite infestation

Note to Figure A-9.3.2.9.(1)-B:
(1) For the height of structural wood elements not directly above finished ground, see Article 9.23.2.3.

A-9.3.2.9.(3) Protection of Structural Wood Elements from Moisture and Decay. There are many above-ground, structural wood systems where precipitation is readily trapped or drying is slow, creating conditions conducive to decay. Beams extending beyond roof decks, junctions between deck members, and connections between balcony guards and walls are three examples of elements that can accumulate water when exposed to precipitation if they are not detailed to allow drainage.

A-9.3.2.9.(4) Protection of Retaining Walls and Cribbing from Decay. Retaining walls supporting soil are considered to be structural elements of the building if a line drawn from the outer edge of the footing to the bottom of the exposed face of the retaining wall is greater than 45° to the horizontal. Retaining walls supporting soil may be structural elements of the building if the line described above has a lower slope.

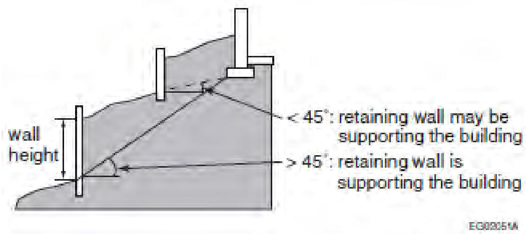


Figure A-9.3.2.9.(4)
Identifying retaining walls that require preservative treatment

Retaining walls that are not critical to the support of building foundations but are greater than 1.2 m in height may pose a danger of sudden collapse to persons adjacent to the wall if the wood is not adequately protected from decay. The height of the retaining wall or cribbing is measured as the vertical difference between the ground levels on each side of the wall.

A-9.4.1.1. Structural Design. Article 9.4.1.1. establishes the principle that the structural members of Part 9 buildings must

- comply with the prescriptive requirements provided in Part 9,
- be designed in accordance with accepted good practice, or
- be designed in accordance with Part 4 using the loads and limits on deflection and vibration specified in Part 9 or Part 4.

Usually a combination of approaches is used. For example, even if the snow load calculation on a wood roof truss is based on Subsection 9.4.2., the joints must be designed in accordance with Part 4. Wall framing may comply with the prescriptive requirements in Subsections 9.23.3., 9.23.10., 9.23.11. and 9.23.12., while the floor framing may be engineered.

Wood Frame Construction," requires engineering expertise. The CWC Guide contains alternative solutions and provides information on the applicability of the Part 9 prescriptive structural requirements to further assist designers and building officials to identify the appropriate design approach. The need for professional involvement in the structural design of a building, whether to Part 4 or Part 9 requirements or accepted good practice, is defined by provincial and territorial legislation.

A-9.4.2.1.(1) Soft Conversion from Imperial Units. The conversion table at the end of the By-law provides factors for the conversion of millimeters to inches. However, not all metric measurements stated in the By-law are exact conversions. For example, while the dimensions given for wood framing members are the exact dimensions of the milled product – i.e., what is commonly referred to as a "2 × 4" is actually 1.5 in. × 3.5 in., which, in mm, is 38 × 89 – the metric dimensions given for spacing between framing elements are actually soft conversions:

Table A-9.4.2.1.(1)

Imperial Unit	Exact Metric Conversion	Soft Metric Conversion Used in Code
12 in.	305 mm	300 mm
16 in.	406 mm	400 mm
24 in.	610 mm	600 mm

It remains common construction practice to arrange joists, rafters and studs in 12, 16 or 24 in. increments so as to properly align them with the edges of sheathing materials. It is therefore assumed that structural elements will be spaced according to the actual metric equivalents.

A-9.4.2.2. Application of Simplified Part 9 Snow Loads. The simplified specified snow loads described in Article 9.4.2.2. may be used where the structure is of the configuration that is typical of traditional wood-frame residential construction and its performance. This places limits on the spacing of joists, rafters and trusses, the spans of these members and supporting members, deflection under load, overall dimensions of the roof and the configuration of the roof. It assumes considerable redundancy in the structure.

Because very large buildings may be constructed under Part 9 by constructing firewalls to break up the building area, it is possible to have Part 9 buildings with very large roofs. The simplified specified snow loads may not be used when the total roof area of the overall structure exceeds 4550 m^2. Thus, the simplified specified snow load calculation may be used for typical townhouse construction but would not be appropriate for much larger commercial or industrial buildings, for example.

The simplified specified snow loads are also not designed to take into account roof configurations that seriously exacerbate snow accumulation. This does not pertain to typical projections above a sloped roof, such as dormers, nor does it pertain to buildings with higher and lower roofs. Although two-level roofs generally lead to drift loading, smaller light-frame buildings constructed according to Part 9 have not failed under these loads. Consequently, the simplified calculation may be used in these cases. Rather, this limitation on application of the simplified calculation pertains to roofs with high parapets or significant other projections above the roof, such as elevator penthouses, mechanical rooms or larger equipment that would effectively collect snow and preclude its blowing off the roof.

The reference to Article 9.4.3.1. invokes, for roof assemblies other than common lumber trusses, the same performance criteria for deflection.

The specific weight of snow on roofs, γ, obtained from measurements at a number of weather stations across Canada varied from about 1.0 to 4.5 kN/m^3. An average value for use in design in lieu of better local data is γ = 3.0 kN/m^3. In some locations the specific weight of snow may be considerably greater than 3.0 kN/m^3. Such locations include regions where the maximum snow load on the roof is reached only after contributions from many snowstorms, coastal regions, and regions where winter rains are considerable and where a unit weight as high as 4.0 kN/m^3 may be appropriate.

A-9.4.2.3.(1) Accessible Platforms Subject to Snow and Occupancy Loads. Many platforms are subject to both occupancy loads and snow loads. These include balconies, decks, verandas, flat roofs over garages and carports. Where such a platform, or a segregated area of such a platform, serves a single dwelling unit, it must be designed for the greater of either the specified snow load or an occupancy load of 1.9 kPa. Where the platform serves more than one single dwelling unit or an occupancy other than a residential occupancy, higher occupancy loads will apply as specified in Table 4.1.5.3.

A-9.4.2.4.(1) Specified Loads for Attics or Roof Spaces with Limited Accessibility. Typical residential roofs are framed with roof trusses and the ceiling is insulated.

Residential trusses are placed at 600 mm on centre with web members joining top and bottom chords. Lateral web bracing is installed perpendicular to the span of the trusses. As a result, there is limited room for movement inside the attic or roof space or for storage of material. Access hatches are generally built to the minimum acceptable dimensions, further limiting the size of material that can be moved into the attic or roof space.

With exposed insulation in the attic or roof space, access is not recommended unless protective clothing and breathing apparatus are worn.

Thus the attic or roof space is recognized as uninhabitable and loading can be based on actual dead load. In emergency situations or for the purpose of inspection, it is possible for a person to access the attic or roof space without over-stressing the truss or causing damaging deflections.

A-Table 9.4.4.1. Classification of Soils. Sand or gravel may be classified by means of a picket test in which a 38 mm by 38 mm picket beveled at the end at 45° to a point is pushed into the soil. Such material is classified as “dense or compact” if a man of average weight cannot push the picket more than 200 mm into the soil and “loose” if the picket penetrates 200 mm or more.

Clay and silt may be classified as “stiff” if it is difficult to indent by thumb pressure, “firm” if it can be indented by moderate thumb pressure, “soft” if it can be easily penetrated by thumb pressure, where this test is carried out on undisturbed soil in the wall of a test pit.

A-9.4.4.4.(1) Soil Movement. In susceptible soils, changes in temperature or moisture content can cause significant expansion and contraction. Soils containing pyrites can expand simply on exposure to air.

Expansion and Contraction due to Moisture
Clay soils are most prone to expansion and contraction due to moisture. Particularly wet seasons can sufficiently increase the volume of the soil under and around the structure to cause heaving of foundations and floors-on-ground, or cracking of foundation walls. Particularly dry seasons or draw-down of water by fast-growing trees can decrease the volume of the soil supporting foundations and floors-on-ground, thus causing settling.

Frost Heave
Frost heave is probably the most commonly recognized phenomenon related to freezing soil. Frost heave results when moisture in frost-susceptible soil (clay and silt) under the footings freezes and expands. This mechanism is addressed by requirements in Section 9.12. regarding the depth of excavations.

Ice Lenses
When moisture in frost-susceptible soils freezes, it forms an ice lens and reduces the vapour pressure in the soil in the area immediately around the lens. Moisture in the ground redistributes to rebalance the vapour pressures providing more moisture in the area of the ice lens. This moisture freezes to the lens and the cycle repeats itself. As the ice lens grows, it exerts pressure in the direction of heat flow. When lenses form close to foundations and heat flow is toward the foundation – as may be the case with unheated crawl spaces or open concrete block foundations insulated on the interior – the forces may be sufficient to crack the foundation.

Adfreezing
Ice lenses can adhere themselves to cold foundations. Where heat flow is essentially upward, parallel to the foundation, the pressures exerted will tend to lift the foundation. This may cause differential movement or cracking of the foundation. Heat loss through basement foundations of cast-in-place concrete or concrete block insulated on the exterior appears to be sufficient to prevent adfreezing. Care must be taken where the foundation does not enclose heated space or where open block foundations are insulated on the interior.

The installation of semi-rigid glass fibre insulation has demonstrated some effectiveness as a separation layer to absorb the adfreezing forces.

Pyrites
Pyrite is the most common iron disulphide mineral in rock and has been identified in rock of all types and ages. It is most commonly found in metamorphic and sedimentary rock, and especially in coal and shale deposits.

Weathering of pyritic shale is a chemical-microbiological oxidation process that results in volume increases that can heave foundations and floors-on-ground. Concentrations of as little as 0.1% by weight have caused heaving. Weathering can be initiated simply by exposing the pyritic material to air. Thus, building on soils that contain pyrites in concentrations that will cause damage to the building should be avoided, or measures should be taken to remove the material or seal it. Material containing pyrites should not be used for backfill at foundations or for supporting foundations or floors-on-ground.

Where it is not known if the soil or backfill contains pyritic material in a deleterious concentration, a test is available to identify its presence and concentration.

References:
(1) Legget, R.F. and Crawford, C.B. Trees and Buildings. Canadian Building Digest 62, Division of Building Research, National Research Council Canada, Ottawa, 1965.
(2) Hamilton, J.J. Swelling and Shrinking Subsoils. Canadian Building Digest 84, Division of Building Research, National Research Council Canada, Ottawa, 1966.
(3) Hamilton, J.J. Foundations on Swelling and Shrinking Subsoils. Canadian Building Digest 184, Division of Building
Research, National Research Council Canada, Ottawa, 1977.
(4) Penner, W., Eden, W.J., and Gratten-Bellew, P.E. Expansion of Pyritic Shales. Canadian Building Digest 52, Division of Building Research, National Research Council Canada, Ottawa, 1975.
(5) Swinton, M.C., Brown, W.C., and Chown, G.A. Controlling the Transfer of Heat, Air and Moisture through the Building Envelope. Small Buildings – Technology in Transition, Building Science Insight '90, Institute for Research in Construction, National Research Council Canada, Ottawa, 1990.

A-9.4.4.6. and 9.15.1.1. Loads on Foundations. The prescriptive solutions provided in Part 9 relating to footings and foundation walls only account for the loads imposed by drained earth. Drained earth is assumed to exert a load equivalent to the load that would be exerted by a fluid with a density of 480 kg/m^3. The prescriptive solutions do not account for surcharges from saturated soil or additional loads from heavy objects located adjacent to the building. Where such surcharges are expected, the footings and foundation walls must be designed and constructed according to Part 4.

A-9.5.1.2. Combination Rooms. If a room draws natural light and natural ventilation from another area, the opening between the two areas must be large enough to effectively provide sufficient light and air. This is why a minimum opening of 3 m^2 is required, or the equivalent of a set of double doors. The effectiveness of the transfer of light and air also depends on the size of the transfer opening in relation to the size of the dependent room; in measuring the area of the wall separating the two areas, the whole wall on the side of the dependent room should be considered, not taking into account offsets that may be in the surface of the wall.

The opening does not necessarily have to be in the form of a doorway; it may be an opening at eye level. However, if the dependent area is a bedroom, provision must be made for the escape window required by Article 9.9.10.1. to fulfill its safety function. This is why a direct passage is required between the bedroom and the other area; the equivalent of at least a doorway is therefore required for direct passage between the two areas.

A-9.5.5.3. Doorways to Rooms with a Bathtub, Shower or Water Closet. If the minimum 860 mm hallway serves more than one room with identical facilities, only one of the rooms is required to have a door not less than 760 mm wide.

If a number of rooms have different facilities, for example, one room has a shower, lavatory and water closet, and another room has a lavatory and water closet, the room with the shower, lavatory and water closet must have the minimum 760 mm wide door.

Where multiple rooms provide the same or similar facilities, one of these rooms must comply with the requirement to have at least one bathtub or shower, one lavatory and one water closet. Where the fixtures are located in two separate rooms served by the same hallway, the requirement for the minimum doorway width would apply to both rooms.

If the minimum 860 mm hallway does not serve any room containing a bathtub, shower and water closet, additional fixtures do not need to be installed.

A-9.6.1.1.(1) Application. The scope of this Section includes glass installed on the interior or on the exterior of a building.

A-9.6.1.2.(2) Mirrored Glass Doors. CAN/CGSB-82.6-M, “Doors, Mirrored Glass, Sliding or Folding, Wardrobe,” covers mirrored glass doors for use on reach-in closets. It specifies that such doors are not to be used for walk-in closets.

A-9.7. Windows, Doors and Skylights. This section applies only to windows, doors and skylights as defined in the scope of the standards referenced in Article 9.7.4.2. Other glazed products, such as site-built windows, curtain walls or sloped glazing, are required to conform to Part 5. It is also permitted for fenestration products within the scope of the NAFS standard to conform to Part 5. This option is typically used for windows and doors that are impractical to subject to the testing requirements of NAFS due to their size or for custom configurations.

A-9.7.3.2.(1)(a) Minimizing Condensation. The total prevention of condensation on the surfaces of fenestration products is difficult to achieve and, depending on the design and construction of the window or door, may not be absolutely necessary.

Clause 9.7.3.2.(1)(a) therefore requires that condensation be minimized, which means that the amount of moisture that condenses on the inside surface of a window, door or skylight, and the frequency at which this occurs, must be limited. The occurrence of such condensation must be sufficiently rare, the accumulation of any water must be sufficiently small, and drying must be sufficiently rapid to prevent the deterioration of moisture-susceptible materials and the growth of fungi.

A-9.7.4. Design and Construction. Garage doors, sloped glazing, curtain walls, storefronts, commercial entrance systems, site-built or site-glazed products, revolving doors, interior windows and doors, storm windows, storm doors, sunrooms and commercial steel doors are not in the scope of NAFS.

All windows, doors and skylights installed to separate conditioned space from unconditioned space or the exterior must also conform to Part 10.

A-9.7.4.2.(1) Standards Referenced for Windows, Doors and Skylights.

General
Doors between an unconditioned garage and a dwelling unit are considered to be in scope of the standard referenced in this Sentence. Although the standard refers to windows in “exterior building envelopes”, a note

to the definition of “building envelope” clarifies that for the purpose of application of the standard, in some cases a building envelope may consist of two separate walls (such as a wall between garage and dwelling unit as well as the exterior wall of the garage itself).

A door leading to the exterior from an unconditioned garage is also within scope of the referenced standard, as it is also part of the exterior building envelope. However, because the scope of the Building By-law takes precedence, these doors are not required to conform to “NAFS”. This Subsection of the By-law does not apply to a door separating two unconditioned spaces.

Canadian Requirements in the Harmonized Standard
In addition to referencing the Canadian Supplement, CSA A440S1, “Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights,” the Harmonized Standard, AAMA/WDMA/CSA 101/I.S.2/A440, “NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights,” contains some Canada-specific test criteria.

Standards Referenced for Excluded Products
Clause 1.1, General, of the Harmonized Standard defines the limits to the application of the standard with respect to various types of fenestration products. A list of exceptions to the application statement identifies a number of standards that apply to excluded products. Compliance with those standards is not required by the By-law; the references are provided for information purposes only.

Label Indicating Performance and Compliance with Standard
The Canadian Supplement requires that a product’s performance ratings be indicated on a label according to the designation requirements in the Harmonized Standard and that the label include
• design pressure, where applicable,
• negative design pressure, where applicable,
• water penetration test pressure, and
• the Canadian air infiltration and exfiltration levels.
It should be noted that, for a product to carry a label in Canada, it must meet all of the applicable requirements of both the Harmonized Standard and the Canadian Supplement, including the forced entry requirements.

Water Penetration Resistance
For the various performance grades listed in the Harmonized Standard, the corresponding water penetration resistance test pressures are a percentage of the design pressure. For R-class products, water penetration resistance test pressures are 15% of design pressure. In Vancouver, driving rain wind pressures (DRWP) have been determined for the locations listed in Appendix C.

These are listed in the Canadian Supplement. The DRWP given in the Canadian Supplement must be used for all products covered in the scope of the Harmonized Standard when used in buildings within the scope of Part 9.

To achieve equivalent levels of water penetration resistance for all locations, the Canadian Supplement includes a provision for calculating specified DRWP at the building site considering building exposure. Specified DRWP values are, in some cases, greater than 15% of design pressure and, in other cases, less than 15% of design pressure. For a fenestration product to comply with the By-law, it must be able to resist the structural and water penetration loads at the building site. Reliance on a percentage of design pressure for water penetration resistance in the selection of an acceptable fenestration product will not always be adequate.

Design pressure values are reported on a secondary designator, which is required by the Canadian Supplement to be affixed to the window.

As an alternative to the above noted provision in the Canadian Supplement for calculating specified DRWP, the Water Resistance values listed in Table C-4 of Appendix C may be used.

Uniform Load Structural Test
The Harmonized Standard specifies that fenestration products be tested at 150% of design pressure for wind (specified wind load) and that skylights and roof windows be tested at 200% of design pressure for snow (specified snow load). With the change in the British Columbia Building Code 2006 to a 1-in-50 return period for wind load, a factor of 1.4 rather than 1.5 is now applied for wind. The Building By-law has traditionally applied a factor of 1.5 rather than 2.0 for snow. Incorporating these lower load factors into the By-law requirements for fenestration would better reflect acceptable minimum performance levels; however, this has not been done in order to avoid adding complexity to the By-law, to recognize the benefits of Canada-US harmonization, and to recognize that differentiation of products that meet the Canadian versus the US requirements would add complexity for manufacturers, designers, specifiers and regulatory officials.

The required design pressure and Performance Grade (PG) rating of doors and windows has been listed for each of the geographic locations found in the Code in Table C-4. These may be used as an alternative to the specified wind load calculations in the Canadian Supplement.

Condensation Resistance
The Harmonized Standard identifies three test procedures that can be used to determine the condensation resistance of windows and doors. Only the physical test procedure given in CSA A440.2, “Fenestration Energy Performance”, can be used to establish Temperature Index (I) values. Computer simulation tools can also be used to estimate the relative condensation resistance of windows, but these methods employ different expressions of performance known as Condensation Resistance Factors (CR). I and CR values are not interchangeable.

Where removable multiple glazing panels (RMGP) are installed on the inside of a window, care should be taken to hermetically seal the RMGP against the leakage of moisture-laden air from the interior into the cavity on the exterior of the RMGP because the moisture transported by the air could lead to significant condensation on the interior surface of the outside glazing.

Basement Windows
Clause 12.4.2, Basement Windows, of the Harmonized Standard refers to products that are intended to meet By-law requirements for ventilation and emergency egress. The minimum test size of 800 mm × 360 mm (total area of 0.288 m^2) specified in the standard will not provide the minimum openable area required by the By-law for bedrooms (i.e. 0.35 m^2 with no dimension less than 380 mm) and the means to provide minimum open area identified in the standard is inconsistent with the requirements of the By-law (See Subsection 9.9.10. for bedroom windows). The minimum test size specified in the standard will also not provide the minimum ventilation area of 0.28 m^2 required for non-heating-season natural ventilation (See Article 9.32.2.2.).

Performance of Doors: Limited Water Ingress Control
While the control of precipitation ingress is a performance requirement for exterior doors, side-hinged doors can comply with the referenced standard, AAMA/WDMA/CSA 101/I.S.2/A440, “NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights,” when tested at a pressure differential of 0 Pa (0.0 psf) or higher, but less than the minimum test pressure required for the indicated performance class and performance grade. Such doors are identified with a “Limited Water” (LW) rating on the product label.

Conditions suitable for the installation of an LW rated door are identified in Sentence 9.7.4.2.(2).

A-9.7.4.3.(2) Performance Requirements. If the option of calculating design pressure performance grade and water resistance values using the Canadian Supplement is chosen, the DRWP values in Table A.1 of that standard must be used for all buildings within the scope of Part 9 of the Building By-law. This requirement applies whether the windows, doors and skylights are designed to conform to Article 9.7.4.2. or to Part 5.

A-9.7.5.2.(1) Forced Entry Via Glazing in Doors and Sidelights. There is no mandatory requirement that special glass be used in doors or sidelights, primarily because of cost. It is, however, a common method of forced entry to break glass in doors and sidelights to gain access to door hardware and unlock the door from the inside. Although insulated glass provides increased resistance over single glazing, the highest resistance is provided by laminated glass. Tempered glass, while stronger against static loads, is prone to shattering under high, concentrated impact loads.

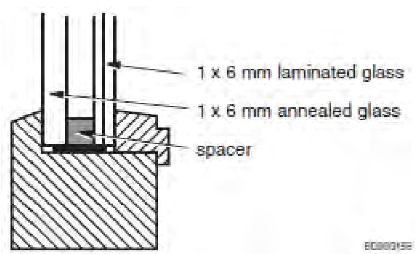


Figure A-9.7.5.2.(1)
Combined laminated/annealed glazing

Laminated glass is more expensive than annealed glass and must be used in greater thicknesses. Figure A-9.7.5.2.(1) shows an insulated sidelight made of one pane of laminated glass and one pane of annealed glass. This method reduces the cost premium that would result if both panes were laminated.

Consideration should be given to using laminated glazing in doors and accompanying sidelights regulated by Article 9.6.1.3., in windows located within 900 mm of locks in such doors, and in basement windows.

Underwriters' Laboratories of Canada have produced ULC-S332, "Burglary Resisting Glazing Material," which provides a test procedure to evaluate the resistance of glazing to attacks by thieves. While it is principally intended for plate glass show windows, it may be of value for residential purposes.

A-9.7.5.2.(6) Door Fasteners. The purpose of the requirement for 30 mm screw penetration into solid wood is to prevent the door from being dislodged from the jamb due to impact forces. It is not the intent to prohibit other types of hinges or strikeplates that are specially designed to provide equal or greater protection.

A-9.7.5.2.(8) Hinged Doors. Methods of satisfying this Sentence include either using non-removable pin hinges or modifying standard hinges by screw fastening a metal pin in a screw hole in one half of the top and bottom hinges. When the door is closed, the projecting portion of the pin engages in the corresponding screw hole in the other half of the hinge and then, even if the hinge pin is taken out, the door cannot be removed.

A-9.7.5.2.(10) & (11) Resistance to Forced Entry Statistical evidence by Vancouver Police has identified that a frequently exploited point of entry in break-ins exists at the residential entry doors due to inherent weaknesses in wood door frame materials, and the location of strikeplate screws located along the grain and near to the deadbolt throw, which contribute to inability for the frame to resist forced entry.

The installation of a metal frame reinforcement plate (See Figures A-9.7.5.2.(10)-A & -B below) directly attached to the backside of a door frame before installation with increased spacing for the points of attachment would significantly increase the resistance of the door to forced entry. This will result reduced incidence of crime and significantly reduce potential costs to owners.

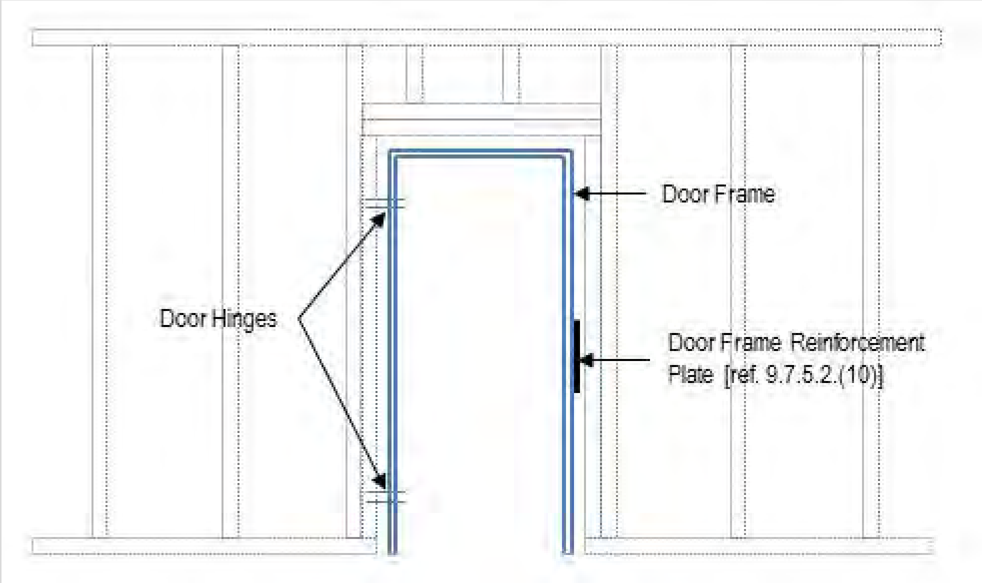


Figure A-9.7.5.2.(10)-A
Typical Location of Door Frame Reinforcement

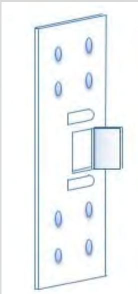


Figure A-9.7.5.2.(10)-B
Frame Reinforcement (Example)

A-9.7.5.3.(1) Resistance of Windows to Forced Entry. Although this Sentence only applies to windows within 2 m of adjacent ground level, certain house and site features, such as balconies or canopy roofs, allow for easy access to windows at higher elevations. Consideration should be given to specifying break-in resistant windows in such locations.

This Sentence does not apply to windows that do not serve the interior of the dwelling unit, such as windows to garages, sun rooms or greenhouses, provided connections between these spaces and the dwelling unit are secure. One method that is often used to improve the resistance of windows to forced entry is the installation of metal "security bars."

However, while many such installations are effective in increasing resistance to forced entry, they may also reduce or eliminate the usefulness of the window as an exit in case of fire or other emergency that prevents use of the normal building exits. Indeed, unless such devices are easily openable from the inside, their installation in some cases would contravene the requirements of Article 9.9.10.1., which requires every bedroom that does not have an exterior door to have at least one window that is large enough and easy enough to open that it can be used as an exit in case of emergency. Thus an acceptable security bar system should be easy to open from the inside while still providing increased resistance to entry from the outside.

A-9.8.4. Tread Configurations. The By-law distinguishes four principal types of stair treads:
• rectangular treads, which are found in straight flights;
• tapered treads, which are found in curved flights, (the term tapered tread also includes winders); and
• winders are described in Note A-9.8.4.6.
See Figure A-9.8.4.-A.

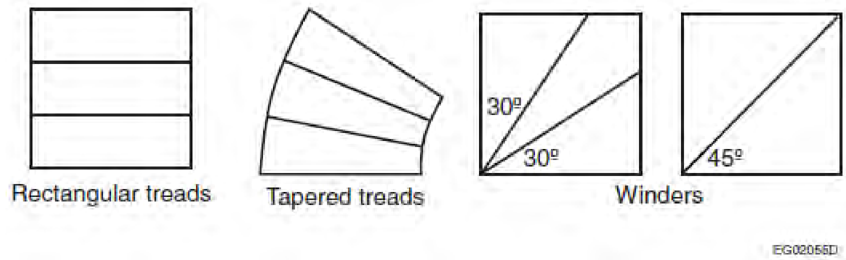


Figure A-9.8.4.-A
Types of treads

Articles 9.8.4.1. to 9.8.4.8. specify various dimensional limits for steps. Figure A-9.8.4.-B illustrates the elements of a step and how these are to be measured.

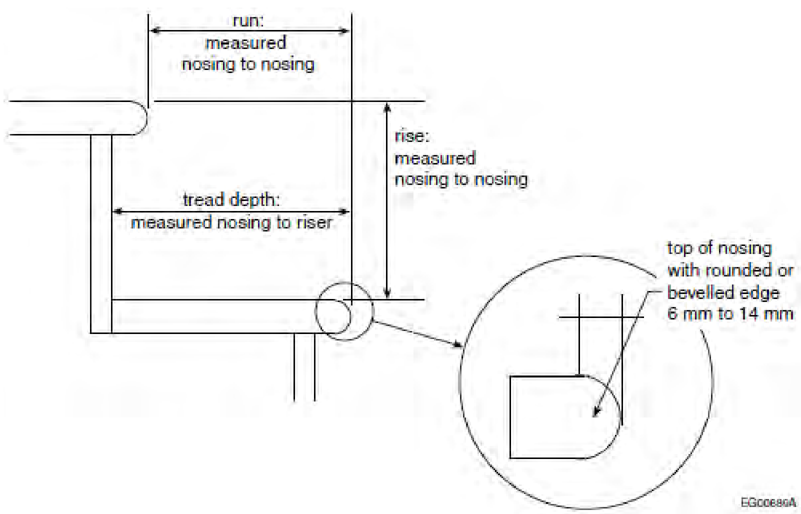


Figure A-9.8.4.-B
Elements of steps and their measurement

A-9.8.4.6. Winders. Where a stair must turn, the safest method of incorporating the turn is to use a landing. Within a dwelling unit, however, where occupants are familiar with their environment, winders are an acceptable method of reducing the amount of floor area devoted to the stair and have not been shown to be more hazardous than a straight run of steps. Nevertheless, care is required to ensure that winders are as safe as possible. Experience has shown that 30° winders are the best compromise and require the least change in the natural gait of the stair user; 45° winders are also acceptable, as they are wider. The By-law permits only these two angles. Although it is normal By-law practice to specify upper and lower limits, in this case it is necessary to limit the winders to specific angles with no tolerance above or below these angles other than normal construction tolerances. One result of this requirement is that winder-type turns in stairs are limited to 30° or 45° (1 winder), 60° (2 winders), or 90° (2 or 3 winders). See Figure A-9.8.4.6.

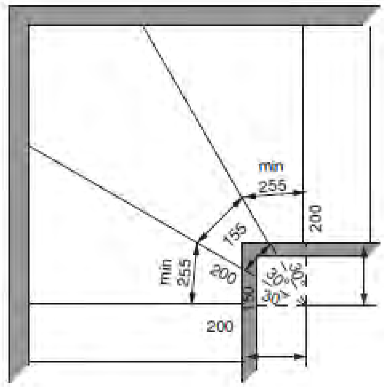


Figure A-9.8.4.6.
Winders

A-9.8.4.8. Tread Nosings. A sloped or beveled edge on tread nosings will make the tread more visible through light modeling. The sloped portion of the nosing must not be too wide so as to reduce the risk of slipping of the foot. See Figure A-9.8.4.-B.

A-9.8.7.1.(2) Wider Stairs than Required. The intent of Sentence 9.8.7.1.(2) is that handrails be installed in relation to the required stair width only, regardless of the actual width of the stair and ramp. The required handrails are provided along the assumed natural path of travel to, from and within the building.

A-9.8.7.2. Continuity of Handrails. The guidance and support provided by handrails is particularly important at the beginning and end of ramps and flights of stairs and at changes in direction such as at landings and winders.
The intent of the requirement in Sentence (2) for handrails to be continuous throughout the length of the stair is that the handrail be continuous from the bottom riser to the top riser of the stair. (See Figure A-9.8.7.2.)

For stairs or ramps serving a single dwelling unit, the intent of the requirement for handrails to be continuous throughout the length of the flight is that the handrail be continuous from the bottom riser to the top riser of the flight. The required handrail may start back from the bottom riser only if it is supported by a newel post or volute installed on the bottom tread. (See Figure A-9.8.7.2.) With regard to stairs serving a single dwelling unit, the handrail may terminate at landings.

In the case of stairs within dwelling units that incorporate winders, the handrail should be configured so that it will in fact provide guidance and support to the stair user throughout the turn through the winder.

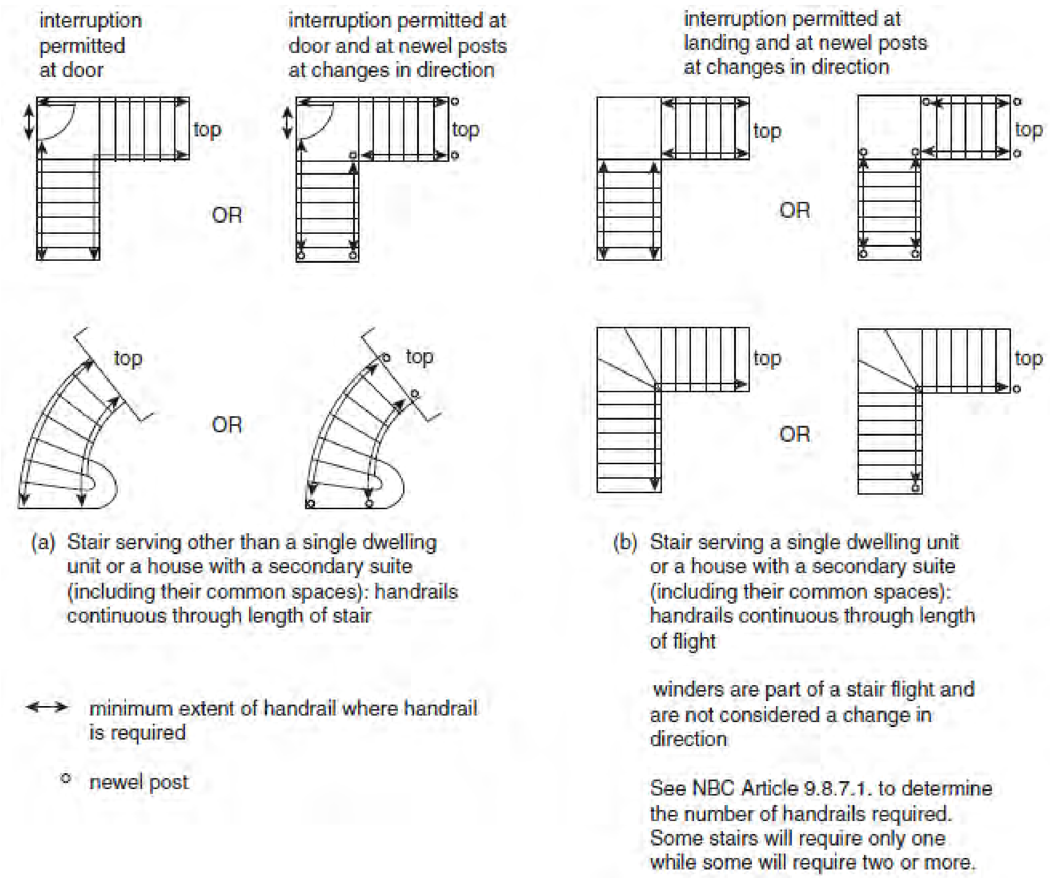


Figure A-9.8.7.2.
Continuity of handrails at the top and bottom of stairs and flights

Note to Figure A-9.8.7.2.:
(1) See Article 9.8.7.1. to determine the number of handrails required. Some stairs will require only one, while some will require two or more.

To achieve this end, the rail should not extend so far into a hallway as to reduce the clear width of the hallway to less than the required width. Where the stair terminates in a room or other space, likely paths of travel through that room or space should be assessed to ensure that any projection of the handrail beyond the end of the stair will not interfere with pedestrian travel. As extensions of handrails beyond the first and last riser are not required in dwelling units (See Sentence 9.8.7.3.(2)) and as occupants of dwellings are generally familiar with their surroundings, the design of dwellings would not generally be affected by this requirement.

Handrails are also required to terminate in a manner that will not create a safety hazard to blind or visually impaired persons, children whose heads may be at the same height as the end of the rail, or persons wearing loose clothing or carrying items that might catch on the end of the rail. One approach to reducing potential hazards is returning the handrail to a wall, floor or post. Again, within dwelling units, where occupants are generally familiar with their surroundings, returning the handrail to a wall, floor or post may not be necessary. For example, where the handrail is fastened to a wall and does not project past the wall into a hallway or other space, a reasonable degree of safety is assumed to be provided; other alternatives may provide an equivalent level of protection.

A-9.8.7.3.(2) Handrail Extensions. As noted in Note A-9.8.7.2., the guidance and support provided by handrails is particularly important at the beginning and end of ramps and flights of stairs and at changes in direction. The extended handrail provides guidance and allows users to steady themselves upon entering or leaving a ramp or flight of stairs. Such extensions are particularly useful to visually-impaired persons, and persons with physical disabilities or who are encumbered in their use of the stairs or ramp.

A-9.8.7.4. Height of Handrails. Figure A-9.8.7.4. illustrates how to measure handrail height.

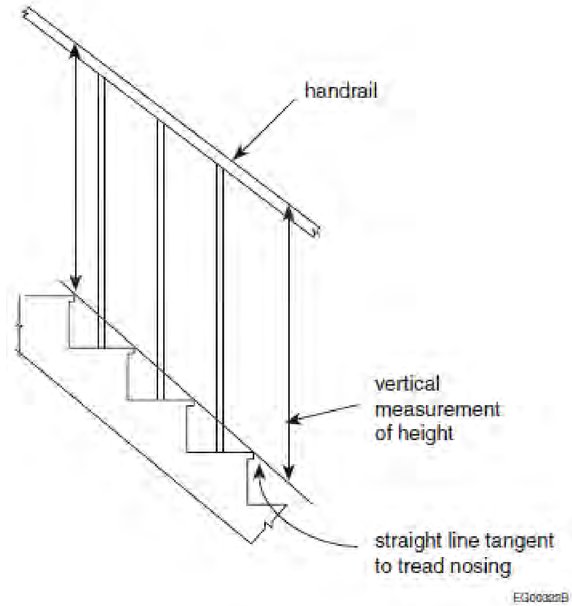


Figure A-9.8.7.4.
Measuring handrail height

A-9.8.7.5.(2) Handrail Sections. Handrails are intended to provide guidance and support to stair users. To fulfil this intent, handrails must be "graspable."

The graspable portion of a handrail should allow a person to comfortably and firmly grab hold by allowing their fingers and thumb to curl under part or all of the handrail. Where the configuration or dimensions of the handrail do not allow a person's fingers and thumb to reach the bottom of it, recesses that are sufficiently wide and deep to accommodate a person's fingers and thumb must be provided on both sides of the handrail, at the bottom of the graspable portion, which must not have any sharp edges.

A-9.8.7.6.(1) Construction Below Handrails. The By-law allowance for projections below a handrail are intended to accommodate structural supports for the handrails, guards, or other ancillary safety features such as intermediate handrails for children. Such construction may project into the required stair width, but shall not extend more than 100 mm from the top surface of the handrail.

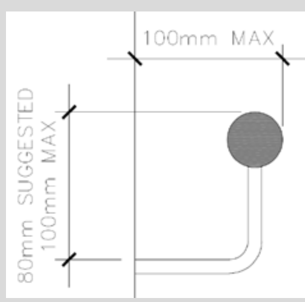


Figure A-9.8.7.6.(1)
Construction below handrails

A-9.8.7.7. Attachment of Handrails. Handrails are intended to provide guidance and support to the stair user and to arrest falls. The loads on handrails may therefore be considerable. The attachment of handrails serving a single dwelling unit may be accepted on the basis of experience or structural design.

A-9.8.8.1. Required Guards. The requirements relating to guards stated in Part 9 are based on the premise that, wherever there is a difference in elevation of 600 mm or more between two floors, or between a floor or other surface to which access is provided for other than maintenance purposes and the next lower surface, the risk of injury in a fall from the higher surface is sufficient to warrant the installation of some kind of barrier to reduce the chances of such a fall. A wall along the edge of the higher surface will obviously prevent such a fall, provided the wall is sufficiently strong that a person cannot fall through it. Where there is no wall, a guard must be installed. Because guards clearly provide less protection than walls, additional requirements apply to guards to ensure that a minimum level of protection is provided. These relate to the characteristics described in Notes A-9.8.8.3., A-9.8.8.5.(1) and (2), A-9.8.8.5.(3) and A-9.8.8.6.(1).

Examples of such surfaces where the difference in elevation could exceed 600 mm and consequently where guards would be required include, but are not limited to, landings, porches, balconies, mezzanines, galleries, and raised walkways. Especially in exterior settings, surfaces adjacent to walking surfaces, stairs or ramps often are not parallel to the walking surface or the surface of the treads or ramps.

Consequently, the walking surface, stair or ramp may need protection in some locations but not in others. (See Figure A-9.8.8.1.) In some instances, grades are artificially raised close to walking surfaces, stairs or ramps to avoid installing guards. This provides little or no protection for the users. That is why the requirements specify differences in elevation not only immediately adjacent to the construction but also for a distance of 1200 mm from it by requiring that the slope of the ground be within certain limits.
(See Figure A-9.8.8.1.)

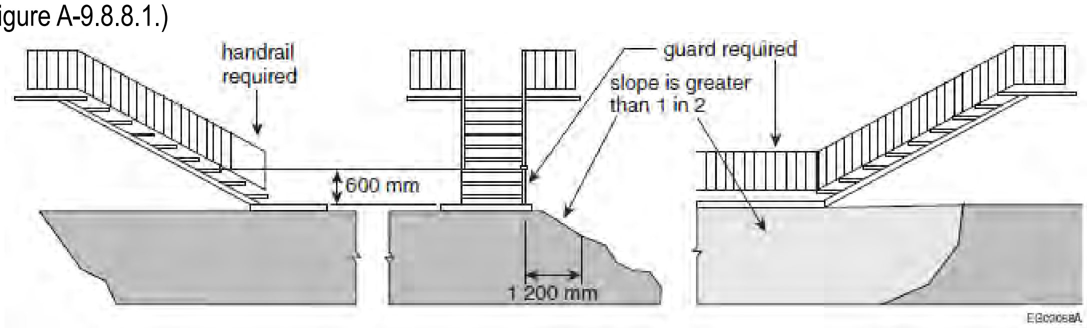


Figure A-9.8.8.1.
Required locations of guards

A-9.8.8.1.(4) Height of Window Sills above Floors or Ground. The primary intent of the requirement is to minimize the likelihood of small children falling significant heights from open windows. Reflecting reported cases, the requirement applies only to dwelling units and generally those located on the second floor or higher of residential or mixed use buildings where the windows are essentially free-swinging or free-sliding.

Free-swinging or free-sliding means that a window that has been cracked open can be opened further by simply pushing on the openable part of the window. Care must be taken in selecting windows, as some with special operating hardware can still be opened further by simply pushing on the window.

Casement windows with crank operators would be considered to conform to Clause (4)(b). To provide additional safety, where slightly older children are involved, occupants can easily remove the crank handles from these windows. Awning windows with scissor hardware, however, may not keep the window from swinging open once it is unlatched. Hopper windows would be affected only if an opening is created at the bottom as well as at the top of the window. The requirement will impact primarily on the use of sliding windows which do not incorporate devices in their construction that can be used to limit the openable area of the window.

The 100 mm opening limit is consistent with widths of openings that small children can fall through. It is only invoked, however, where the other dimension of the opening is more than 380 mm. Again, care must be taken in selecting a window. At some position, scissor hardware on an awning window may break up the open area such that there is no unobstructed opening with dimensions greater than 380 mm and 100 mm. At another position, however, though the window is not open much more, the hardware may not adequately break up the opening. The 450 mm height off the floor recognizes that furniture is often placed under windows and small children are often good climbers.

A-9.8.8.1.(9) and (10) Protection Around Swimming Pools. Fences and gates enclosing swimming pools are intended to prevent unsupervised people and especially children from gaining access to a pool. The protective barrier may be located at the property boundary and may comprise building walls, gates and other barriers that meet guard requirements.

A-9.8.8.2. Loads on Guards. Guards must be constructed so as to be strong enough to protect persons from falling under normal use. Many guards installed in dwelling units or on exterior stairs serving one or two dwelling units have demonstrated acceptable performance over time. The loading described in the first row of Table 9.8.8.2. is intended to be consistent with the performance provided by these guards. Examples of guard construction presented in the "2012 Building Code Compendium, Volume 2, Supplementary Standard SB-7, Guards for Housing and Small Buildings" meet the criteria set in the National Building Code for loads on guards, including the more stringent requirements of Sentences 9.8.8.2.(1) and (2).

The load on guards within dwelling units, or on exterior guards serving not more than two dwelling units, is to be imposed over an area of the guard such that, where standard balusters are used and installed at the maximum 100 mm spacing permitted for required guards, 3 balusters will be engaged. Where the balusters are wider, only two may be engaged unless they are spaced closer together. Where the guard is not required, and balusters are installed more than 100 mm apart, fewer balusters may be required to carry the imposed load.

A-9.8.8.3. Minimum Heights. Guard heights are generally based on the waist heights of average persons. Generally, lower heights are permitted in dwelling units because the occupants become familiar with the potential hazards, and situations which lead to pushing and jostling under crowded conditions are less likely to arise.

A-9.8.8.5.(1) and (2) Risk of Falling through Guards. The risk of falling through a guard is especially prevalent for children. Therefore the requirements are stringent for guards in all buildings except industrial buildings, where children are unlikely to be present except under strict supervision.

A-9.8.8.5.(3) Risk of Children Getting Their Head Stuck between Balusters. The requirements to prevent children falling through guards also serve to provide adequate protection against this problem. However, guards are often installed where they are not required by the By-law; i.e., in places where the difference in elevation is less than 600 mm. In these cases, there is no need to require the openings between balusters to be less than 100 mm. However, there is a range of openings between 100 mm and 200 mm in which children can get their head stuck. Therefore, openings in this range are not permitted except in buildings of industrial occupancy, where children are unlikely to be present except under strict supervision.

A-9.8.8.6.(1) Configuration of Members, Attachments or Openings in Guards so as to not Facilitate Climbing. Some configurations of members, attachments or openings may be part of a guard design and still comply with Sentence 9.8.8.6.(1). Figures A-9.8.8.6.(1)-A to A-9.8.8.6.(1)-D present a few examples of designs that are considered to not facilitate climbing.

Protrusions that are greater than 450 mm apart horizontally and vertically are considered sufficiently far apart to reduce the likelihood that young children will be able to get a handhold or toehold on the protrusions and climb the guard.

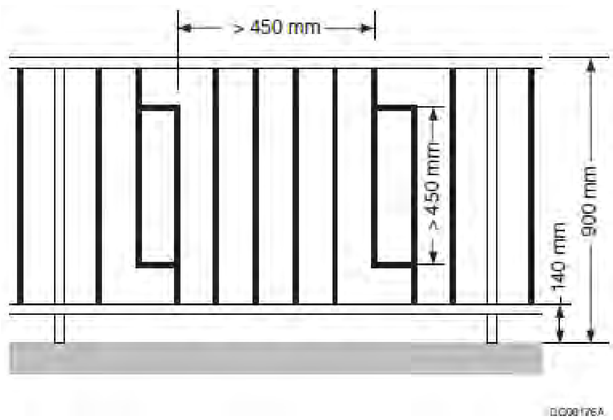


Figure A-9.8.8.6.(1)-A
Example of minimum horizontal and vertical clearances between protrusions in guards

Protrusions that present a horizontal offset of 15 mm or less are considered to not provide a sufficient foot purchase to facilitate climbing.

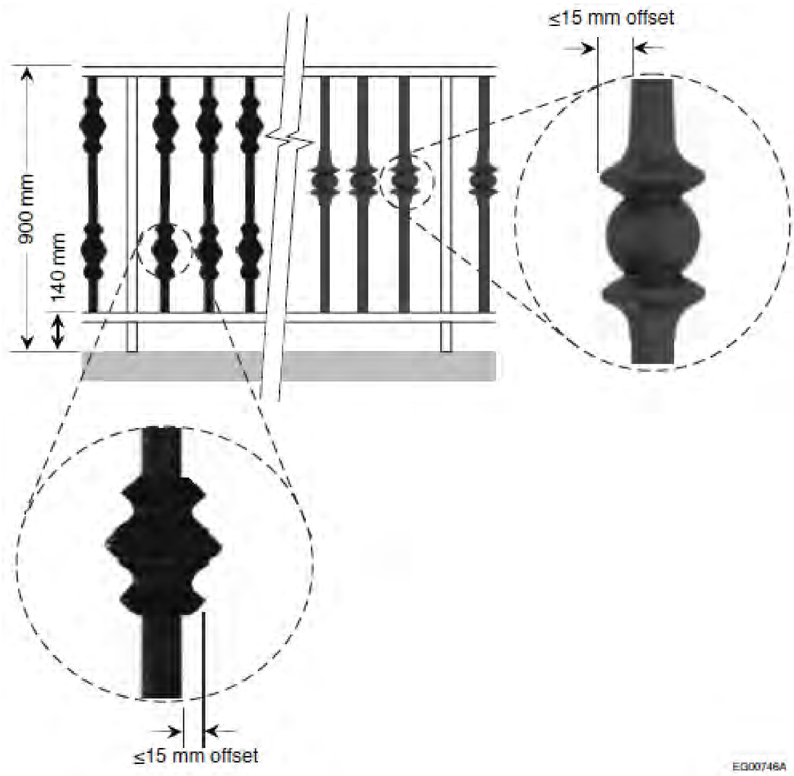


Figure A-9.8.8.6.(1)-B
Examples of maximum horizontal offset of protrusions in guards

A guard incorporating spaces that are not more than 45 mm wide by 20 mm high is considered to not facilitate climbing because the spaces are too small to provide a toehold.

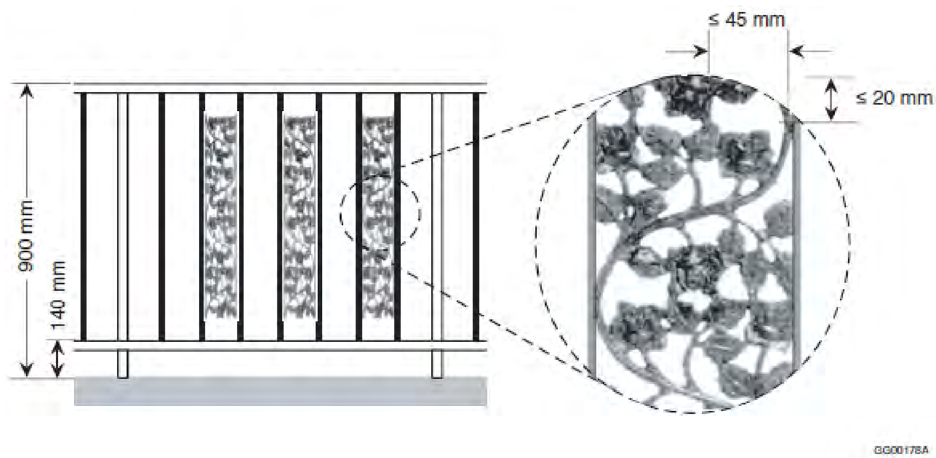


Figure A-9.8.8.6.(1)-C
Example of a guard with spaces created by the protruding elements that are not more than 45 mm wide and 20 mm high

Protrusions that present more than a 2-in-1 slope on the offset are considered to not facilitate climbing because such a slope is considered too steep to provide adequate footing.

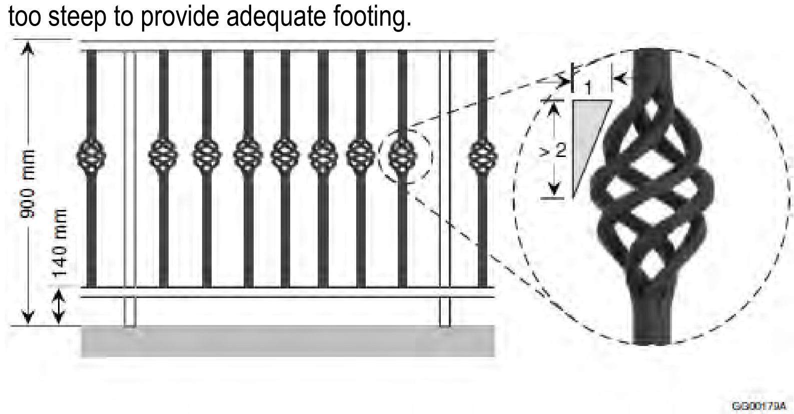


Figure A-9.8.8.6.(1)-D
Example of guard protrusions with a slope greater than 2 in 1

A-9.9.4.5.(1) Openings in Exterior Walls of Exits.

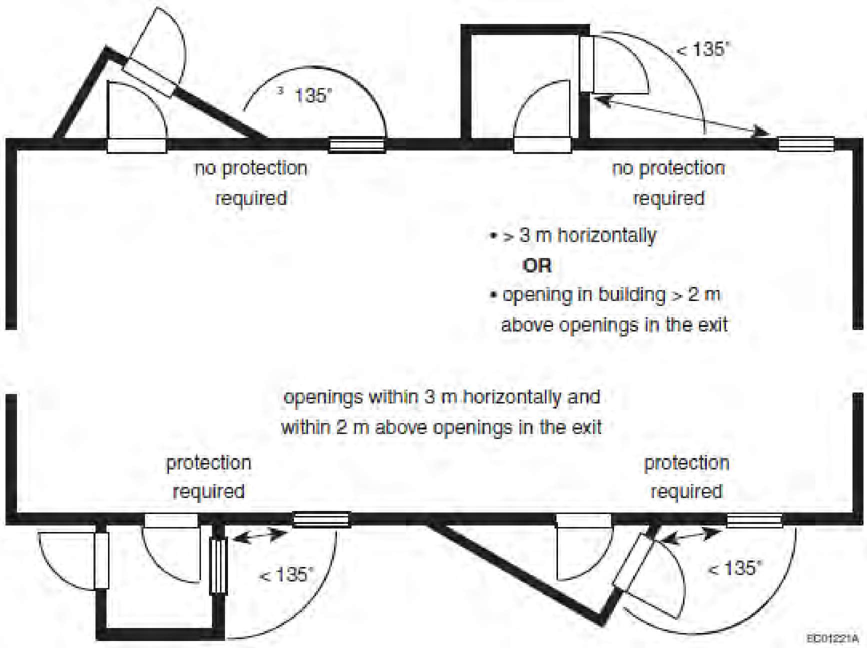


Figure A-9.9.4.5.(1)
Protection of openings in exterior walls of exits

A-9.9.8.4.(1) Independent and Remote Exits. Subsection 9.9.8. requires that some floor areas have more than one exit.

The intent is to ensure that, if one exit is made untenable or inaccessible by a fire, or its exterior door is blocked by an exterior incident, one or more other exits will be available to permit the occupants to escape. However, if the exits are close together, all exits might be made untenable or inaccessible by the same fire. Sentence 9.9.8.4.(1) therefore requires at least two of the exits to be located remotely from each other. This is not a problem in many buildings falling under Part 9. For instance, apartment buildings usually have exits located at either end of long corridors. However, in other types of buildings (e.g. dormitory and college residence buildings) this is often difficult to accomplish and problems arise in interpreting the meaning of the word "remote." Article 3.4.2.3. is more specific, generally requiring the distance between exits to be one half the diagonal dimension of the floor area or at least 9 m. However, it is felt that such criteria would be too restrictive to impose on the design of all the smaller buildings which come under Part 9.

Nevertheless, the exits should be placed as far apart as possible and the Part 3 criteria should be used as a target. Designs in which the exits are so close together that they will obviously both become contaminated in the event of a fire are not acceptable.

A-9.9.10.1.(1) Escape Windows from Bedrooms. Sentence 9.9.10.1.(1) generally requires every bedroom in an unsprinklered suite to have at least one window or door opening to the outside that is large enough and easy enough to open so that it can be used as an exit in the event that a fire prevents use of the building's normal exits. The minimum unobstructed opening specified for escape windows must be achievable using only the normal window operating procedure. The escape path must not go through nor open onto another room, floor or space.
Where a bedroom is located in an unsprinklered suite in a basement, an escape window or door must be located in the bedroom. It is not sufficient to rely on egress through other basement space to another escape window or door.

Window Height
The Article does not set a maximum sill height for escape windows; it is therefore possible to install a window or skylight that satisfies the requirements of the Article but defeats the Article's intent by virtue of

being so high that it cannot be reached for exit purposes. It is recommended that the sills of windows intended for use as emergency exits be not higher than 1.5 m above the floor. However, it is sometimes difficult to avoid having a higher sill: on skylights and windows in basement bedrooms for example. In these cases, it is recommended that access to the window be improved by some means such as built-in furniture installed below the window.

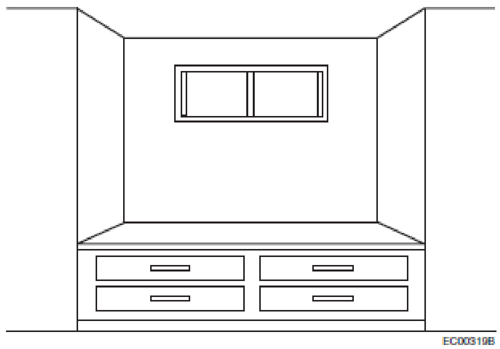


Figure A-9.9.10.1.(1)
Built-in furniture to improve access to a window

A-9.9.10.1.(2) Bedroom Window Opening Areas and Dimensions. Although the minimum opening dimensions required for height and width are 380 mm, a window opening that is 380 mm by 380 mm would not comply with the minimum area requirements. (See Figure A-9.9.10.1.(2))

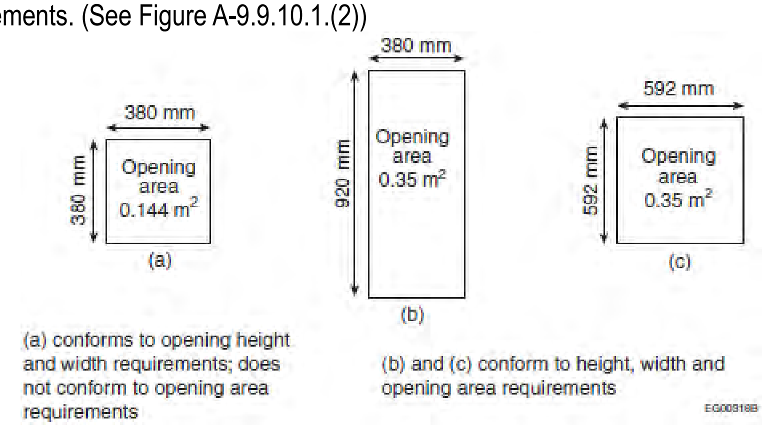


Figure A-9.9.10.1.(2)
Window opening areas and dimensions

A-9.9.10.1.(3) Window Opening into a Window Well. Sentence 9.9.10.1.(3) specifies that there must be a minimum clearance of 760 mm in front of designated escape windows to allow persons to escape a basement bedroom in an emergency.

This specified minimum clearance is consistent with the minimum required width for means of egress from a floor area (See Article 9.9.5.5.) and the minimum required width for path of travel on exit stairs (See Article 9.9.6.1.). It is considered the smallest acceptable clearance between the escape window and the facing wall of the window well that can accommodate persons trying to escape a bedroom in an emergency given that they are not moving straight through the window but must move outward and up, and must have sufficient space to change body orientation. Once this clearance is provided, no additional clearance is needed for windows with sliders, casements, or inward-opening awnings.

However, for windows with outward-opening awnings, additional clearance is needed to provide the required 760 mm beyond the outer edge of the sash. (See Figure A-9.9.10.1.(3).)

Depending on the likelihood of snow accumulation in the window well, it could be difficult – if not impossible – to escape in an emergency. The window well should be designed to provide sufficient clear space for a person to get out the window and then out the well, taking into account potential snow accumulation.

Hopper windows (bottom-hinged operators) should not be used as escape windows in cases where the occupants would be required to climb over the glass.

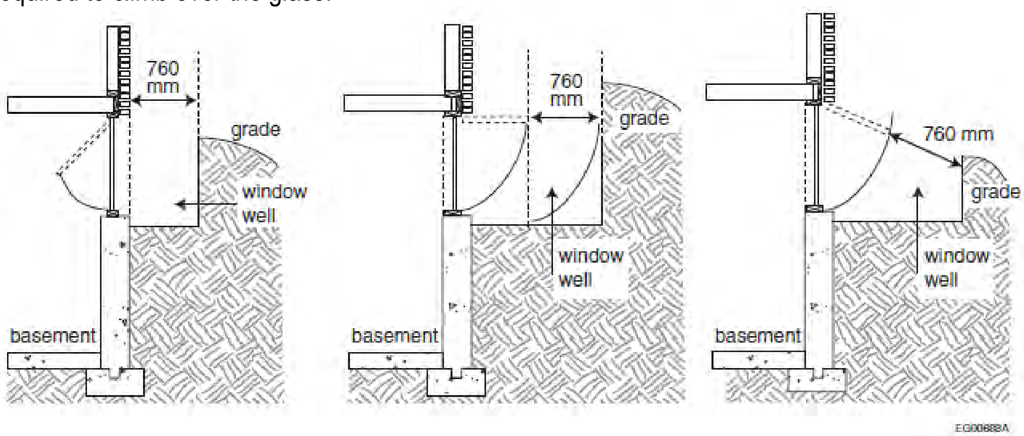


Figure A-9.9.10.1.(3)
Windows providing a means of escape that open into a window well

A-9.10.1.4.(1) Commercial Cooking Equipment. Part 6 refers to NFPA 96, "Ventilation Control and Fire Protection of
Commercial Cooking Operations," which in turn references "Commercial Cooking Equipment." However, the deciding factor as to whether or not NFPA 96 applies is the potential for production of grease-laden vapours and smoke, rather than the type of equipment used. While NFPA 96 does not apply to domestic equipment for normal residential family use, it should apply to domestic equipment used in commercial, industrial, institutional and similar cooking applications where the potential for the production of smoke and grease-laden vapours exceeds that for normal residential family use.

A-9.10.3.1. Fire and Sound Resistance of Building Assemblies. Tables 9.10.3.1.-A and 9.10.3.1.-B have been developed from information gathered from tests. While a large number of the assemblies listed were tested, the fire-resistance and acoustical ratings for others were assigned on the basis of extrapolation of information from tests of similar assemblies. Where there was enough confidence relative to the fire performance of an assembly, the fire-resistance ratings were assigned relative to the commonly used minimum ratings of 30 min, 45 min and 1 h, including a designation of "< 30 min" for assemblies that are known not to meet the minimum 30-minute rating. Where there was not enough comparative information on an assembly to assign to it a rating with confidence, its value in the tables has been left blank (hyphen), indicating that its rating remains to be assessed through another means. Future work is planned to develop much of this additional information.

These tables are provided only for the convenience of By-law users and do not limit the number of assemblies permitted to those in the tables. Assemblies not listed or not given a rating in these tables are equally acceptable provided their fire and sound resistance can be demonstrated to meet the above-noted requirements either on the basis of tests referred to in Article 9.10.3.1. and Subsection 9.11.1. or by using the data in Appendix D, Fire-Performance Ratings. It should be noted, however, that Tables 9.10.3.1.-A and 9.10.3.1.-B are not based on the same assumptions as those used in Appendix D. Assemblies in Tables 9.10.3.1.-A and 9.10.3.1.-B are described through their generic descriptions and variants and include details given in the notes to the tables. Assumptions for Appendix D include different construction details that must be followed rigorously for the calculated ratings to be expected. These are two different methods of choosing assemblies that meet required fire ratings.

Table 9.10.3.1.-B presents fire-resistance and acoustical ratings for floor, ceiling and roof assemblies. The fire-resistance ratings are appropriate for all assemblies conforming to the construction specifications given in Table 9.10.3.1.-B, including applicable table notes. Acoustical ratings for assemblies decrease with decreasing depth and decreasing separation of the structural members; the values listed for sound transmission class and impact insulation class are suitable for the minimum depth of structural members identified in the description, including applicable table notes, and for structural member spacing of 305 mm o.c., unless other values are explicitly listed for the assembly. Adjustments to the acoustical ratings to allow for the benefit of deeper or more widely spaced structural members are given in Table Notes (9) and (10).

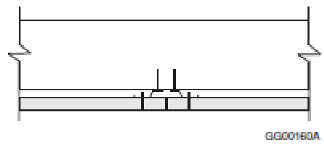


Figure A-9.10.3.1.-A
Single layer butt joint details
Notes to Figure A-9.10.3.1.-A:
(1) Figure is for illustrative purposes only and is not to scale.
(2) The structural member can be any one of the types described in the Table.
(3) Adjacent gypsum board butt ends are attached to separate resilient channels using regular Type S screws, located a minimum of 38 mm from the butt end.

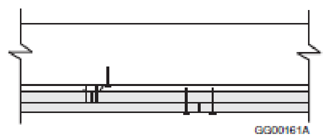


Figure A-9.10.3.1.-B
Double layer butt joint details
Notes to Figure A-9.10.3.1.-B:
(1) Figure is for illustrative purposes only and is not to scale.
(2) The structural member can be any one of the types described in the Table.
(3) Base layer butt ends can be attached to a single resilient channel using regular Type S screws.
(4) Type G screws measuring a minimum of 32 mm in length and located a minimum of 38 mm from the butt end are used to fasten the butt ends of the face layer to the base layer.

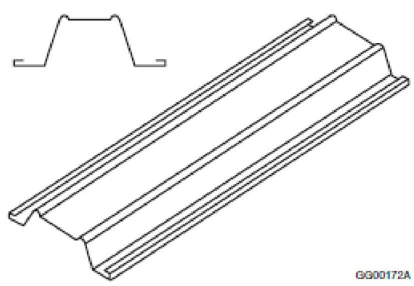


Figure A-9.10.3.1.-C
Example of steel furring channel
Note to Figure A-9.10.3.1.-C:
(1) Figure is for illustrative purposes only and is not to scale.

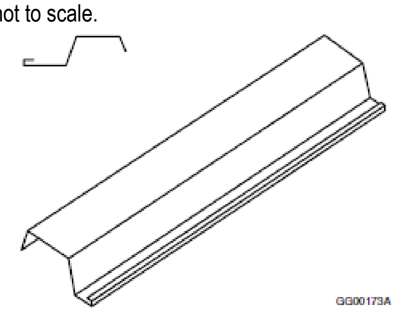


Figure A-9.10.3.1.-D
Example of resilient metal channel

Note to Figure A-9.10.3.1.-D:
(1) Figure is for illustrative purposes only and is not to scale.

A-9.10.4.1.(4) Mezzanines Not Considered as Storeys. Mezzanines increase the occupant load and the fire load of the storey of which they are part. To take the added occupant load into account for the purpose of evaluating other requirements that are dependent on this criteria, their floor area is added to the floor area of the storey.

A-9.10.9.6.(1) Penetration of Fire-Rated Assemblies by Service Equipment. This Sentence, together with Article 3.1.9.1., is intended to ensure that the integrity of fire-rated assemblies is maintained where they are penetrated by various types of service equipment.

For buildings regulated by the requirements in Part 3, fire stop materials used to seal openings around building services, such as pipes, ducts and electrical outlet boxes, must meet a minimum level of performance demonstrated by standard test criteria.

This is different from the approach in Part 9. Because of the type of construction normally used for buildings regulated by the requirements in Part 9, it is assumed that this requirement is satisfied by the use of generic fire stop materials such as mineral wool, gypsum plaster or Portland cement mortar.

A-9.10.9.16.(4) Separation between Dwelling Units and Storage or Repair Garages. The gas-tight barrier between a dwelling unit and an attached garage is intended to provide protection against the entry of carbon monoxide and gasoline fumes into the dwelling unit. Building assemblies incorporating an air barrier system will perform adequately with respect to gas tightness, provided all joints in the airtight material are sealed and reasonable care is exercised where the wall or ceiling is pierced by building services. Where a garage is open to the adjacent attic space above the dwelling unit it serves, a gas-tight barrier in the ceiling of the dwelling unit will also provide protection. Unit masonry walls forming the separation between a dwelling unit and an adjacent garage should be provided with two coats of sealer or plaster, or covered with gypsum board on the side of the wall exposed to the garage. All joints must be sealed to ensure continuity of the barrier. (See also Sentences 9.25.3.3.(3) to (8).)

A-9.10.12.4.(1) Protection of Overhang of Common Roof Space.

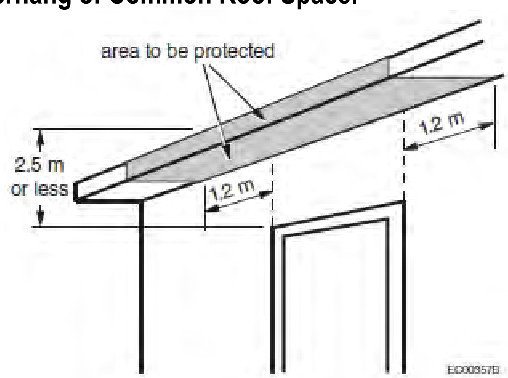


Figure A-9.10.12.4.(1)
Protection of overhang of common roof space

A-9.10.12.4.(3) Protection at Soffits. The materials required by this Sentence to be used as protection for soffit spaces in certain locations do not necessarily have to be the finish materials. They can be installed either behind the finishes chosen for the soffits or in lieu of these.

A-9.10.13.2.(1) Wood Doors in Fire Separations. CAN/ULC-S113, "Wood Core Doors Meeting the Performance

Required by CAN/ULC-S104 for Twenty Minute Fire Rated Closure Assemblies," provides construction details to enable manufacturers to build wood core doors that will provide a 20 min fire-protection rating without the need for testing. The standard requires each door to be marked with
1. the manufacturer's or vendor's name or identifying symbol,
2. the words "Fire Door," and
3. a reference to the fire-protection rating of 20 min.

A-9.10.14.5.(1) Minor Combustible Cladding Elements. Minor elements of cladding that is required to be noncombustible are permitted to be of combustible material, provided they are distributed over the building face and not concentrated in one area. Examples of minor combustible cladding elements include door and window trim and some decorative elements.

A-9.10.14.5.(7) Permitted Projections. The definition of exposing building face provided in Sentence 1.4.1.2.(1) of Division A refers to "that part of the exterior wall of a building … or, where a building is divided into fire compartments, the exterior wall of a fire compartment …" Because the exposing building face is defined with respect to the exterior wall, projections from exposing building faces are elements that do not incorporate exterior walls. Depending on their specific configurations, examples of constructions that would normally be permitted by Sentence 9.10.14.5.(7) are balconies, platforms, canopies, eave projections and stairs. However, if a balcony, platform or stair is enclosed, its exterior wall would become part of an exposing building face and the construction could not be considered to be a projection from the exposing building face.

A-9.10.14.5.(8) Protection at Projections. Sentence 9.10.14.5.(7) permits certain projections from exposing building faces where the projections do not have exterior walls and thus clearly do not constitute part of the exposing building face.

Sentence 9.10.14.5.(8) refers to other types of projections from the exposing building face, such as those for fireplaces and chimneys.
It is recognized that these types present more vertical surface area compared to platforms, canopies and eave projections, and may be enclosed by constructions that are essentially the same as exterior walls. These constructions, however, do not enclose habitable space, are of limited width and may not extend a full storey in height. Consequently, Sentence (8) allows these projections beyond the exposing building face of buildings identified in Sentence (6), provided additional fire protection is installed on the projection.

Figure A-9.10.14.5.(8) illustrates projections that extend within 1.2 m of the property line where additional protection must be provided. Where a projection extends within 0.6 m of the property line, it must be protected to the same degree as an exposing building face that has a limiting distance of less than 0.6 m. Where a projection extends to less than 1.2 m but not less than 0.6 m of the property line, it must be protected to the same degree as an exposing building face that has a limiting distance of less than 1.2 m.

Protection is also required on the underside of the projection where the projection is more than 0.6 m above finished ground level, measured at the exposing building face.

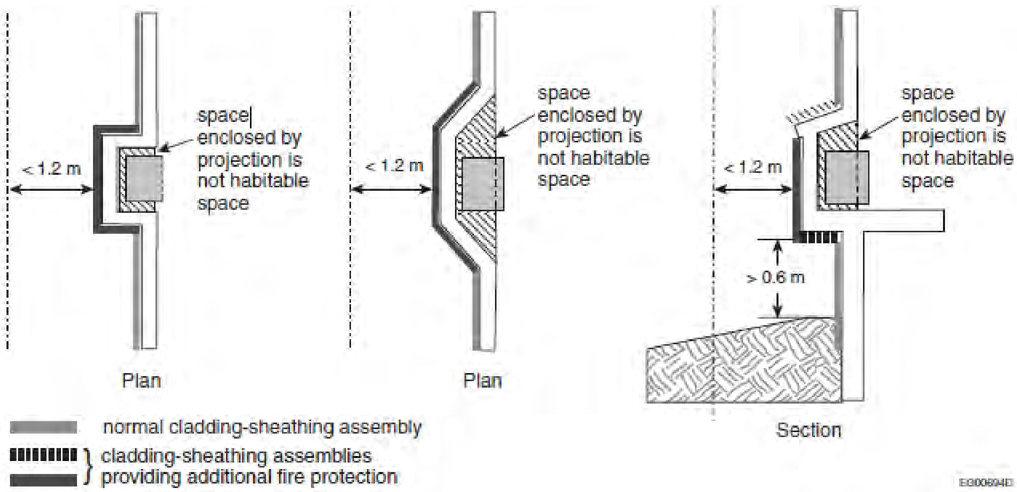


Figure A-9.10.14.5.(8)
Protection at projections

A-9.10.14.5.(11) and 9.10.15.5.(10) Roof Soffit Projections.

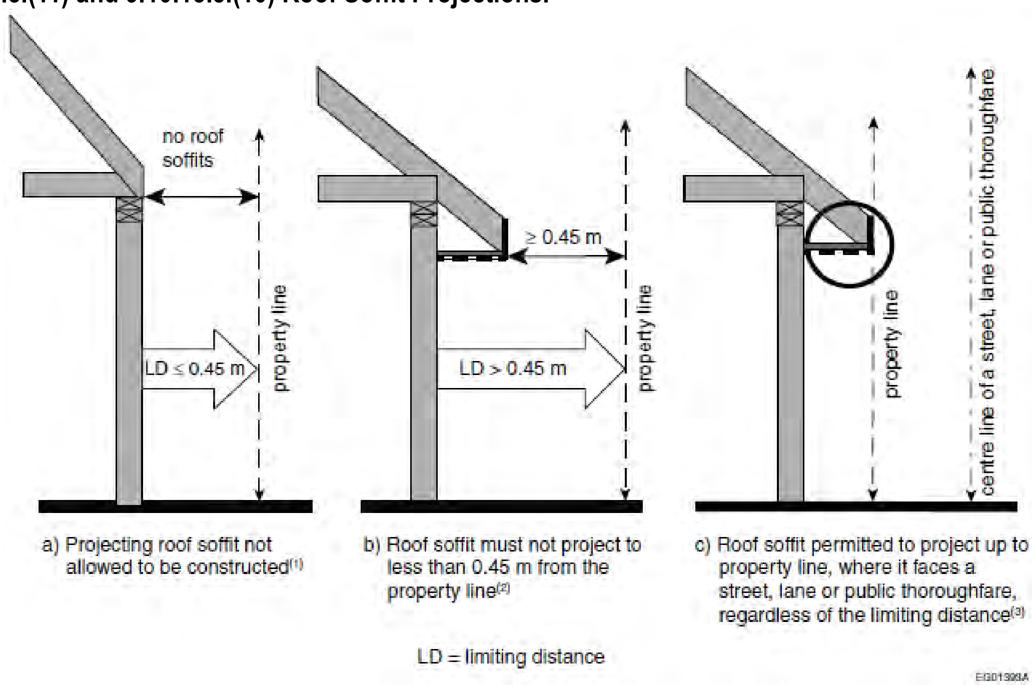


Figure A-9.10.14.5.(11) and 9.10.15.5.(10)
Roof soffit projections
Notes to Figure A-9.10.14.5.(11) and 9.10.15.5.(10):
(1) See Sentences 3.2.3.6.(2), 9.10.14.5.(9) and 9.10.15.5.(8).
(2) See Sentences 3.2.3.6.(3), 9.10.14.5.(10) and 9.10.15.5.(9).
(3) See Sentences 3.2.3.6.(4), 9.10.14.5.(11) and 9.10.15.5.(10).

A-9.10.15. Application of Subsection Subsection 9.10.15. applies to the spatial separation between buildings of residential occupancy where there is no principal dwelling unit ,including its ancillary residential unit, above another dwelling unit. Such buildings include detached houses, semi-detached houses (doubles) and row houses, where there is no dwelling unit above another dwelling unit. The general intent of Vancouver's expanded spatial separation provisions in Subsection 9.10.15. is that each legal entity is self-contained and should not overlap (and therefore impact) on an adjacent legal entity and creating complex spatial arrangements that are no longer reflective of a traditional house.

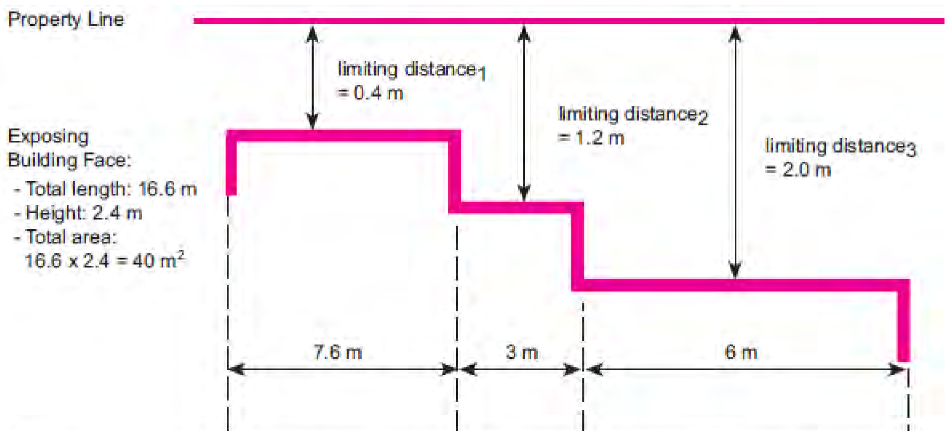
A-9.10.15.4.(2) Staggered or Skewed Exposing Building Faces of Houses. Studies at the National Fire Laboratory of the National Research Council have shown that, where an exposing building face is stepped back from the property line or is at an angle to the property line, it is possible to increase the percentage of glazing in those portions of the exposing building face further from the property line without increasing the amount of radiated energy that would reach the property line in the event of a fire in such a building. Figures A-9.10.15.4.(2)-A, A-9.10.15.4.(2)-B and A-9.10.15.4.(2)-C show how Sentences 9.10.15.4.(1) and (2), and 9.10.15.5.(2) and (3) can be applied to exposing building faces that are stepped back from or not parallel to the property line.

The following procedure can be used to establish the maximum permitted area of glazed openings for such facades:

1. Calculate the total area of the exposing building face, i.e. facade of the fire compartment, as described in the definition of exposing building face.
2. Identify the portions into which the exposing building face is to be divided. It can be divided in any number of portions, not necessarily of equal size.
3. Measure the limiting distance for each portion. The limiting distance is measured along a line perpendicular to the wall surface from the point closest to the property line.
4. Establish the line in Table 9.10.15.4. from which the maximum permitted percentage area of unprotected openings will be read. The selection of the line depends on the maximum area of exposing building face for the whole fire compartment, including all portions, as determined in Step 1.
5. On that line, read the maximum percentage area of unprotected openings permitted in each portion of the exposing building face according to the limiting distance for that portion.
6. Calculate the maximum area of unprotected openings permitted in each portion. The area is calculated from the percentage found applied to the area of that portion.

Table 9.10.15.4. is used to read the maximum area of unprotected openings: this means that the opaque portion of doors does not have to be counted as for other types of buildings.

Note that this Note and the Figures do not describe or illustrate maximum permitted concentrated area or spacing of individual unprotected openings, or limits on the location of dividing lines between portions of the exposing building face depending on the location of these openings with respect to interior rooms or spaces. See Sentences 9.10.15.2.(2) and 9.10.15.4.(2) to (4) for the applicable requirements.

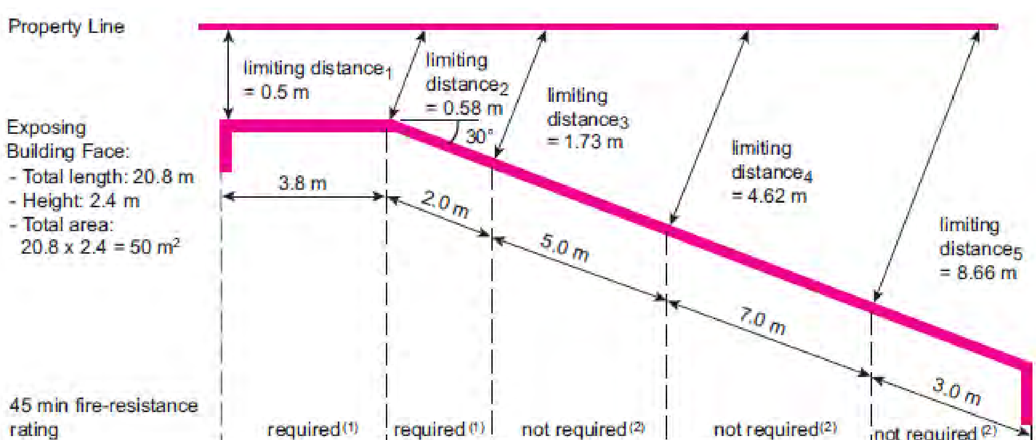


45 min fire-resistance rating	required(1)	not required(2)	not required(2)
Type of cladding	noncombustible(1)	no limits(2)	no limits(2)
Permitted % of glazed openings(3)	0%	7%	11%
Permitted aggregate area of glazed openings	0	3 x 2.4 x 0.07 = 0.50 m²	6 x 2.4 x 0.11 = 1.58 m²

EG00417D

Figure A-9.10.15.4.(2)-A
Example of determination of criteria for the exposing building face of a staggered wall of a house

Notes to Figure A-9.10.15.4.(2)-A:
(1) See Sentence 9.10.15.5.(2).
(2) See Sentence 9.10.15.5.(3).
(3) See Table 9.10.15.4., Subclause 9.10.15.2.(1)(b)(iii) and Sentence 9.10.15.4.(2).



45 min fire-resistance rating	required(1)	required(1)	not required(2)	not required(2)	not required(2)
Type of cladding	noncombustible(1)	noncom-bustible(1)	no limits(2)	no limits(2)	no limits(2)
Permitted % of glazed openings(3)(4)	0%	0%	9%	28%	100%
Permitted aggregate area of glazed openings	0	0	5.0 x 2.4 x 0.09 = 1.08 m²	7.0 x 2.4 x 0.28 = 4.70 m²	3.0 x 2.4 x 1.0 = 7.2 m²

EG00378D

Figure A-9.10.15.4.(2)-B
Example of determination of criteria for the exposing building face of a skewed wall of a house with some arbitrary division of the wall

Notes to Figure A-9.10.15.4.(2)-B:
(1) See Sentence 9.10.15.5.(2).
(2) See Sentence 9.10.15.5.(3).
(3) See Table 9.10.15.4., Subclause 9.10.15.2.(1)(b)(iii) and Sentence 9.10.15.4.(2).
(4) To simplify the calculations, choose the column for the lesser limiting distance nearest to the actual limiting distance. Interpolation for limiting distance is also acceptable and may result in a slightly larger permitted area of glazed openings. Interpolation can only be used for limiting distances greater than 1.2 m.

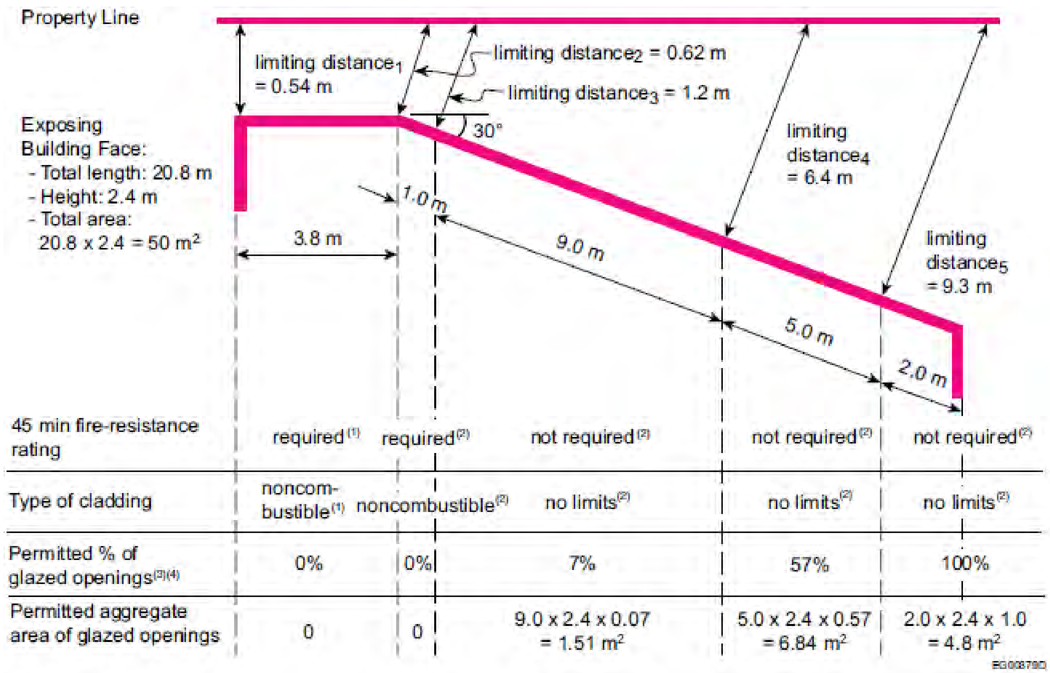


Figure A-9.10.15.4.(2)-C
Example of determination of criteria for the exposing building face of a skewed wall of a house with a different arbitrary division of the wall

Notes to Figure A-9.10.15.4.(2)-C:
(1) See Sentence 9.10.15.5.(2).
(2) See Sentence 9.10.15.5.(3).
(3) See Table 9.10.15.4., Subclause 9.10.15.2.(1)(b)(iii) and Sentence 9.10.15.4.(2).
(4) To simplify the calculations, choose the column for the lesser limiting distance nearest to the actual limiting distance. Interpolation for limiting distance is also acceptable and may result in a slightly larger permitted area of unprotected openings. Interpolation can only be used for limiting distances greater than 1.2 m.

A-9.10.19.3.(1) Location of Smoke Alarms. There are two important points to bear in mind when considering where to locate smoke alarms in dwelling units:

- The most frequent point of origin for fires in dwelling units is the living area.
- The main concern in locating smoke alarms is to provide warning to people asleep in bedrooms.

A smoke alarm located in the living area and wired so as to sound another smoke alarm located near the bedrooms is the ideal solution. However, it is difficult to define exactly what is meant by “living area.” It is felt to be too stringent to require a smoke alarm in every part of a dwelling unit that could conceivably be considered a “living area” (living room, family room, study, etc.). Sentence 9.10.19.3.(1) addresses these issues by requiring at least one smoke alarm on every storey containing a sleeping room. Thus, in a dwelling unit complying with Sentence 9.10.19.3.(1), every living area will probably be located within a reasonable distance of a smoke alarm. Nevertheless, where a choice arises as to where on a storey to locate the required smoke alarm or alarms, one should be located as close as possible to a living area, provided the requirements related to proximity to bedrooms are also satisfied.

A smoke alarm is not required on each level in a split-level dwelling unit as each level does not count as a separate storey. Determine the number of storeys in a split-level dwelling unit and which levels are part of which storey as follows:
1. establish grade, which is the lowest of the average levels of finished ground adjoining each exterior wall of a building;
2. identify the first storey, which is the uppermost storey having its floor level not more than 2 m above grade;
3. identify the basement, which is the storey or storeys located below the first storey;
4. identify the second storey and, where applicable, the third storey.
As a minimum, one smoke alarm is required to be installed in each storey, preferably on the upper level of each one. As noted above,
however, when the dwelling unit contains more than one sleeping area, an alarm must be installed to serve each area. Where the
sleeping areas are on two levels of a single storey in a split-level dwelling unit, an additional smoke alarm must be installed so that both
areas are protected. See Figure A-9.10.19.3.(1).

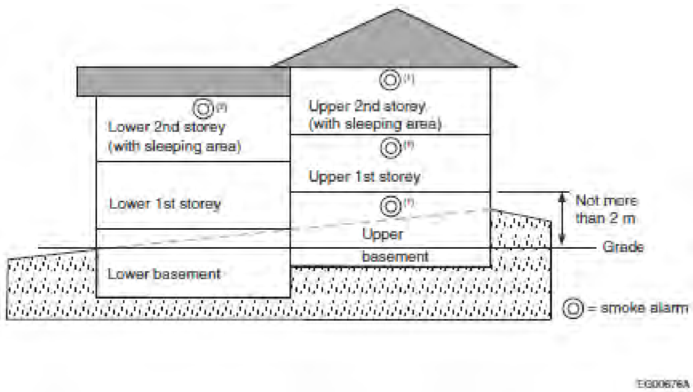


Figure A-9.10.19.3.(1)
Two-storey split-level building

Notes to Figure A-9.10.19.3.(1):
(1) One smoke alarm required for each of the basement, first storey and second storey.
(2) An additional smoke alarm is required on the lower level of the second storey outside the sleeping rooms.

A-9.10.20.3.(1) Fire Department Access Route Modification. In addition to other considerations taken into account in the planning of fire department access routes, special variations could be permitted for a house or residential building that is protected with an automatic sprinkler system. The sprinkler system must be designed in accordance with the appropriate NFPA standard and there must be assurance that water supply pressure and quantity are unlikely to fail. These considerations could apply to buildings that are located on the sides of hills and are not conveniently accessible by roads designed for firefighting equipment and also to infill housing units that are located behind other buildings on a given property.

A-9.10.22. Clearances from Gas, Propane and Electric Cooktops. CSA C22.1, “Canadian Electrical Code, Part I,” which is adopted by the Electrical Safety Regulation referenced in Article 9.34.1.1., and CSA B149.1, “Natural Gas and Propane Installation Code,” which is adopted by the Gas Safety Regulation referenced in Article 9.10.22.1., address clearances directly above, in front of, behind and beside the appliance. Where side clearances are zero, the standards do not address clearances to building elements located both above the level of the cooktop elements or burners and to the side of the appliance. Through reference to the above noted regulations and their adopted standards, and the requirements in Articles 9.10.22.2. and 9.10.22.3., the British Columbia Building Code addresses all clearances. Where clearances are addressed by the British Columbia Building Code and the above noted regulations and their adopted standards, conformance with all relevant criteria is achieved by compliance with the most stringent criteria.

Installation of Microwave Ovens Over Cooktops
The minimum vertical clearances stated in Article 9.10.22.2. apply only to combustible framing, finishes and cabinets. They do not apply to microwave ovens installed over cooktops nor to range hoods. The "Canadian Electrical Code, Part I" requires that microwave ovens comply with CAN/CSA-C22.2 No. 150, "Microwave Ovens." This standard includes tests to confirm that the appliance will not present a hazard when installed according to the manufacturer's instructions.

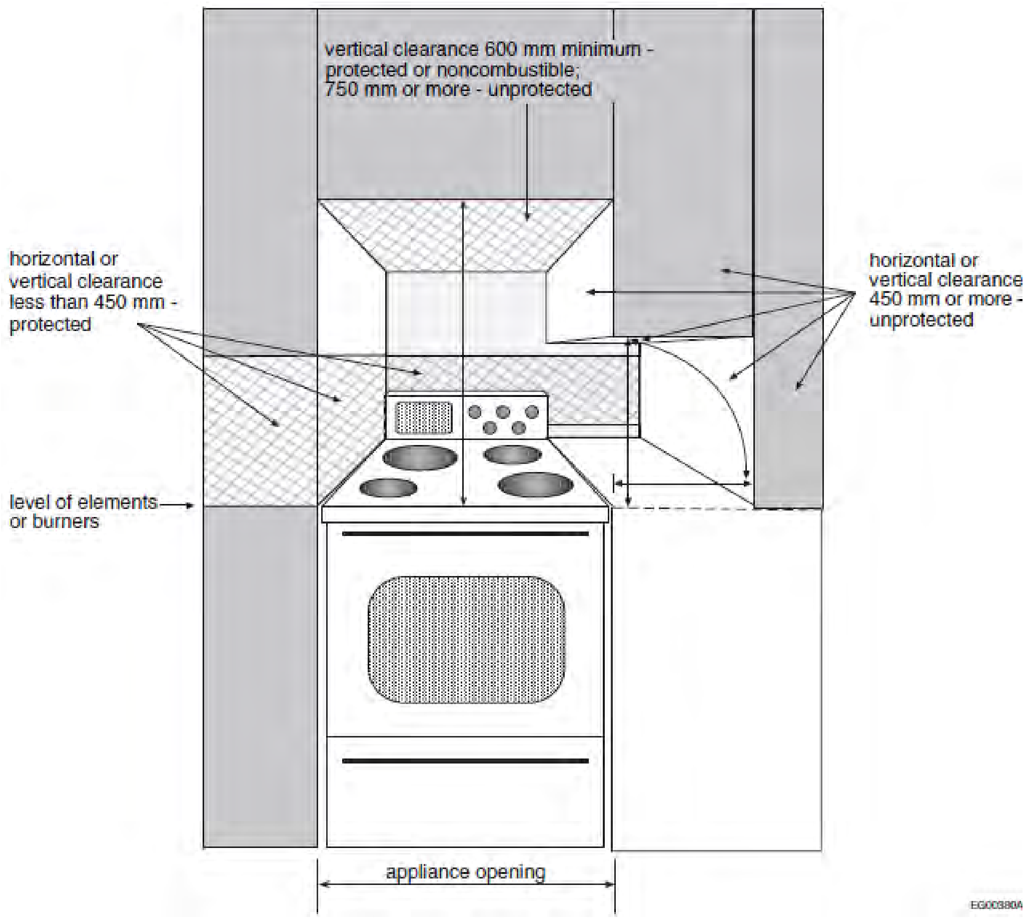


Figure A-9.10.22.
Clearances from cooktops to walls and cabinetry

A-9.11. Sound Transmission.

Airborne Sound
Airborne sound is transmitted between adjoining spaces directly through the separating wall, floor and ceiling assemblies and via the junctions between these separating assemblies and the flanking assemblies. The Sound Transmission Class (STC) rating describes the performance of the separating wall or floor/ceiling assembly, whereas the Apparent Sound Transmission Class (ASTC) takes into consideration the performance of the separating element as well as the flanking transmission paths. Therefore, from the occupants' point of view, the best indicator of noise protection between two spaces is the ASTC rating.

As a key principle, it is important to follow a “whole-system” approach when designing or constructing assemblies that separate dwelling units because the overall sound performance of walls and floors is also influenced by fire protection measures and the structural design of the assemblies. Likewise, changes to the construction of assemblies to meet sound transmission requirements may have fire and structural implications. Another key principle is that enhancing the performance of the separating element does not automatically enhance the system’s performance.

For horizontally adjoining spaces, the separating assembly is the intervening wall and the pertinent flanking surfaces include those of the floor, ceiling, and side wall assemblies that have junctions with the separating wall assembly, normally at its four edges. For each of these junctions, there is a set of sound transmission paths. Figure A-9.11.-A illustrates the horizontal sound transmission paths at the junction of a separating wall with flanking floor assemblies.

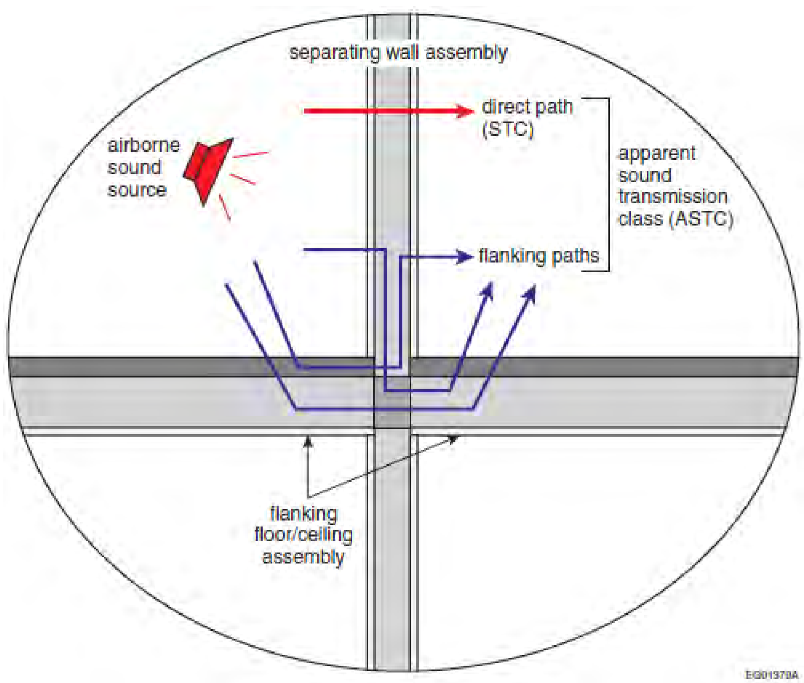


Figure A-9.11.-A
Horizontal sound transmission paths at floor/wall junction

For vertically adjoining spaces, the separating assembly is the intervening floor/ceiling and the pertinent flanking surfaces include those of the side wall assemblies in the upper and lower rooms that have junctions with the separating floor/ceiling assembly at its edges, of which there are normally four. For each of these junctions, there is a set of sound transmission paths. Figure A-9.11.-B illustrates the vertical sound transmission paths at the junction of a separating floor/ceiling assembly with two flanking wall assemblies.

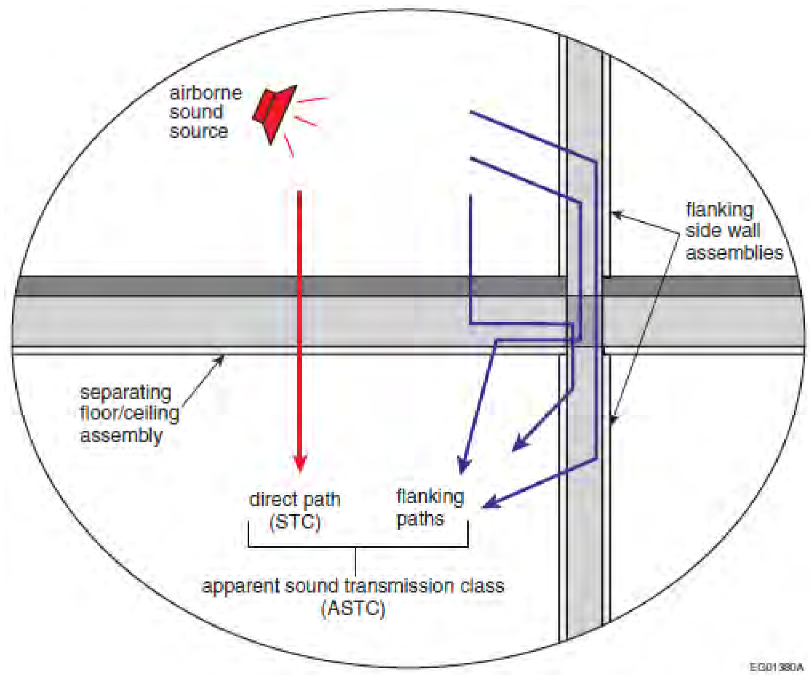


Figure A-9.11.-B
Vertical sound transmission paths at wall/floor junction

Control of Sound Leaks
The metrics used to characterize the sound transmission performance of assemblies separating dwelling units do not account for the adverse effects of air leaks in those assemblies, which can transfer sound. Sound leaks can occur where a wall meets another wall, the floor, or the ceiling. They can also occur where wall finishes are cut to allow the installation of equipment or services. The following are examples of measures for controlling sound leaks:
• avoid back-to-back electrical outlets or medicine cabinets;
• carefully seal cracks or openings so structures are effectively airtight;
• apply sealant below the plates in stud walls, between the bottom of gypsum board and the structure behind, around all penetrations for services and, in general, wherever there is a crack, a hole or the possibility of one developing;
• include sound-absorbing material inside the wall if not already required

The reduction of air leakage is also addressed to some extent by the smoke tightness requirements in the By-law.

The calculation of and laboratory testing for STC and ASTC ratings are performed on intact assemblies having no penetrations or doors. When measuring ASTC ratings in the field, openings can be blocked with insulation and drywall.

To verify that the required acoustical performance is being achieved, a field test can be done at an early stage of construction. ASTM E 336, “Measurement of Airborne Sound Attenuation between Rooms in Buildings,” gives a complete measurement. A simpler and less expensive method is presented in ASTM E 597, “Determining a Single Number Rating of Airborne Sound Insulation for Use in Multi-Unit Building Specifications.” The rating derived from this test is usually within 2 points of the STC obtained from ASTM E 336. It is useful for verifying performance and finding problems during construction. Alterations can then be made prior to project completion.

Impact Noise
Section 9.11. has no requirements for the control of impact noise transmission. However, footsteps and other impacts can cause severe annoyance in multifamily residences. Builders concerned about quality and reducing occupant complaints will ensure that floors are designed to minimize impact transmission. A recommended criterion is that bare floors (tested without a carpet) should achieve an impact insulation class (IIC) of 55. Some lightweight floors that satisfy this requirement may still elicit complaints about low frequency impact noise transmission. Adding carpet to a floor will always increase the IIC rating but will not necessarily reduce low frequency noise transmission. Good footstep noise rejection requires fairly heavy floor slabs or floating floors.

The most frequently used test methods for impact noise are ASTM E 492, "Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine," and ASTM E 1007, "Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures."

Machinery Noise
Elevators, garbage chutes, plumbing, fans, and heat pumps are common sources of noise in buildings. To reduce annoyance from these, they should be placed as far as possible from sensitive areas. Vibrating parts should be isolated from the building structure using resilient materials such as neoprene or rubber.

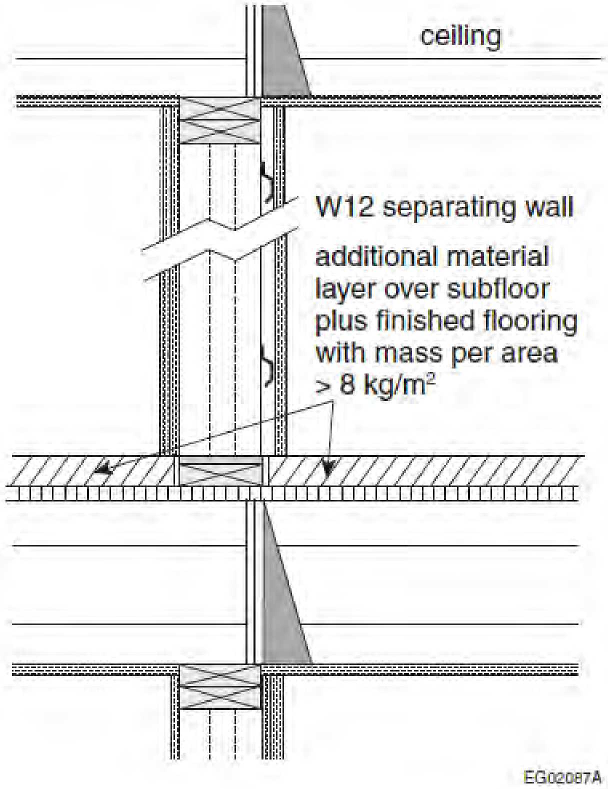
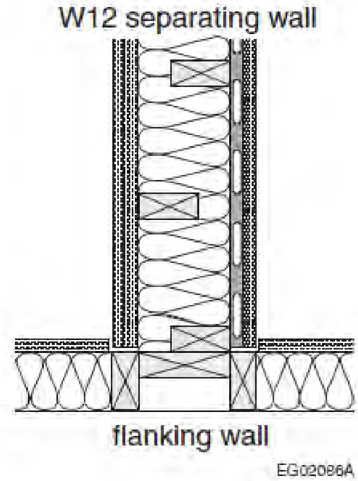
A-9.11.1.3.(2)(b) Control of Airborne Noise in Buildings. Tables 9.10.3.1.-A and 9.10.3.1.-B present separating assemblies that comply with Section 9.11. However, selecting an appropriate separating assembly is only one part of the solution for reducing airborne sound transmission between adjoining spaces: to fully address the sound performance of the whole system, flanking assemblies must be connected to the separating assembly in accordance with Article 9.11.1.4.

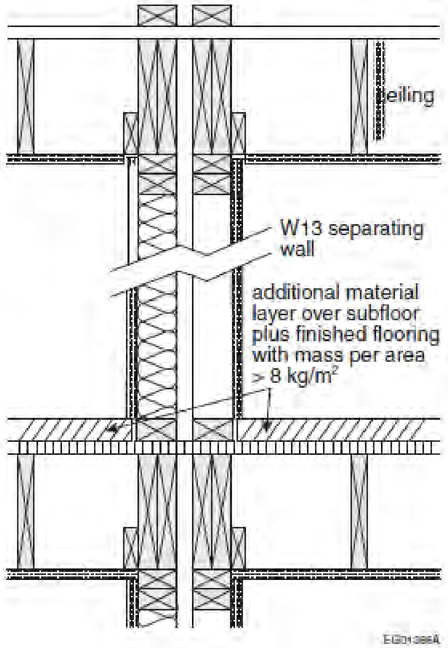
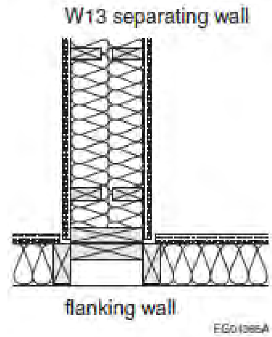
A-9.11.1.4. Adjoining Constructions. Tables A-9.11.1.4.-A to A-9.11.1.4.-D present generic options for the design and construction of junctions between separating and flanking assemblies. Constructing according to these options is likely to meet or exceed an ASTC rating of 47. Other designs may be equally acceptable if their sound resistance can be demonstrated to meet the minimum ASTC rating or better on the basis of tests referred to in Article 9.11.1.2., or if they comply with Subsection 5.8.1. However, some caution should be applied when designing solutions that go beyond the options provided in these Tables: for example, adding more material to a wall could negatively impact its sound performance or have no effect at all.

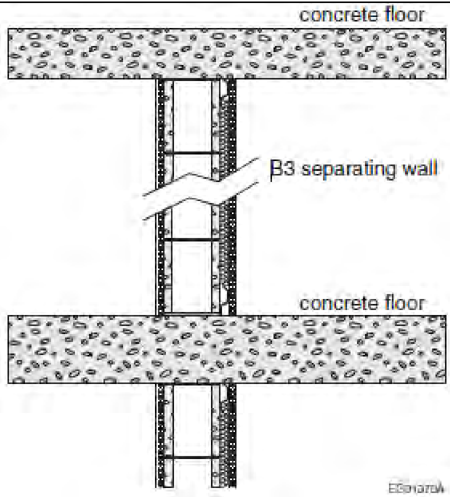
Table A-9.11.1.4.-A presents compliance options for the construction of separating wall assemblies with flanking floor, ceiling and wall assemblies in horizontally adjoining spaces.

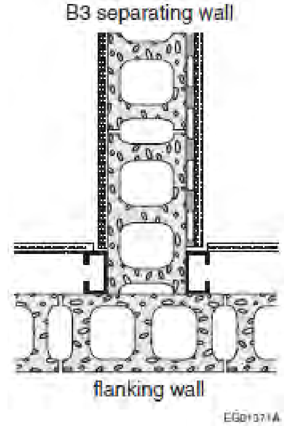
Table A-9.11.1.4.-A
Options for the Design and Construction of Junctions and Flanking Surfaces Between Separating Wall Assemblies in Horizontally Adjoining Spaces for Compliance with Clause 9.11.1.1.(1)(b)

Type of Separating Wall Assembly with STC ≥ 50 from Table 9.10.3.1.-A	**Options for Design and Construction of Junctions and Flanking Surfaces**(1) **to Address Horizontal Sound Transmission Paths**		
	Bottom Junction (between separating wall and flanking floors)	**Top Junction (between separating wall and flanking ceiling)**	**Side Junctions (between separating wall and flanking walls)**
	Example Showing Side View of Bottom and Top Junctions		Example Showing Plan View of Side Junctions

			
W13, W14, W15	• for additional material layer and finished flooring, see Table 9.11.1.4. • subfloor on both sides of wall is plywood, OSB, waferboard (15.5 mm thick) or tongue and groove lumber (≥ 17 mm thick) • floor is framed with wood joists, wood I-joists or wood trusses spaced ≥ 400 mm o.c., with or without absorptive material(2) in cavities • floor joists or trusses are oriented parallel to separating wall (non-loadbearing case) or perpendicular to separating wall but are not continuous across junction (loadbearing case) • near leaf of separating wall is supported on "designated" joist	• wood joists, wood I-joists or wood trusses are oriented perpendicular or parallel to separating wall, with or without absorptive material(2) in cavities • joist framing at junction is supported on near leaf of separating wall • gypsum board ceiling panels end at wall framing and are fastened directly to bottom of ceiling framing or	• flanking wall framing is fastened to adjacent leaf of separating wall • flanking wall is framed with single row of wood studs, staggered studs on a single 38 mm × 140 mm plate, or 2 rows of 38 mm × 89 mm wood studs on separate 38 mm × 89 mm plates, with or without absorptive material(2) in cavities • gypsum board panels on flanking walls ends or is cut at framing of separating wall and is fastened on resilient metal channels(3) or directly to framing of flanking wall if that framing and any sheathing are not continuous across the junction
	Example Showing Side View of Bottom and Top Junctions		Example Showing Plan View of Side Junctions

			
	• F1 concrete floor assembly from Table 9.10.3.1.-B with mass per area not less than 300 kg/m² (e.g. normal-weight concrete with average thickness of 130 mm) • with or without an additional material layer or finished flooring	• F1 concrete floor assembly from Table 9.10.3.1.-B with mass per area not less than 300 kg/m² (e.g. normal-weight concrete with average thickness of 130 mm) • with or without gypsum board ceiling suspended below concrete floor	• flanking wall framing is structurally connected to separating wall and terminates where it butts against framing of separating wall or is continuous across junction • gypsum board on flanking walls ends or is cut at separating wall and is fastened directly to framing or on resilient metal channels(3) • flanking wall consists of steel framing (loadbearing or non-loadbearing steel studs) or concrete blocks with mass per area not less than 200 kg/m² (e.g. normal-weight hollow core concrete block units(4) with a gypsum board lining supported on framing providing a cavity not less than 50 mm deep) • with or without absorptive material(2) in cavities behind gypsum board of flanking walls
	Example Showing Side View of Bottom and Top Junctions		Examples Showing Plan View of Side Junctions





Notes to Table A-9.11.1.4.-A:

(1) See also Table A-9.11.1.4.-B.

(2) Sound absorptive material is porous (closed-cell foam was not tested) and includes fibre processed from rock, slag, glass or cellulose fibre with a maximum density of 32 kg/m^3. See Notes (5) and (8) of Table 9.10.3.1.-A and Note (5) of Table 9.10.3.1.-B for additional information.

(3) Resilient metal channels are formed from steel having a maximum thickness of 0.46 mm (25 gauge) with slits or holes in the single “leg” between the faces fastened to the framing and to the gypsum board (See Figure A-9.10.3.1.-D). ASTM C 754, “Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products,” describes the installation of resilient metal channels.

(4) Normal-weight concrete block units conforming to CSA A165.1, “Concrete Block Masonry Units,” have aggregate with a density not less than 2 000 kg/m^3; 190 mm hollow core units are 53% solid, providing a wall mass per area over 200 kg/m^2; 140 mm hollow core units are 75% solid, providing a wall mass per area over 200 kg/m^2.

Table A-9.11.1.4.-B presents options for improving the sound performance of separating wall systems beyond that achieved by implementing the options presented in Table A-9.11.1.4.-A. The suggested performance improvement options are listed in order of approximate acoustic priority and are interdependent, i.e., if options at the top of the list are not implemented, then options at the bottom of the list will have much lesser effect.

Table A-9.11.1.4.-B
Options for the Construction of a Separating Wall System to Further Improve the Sound Insulation Performance Achieved with the Options in Table A-9.11.1.4.-A

Type of Separating Wall Assembly with STC ≥ 50 from Table 9.10.3.1.-A	Performance Improvement Options for Junctions Between Separating Walls and Flanking Floor/Ceiling Assemblies
W4, W5, W6, W8, W9, W10, W11, W12	• Increase mass per area of additional material layer and finished flooring over subfloor (e.g. concrete or gypsum concrete topping) • Choose separating wall assembly with higher STC rating • Orient floor and ceiling joists parallel to separating wall (non-loadbearing case) • Add resilient layer under additional material layer over subfloor or between additional material layer and finished flooring • Support gypsum board panels of ceiling on resilient metal channels(1) • Support gypsum board panels of flanking walls on resilient metal channels(1)
W13, W14, W15	• If seismic or other structural requirements permit, choose a fire block detail at floor/wall junction in accordance with Subsection 9.10.16. that does not provide a rigid connection between the two rows of framing

	of the separating wall (e.g. subfloor not continuous across junction and semi-rigid fibre insulation board filling the gap in accordance with Article 9.10.16.3.). In this case, an additional material layer would not be necessary. Also, choose separating wall assembly with higher STC rating (e.g. more absorptive material(2) in cavities and/or more gypsum board). • If having a rigid structural connection at the floor/wall junction (such as subfloor continuous across the junction) is required for seismic or other structural reasons, obtain a higher ASTC rating as follows: • Increase combined mass per area of additional material layer over subfloor and finished flooring (e.g. concrete or gypsum concrete topping) • Choose separating wall assembly with higher STC rating (e.g. more absorptive material(2) and/or more gypsum board) • Support gypsum board panels of ceiling on resilient metal channels(1) • Support gypsum board panels of flanking walls on resilient metal channels(1) • Add resilient layer under additional material layer over subfloor or between additional material layer and finished flooring
S1 to S15	• Choose separating wall assembly with higher STC rating • Increase thickness of concrete floor slab and/or add material layer and finished flooring over subfloor • Add gypsum board ceiling on framing supported under the floor above, with cavity not less than 100 mm deep • Add resilient layer under additional material layer over subfloor or between additional material layer and finished flooring • Support gypsum board panels of flanking walls on resilient metal channels(1) if steel studs are loadbearing type
B1 to B10	• Choose separating wall assembly with higher STC rating • Add gypsum board ceiling supported below concrete floor with cavity not less than 100 mm deep and sound absorptive material(2) in cavity • Increase thickness of concrete floor slab and/or add material layer and finished flooring over subfloor • Add resilient layer under additional material layer over subfloor or between additional material layer and finished flooring and increase mass per area of additional material layer and finished flooring (e.g. floating concrete or gypsum concrete topping) • Support gypsum board panels of flanking walls on resilient metal channels(1) if steel studs are loadbearing type

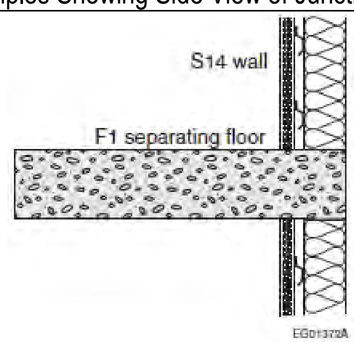
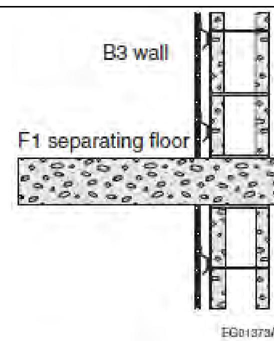
Notes to Table A-9.11.1.4.-B:

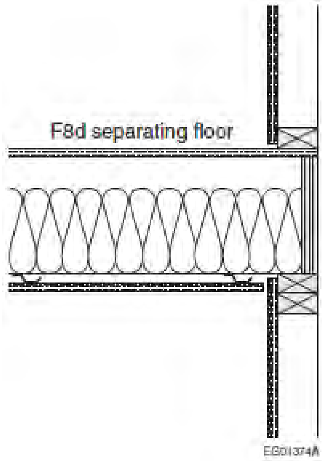
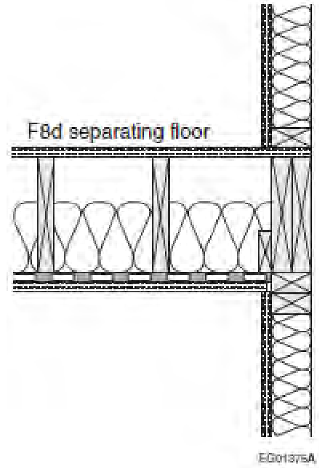
(1) Resilient metal channels are formed from steel having a maximum thickness of 0.46 mm (25 gauge) with slits or holes in the single "leg" between the faces fastened to the framing and to the gypsum board (See Figure A-9.10.3.1.-D). ASTM C 754, "Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products," describes the installation of resilient metal channels.

(2) Sound absorptive material is porous (closed-cell foam was not tested) and includes fibre processed from rock, slag, glass or cellulose fibre with a maximum density of 32 kg/m^3. See Notes (5) and (8) of Table 9.10.3.1.-A and Note (5) of Table 9.10.3.1.-B for additional information.

Table A-9.11.1.4.-C presents compliance options for the construction of separating floor/ceiling assemblies with flanking wall assemblies in vertically adjoining spaces.

Table A-9.11.1.4.-C
Options for the Design and Construction of Junctions and Flanking Surfaces Between Separating Floor/Ceiling Assemblies in Vertically Adjoining Spaces for Compliance with Clause 9.11.1.1.(1)(b)

Type of Separating Floor/Ceiling Assembly with STC ≥ 50 from Table 9.10.3.1.-B	**Options for Design and Construction of Junctions and Flanking Surfaces**(1) **to Address Vertical Sound Transmission Paths**	
	Junctions with Flanking Steel-Framed Walls	Junctions with Flanking Concrete Walls
F1 (with or without gypsum board ceiling)	• floor ends at flanking wall assembly (T-junction) or extends beyond it (cross-junction) • steel framing of flanking walls is loadbearing or non-loadbearing, with a single row of steel studs, staggered studs, or 2 rows of studs, with studs spaced not less than 400 mm o.c., with or without absorptive material(2) in cavities • flanking wall structure is fastened to separating concrete floor but is not continuous across junction • gypsum board on flanking walls is not continuous across junction and is fastened directly to wall framing or on resilient metal channels(3)	• floor ends at flanking wall assembly (T-junction) or extends beyond it (cross-junction) • one wythe of concrete blocks with mass per area not less than 200 kg/m² (e.g. normal-weight hollow core concrete block units(4)) • loadbearing (solid) or non-loadbearing (resilient) junction between top of flanking concrete block wall and floor structure • gypsum board lining is supported on wood or steel framing providing a cavity not less than 50 mm deep, with or without absorptive material(2) in cavities • gypsum board on flanking walls is not continuous across junction and is fastened directly to wall framing or on resilient metal channels(3)
	Examples Showing Side View of Junctions	
		
F8 to F38	Junctions with Flanking Loadbearing or Non-Loadbearing Walls	
	• wood studs of flanking wall are 38 mm × 89 mm or 38 mm × 140 mm and spaced 400 mm or 600 mm o.c. • flanking wall framing consists of single row of wood studs, staggered studs on a single 38 mm × 140 mm plate, or 2 rows of 38 mm × 89 mm wood studs on separate 38 mm × 89 mm plates, with or without absorptive material(2) in wall cavities • gypsum board on flanking walls ends or is cut near floor framing and is fastened directly to wall framing or supported on resilient metal channels(3)	
	Example Showing Side View of Junctions in Flanking Loadbearing Wall	Example Showing Side View of Junctions in Flanking Non-Loadbearing Wall

Notes to Table A-9.11.1.4.-C:
(1) See also Table A-9.11.1.4.-D.
(2) Sound absorptive material is porous (closed-cell foam was not tested) and includes fibre processed from rock, slag, glass or cellulose fibre with a maximum density of 32 kg/m^3. See Notes (5) and (8) of Table 9.10.3.1.-A and Note (5) of Table 9.10.3.1.-B for additional information.
(3) Resilient metal channels are formed from steel having a maximum thickness of 0.46 mm (25 gauge) with slits or holes in the single “leg” between the faces fastened to the framing and to the gypsum board (See Figure A-9.10.3.1.-D). ASTM C 754, “Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products,” describes the installation of resilient metal channels.
(4) Normal-weight concrete block units conforming to CSA A165.1, “Concrete Block Masonry Units,” have aggregate with a density not less than 2000 kg/m^3; 190 mm hollow core units are 53% solid, providing a wall mass per area over 200 kg/m^2; 140 mm hollow core units are 75% solid, providing a wall mass per area over 200 kg/m^2.

Table A-9.11.1.4.-D presents options for improving the sound performance of separating floor/ceiling assemblies beyond that achieved by implementing the options presented in Table A-9.11.1.4.-C. The suggested performance improvement options are listed in order of approximate acoustic priority and are interdependent, i.e., if options at the top of the list are not implemented, then options at the bottom of the list will have much lesser effect.

Table A-9.11.1.4.-D
Options for the Construction of a Separating Floor System to Further Improve the Sound Insulation Performance Achieved with the Options in Table A-9.11.1.4.C.

Type of Separating Floor Assembly with STC ≥ 50 from Table 9.10.3.1.-B	Performance Improvement Options for Junctions Between Separating Floors and Flanking Wall Assemblies
F1 (with or without gypsum board ceiling)	• Add heavier additional material layer over subfloor and/or resilient layer under additional material layer or between additional material layer and finished flooring • Add gypsum board ceiling supported at least 100 mm below concrete floor with minimal structural connection (e.g. ceiling framing supported resiliently) and sound absorptive material(1) in cavity • Support gypsum board of flanking walls of lower room on resilient metal channels(2) (if framed with loadbearing studs)
F8 to F38	• Add heavier additional material layer over subfloor and/or resilient layer under additional material layer or between additional material layer and finished flooring • Add more/heavier gypsum board to ceiling and increase spacing of resilient metal channels(2) to 600 mm o.c. • Support gypsum board of flanking loadbearing walls of lower room on resilient metal channels(2) • Support gypsum board on flanking non-loadbearing walls of lower room on resilient metal

	channels(2)

Notes to Table A-9.11.1.4.-D:
(1) Sound absorptive material is porous (closed-cell foam was not tested) and includes fibre processed from rock, slag, glass or cellulose fibre with a maximum density of
32 kg/m3. See Notes (5) and (8) of Table 9.10.3.1.-A and Note (5) of Table 9.10.3.1.-B for additional information.
(2) Resilient metal channels are formed from steel having a maximum thickness of 0.46 mm (25 gauge) with slits or holes in the single “leg” between the faces fastened to the
framing and to the gypsum board (See Figure A-9.10.3.1.-D). ASTM C 754, “Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products,”
describes the installation of resilient metal channels.

A-Table 9.11.1.4. Floor Treatments. The sound insulation performance of lightweight framed floors can be improved by adding floor treatments, i.e., additional layers of material over the subfloor (e.g. concrete topping, OSB or plywood) and finished flooring or coverings (e.g., carpet, engineered wood). Table A-Table 9.11.1.4. presents the mass per area values based on thickness and density of a number of generic floor treatment materials (the values for proprietary products may be different; consult the manufacturer’s current data sheets for their products’ values).

Table A-9.11.1.4.
Mass per Area of Floor Treatment Materials

Floor Treatment Material	Thickness, mm	Density, kg/m^3	Mass per Area, kg/m^2
Materials Typically Having a Mass per Area Less Than 8 kg/m^2			
Medium-density fibreboard (MDF)	2.9-6.1	790-810	2.3-5.0
Plywood – generic softwood	12.5-13.3	450-500	5.6-6.6
	15.5-16.3		7.0-8.1
Ceramic tile	8.4	700-1000	5.9-8.4
Materials Typically Having a Mass per Area Greater Than 8 kg/m^2 but Less Than 16 kg/m^2			
Particleboard	11.3-19.2	710-755	8.1-14.5
Medium-density fibreboard (MDF)	13.9-21.1	640-755	8.9-15.9
Oriented strandboard (OSB)	14.3-15.8	600-680	8.6-10.7
	17.3-18.8		10.4-12.8
Plywood – generic softwood	25.5	450-500	11.5-13.1
Materials Typically Having a Mass per Area Greater Than 16 kg/m^2 but Less Than 32 kg/m^2			
	25.0-32.1	640-740	16.0-23.7
Materials Typically Having a Mass per Area Greater Than 32 kg/m^2			
Concrete	40.0-50.0	2015-2380	80.6-119.0
Gypsum concrete	25.0	1840-1870	46.1-46.7

A-Table 9.12.2.2. Minimum Depths of Foundations. The requirements for clay soils or soils not clearly defined are intended to apply to those soils that are subject to significant volume changes with changes in moisture content.

A-9.12.2.2.(2) Depth and Insulation of Foundations.

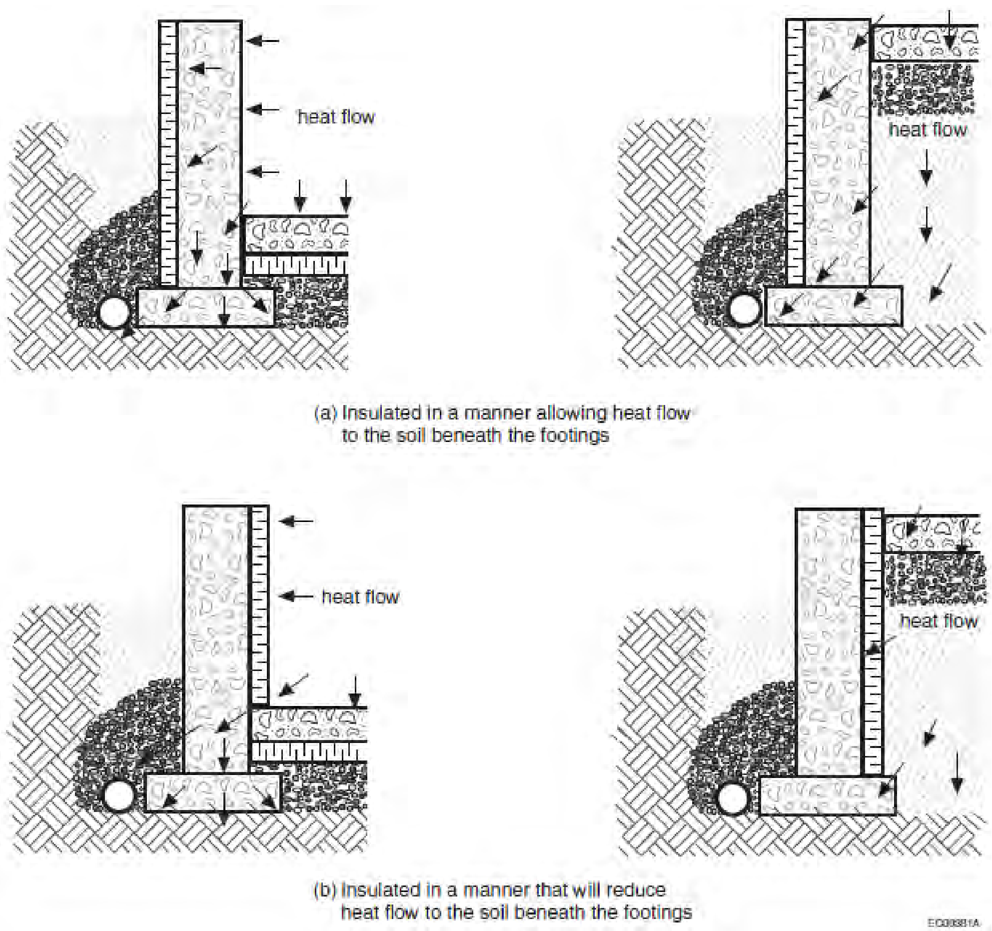


Figure A-9.12.2.2.(2)
Foundation insulation and heat flow to footings

A-9.12.3.3.(1) Deleterious Material in Backfill. The deleterious debris referred to in this provision includes, but is not limited to:
- organic material and other material subject to decomposition and compaction, which could have an adverse effect on grading around the building,
- materials that will off-gas and have the potential to pose a health hazard, and
- materials that are incompatible with materials used in the foundations, footings, drainage materials or components, or other elements of the building whose required performance would be adversely affected.

A-9.13.2.5. Protection of Interior Finishes against Moisture. Excess water from cast-in-place concrete and ground moisture tends to migrate toward interior spaces, particularly in the spring and summer. Where moisture-susceptible materials, such as finishes or wood members, are in contact with the foundation wall, the moisture needs to be controlled by installing a moisture barrier on the interior surface of the foundation wall that extends from the underside of the interior finish up the face of the wall to a point just above the level of the ground outside.

The reason the moisture barrier on the interior surface of the foundation wall must be stopped near ground level is to allow any moisture that finds its way into the finished wall cavity from the interior space (through leaks in the air or vapour barrier) to diffuse to the exterior. If the vapour permeance of dampproofing membranes or coatings exceeds 170 ng/(Pa·s·m^2), such moisture barriers may be carried full height; if their vapour permeance is less than that, this moisture risks being trapped on the interior surface of the moisture barriers. The permeance limit corresponds to the lower limit for breather-type membranes, such as asphalt-impregnated sheathing paper.

Some insulation products can also be used to protect interior finishes from the effects of moisture. They have shown acceptable performance when applied over the entire foundation wall because, in this case, they also provide vapour barrier and moisture barrier functions and possibly also the air barrier function. Where a single product provides all these functions, there is no risk of trapping moisture between two functional barriers with low water vapour permeance.

A-9.13.4. Soil Gas Control. Outdoor air entering a dwelling through above-grade leaks in the building envelope normally improves the indoor air quality in the dwelling by reducing the concentrations of pollutants and water vapour. It is only undesirable because it cannot be controlled. On the other hand, air entering a dwelling through below-grade leaks in the envelope may increase the water vapour content of the indoor air and may also bring in a number of pollutants picked up from the soil. This mixture of air, water vapour and pollutants is sometimes referred to as "soil gas." One pollutant often found in soil gas is radon.

Sentence 9.13.4.2.(1), which requires the installation of an air barrier system, addresses the protection from all soil gases, while the remainder of Article 9.13.4.2. along with Article 9.13.4.3., which require the provision of the means to depressurize the space between the air barrier system and the ground, specifically address the capability to mitigate high radon concentrations in the future, should this become necessary.

Radon is a colourless, odourless, radioactive gas that occurs naturally as a result of the decay of radium. It is found to varying degrees as a component of soil gas in all regions of Canada and is known to enter dwelling units by infiltration into basements and crawl spaces.

The presence of radon in sufficient quantity can lead to an increased risk of lung cancer.

The potential for high levels of radon infiltration is very difficult to evaluate prior to construction and thus a radon problem may only become apparent once the building is completed and occupied. Therefore various sections of Part 9 require the application of certain radon exclusion measures in all dwellings. These measures are

- low in cost,
- difficult to retrofit, and
- desirable for other benefits they provide.

The principal method of resisting the ingress of all soil gases, a resistance which is required for all buildings (See Sentence 9.13.4.2.(1)), is to seal the interface between the soil and the occupied space, so far as is reasonably practicable. Sections 9.18. and 9.25. contain requirements for air and soil gas barriers in assemblies in contact with ground, including those in crawl spaces. Providing control joints to reduce cracking of foundation walls and airtight covers for sump pits (See Section 9.14.) are other measures that can help achieve this objective. The requirements provided in Subsection 9.25.3. are explained in Notes A-9.25.3.4. and 9.25.3.6. and A-9.25.3.6.(2) and (3).

The principal method of excluding radon is to ensure that the pressure difference across the ground/space interface is positive (i.e., towards the outside) so that the inward flow of radon through any remaining leaks will be minimized. The requirements provided in Article 9.13.4.3. are explained in Note A-9.13.4.3.

A-9.13.4.2.(3) Exception for Buildings Occupied for a Few Hours a Day. The criterion used by Health Canada to establish the guideline for acceptable radon concentration is the time that occupants spend inside buildings. Health Canada recommends installing a means for the future removal of radon in buildings that are occupied by persons for more than 4 hours per day. Sentence 9.13.4.2.(3) therefore does not apply to buildings or portions of buildings that are intended to be occupied for less than 4 hours a day. Addressing a radon problem in such buildings in the future, should that become necessary, can also be achieved by providing a means for increased ventilation at times when these buildings are occupied.

A-9.13.4.3.

Providing Performance Criteria for the Depressurization of the Space Between the Air Barrier System and the Ground
Article 9.13.4.3. contains two sets of requirements: Sentence (2) describes the criteria for subfloor depressurization systems using performance-oriented language, while Sentence (3) describes one particular acceptable solution using more prescriptive language. In some cases, subfloor depressurization requires a solution other than the one described in Sentence (3), for example, where compactable fill is installed under slab-on-grade construction.

Completion of a Subfloor Depressurization System
The completion of a subfloor depressurization system may be necessary to reduce the radon concentration to a level below the guideline specified by Health Canada. In this case, to complete the system, the radon vent pipe is mechanically assisted to enable effective depressurization of the space between the air barrier system and the ground. An electrically powered fan is typically installed somewhere along the radon vent pipe.

Further information on protection from radon ingress can be found in the following Health Canada publications:
• “Radon: A Guide for Canadian Homeowners” (CMHC/HC), and
• “Guide for Radon Measurements in Residential Dwellings (Homes).”

A-9.13.4.3. Vent Terminals. To prevent soil gases from entering a building through air intakes, windows, and other openings in the building envelope, radon vent pipe terminations should be installed in a similar manner to plumbing vent terminals.
(See A-2.5.6.5.(4) in Appendix A of Division B to Book II of the Code.)

A-9.13.4.3.(2)(b)(i) and (3)(b)(i) Effective Depressurization. To allow effective depressurization of the space between the air barrier system and the ground, the extraction opening (the pipe) should not be blocked and should be arranged such that air can be extracted from the entire space between the air barrier system and the ground. This will ensure that the extraction system can maintain negative pressure underneath the entire floor (or in heated crawl spaces underneath the air barrier system). The arrangement and location of the extraction system inlet(s) may have design implications where the footing layout separates part of the space underneath the floor.

A-9.14.2.1.(2)(a) Insulation Applied to the Exterior of Foundation Walls. In addition to the prevention of heat loss, some types of mineral fibre insulation, such as rigid glass fibre, are installed on the exterior of basement walls for the purpose of moisture control. This is sometimes used instead of crushed rock as a drainage layer between the basement wall and the surrounding soil in order to facilitate the drainage of soil moisture. Water drained by this drainage layer must be carried away from the foundation by the footing drains or the granular drainage layer in order to prevent it from developing hydro-static pressure against the wall. Provision must be made to permit the drainage of this water either by extending the insulation or crushed rock to the drain or by the installation of granular material connecting the two. The installation of such drainage layer does not eliminate the need for normal waterproofing or dampproofing of walls as specified in Section 9.13.

A-9.15.1.1. Application of Footing and Foundation Requirements to Decks and Similar Constructions. Because decks, balconies, verandas and similar platforms support occupancies, they are, by definition, considered as buildings or parts of buildings. Consequently, the requirements in Section 9.15. regarding footings and foundations apply to these constructions.

A-9.15.1.1.(1)(c) and 9.20.1.1.(1)(b) Flat Insulating Concrete Form Walls. Insulating concrete form (ICF) walls are concrete walls that are cast into polystyrene forms, which remain in place after the concrete has cured. Flat ICF walls are solid ICF walls where the concrete is of uniform thickness over the height and width of the wall.

A-9.15.2.4.(1) Preserved Wood Foundations – Design Assumptions. Tabular data and figures in CSA S406, "Permanent Wood Foundations for Housing and Small Buildings," are based upon the general principles provided in CSA O86, "Engineering Design in Wood," with the following assumptions:

- soil bearing capacity: 75 kPa or more,
- clear spans for floors: 5 000 mm or less,
- floor loadings: 1.9 kPa for first floor and suspended floor, and 1.4 kPa for second storey floor,
- foundation wall heights: 2 400 mm for slab floor, 3 000 mm for suspended wood floor,
- top of granular layer to top of suspended wood floor: 600 mm,
- lateral load from soil pressure: equivalent to fluid pressure of 4.7 kPa per metre of depth,
- ground snow load: 3 kPa,
- basic snow load coefficient: 0.6,
- roof loads are carried to the exterior wall,
- dead loads:

roof	0.50 kPa
floor	0.47 kPa
wall (with siding)	0.32 kPa
wall (with masonry veneer)	1.94 kPa
foundation wall	0.27 kPa
partitions	0.20 kPa

A-9.15.3.4.(2) Footing Sizes. The footing sizes in Table 9.15.3.4. are based on typical construction consisting of a roof, not more than 3 storeys, and centre bearing walls or beams. For this reason, Clause 9.15.3.3.(1)(b) stipulates a maximum supported joist span of 4.9 m.

It has become common to use flat wood trusses or wood I-joists to span greater distances in floors of small buildings. Where these spans exceed 4.9 m, minimum footing sizes may be based on the following method:

(a) Determine for each storey the span of joists that will be supported on a given footing. Sum these lengths (sum_1).
(b) Determine the product of the number of storeys times 4.9 m (sum_2).
(c) Determine the ratio of sum_1 to sum_2.
(d) Multiply this ratio by the minimum footing sizes in Table 9.15.3.4. to get the required minimum footing size.

Example: A 2-storey house is built using wood I-joists spanning 6 m.
(a) $sum_1 = 6 + 6 = 12$ m
(b) $sum_2 = 4.9 \times 2 = 9.8$ m
(c) ratio $sum_1/sum_2 = 12/9.8 = 1.22$
(d) required minimum footing size = 1.22 × 350 mm (minimum footing size provided in Table 9.15.3.4.) = 427 mm.

A-9.16.2.1.(1) Drainage Layer Beneath Floors-on-Ground. A drainage layer required by Sentence 9.16.2.1.(1) shall also be gas-permeable and conform to Article 9.13.4.3. in buildings to which that Article applies.

A-9.17.2.2.(2) Lateral Support of Columns. Because the By-law does not provide prescriptive criteria to describe the minimum required lateral support, constructions are limited to those that have demonstrated effective performance over time and those that are designed according to Part 4. Verandas on early 20th century homes provide one example of constructions whose floor and roof are typically tied to the rest of the building to provide effective lateral support. Large decks set on tall columns, however, are likely to require additional lateral support even where they are connected to the building on one side.

A-9.17.3.4. Design of Steel Columns. The permitted live floor loads of 2.4 kPa and the spans described for steel beams, wood beams and floor joists are such that the load on columns could exceed 36 kN, the maximum allowable load on columns prescribed in CAN/CGSB-7.2, "Adjustable Steel Columns." In the context of Part 9, loads on columns are calculated from the supported area times the live load per unit area, using the supported length of joists and beams. The supported length is half of the joist spans on each side of the beam and half the beam span on each side of the column.

Dead load is not included based on the assumption that the maximum live load will not be applied over the whole floor. Designs according to Part 4 must consider all applied loads.

A-9.18.7.1.(4) Protection of Ground Cover in Warm Air Plenums. The purpose of the requirement is to protect combustible ground cover from smouldering cigarette butts that may drop through air registers. The protective material should extend beyond the opening of the register and have up-turned edges, as a butt may be deflected sideways as it falls.

A-9.19.1.1.(1) Venting of Attic or Roof Spaces. Controlling the flow of moisture by air leakage and vapour diffusion into attic or roof spaces is necessary to limit moisture-induced deterioration. Given that imperfections normally exist in the vapour barriers and air barrier systems, recent research indicates that venting of attic or roof spaces is generally still required. The exception provided in Article 9.19.1.1. recognizes that some specialized ceiling-roof assemblies, such as those used in some factory-built buildings, have, over time, demonstrated that their construction is sufficiently tight to prevent excessive moisture accumulation. In these cases, ventilation would not be required.

Further, the use of spray-in-place foam (SPF) insulation may also be considered sufficiently tight to prevent excessive moisture accumulation provided that acceptable procedures, material requirements, location restraints, installation requirements and inspection documentation has been met. The exception for SPF is for a ‘typical’ indoor environment. The exception shall not be used for high humidity interior environments such as ceilings above indoor hot tubs, etc. Caution should also be given to the use of SPF in ceilings above kitchens and bathrooms, where the incorrect use of venting equipment could create high humidity conditions for extended periods of time. For installations where the ceiling-roof assembly has a slope of less than 2-in-12, additional attention should be given to the roof membrane. More frequent monitoring and maintenance is recommended. Where possible, it is recommended that the vapour be allowed to transfer to the top side of the assembly, in other words, consideration should be given for cross ventilation above the roof sheathing.

A-9.19.2.1.(1) Access to Attic or Roof Space. The term “open space” refers to the space between the insulation and the roof sheathing. Sentence 9.19.2.1.(1) requires the installation of an access hatch where the open space in the attic or roof is large enough to allow visual inspection. Although the dimensions of an uninsulated attic or roof space may meet the size that triggers the requirement for an access hatch to be installed, most of that space will actually be filled with insulation and may therefore not be easily inspected, particularly in smaller buildings or under low-sloped roofs.

A-9.20.1.2. Seismic Information. Information on spectral response acceleration values for various locations can be found in Appendix C.

A-9.20.5.1.(1) Masonry Support. Masonry veneer must be supported on a stable structure in order to avoid cracking of the masonry due to differential movement relative to parts of the support. Wood framing is not normally used as a support for the weight of masonry veneer because of its shrinkage characteristics. Where the weight of masonry veneer is supported on a wood structure, as is the case for the preserved wood foundations referred to in Sentence 9.20.5.1.(1) for example, measures must be taken to ensure that any differential movement that may be harmful to the performance of masonry is minimized or accommodated. The general principle stated in Article 9.4.1.1., however, makes it possible to support the weight of masonry veneer on wood framing, provided that engineering design principles prescribed in Part 4 are followed to ensure that the rigidity of the support is compatible with the stiffness of the masonry being supported and that differential movements between the support and masonry are accommodated.

A-9.20.8.5.(1) Projection of Masonry Beyond Supporting Members.

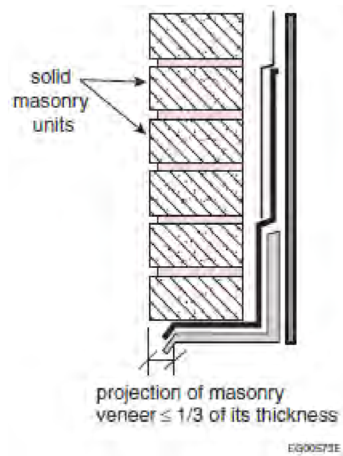


Figure A-9.20.8.5.(1)
Maximum projection of masonry veneer beyond its support

A-9.20.12.2.(2) Corbelling of Masonry Foundation Walls.

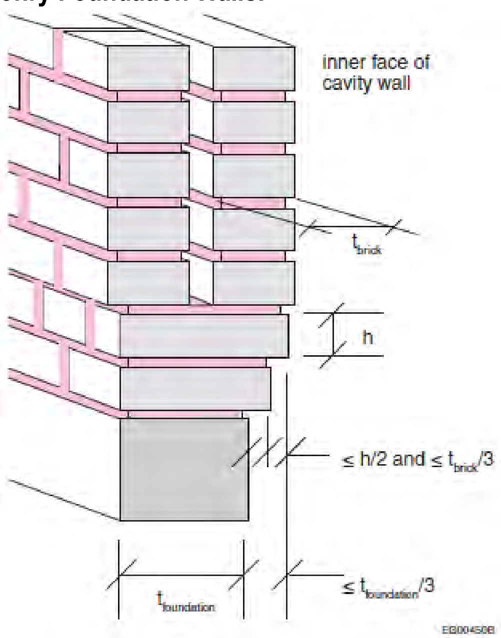


Figure A-9.20.12.2.(2)
Maximum corbel dimensions

A-9.20.13.9.(3) Dampproofing of Masonry Walls. The reason for installing a sheathing membrane behind masonry walls is to prevent rainwater from reaching the interior finish if it should leak past the masonry. The sheathing membrane intercepts the rainwater and leads it to the bottom of the wall where the flashing directs it to the exterior via weep holes. If the insulation is a type that effectively resists the penetration of water, and is installed so that water will not collect behind it, then there is no need for a sheathing membrane. If water that runs down between the masonry and the insulation is able to leak out at the joints in the insulation, such insulation will not act as a substitute for a sheathing membrane. If water cannot leak through the joints in the insulation but collects in cavities between the masonry and insulation, subsequent freezing could damage the wall. Where a sheathing membrane is not used, the adhesive or mortar should therefore be applied to form a continuous bond between the masonry and the insulation. If this is not practicable because of an irregular masonry surface, then a sheathing membrane is necessary.

A-9.21.3.6.(2) Metal Chimney Liners. Under the provisions of Article 1.2.1.1. of Division A, masonry chimneys with metal liners may be permitted to serve solid-fuel-burning appliances if tests show that such liners will provide an equivalent level of safety.

A-9.21.4.4.(1) Location of Chimney Top.

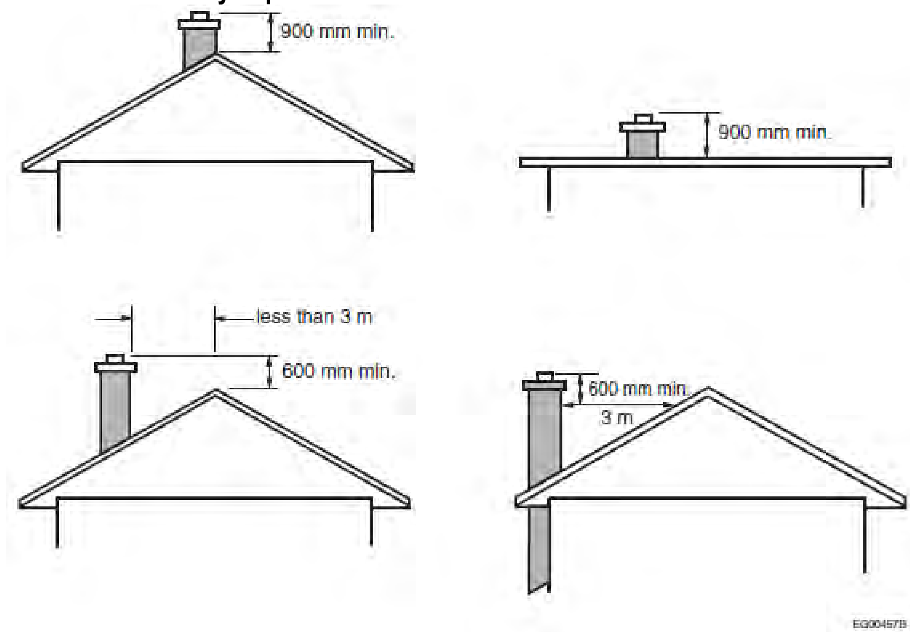


Figure A-9.21.4.4.(1)
Vertical and horizontal distances from chimney top to roof

A-9.21.4.5.(2) Lateral Support for Chimneys. Where a chimney is fastened to the house framing with metal anchors, in accordance with CSA A370, "Connectors for Masonry," it is considered to have adequate lateral support. The portion of the chimney stack above the roof is considered as free standing and may require additional lateral support.

A-9.21.5.1.(1) Clearance from Combustible Materials. For purposes of this Sentence, an exterior chimney can be considered to be one which has at least one surface exposed to the outside atmosphere or unheated space over the majority of its height. All other chimneys should be considered to be interior.

A-9.23.1.1. Constructions Other than Light Wood-Frame Constructions. The prescriptive requirements in Section 9.23. apply only to standard light wood-frame construction. Other constructions, such as post, beam and plank construction, plank frame wall construction, and log construction must be designed in accordance with Part 4.

A-9.23.1.1.(1) Application of Section 9.23. In previous editions of the By-law, Sentence 9.23.1.1.(1) referred to "conventional" wood-frame construction. Over time, conventions have changed and the application of Part 9 has expanded.

The prescriptive requirements provided in Section 9.23. still focus on lumber beams, joists, studs and rafters as the main structural elements of "wood-frame construction." The requirements recognize – and have recognized for some time – that walls and floors may be supported by components made of material other than lumber; for example, by foundations described in Section 9.15. or by steel beams described in Article 9.23.4.3. These constructions still fall within the general category of wood-frame construction.

With more recent innovations, alternative structural components are being incorporated into wood-frame buildings. Wood I-joists, for example, are very common. Where these components are used in lieu of lumber, the requirements in Section 9.23. that specifically apply to lumber joists do not apply to these components: for example, limits on spans and acceptable locations for notches and holes. However, requirements regarding the fastening of floor sheathing to floor joists still apply, and the use of wood I-joists does not affect the requirements for wall or roof framing. Similarly, if steel floor joists are used in lieu of lumber joists, the requirements regarding wall or roof framing are not affected.

Conversely, Sentence 9.23.1.1.(1) precludes the installation of precast concrete floors on wood-frame walls since these are not "generally comprised of … small repetitive structural members … spaced not more than 600 mm o.c." Thus, the reference to "engineered components" in Sentence 9.23.1.1.(1) is intended to indicate that, where an engineered product is used in lieu of lumber for one part of the building, this does not preclude the application of the remainder of Section 9.23. to the structure, provided the limits to application with respect to cladding, sheathing or bracing, spacing of framing members, supported loads and maximum spans are respected.

A-9.23.3.1.(2) Alternative Nail Sizes. Where power nails or nails with smaller diameters than that required by Table 9.23.3.4. are used to connect framing, the following equations can be used to determine the required spacing or required number of nails. The maximum spacing can be reduced using the following equation:

$$S_{adj} = S_{table} \cdot (D_{red}/D_{table})^2$$

where

S_{adj} = adjusted nail spacing ≥ 20 × nail diameter,
S_{table} = nail spacing required by Table 9.23.3.4.,
D_{red} = smaller nail diameter than that required by Table 9.23.3.1., and
D_{table} = nail diameter required by Table 9.23.3.1.

The number of nails can be increased using the following equation:

$$N_{adj} = N_{table} \cdot (D_{table}/D_{red})^2$$

where

N_{adj} = adjusted number of nails,
N_{table} = number of nails required by Table 9.23.3.4.,
D_{table} = nail diameter required by Table 9.23.3.1., and
D_{red} = smaller nail diameter than required by Table 9.23.3.1.

Note that nails should be spaced sufficiently far apart – preferably no less than 55 mm apart – to avoid splitting of framing lumber.

A-9.23.3.1.(3) Standard for Screws. The requirement that wood screws conform to ASME B18.6.1, "Wood Screws (Inch Series)," is not intended to preclude the use of Robertson head screws. The requirement is intended to specify the mechanical properties of the fastener, not to restrict the means of driving the fastener.

A-9.23.3.3.(1) Prevention of Splitting. Figure A-9.23.3.3.(1) illustrates the intent of the phrase "staggering the nails in the direction of the grain."

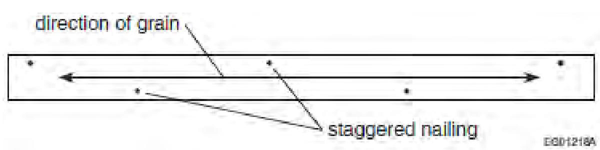


Figure A-9.23.3.3.(1)
Staggered nailing

A-Table 9.23.3.5.-B Alternative Nail Sizes. Where power nails or nails having a different diameter than the diameters listed in CSA B111, "Wire Nails, Spikes and Staples," are used to connect the edges of the wall sheathing to the wall framing of wood-sheathed braced wall panels, the maximum spacing should be as shown in Table A-Table 9.23.3.5.-B.

Table A-Table 9.23.3.5.-B
Alternative Nail Diameters and Spacing

Element	Nail Diameter, mm(1)	Maximum Spacing of Nails Along Edges of Wall Sheathing, mm o.c.
Plywood, OSB or waferboard	2.19-2.52	75
	2.53-2.82	100
	2.83-3.09	125
	>3.09	150

A-9.23.4.2. Span Tables for Wood Joists, Rafters and Beams. In these span tables the term “rafter” refers to a sloping wood framing member which supports the roof sheathing and encloses an attic space but does not support a ceiling. The term “roof joist” refers to a horizontal or sloping wood framing member that supports the roof sheathing and the ceiling finish but does not enclose an attic space.
Where rafters or roof joists are intended for use in a locality having a higher specified roof snow load than shown in the tables, the maximum member spacing may be calculated as the product of the member spacing and specified snow load shown in the span tables divided by the specified snow load for the locality being considered. The following examples show how this principle can be applied:

(a) For a 3.5 kPa specified snow load, use spans for 2.5 kPa and 600 mm o.c. spacing but space members 400 mm o.c.
(b) For a 4.0 kPa specified snow load, use spans for 2.0 kPa and 600 mm o.c. spacing but space members 300 mm o.c.

The maximum spans in the span tables are measured from the inside face or edge of support to the inside face or edge of support.

In the case of sloping roof framing members, the spans are expressed in terms of the horizontal distance between supports rather than the length of the sloping member. The snow loads are also expressed in terms of the horizontal projection of the sloping roof. Spans for odd size lumber may be estimated by straight line interpolation in the tables.

These span tables may be used where members support a uniform live load only. Where the members are required to be designed to support a concentrated load, they must be designed in conformance with Subsection 4.3.1.

Supported joist length in Span Tables 9.23.4.2.-H, 9.23.4.2.-I and 9.23.4.2.-J means half the sum of the joist spans on both sides of the beam. For supported joist lengths between those shown in the tables, straight line interpolation may be used in determining the maximum beam span.

Span Tables 9.23.4.2.-A to 9.23.12.3.-D cover only the most common configurations. Especially in the area of floors, a wide variety of other configurations is possible: glued subfloors, concrete toppings, machine stress rated lumber, etc. The Canadian Wood Council publishes “The Span Book,” a compilation of span tables covering many of these alternative configurations. Although these tables have not been subject to the formal committee review process, the Canadian Wood Council generates, for the CCBFC, all of the By-law’s span tables for wood structural components; thus By-law users can be confident that the alternative span tables in “The Span Book” are consistent with the span tables in the By-law and with relevant By-law requirements.

Spans for wood joists, rafters and beams which fall outside the scope of these tables, including those for U.S. species and individual species not marketed in the commercial species combinations described in the span tables, can be calculated in conformance with CSA O86, “Engineering Design in Wood.”

A-9.23.4.2.(2) Numerical Method to Establish Vibration-Controlled Spans for Wood-Frame Floors. In addition to the normal strength and deflection analyses, the calculations on which the floor joist span tables are based include a method of ensuring that the spans are not so long that floor vibrations could lead to occupants perceiving the floors as too "bouncy" or "springy."
Limiting deflection under the normal uniformly distributed loads to 1/360 of the span does not provide this assurance. Normally, vibration analysis requires detailed dynamic modelling. However, the calculations for the span tables use the following simplified static analysis method of estimating vibration-acceptable spans:

- The span which will result in a 2 mm deflection of a single joist supporting a 1 kN concentrated midpoint load is calculated.
- This span is multiplied by a factor, K, to determine the "vibration-controlled" span for the entire floor system. If this span is less than the strength- or deflection-controlled span under uniformly distributed load, the vibration-controlled span becomes the maximum span.
- The K factor is determined from the following relationship:

$$\ln(K) = A - B \cdot \ln\left(\frac{S_i}{S_{184}}\right) + G$$

where
A, B = constants, the values of which are determined from Tables A-9.23.4.2.(2)-A or A-9.23.4.2.(2)-B,
G = constant, the value of which is determined from Table A-9.23.4.2.(2)-C,
S_i = span which results in a 2 mm deflection of the joist in question under a 1 kN concentrated midpoint load,
S_{184} = span which results in a 2 mm deflection of a 38 × 184 mm joist of same species and grade as the joist in question under a 1 kN concentrated midpoint load.

For a given joist species and grade, the value of K shall not be greater than K3, the value which results in a vibration-controlled span of exactly 3 m. This means that for vibration-controlled spans 3 m or less, K always equals K3, and for vibration-controlled spans greater than 3 m, K is as calculated.

Note that, for a sawn lumber joist, the ratio S_i/S_{184} is equivalent to its depth (mm) divided by 184.

Due to rounding differences, the method, as presented here, might produce results slightly different from those produced by the computer program used to generate the span tables.

Table A-9.23.4.2.(2)-A
Constants A and B for Calculating Vibration-Controlled Floor Joist Spans – General Cases
Forming Part of Note A-9.23.4.2.(2)

Subfloor Thickness, mm	With Strapping(1)			With Bridging			With Strapping and Bridging		
	Joist Spacing, mm			Joist Spacing, mm			Joist Spacing, mm		
	300	400	600	300	400	600	300	400	600
Constant A									
15.5	0.30	0.25	0.20	0.37	0.31	0.25	0.42	0.35	0.28
19.0	0.36	0.30	0.24	0.45	0.37	0.30	0.50	0.42	0.33
Constant B									
	0.33			0.38			0.41		

Notes to Table A-9.23.4.2.(2)-A:
(1) Gypsum board attached directly to joists can be considered equivalent to strapping.

Table A-9.23.4.2.(2)-B
Constants A and B for Calculating Vibration-Controlled Floor Joist Spans – Special Cases
Forming Part of Note A-9.23.4.2.(2)

Subfloor Thickness, mm	Joists with Ceiling Attached to Wood Furring(1)						Joists with Concrete Topping(2)		
	With Strapping(1)			With Bridging			With Strapping and Bridging		
	Joist Spacing, mm			Joist Spacing, mm			Joist Spacing, mm		
	300	400	600	300	400	600	300	400	600
Constant A									
15.5	0.39	0.33	0.24	0.49	0.44	0.38	0.58	0.51	0.41
19.0	0.42	0.36	0.27	0.51	0.46	0.40	0.62	0.56	0.47
Constant B									
	0.34			0.37			0.35		

Notes to Table A-9.23.4.2.(2)-B:
(1) Wood furring means 19 × 89 mm boards not more than 600 mm o.c., or 19 × 64 mm boards not more than 300 mm o.c. For all other cases, see Table A-9.23.4.2.(2)-A.
(2) 30 mm to 51 mm normal weight concrete (not less than 20 MPa) placed directly on the subflooring.

Table A-9.23.4.2.(2)-C
Constant G for Calculating Vibration-Controlled Floor Joist Spans
Forming Part of Note A-9.23.4.2.(2)

Floor Description	Constant G
Floors with nailed(1) subfloor	0.00
Floor with nailed and field-glued(2) subfloor, vibration-controlled span greater than 3 m	0.10
Floor with nailed and field-glued(2) subfloor, vibration-controlled span 3 m or less	0.15

Notes to Table A-9.23.4.2.(2)-C:
(1) Common wire nails, spiral nails or wood screws can be considered equivalent for this purpose.
(2) Subfloor field-glued to floor joists with elastomeric adhesive complying with CAN/CGSB-71.26-M, “Adhesive for Field-Gluing Plywood to Lumber Framing for
Floor Systems.”

Additional background information on this method can be found in the following publications:

- Onysko, D.M. “Deflection Serviceability Criteria for Residential Floors.” Project 43-10C-024. Forintek Canada Corp., Ottawa, Canada 1988.
- Onysko, D.M. “Performance and Acceptability of Wood Floors – Forintek Studies.” Proceedings of Symposium/Workshop on Serviceability of Buildings, Ottawa, May 16-18, National Research Council of Canada, Ottawa, 1988.

A-9.23.4.3.(1) Maximum Spans for Steel Beams Supporting Floors in Dwellings. A beam may be considered to be laterally supported if wood joists bear on its top flange at intervals of 600 mm or less over its entire length, if all the load being applied to this beam is transmitted through the joists and if 19 mm by 38 mm wood strips in contact with the top flange are nailed on both sides of the beam to the bottom of the joists supported. Other additional methods of positive lateral support are acceptable.

For supported joist lengths intermediate between those in the table, straight line interpolation may be used in determining the maximum beam span.

A-Table 9.23.4.3. Spans for Steel Beams. The spans provided in Table 9.23.4.3. reflect a balance of engineering and acceptable proven performance. The spans have been calculated based on the following assumptions:

- simply supported beam spans
- laterally supported top flange

- yield strength 350 MPa
- deflection limit L/360
- live load: first floor = 1.9 kPa; second floor = 1.4 kPa
- dead load: 1.5 kPa (0.5 kPa floor + 1.0 kPa partition)

The calculation used to establish the specified maximum beam spans also applies a revised live load reduction factor to account for the lower probability of a full live load being applied over the supported area in Part 9 buildings.

A-9.23.4.4. Concrete Topping. Vibration-controlled spans given in Span Table 9.23.4.2.-B for concrete topping are based on a partial composite action between the concrete, subflooring and joists. Normal weight concrete having a compressive strength of not less than 20 MPa, placed directly on the subflooring, provides extra stiffness and results in increased capacity. The use of a bond breaker between the topping and the subflooring, or the use of lightweight concrete topping limits the composite effects.

Where either a bond breaker or lightweight topping is used, Span Table 9.23.4.2.-A may be used but the additional dead load imposed by the concrete must be considered. The addition of 51 mm of concrete topping can impose an added load of 0.8 to 1.2 kPa, depending on the density of the concrete.

Example
Assumptions:

– basic dead load	= 0.5 kPa
– topping dead load	= 0.8 kPa
– total dead load	= 1.3 kPa
– live load	= 1.9 kPa
– vibration limit	per Note A-9.23.4.2.(2)
– deflection limit	= 1/360
– ceiling attached directly to joists, no bridging	

The spacing of joists in the span tables can be conservatively adjusted to allow for the increased load by using the spans in Span Table 9.23.4.2.-A for 600 mm spacing, but spacing the joists 400 mm apart. Similarly, floor beam span tables can be adjusted by using 4.8 m supported length spans for cases where the supported length equals 3.6 m.

A-9.23.8.3. Joint Location in Built-Up Beams.

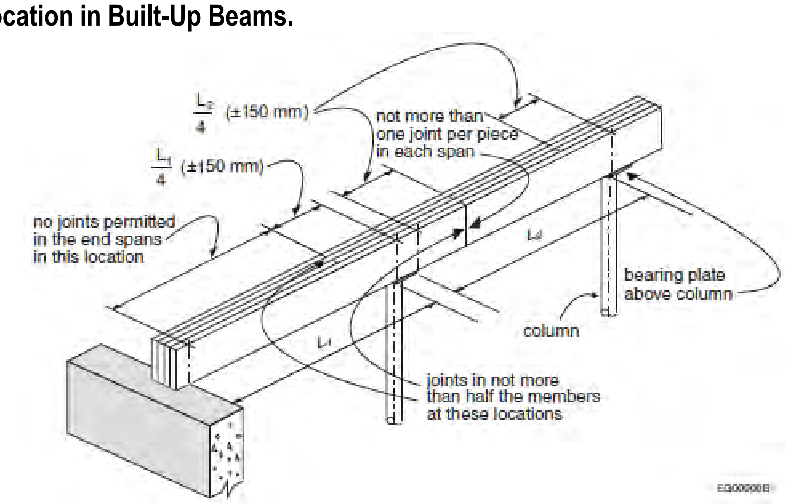


Figure A-9.23.8.3.
Joint location in built-up beams

A-9.23.10.4.(1) Fingerjoined Lumber. NLGA 2014, “Standard Grading Rules for Canadian Lumber,” referenced in

Article 9.3.2.1., refers to two special product standards, SPS-1, “Fingerjoined Structural Lumber,” and SPS-3, “Fingerjoined “Vertical Stud Use Only” Lumber,” produced by NLGA. Material identified as conforming to these standards is considered to meet the requirements in this Sentence for joining with a structural adhesive. Lumber fingerjoined in accordance with SPS-3 should be used as a vertical end-loaded member in compression only, where sustained bending or tension-loading conditions are not present, and where the moisture content of the wood will not exceed 19%. Fingerjoined lumber may not be visually regraded or remanufactured into a higher stress grade even if the quality of the lumber containing fingerjoints would otherwise warrant such regrading.

A-9.23.10.6.(3) Single Studs at Sides of Openings.

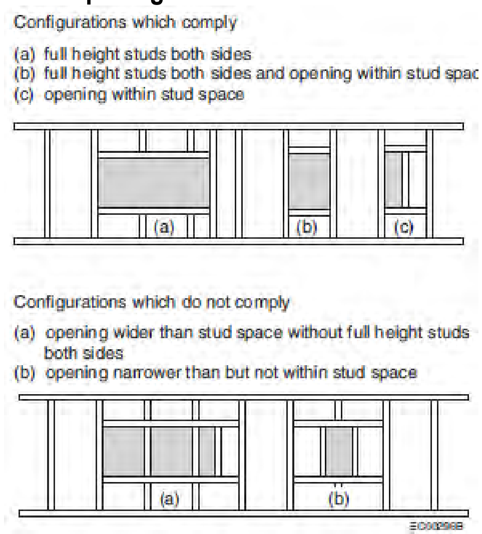


Figure A-9.23.10.6.(3)-A
Single studs at openings in non-loadbearing interior walls

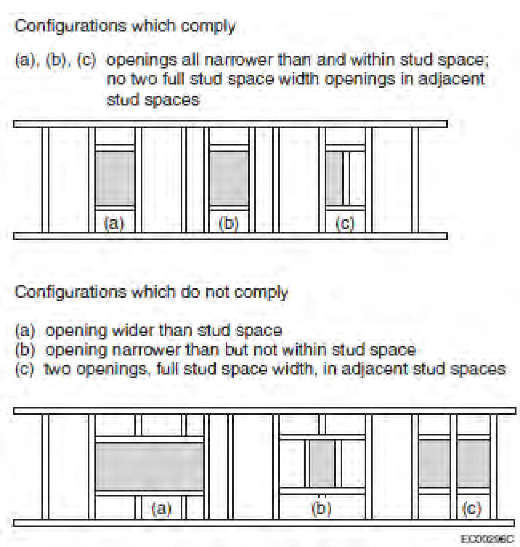


Figure A-9.23.10.6.(3)-B
Single studs at openings in all other walls

A-9.23.13. Bracing for Resistance to Lateral Loads. Subsection 9.23.14. along with Articles 9.23.3.4., 9.23.3.5., 9.23.6.1., 9.23.9.8., 9.23.15.5., 9.29.5.8., 9.29.5.9., 9.29.6.3. and 9.29.9.3. provide explicit requirements to address resistance to wind and earthquake loads in higher wind and earthquake regions of British Columbia.

Table A-9.23.13.
Application of Lateral Load Requirements

Applicable Requirements	Wind (HWP)			Earthquake Sa(0.2)				
	Low to Moderate	High	Extreme	Low to Moderate	High	Extreme	High	Extreme
	HWP<0.80 kPa	0.80 ≤ HWP < 1.20 kPa	HWP ≥ 1.20 kPa	S_a(0.2) ≤ 0.70	0.70 < S_a(0.2) ≤ 1.8	Sa(0.2) > 1.8	0.70 < Sa(0.2) ≤ 1.8	Sa(0.2) > 1.8
	All Construction			All Construction	Heavy Construction(1)		Light Construction	
Design requirements in 9.23.16.2., 9.27., 9.29.	X(2)	N/A	N/A	X	N/A	N/A	N/A	N/A
Bracing requirements in 9.23.13.	X	X	N/A	X	X(3)(4)	N/A	X(4)(5)	N/A
Part 4 or CWC Guide	X	X	X	X	X	X	X	X
X = requirements are applicable								

Notes to Table A-9.23.13.:
(1) See Note A-9.23.13.2.(1)(a)(i).
(2) Requirements apply to exterior walls only.
(3) Requirements apply where lowest exterior frame walls support not more than one floor.
(4) All constructions may include the support of a roof in addition to the stated number of floors.
(5) Requirements apply where lowest exterior frame walls support not more than two floors.

A-9.23.13.1.

Bracing to Resist Lateral Loads in Low Load Locations
Of the 109 locations identified in Appendix C, 68 are locations where the seismic spectral response acceleration, Sa(0.2), is less than or equal to 0.70 and the 1-in-50 hourly wind pressure is less than 0.80 kPa. For buildings in these locations, Sentence 9.23.13.1.(2) requires only that exterior walls be braced using the acceptable materials and fastening specified. There are no spacing or dimension requirements for braced wall panels in these buildings.

Structural Design for Lateral Wind and Earthquake Loads
In cases where lateral load design is required, CWC 2014, “Engineering Guide for Wood Frame Construction,” provides acceptable engineering solutions as an alternative to Part 4. The CWC Guide also contains alternative solutions and provides information on the applicability of the Part 9 prescriptive structural requirements to further assist designers and building officials to identify the appropriate design approach.

A-9.23.13.2.(1)(a)(i) Heavy Construction. “Heavy construction” refers to buildings with tile roofs, stucco walls or floors with concrete topping, or that are clad with directly-applied heavyweight materials.

Heavyweight construction assemblies increase the lateral load on the structure during an earthquake. Assemblies should be considered as heavyweight where their average dead weight is as follows (an additional partition weight of 0.5 kPa per floor is assumed):
• floor: 0.5 to 1.5 kPa
• roof: 0.5 to 1.0 kPa
• wall (vertical area): 0.32 to 1.2 kPa

A-9.23.13.4. Braced Wall Bands. Article 9.23.13.4. specifies the required characteristics of braced wall bands and their position in the building. Figures A-9.23.13.4.-A, A-9.23.13.4.-B and A-9.23.13.4.-C illustrate these requirements.

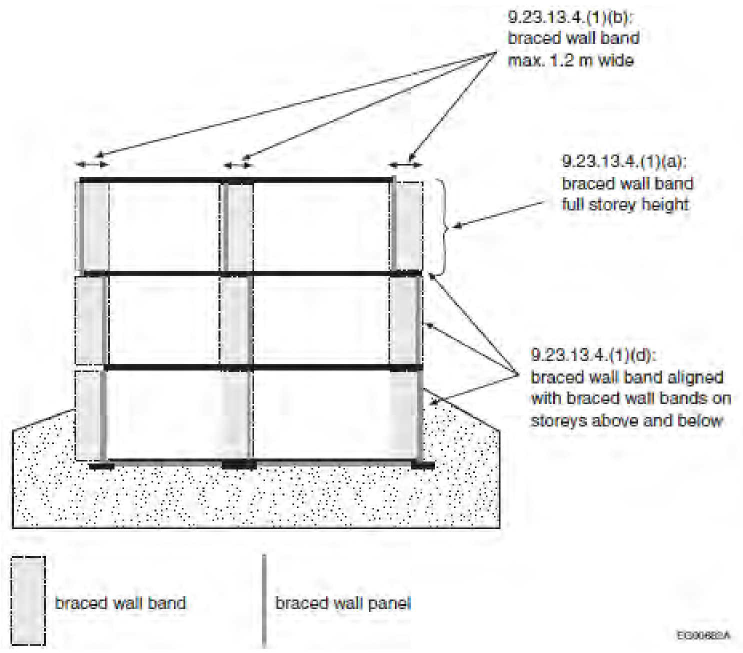


Figure A-9.23.13.4.-A
Braced wall bands in an example building section [Clauses 9.23.13.4.(1)(a), (b) and (d)]

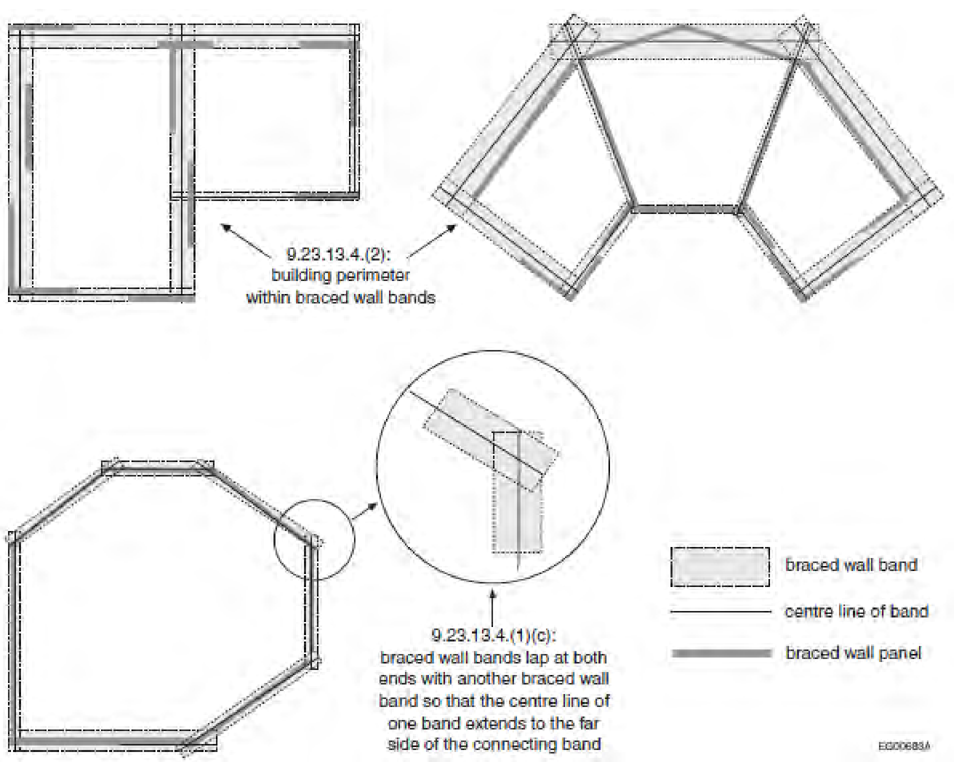


Figure A-9.23.13.4.-B
Lapping bands and building perimeter within braced wall bands [Clause 9.23.13.4.(1)(c) and Sentence 9.23.13.4.(2)]

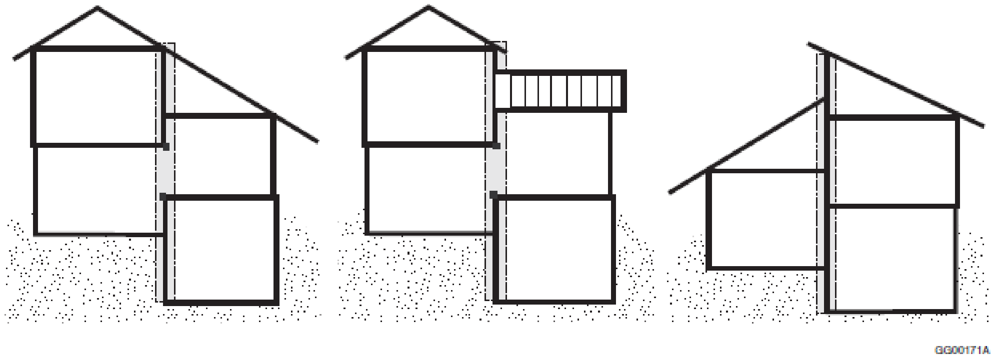


Figure A-9.23.13.4.-C
Braced wall band at change in floor level in split-level buildings [Sentence 9.23.13.4.(3)]

A-Table 9.23.13.5. Spacing of Braced Wall Bands and Braced Wall Panels. Identifying adjacent braced wall bands and determining the spacing of braced wall panels and braced wall bands is not complicated where the building plan is orthogonal or there are parallel braced wall bands: the adjacent braced wall band is the nearest parallel band. Figure Table A-9.23.13.5.-A illustrates spacing.

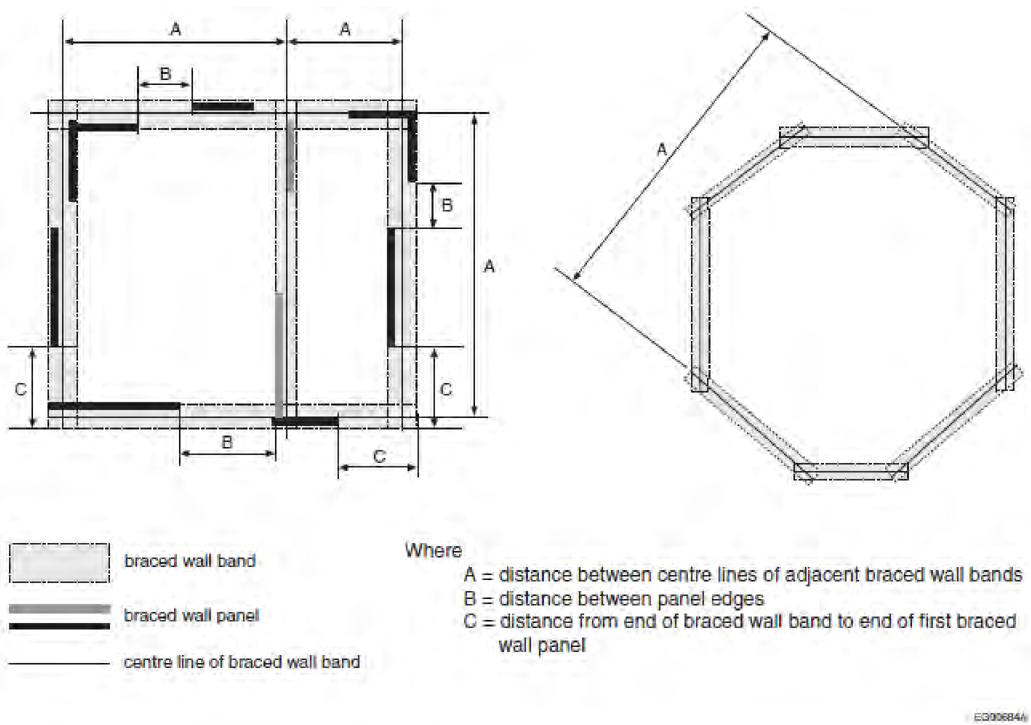


Figure Table A-9.23.13.5.-A
Spacing of parallel braced wall bands and spacing of braced wall panels

Identifying and Spacing Adjacent Non-Parallel Braced Wall Bands

Identifying the adjacent braced wall band and the spacing between braced wall bands is more complicated where the building plan is not orthogonal.

Where the plan is triangular, all braced wall bands intersect with the subject braced wall band. The prescriptive requirements in Part 9 do not apply to these cases and the building must be designed according to Part 4 with respect to lateral load resistance.

Where the braced wall bands are not parallel, the adjacent band is identified as follows using Figure Table A-9.23.13.5.-B as an example:
1. Determine the mid-point of the centre line of the subject braced wall band (A);
2. Project a perpendicular line from this mid-point (B);
3. The first braced wall band encountered is the adjacent braced wall band (C);
4. Where the projected line encounters an intersection point between two braced wall bands, either wall band may be identified as the adjacent braced wall band (complex cases).

The spacing of non-parallel braced wall bands is measured as the greatest distance between the centre lines of the bands.

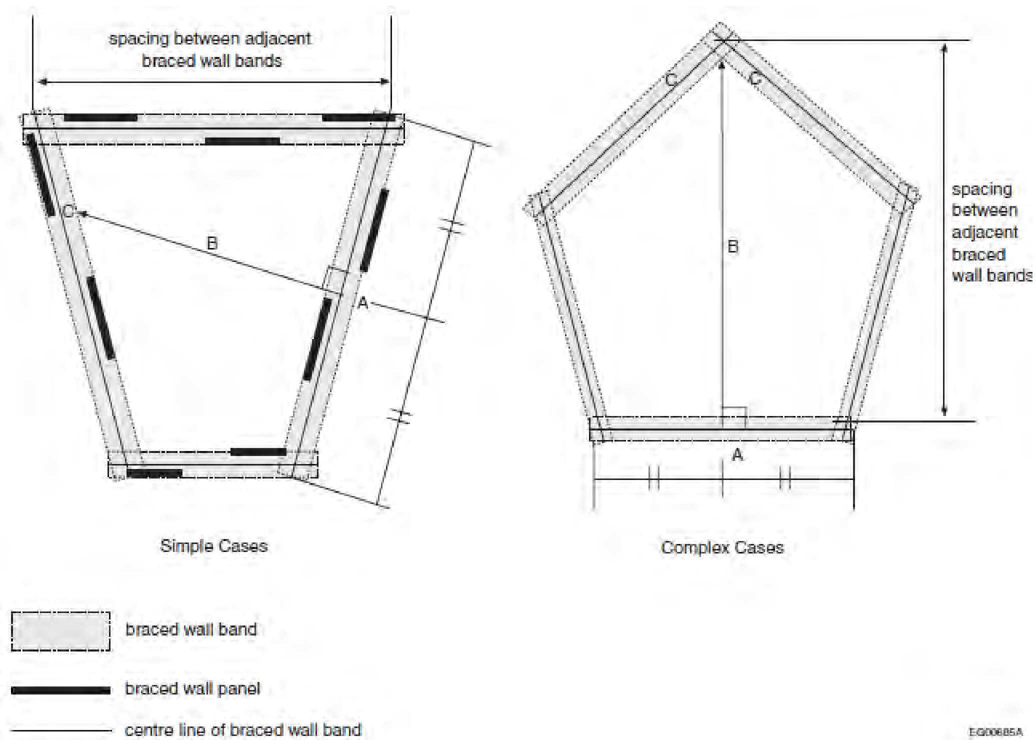


Figure Table A-9.23.13.5.-B
Identification and spacing of adjacent non-parallel braced wall bands

A-9.23.13.5.(2) Perimeter Foundation Walls. Where the perimeter foundation walls in basements and crawl spaces extend from the footings to the underside of the supported floor, these walls perform the same function as braced wall bands with braced wall panels. All other braced wall bands in the basement or crawl space that align with bands with a wood-based bracing material on the upper floors need to be constructed with braced wall panels, which must be made of a wood-based bracing material, masonry or concrete. See Figure A-9.23.13.5.(2).

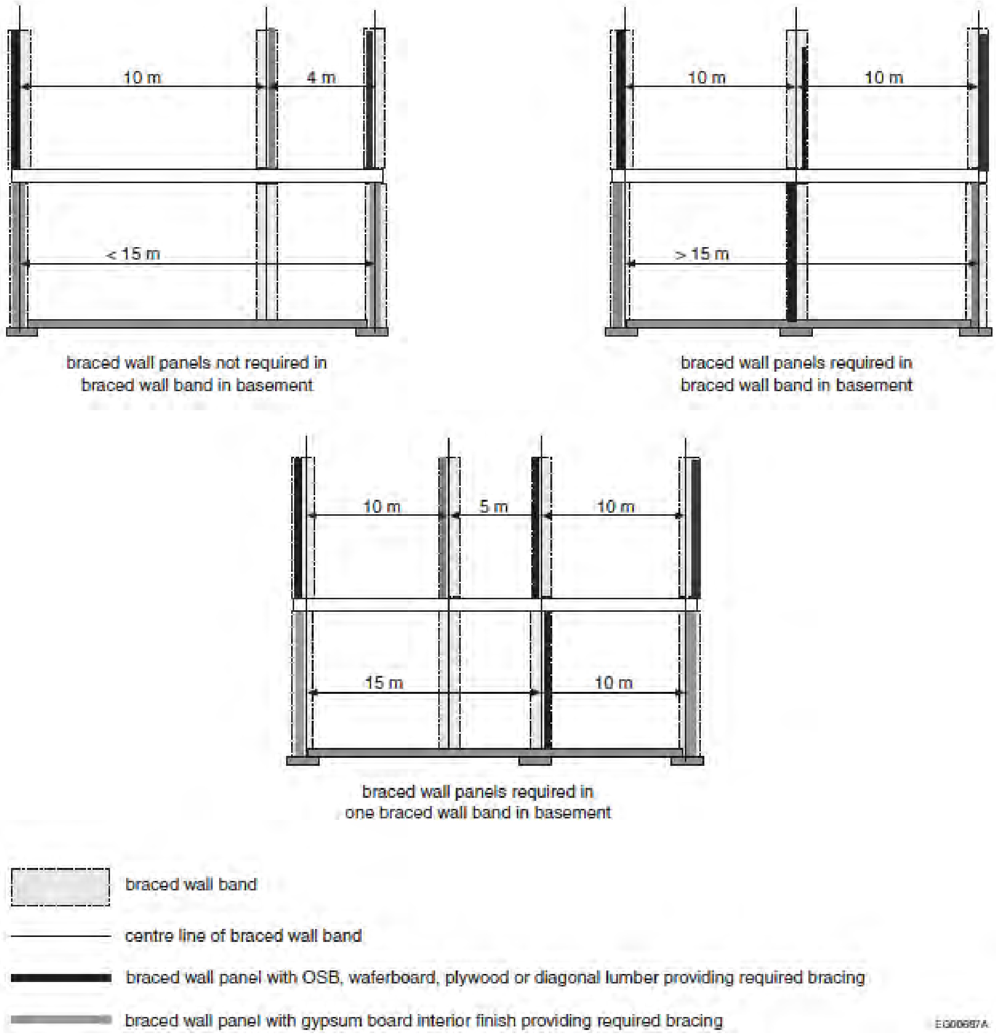


Figure A-9.23.13.5.(2)
Braced wall bands in basements or crawl spaces with optional and required braced wall panels

A-9.23.13.5.(3) Attachment of a Porch Roof to Exterior Wall Framing.

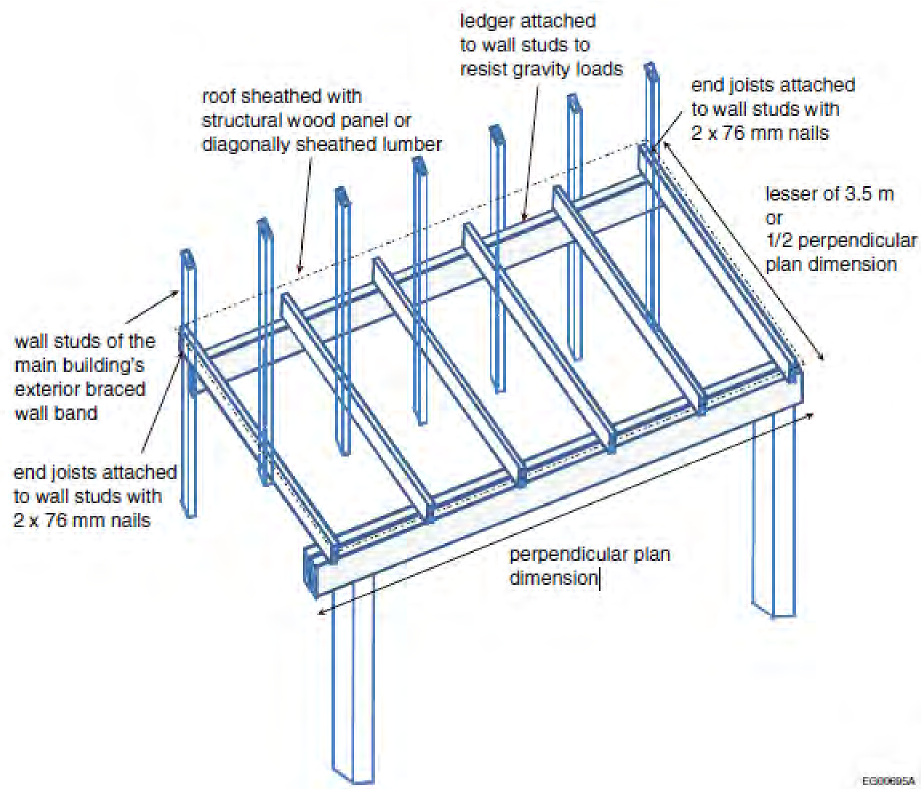
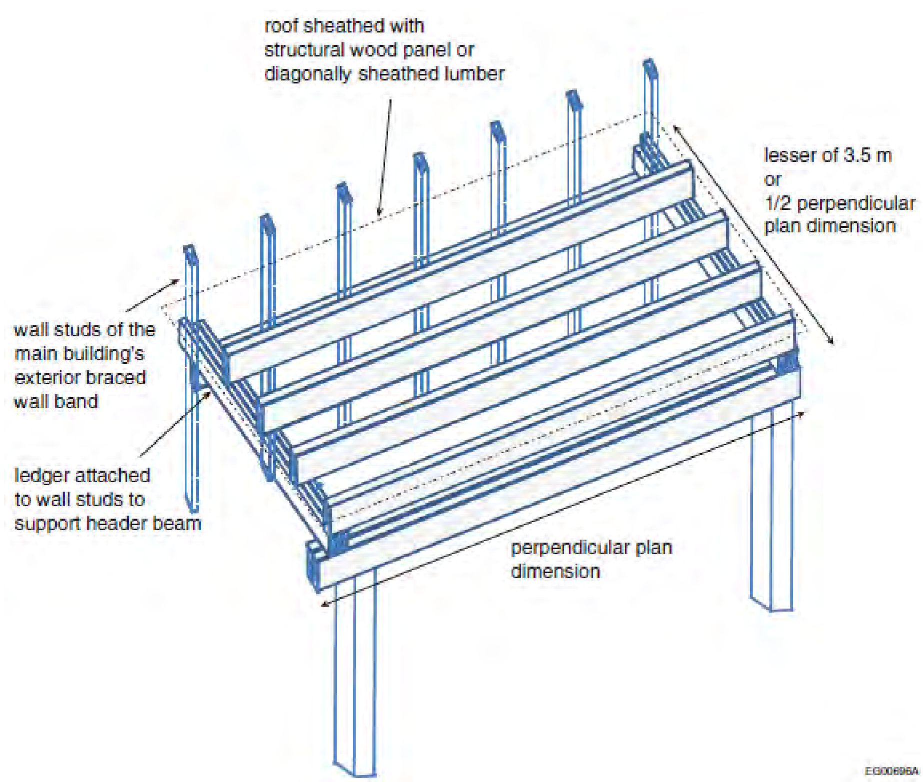


Figure A-9.23.13.5.(3)-A
Framing perpendicular to plane of wall (balloon construction)



Framing parallel to plane of wall

A-9.23.13.6.(5) and (6) Use of Gypsum Board Interior Finish to Provide Required Bracing. Braced wall panels constructed with gypsum board provide less resistance to lateral loads than panels constructed with OSB, waferboard, plywood or diagonal lumber; Sentence (5) therefore limits the use of gypsum board to interior walls. Sentence (6) further limits its use to provide the required lateral resistance by requiring that walls not more than 15 m apart be constructed with panels made of wood or wood-based sheathing. See Figure A-9.23.13.6.(5) and (6).

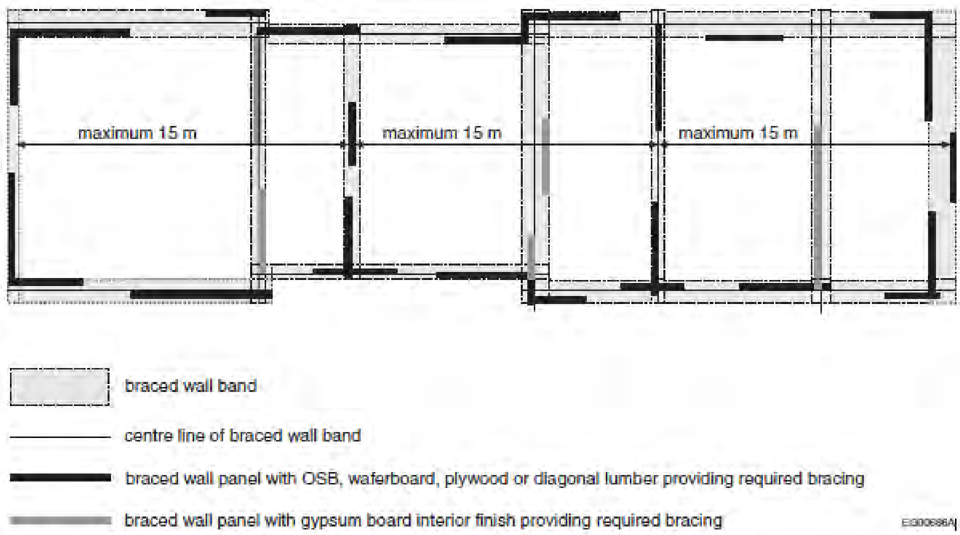


Figure A-9.23.13.6.(5) and (6)
Braced wall panels constructed of wood-based material

A-9.23.14.11.(2) Wood Roof Truss Connections. Sentence 9.23.14.11.(2) requires that the connections used in wood roof trusses be designed in conformance with Subsection 4.3.1. and Sentence 2.2.1.2.(1) of Division C, which applies to all of Part 4, requires that the designer be a professional engineer or architect skilled in the work concerned. This has the effect of requiring that the trusses themselves be designed by professional engineers or architects. Although this is a departure from the usual practice in Part 9, it is appropriate, since wood roof trusses are complex structures which depend on a number of components (chord members, web members, cross-bracing, connectors) working together to function safely. This complexity precludes the standardization of truss design into tables comprehensive enough to satisfy the variety of roof designs required by the housing industry.

A-9.23.15.2.(4) Water Absorption Test. A method for determining water absorption is described in ASTM D 1037, “Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.” The treatment to reduce water absorption may be considered to be acceptable if a 300 mm × 300 mm sample when treated on all sides and edges does not increase in weight by more than 6% when tested in the horizontal position.

A-9.23.15.4.(2) OSB. CSA O437.0, “OSB and Waferboard,” requires that Type O (aligned or oriented) panels be marked to show the grade and the direction of face alignment.

A-9.24.3.2.(3) Framing Above Doors in Steel Stud Fire Separations.

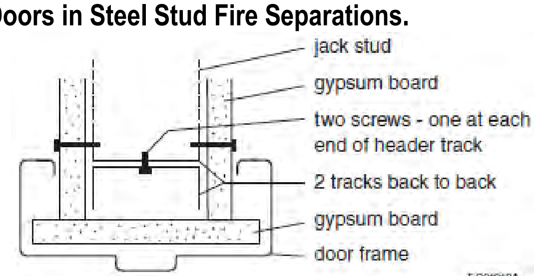


Figure A-9.24.3.2.(3)
Steel stud header detail

A-9.25.2.2.(2) Flame-Spread Ratings of Insulating Materials. Part 9 has no requirements for flame-spread ratings of insulation materials since these are seldom exposed in parts of buildings where fires are likely to start. Certain of the insulating material standards referenced in Sentence 9.25.2.2.(1) do include flame-spread rating criteria. These are included either because the industry producing the product wishes to demonstrate that their product does not constitute a fire hazard or because the product is regulated by authorities other than building authorities (e.g., "Hazardous Products Act"). However, the Code cannot apply such requirements to some materials and not to others. Hence, these flame-spread rating requirements are excepted in referencing these standards.

A-9.25.2.3.(3) Position of Insulation. For thermal insulation to be effective, it must not be short-circuited by convective airflow through or around the material. If low-density fibrous insulation is installed with an air space on both sides of the insulation, the temperature differential between the warm and cold sides will drive convective airflow around the insulation. If foamed plastic insulation is spot-adhered to a backing wall or adhered in a grid pattern to an air-permeable substrate, and is not sealed at the joints and around the perimeter, air spaces between the insulation and the substrate will interconnect with spaces behind the cladding. Any temperature or air pressure differential across the insulation will again lead to short circuiting of the insulation by airflow. Thermal insulation must therefore be installed in full and continuous contact with the air barrier or another continuous component with low air permeance. (See Note A-9.25.5.1.(1) for examples of low-air-permeance materials.)

A-9.25.2.4.(3) Loose-Fill Insulation in Existing Wood-Frame Walls. The addition of insulation into exterior walls of existing wood-frame buildings increases the likelihood of damage to framing and cladding components as a result of moisture accumulation. Many older homes were constructed with little or no regard for protection from vapour transmission or air leakage from the interior. Adding thermal insulation will substantially reduce the temperature of the siding or sheathing in winter months, possibly leading to condensation of moisture at this location.

Defects in exterior cladding, flashing and caulking could result in rain entering the wall cavity. This moisture, if retained by the added insulation, could initiate the process of decay.

Steps should be taken therefore, to minimize these effects prior to the retrofit of any insulation. Any openings in walls that could permit leakage of interior heated air into the wall cavity should be sealed. The inside surface should be coated with a low-permeability paint to reduce moisture transfer by diffusion. Finally, the exterior siding, flashing and caulking should be checked and repaired if necessary to prevent rain penetration.

A-9.25.2.4.(5) Loose-Fill Insulation in Masonry Walls. Typical masonry cavity wall construction techniques do not lend themselves to the prevention of entry of rainwater into the wall space. For this reason, loose-fill insulation used in such space must be of the water repellent type. A test for water-repellency of loose-fill insulation suitable for installation in masonry cavity walls can be found in ASTM C 516, "Vermiculite Loose Fill Thermal Insulation."

A-9.25.3.1.(1) Air Barrier Systems for Control of Condensation. The majority of moisture problems resulting from condensation of water vapour in walls and ceiling/attic spaces are caused by the leakage of moist interior heated air into these spaces rather than by the diffusion of water vapour through the building envelope.

Protection against such air leakage must be provided by a system of air-impermeable materials joined with leak-free joints. Generally, air leakage protection can be provided by the use of air-impermeable sheet materials, such as gypsum board or polyethylene of sufficient thickness, when installed with appropriate structural support. However, the integrity of the airtight elements in the air barrier system can be compromised at the joints and here special care must be taken in design and construction to achieve an effective air barrier system.

Although Section 9.25. refers separately to vapour barriers and airtight elements in the air barrier system, these functions in a wall or ceiling assembly of conventional wood-frame construction are often combined as a single membrane that acts as a barrier against moisture diffusion and the movement of interior air into insulated wall or roof cavities. Openings cut through this membrane, such as for electrical boxes, provide opportunities for air leakage into concealed spaces, and special measures must be taken to make such openings as airtight as possible. Attention must also be paid to less obvious leakage paths, such as holes for electric wiring, plumbing installations, wall-ceiling and wall-floor intersections, and gaps created by shrinkage of framing members.

In any case, air leakage must be controlled to a level where the occurrence of condensation will be sufficiently rare, or the quantities accumulated sufficiently small, and drying sufficiently rapid, to avoid material deterioration and the growth of mould and fungi.

Generally the location in a building assembly of the airtight element of the air barrier system is not critical; it can restrict air leakage whether it is located near the outer surface of the assembly, near the inner surface or at some intermediate location. However, if a material chosen to act as an airtight element in the air barrier system also has the characteristics of a vapour barrier (i.e., low permeability to water vapour), its location must be chosen more carefully in order to avoid moisture problems. (See Notes A-9.25.5.1.(1) and A-9.25.4.3.(2).)

In some constructions, an airtight element in the air barrier system is the interior finish, such as gypsum board, which is sealed to framing members and adjacent components by gaskets, caulking, tape or other methods to complete the air barrier system. In such cases, special care in sealing joints in a separate vapour barrier is not critical. This approach often uses no separate vapour barrier but relies on appropriate paint coatings to give the interior finish sufficient resistance to water vapour diffusion that it can provide the required vapour diffusion protection.

The wording in Section 9.25. allows for such innovative techniques, as well as the more traditional approach of using a continuous sheet, such as polyethylene, to act as an “air/vapour barrier.”

Further information can be found in CBD 231, “Moisture Problems in Houses” (Canadian Building Digest 231), by A.T. Hansen, which is available from NRC.

A-9.25.3.4. and 9.25.3.6. Air Leakage and Soil Gas Control in Floors-on-ground. The requirement in Sentence 9.25.3.3.(6) regarding the sealing of penetrations of the air barrier also applies to hollow metal and masonry columns penetrating the floor slab. Not only the perimeters but also the centres of such columns must be sealed or blocked.

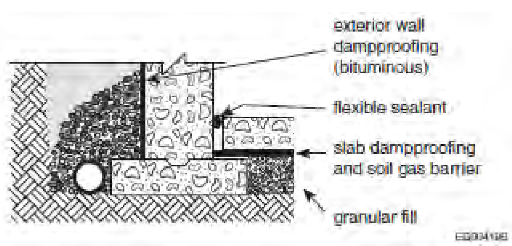


Figure A-9.25.3.4. and 9.25.3.6.-A
Dampproofing and soil gas control at foundation wall/floor junctions with solid walls

The requirement in Sentence 9.25.3.6.(6) regarding drainage openings in slabs can be satisfied with any of a number of proprietary devices that prevent the entry of radon and other soil gases through floor drains. Some types of floor drains incorporate a trap that is connected to a nearby tap so that the trap is filled every time the tap is used. This is intended to prevent the entry of sewer gas but would be equally effective against the entry of radon and other soil gases.

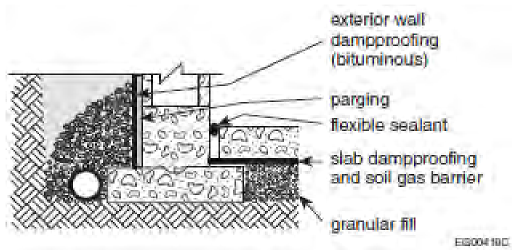


Figure A-9.25.3.4. and 9.25.3.6.-B
Dampproofing and soil gas control at foundation wall/floor junctions with hollow walls

A-9.25.3.6.(2) and (3) Polyethylene Air Barriers under Floors-on-Ground. Floors-on-ground separating conditioned space from the ground must be constructed to reduce the potential for the entry of air, radon or other soil gases. In most cases, this will be accomplished by placing 0.15 mm polyethylene under the floor.
Finishing a concrete slab placed directly on polyethylene can, in many cases, cause problems for the inexperienced finisher. A rule of finishing, whether concrete is placed on polyethylene or not, is to never finish or "work" the surface of the slab while bleed water is present or before all the bleed water has risen to the surface and evaporated. If finishing operations are performed before all the bleed water has risen and evaporated, surface defects such as blisters, crazing, scaling and dusting can result. In the case of slabs placed directly on polyethylene, the amount of bleed water that may rise to the surface and the time required for it to do so are increased compared to a slab placed on a compacted granular base. Because of the polyethylene, the excess water in the mix from the bottom portion of the slab cannot bleed downward and out of the slab and be absorbed into the granular material below. Therefore, all bleed water, including that from the bottom of the slab, must now rise through the slab to the surface. Quite often in such cases, finishing operations are begun too soon and surface defects result.

One solution that is often suggested is to place a layer of sand between the polyethylene and the concrete. However, this is not an acceptable solution for the following reason: it is unlikely that the polyethylene will survive the slab pouring process entirely intact.

Nevertheless, the polyethylene will still be effective in retarding the flow of soil gas if it is in intimate contact with the concrete; soil gas will only be able to penetrate where a break in the polyethylene coincides with a crack in the concrete. The majority of concrete cracks will probably be underlain by intact polyethylene. On the other hand, if there is an intervening layer of a porous medium, such as sand, soil gas will be able to travel laterally from a break in the polyethylene to the nearest crack in the concrete and the total system will be much less resistant to soil gas penetration.

To reduce and/or control the cracking of concrete slabs, it is necessary to understand the nature and causes of volume changes of concrete and in particular those relating to drying shrinkage. The total amount of water in a mix is by far the largest contributor to the amount of drying shrinkage and resulting potential cracking that may be expected from a given concrete. The less total amount of water in the mix, the less volume change (due to evaporation of water), which means the less drying shrinkage that will occur. To lessen the volume change and potential cracking due to drying shrinkage, a mix with the lowest total amount of water that is practicable should always be used. To lower the water content of a mix, superplasticizers are often added to provide the needed workability of the concrete during the placing operation. Concretes with a high water-to-cementing-materials ratio usually have high water content mixes. They should be avoided to minimize drying shrinkage and cracking of the slab. The water-to-cementing-materials ratio for slabs-on-ground should be no higher than 0.55.

A-9.25.4.2.(2) Normal Conditions. The requirement for a 60 ng/Pa·s·m^2 vapour barrier stated in Sentence 9.25.4.2.(1) is based on the assumption that the building assembly is subjected to conditions that are considered normal for typical residential occupancies, and business and personal services occupancies.
However, where the intended use of an occupancy includes facilities or activities that will generate a substantial amount of moisture indoors during the heating season, such as swimming pools, greenhouses, laundromats, and any

continuous operation of hot tubs and saunas, the building envelope assemblies would have to demonstrate acceptable performance levels in accordance with the requirements in Part 5.

A-9.25.4.3.(2) Location of Vapour Barriers. Assemblies in which the vapour barrier is located partway through the insulation meet the intent of this Article provided it can be shown that the temperature of the vapour barrier will not fall below the dew point of the heated interior air.

A-9.25.5.1. Location of Low Permeance Materials.

Low Air- and Vapour-Permeance Materials and Implications for Moisture Accumulation

The location in a building assembly of a material with low air permeance is generally not critical; the material can restrict outward movement of indoor air whether it is located near the outer surface of the assembly, near the inner surface, or at some intermediate location, and such restriction of air movement is generally beneficial, whether or not the particular material is designated as part of the air barrier system. However, if such a material also has the characteristics of a vapour barrier (i.e. low permeability to water vapour), its location must be chosen more carefully in order to avoid moisture accumulation.

Any moisture from the indoor air that diffuses through the inner layers of the assembly or is carried by air leakage through those layers may be prevented from diffusing or being transferred through the assembly by a low air- and vapour-permeance material.

This moisture transfer will usually not cause a problem if the material is located where the temperature is above the dew point of the indoor air: the water vapour will remain as vapour, the humidity level in the assembly will come to equilibrium with that of the indoor air, further accumulation of moisture will cease or stabilize at a low rate, and no harm will be done.

But if the low air- and vapour-permeance material is located where the temperature is below the dew point of the air at that location, water vapour will condense and accumulate as water or ice, which will reduce the humidity level and encourage the movement of more water vapour into the assembly. If the temperature remains below the dew point for any length of time, significant moisture could accumulate. When warmer weather returns, the presence of a material with low water vapour permeance can retard drying of the accumulated moisture. Moisture that remains into warmer weather can support the growth of decay organisms.

Due consideration should be given to the properties and location of any material in the building envelope, including paints, liquid-applied or sprayed-on and trowelled-on materials. It is recognized that constructions that include low air- and vapour-permeance materials are acceptable, but only where these materials are not susceptible to damage from moisture or where they can accommodate moisture, for example insulated concrete walls. Further information on the construction of basement walls may be found in “Performance Guidelines for Basement Envelope Systems and Materials,” published by NRC-IRC.

Cladding

Different cladding materials have different vapour permeances and different degrees of susceptibility to moisture deterioration. They are each installed in different ways that are more or less conducive to the release of moisture that may accumulate on the inner surface. Sheet or panel-type cladding materials, such as metal sheet, have a vapour permeance less than 60 ng/(Pa·s·m^2).

Sheet metal cladding that has lock seams also has a low air leakage characteristic and so must be installed outboard of a drained and vented air space. Assemblies clad with standard residential vinyl or metal strip siding do not require additional protection as the joints are not so tight as to prevent the dissipation of moisture.

Sheathing
Like cladding, sheathing materials have different vapour permeances and different degrees of susceptibility to moisture deterioration.

Low-permeance sheathing may serve as the vapour barrier if it can be shown that the temperature of the interior surface of the sheathing will not fall below that at which saturation will occur. This may be the case where insulating sheathing is used.

Thermal Insulation
Where low-permeance foamed plastic is the sole thermal insulation in a building assembly, the temperature of the inner surface of this element will be close to the interior temperature. If the foamed plastic insulation has a permeance below 60 ng/Pa·s·m^2, it can fulfill the function of a vapour barrier to control condensation within the assembly due to vapour diffusion. However, where low-permeance thermal insulating sheathing is installed on the outside of an insulated frame wall, the temperature of the inner surface of the insulating sheathing may fall below the dew point; in this case, the function of vapour barrier has to be provided by a separate building element installed on the warm side of the assembly.

Normal Conditions
The required minimum ratios given in Table 9.25.5.2. are based on the assumption that the building assembly is subjected to conditions that are considered normal for typical residential occupancies, and business and personal services occupancies.

However, where the intended use of an occupancy includes facilities or activities that will generate a substantial amount of moisture indoors during the heating season, such as swimming pools, greenhouses, the operation of a laundromat or any continuous operation of hot tubs and saunas, the building envelope assemblies would have to demonstrate acceptable performance levels in accordance with the requirements in Part 5.

A-9.25.5.1.(1) Air and Vapour Permeance Values. The air leakage characteristics and water vapour permeance values for a number of common materials are given in Table A-9.25.5.1.(1). These values are provided on a generic basis; proprietary products may have values differing somewhat from those in the Table (consult the manufacturers' current data sheets for their products' values).
The values quoted are for the material thickness listed. Water vapour permeance is inversely proportional to thickness: therefore, greater thicknesses will have lower water vapour permeance values.

Table A-9.25.5.1.(1)
Air and Vapour Permeance Values[(1)]
Forming Part of Note A-9.25.5.1.(1)

Material	Air Leakage Characteristic, L/(s·m^2) at 75 Pa(Air Permeance)	Water Vapour Permeance, (Dry Cup) ng/(Pa·s·m^2)
Sheet and panel-type materials		
12.7-mm gypsum board	0.02	2600
• painted (1 coat primer)	negligible	1300
• painted (1 coat primer + 2 coats latex paint)	negligible	180
12.7-mm foil-backed gypsum board	negligible	negligible
12.7-mm gypsum board sheathing	0.0091	1373
6.4-mm plywood	0.0084	23-74
11-mm oriented strandboard	0.0108	44 (range)
12.5-mm cement board	0.147	590

plywood (from 9.5 mm to 18 mm)	negligible-0.01	40-57
fibreboard sheathing	0.012 - 1.91	100 - 2900
17-mm wood sheathing	high-depends on no. of joints	982
Insulation		
27-mm foil-faced polyisocyanurate	negligible	4.3
27-mm paper-faced polyisocyanurate	negligible	61.1
25-mm extruded polystyrene	negligible	23 - 92
25-mm expanded polystyrene (Type 2)	0.0214	86 - 160
fibrous insulations	very high	very high
25-mm polyurethane spray foam – low density	0.011	894 - 3791
25-mm polyurethane spray foam–medium density	negligible	96(2)
Membrane-type materials		
asphalt-impregnated paper (10 min paper)	0.0673	370
asphalt-impregnated paper (30 min paper)	0.4	650
asphalt-impregnated paper (60 min paper)	0.44	1800
water-resistive barriers (9 materials)	negligible - 4.3	30 - 1200
0.15-mm polyethylene	negligible	1.6 - 5.8
asphalt-saturated felt (#15)	0.153	290
building paper	0.2706	170 - 1400
spun-bonded polyolefin film (expanded)	0.9593	3646
Other materials		
brick (6 materials)	negligible	102 - 602
metal	negligible	negligible
mortar mixes (4 materials)	negligible	13 - 690
stucco	negligible	75 - 240
50-mm reinforced concrete (density: 2 330 kg/m^3)	negligible	23

Notes to Table A-9.25.5.1.(1):

(1) Air leakage and vapour permeance values derived from:

- Bombaru, D., Jutras, R. and Patenaude, A. “Air Permeance of Building Materials.” Summary Report prepared by AIR-INS Inc. for Canada Mortgage and Housing Corporation, Ottawa, 1988. Values indicate properties of tested materials only; values for specific products may vary significantly.
- “Details of Air Barrier Systems for Houses.” Tarion Warranty Corporation (formerly Ontario New Home Warranty Program), Toronto, 1993.
- Kumaran, M.K., et al., ASHRAE Research Report 1018 RP, A Thermal and Moisture Transport Property Database for Common Building and Insulating Materials.
- Kumaran, M.K., Lackey, J., Normandin, N., van Reenen, D., Tariku, F., Summary Report from Task 3 of MEWS Project at the Institute for Research in Construction-Hygrothermal Properties of Several Building Materials, IRC-RR-110, March 2002.
- Mukhopadhyaya, P., Kumaran, M.K., et al., Hygrothermal Properties of Exterior Claddings, Sheathings Boards, Membranes and Insulation Materials for Building Envelope Design, Proceedings of Thermal Perfomance of the Exterior Envelopes of Whole Building X, Clearwater, Florida, December 2-7, 2007, pp. 1-16 (NRCC-50287).

(2) This water vapour permeance value is for a 25-mm-thick core layer of medium-density polyurethane spray foam. When installed in the field, a low permeance resin layer forms where the foam is in contact with the substrate. The water vapour permeance of the installed foam, were it measured including the resin layer, would therefore likely be lower than the value listed in the Table.

A-9.25.5.1.(1)(a)(ii) Reduced Potential for Condensation in the Building Envelope. The requirements in Article 9.25.5.2. aim to reduce the risk of condensation being introduced into wall assemblies due to the water vapour permeance of the outboard materials. Research has confirmed that the reduced condensation potential of exterior continuous insulation with a thermal resistance of at least 0.7 (m^2·K)/W and a water vapour permeance between 30 and 1800 ng/(Pa·s·m^2) compares to reference assemblies without exterior insulation in a given geographic location and climatic exposure.

A-9.25.5.1.(3) Wood-based Sheathing Materials. Wood-based sheathing materials, such as plywood and OSB, that are not more than 12.5 mm thick are exempt from complying with Sentence 9.25.5.1.(1) because wood has an adaptive vapour permeance based on relative humidity: it has a low vapour permeance in an environment with low relative humidity and a higher vapour permeance in an environment with high relative humidity (See Figure A-9.25.5.1.(3)). This adaptive vapour permeance means that wood-based materials located on the outboard side of an assembly in winter, where the RH is typically 75% or higher, are relatively vapour-open, thus allowing greater vapour movement. The same wood-based material located on the inboard side of an assembly, where the RH is typically much lower in winter, has a low vapour permeance, thus mitigating the movement of vapour.

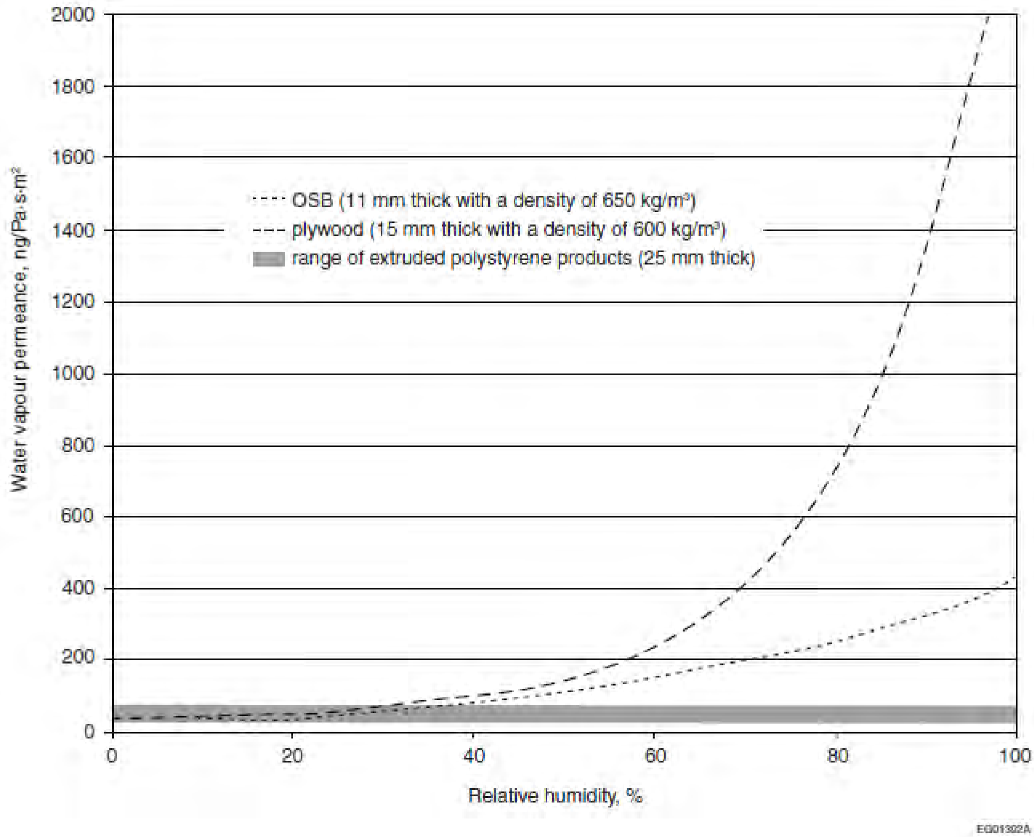


Figure A-9.25.5.1.(3)
Adaptive water vapour permeance of wood-based sheathing materials

A-9.25.5.2. Assumptions Followed in Developing Table 9.25.5.2. Article 9.25.5.2. specifies that a low air- and vapour-permeance material must be located on the warm face of the assembly, outboard of a vented air space, or within the assembly at a position where its inner surface is likely to be warm enough for most of the heating season such that no significant accumulation of moisture will occur. This last position is defined by the ratio of the thermal resistance values outboard and inboard of the innermost impermeable surface of the material in question.

The design values given in Table 9.25.5.2. are based on the assumption that the building includes a mechanical ventilation system (between 0.3 and 0.5 air changes per hour), a 60 ng/Pa·s·m^2 vapour barrier, and an air barrier (values between 0.024 and 0.1 L/sm^2 through the assembly were used). The moisture generated by occupants and their use of bathrooms, cleaning, laundry and kitchen appliances was assumed to fall between 7.5 and 11.5 L per day.

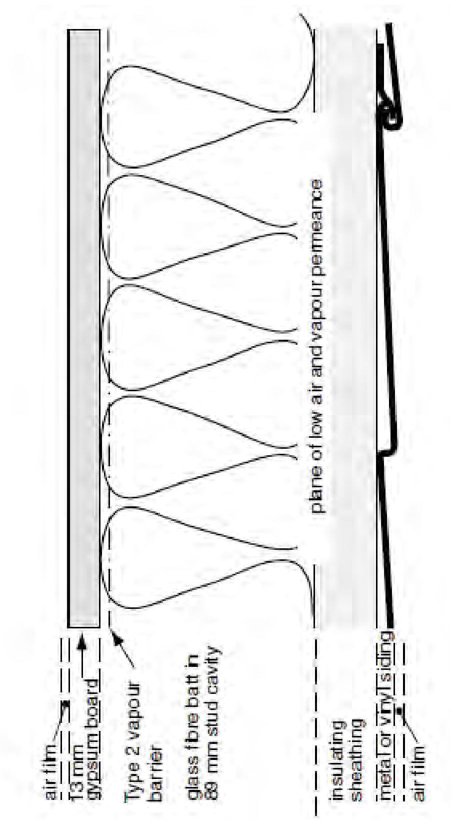
It has been demonstrated through modelling under these conditions that assemblies constructed according to the requirements in Table 9.25.5.2. do not lead to moisture accumulation levels that may lead to deterioration as long as the average monthly vapour pressure difference between the exterior and interior sides over the heating season does not increase above 750 Pa, which would translate into an interior relative humidity of 35% in colder climates and 60% in mild climates.

Health Canada recommends an indoor relative humidity between 35% and 50% for healthy conditions. ASHRAE accepts a 30% to 60% range. Environments that are much drier tend to exacerbate respiratory problems and allergies; more humid environments tend to support the spread of microbes, moulds and dust mites, which can adversely affect health.

In most of Canada in the winter, indoor RH is limited by the exterior temperature and the corresponding temperature on the inside of windows. During colder periods, indoor RH higher than 35% will cause significant condensation on windows. When this occurs, occupants are likely to increase the ventilation to remove excess moisture. Although indoor RH may exceed 35% for short periods when the outside temperature is warmer, the criteria provided in Table 9.25.5.2. will still apply. Where higher relative humidities are maintained for extended periods in these colder climates, the ratios listed in the Table may not provide adequate protection.

Some occupancies require that RH be maintained above 35% throughout the year, and some interior spaces support activities such as swimming that create high relative humidities. In these cases, Table 9.25.5.2. cannot be used and the position of the materials must be determined according to Part 5.

It should be noted that Part 9 building envelopes in regions with colder winters have historically performed acceptably when the interior RH does not exceed 35% over most of the heating season. With tighter building envelopes, it is possible to raise interior RH levels above 35%. There is no information, however, on how Part 9 building envelopes will perform when exposed to these higher indoor RH levels for extended periods during the heating season over many years. Operation of the ventilation system, as intended to remove indoor pollutants, will maintain the lower RH levels as necessary.



	Inboard			Outboard		
RSI value	0.12	0.08	2.11	0.87	0.12	0.03
Total RSI value	2.31			1.02		
Ratio	$\frac{1.02}{2.31} = 0.44$					

EG00382C

Figure A-9.25.5.2.
Example of a wall section showing thermal resistance inboard and outboard of a plane of low air and vapour permeance

The method of calculating the inboard to outboard thermal resistance ratio is illustrated in Figure A-9.25.5.2. The example wall section shows three planes where low air- and vapour-permeance materials have been installed. A vapour barrier, installed to meet the requirements of Subsection 9.25.4., is on the warm side of the insulation consistent with Clause 9.25.5.2.(1)(a) and Sentences 9.25.4.1.(1) and 9.25.4.3.(2). The vinyl siding has an integral drained and vented air space consistent with Clause 9.25.5.2.(1)(c). The position of the interior face of the low-permeance insulating sheathing, however, must be reviewed in terms of its thermal resistance relative to the overall thermal resistance of the wall, and the climate where the building is located.

Comparing the RSI ratio from the example wall section with those in Table 9.25.5.2. indicates that this wall would be acceptable in areas with Celsius degree-day values up to 7999, which includes, for example, Whitehorse, Fort McMurray, Yorkton, Flin Flon, Geraldton, Val-d'Or and Wabush. (Degree-day values for various locations in Canada are provided in Appendix C.)

A similar calculation would indicate that, for a similar assembly with a 140 mm stud cavity filled with an RSI 3.52 batt, the ratio would be 0.28. Thus such a wall could be used in areas with Celsius degree-day values up to 4999, which includes, for example, Cranbrook, Lethbridge, Ottawa, Montreal, Fredericton, Sydney, Charlottetown and St. John's.

Similarly, if half the thickness of the same low-permeance sheathing were used, the ratio with an 89 mm cavity would be 0.25, permitting its use in areas with Celsius degree-day values up to 4999. The ratio with a 140 mm cavity would be 0.16; thus this assembly could not be used anywhere, since this ratio is below the minimum permitted in Table 9.25.5.2.

Table A-9.25.5.2. shows the minimum thicknesses of low-permeance insulating sheathing necessary to satisfy Article 9.25.5.2. in various degree-day zones for a range of resistivity values of insulating sheathing. These thicknesses are based on the detail shown in Figure A-9.25.5.2. but could also be used with cladding details, such as brick veneer or wood siding, which provide equal or greater outboard thermal resistance.

Table A-9.25.5.2.
Minimum Thicknesses of Low-Permeance Insulating Sheathing
Forming Part of Note A-9.25.5.2.

Celsius Heating Degree-days	Min. RSI Ratio	38x 89 Framing Min. Sheathing Thickness, mm Sheathing Thermal Resistance, RSI/mm				Min. RSI Ratio	38 x 140 Framing Min. Sheathing Thickness, mm Sheathing Thermal Resistance, RSI/mm			
		0.0300	**0.0325**	**0.0350**	**0.0400**		**0.0300**	**0.0325**	**0.0350**	**0.0400**
≤4999	0.20	0.46								
5000 to 5999	0.30	0.69								
6000 to 6999	0.35	0.81								
7000 to 7999	0.40	0.92								
8000 to 8999	0.50	1.16								
9000 to 9999	0.55	1.27								
10000 to 10999	0.60	1.39								
11000 to 11999	0.65	1.50								
≥12000	0.75	1.73								

References

(1) "Exposure Guidelines for Residential Indoor Air Quality," Environmental Health Directorate, Health Protection Branch, Health Canada, Ottawa, April 1987 (Revised July 1989).
(2) ANSI/ASHRAE 62, "Ventilation for Acceptable Indoor Air Quality."

A-9.26.1.1.(1) Platforms that Effectively Serve as Roofs. Decks, balconies, exterior walkways and similar exterior surfaces effectively serve as roofs where these platforms do not permit the free drainage of water through the deck. When water is driven by wind across the deck (roof) surface, it can be driven upward when it encounters an interruption.

A-9.26.2.3.(4) Fasteners for Treated Shingles. Where shingles or shakes have been chemically treated with a preservative or a fire retardant, the fastener should be of a material known to be compatible with the chemicals used in the treatment.

A-9.26.4.1. Junctions between Roofs and Walls or Guards. Drainage of water from decks and other platforms that effectively serve as roofs will be blocked by walls, and blocked or restricted by guards where significant lengths and heights of material are connected to the deck. Without proper flashing at such roof-wall junctions or roof-guard junctions, water will generally leak into the adjoining constructions and can penetrate into supporting constructions below. Exceptions include platforms where waterproof curbs of sufficient height are cast-in or where the deck and wall or guard are unit-formed. In these cases, the monolithic deck-wall or deck-guard junctions will minimize the likelihood of water ingress. (See also Note A-9.26.1.1.(1).)

A-9.26.17.1.(1) Installation of Concrete Roof Tiles. Where concrete roof tiles are to be installed, the dead load imposed by this material should be considered in determining the minimum sizes and maximum spans of the supporting roof members.

A-9.26.18.3.(1) Overflow Outlets. Where a roof or balcony is entirely enclosed by parapet walls there is a likelihood of drains becoming obstructed with materials such as leaves falling during heavy autumn rains. It is recommended that a secondary means of drainage such as scuppers be provided. Overflow outlets should be installed in the parapet walls in sufficient number and at an appropriate height to drain the roof or balcony, to avoid water backing up into moisture sensitive assemblies, and to prevent structural collapse from ponding.

A-9.27.1.1.(5) EIFS on Walls with Cold-Formed Steel Stud Framing. While Part 9 permits the installation of exterior insulation finish systems on walls with cold-formed steel stud framing, the design of loadbearing steel walls is outside the scope of Part 9 and is addressed in Part 4 (See Sentence 9.24.1.1.(2)).

A-9.27.2. Required Protection from Precipitation. Part 5 and Part 9 of the NBC recognize that mass walls and face-sealed, concealed barrier and rainscreen assemblies have their place in the Canadian context.

Mass walls are generally constructed of cast-in-place concrete or masonry. Without cladding or surface finish, they can be exposed to precipitation for a significant period before moisture will penetrate from the exterior to the interior. The critical characteristics of these walls are related to thickness, mass, and moisture transfer properties, such as shedding, absorption and moisture diffusivity.

Face-sealed assemblies have only a single plane of protection. Sealant installed between cladding elements and other envelope components is part of the air barrier system and is exposed to the weather. Face-sealed assemblies are appropriate where it can be demonstrated that they will provide acceptable performance with respect to the health and safety of the occupants, the operation of building services and the provision of conditions suitable for the intended occupancy. These assemblies, however, require more intensive, regular and ongoing maintenance, and should only be selected on the basis of life-cycle costing considering the risk of failure and all implications should failure occur. Climate loads such as wind-driven rain, for example, should be considered. Face-sealed assemblies are not recommended where the building owner may not be aware of the maintenance issue or where regular maintenance may be problematic.

Concealed barrier assemblies include both a first and second plane of protection. The first plane comprises the cladding, which is intended to handle the majority of the precipitation load. The second plane of protection is intended to handle any water that penetrates the cladding plane. It allows for the dissipation of this water, primarily by gravity drainage, and provides a barrier to further ingress.

Like concealed barrier assemblies, rainscreen assemblies include both a first and second plane of protection. The first plane comprises the cladding, which is designed and constructed to handle virtually all of the precipitation load. The second plane of protection is designed and constructed to handle only very small quantities of incidental water; composition of the second plane is described in Note A-9.27.3.1. In these assemblies, the air barrier system, which plays a role in controlling precipitation ingress due to air pressure difference, is protected from the elements. (See Figure A-9.27.2.)

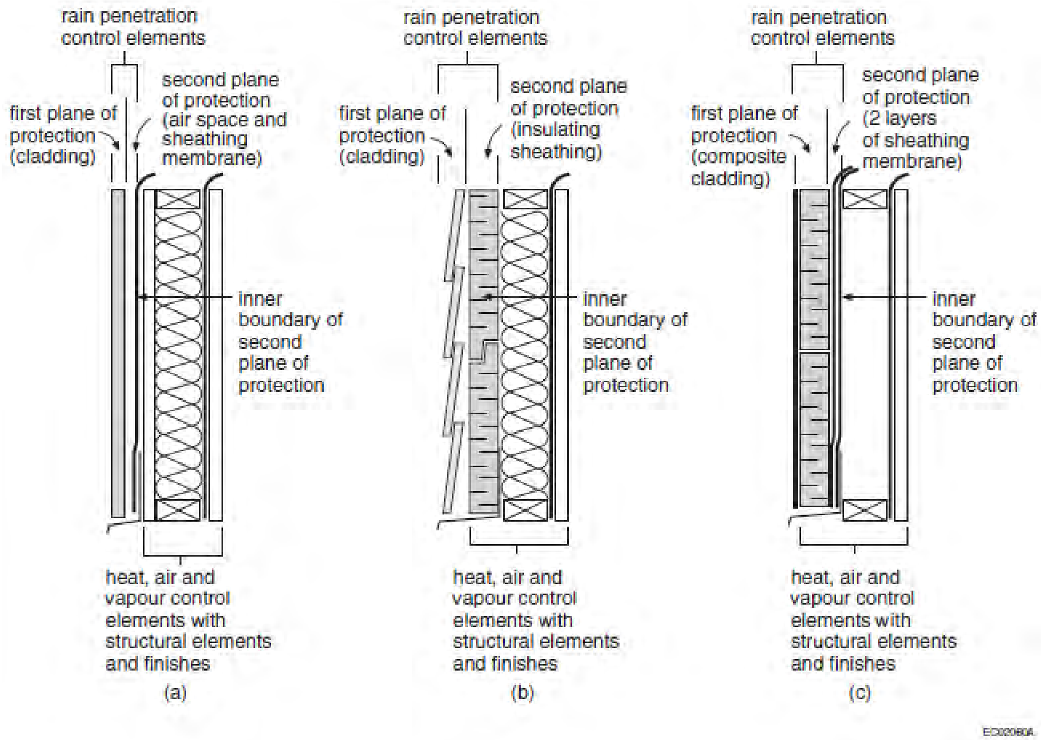


Figure A-9.27.2.
Generic rainscreen assemblies

The cladding assembly described in Sentence 9.27.2.2.(4) is a basic rainscreen assembly. This approach is required for residential buildings where a higher level of ongoing performance is expected without significant maintenance. This approach, however, is recommended in all cases.

The cladding assemblies described in Sentence 9.27.2.2.(5) are also rainscreen assemblies. The assembly described in Clause 9.27.2.2.(1)(c) is again a basic rainscreen assembly. A wall with a capillary break as described in Clause 9.27.2.2.(1)(a) is an open rainscreen assembly. Walls with a capillary break as described in Clause 9.27.2.2.(1)(b) have been referred to as drainscreen assemblies.

A-9.27.2.1.(1) Minimizing Precipitation Ingress. The total prevention of precipitation ingress into wall assemblies is difficult to achieve and, depending on the wall design and construction, may not be absolutely necessary. The amount of moisture that enters a wall, and the frequency with which this occurs, must be limited. The occurrence of ingress must be sufficiently rare, accumulation sufficiently small and drying sufficiently rapid to prevent the deterioration of moisture-susceptible materials and the growth of fungi.

A-9.27.2.2. Required Levels of Protection from Precipitation. Precursors to Part 9 and all editions of the By-law containing a Part 9 applying to housing and small buildings included a performance-based provision requiring that cladding provide protection from the weather for inboard materials. Industry requested that Part 9 provide additional guidance to assist in determining the minimum levels of protection from precipitation to be provided by cladding assemblies. As with all requirements in the the By-law, the new requirements in Article 9.27.2.2. describe the minimum cladding assembly configuration. Designers must still consider local accepted good practice, demonstrated performance and the specific conditions to which a particular wall will be exposed when designing or selecting a cladding assembly.

Capillary Breaks

The properties that are necessary for a material or assembly to provide a capillary break, and quantitative values for those properties, have not been defined. Among the material properties that need to be addressed are water absorption and susceptibility to moisture-related deterioration. Among the assembly characteristics to be considered are bridging of spaces by water droplets, venting and drainage.

Clause 9.27.2.2.(1)(a) describes the capillary break configuration typical of open rainscreen construction. The minimum 9.5 mm will avoid bridging of the space by water droplets and allow some construction tolerance.
Clause 9.27.2.2.(1)(b) describes a variation on the typical open rainscreen configuration. Products used to provide the capillary break include a variety of non-moisture-susceptible, open-mesh materials.
Clause 9.27.2.2.(1)(c) describes a configuration that is typical of that provided by horizontal vinyl and metal siding, without contoured insulating backing. The air space behind the cladding components and the loose installation reduce the likelihood of moisture becoming trapped and promote drying by airflow.

Clause 9.27.2.2.(1)(d) recognizes the demonstrated performance of masonry cavity walls and masonry veneer walls.

Moisture Index
The moisture index (MI) for a particular location reflects both the wetting and drying characteristics of the climate and depends on
• annual rainfall, and
• the temperature and relative humidity of the outdoor ambient air.
MI values are derived from detailed research and calculations.
Due to a lack of definitive data, the MI values identified in Sentence 9.27.2.2.(5), which trigger exceptions to or additional precipitation protection, are based on expert opinion. Designers should consider local experience and demonstrated performance when selecting materials and assemblies for protection from precipitation. For further information on MI, see Appendix C.

A-9.27.3.1. Second Plane of Protection. As specified in Sentence 9.27.3.1.(1), the second plane of protection consists of a drainage plane with an appropriate material serving as the inner boundary and flashing to dissipate rainwater or meltwater to the exterior.

Drainage Plane
Except for masonry walls, the simplest configuration of a drainage plane is merely a vertical interface between materials that will allow gravity to draw the moisture down to the flashing to allow it to dissipate to the exterior. It does not necessarily need to be constructed as a clear drainage space (air space).
For masonry walls, an open rainscreen assembly is required; that is, an assembly with first and second planes of protection where the drainage plane is constructed as a drained and vented air space. Such construction also constitutes best practice for walls other than masonry walls.

Section 9.20. requires drainage spaces of 25 mm for masonry veneer walls and 50 mm for cavity walls. In other than masonry walls, the drainage space in an open rainscreen assembly should be at least 10 mm deep. Drainage holes must be designed in conjunction with the flashing.

Sheathing Membrane
The sheathing membrane described in Article 9.27.3.2. is not a waterproof material. When installed to serve as the inner boundary of the second plane of protection, and when that plane of protection includes a drainage space at least 9.5 mm deep, the performance of the identified sheathing membrane has been demonstrated to be adequate. This is because the material is expected to have to handle only a very small quantity of water that penetrates the first plane of protection.

If the 9.5 mm drainage space is reduced or interrupted, the drainage capacity and the capillary break provided by the space will be reduced. In these cases, the material selected to serve as the inner boundary may need to be upgraded to provide greater water resistance in order to protect moisture-susceptible materials in the backing wall.

Appropriate Level of Protection
It is recognized that many cladding assemblies with no space or with discontinuous space behind the cladding, and with the sheathing membrane material identified in Article 9.27.3.2., have provided acceptable performance with a range of precipitation loads imposed on them. Vinyl and metal strip siding, and shake and shingle cladding, for example, are installed with discontinuous drained spaces, and have demonstrated acceptable performance in most conditions. Lapped wood and composite strip sidings, depending on their profiles, may or may not provide discontinuous spaces, and generally provide little drainage. Cladding assemblies with limited drainage capability that use a sheathing membrane meeting the minimum requirements are not recommended where they may be exposed to high precipitation loads or where the level of protection provided by the cladding is unknown or questionable. Local practice with demonstrated performance should be considered. (See also Article 9.27.2.2. and Note A-9.27.2.2.)

A-9.27.3.4.(2) Detailing of Joints in Exterior Insulating Sheathing. The shape of a joint is critical to its ability to shed water. Tongue and groove, and lapped joints can shed water if oriented correctly. Butt joints can drain to either side and so should not be used unless they are sealed. However, detailing of joints requires attention not just to the shape of the joint but also to the materials that form the joint. For example, even if properly shaped, the joints in insulating sheathing with an integral sheathing membrane could not be expected to shed water if the insulating material absorbs water, unless the membrane extends through the joints.

A-9.27.3.5.(1) Sheathing Membranes in lieu of Sheathing. Article 9.23.17.1., Required Sheathing, indicates that sheathing must be installed only where the cladding requires intermediate fastening between supports (studs) or where the cladding requires a solid backing. Cladding such as brick or panels would be exempt from this requirement and in these cases a double layer of sheathing membrane would generally be needed. The exception (Article 9.27.3.6.) applies only to those types of cladding that provide a face seal to the weather.

A-9.27.3.6. Sheathing Membrane under Face Sealed Cladding. The purpose of sheathing membrane on walls is to reduce air infiltration and to control the entry of wind-driven rain. Certain types of cladding consisting of very large sheets or panels with well-sealed joints will perform this function, eliminating the need for sheathing membrane. This is true of the metal cladding with lock-seamed joints sometimes used on mobile homes. However, it does not apply to metal or plastic siding applied in narrow strips which is intended to simulate the appearance of lapped wood siding. Such material does not act as a substitute for sheathing membrane since it incorporates provision for venting the wall cavity and has many loosely-fitted joints which cannot be counted on to prevent the entry of wind and rain.

Furthermore, certain types of sheathing systems can perform the function of the sheathing membrane. Where it can be demonstrated that a sheathing material is at least as impervious to air and water penetration as sheathing membrane and that its jointing system results in joints that are at least as impervious to air and water penetration as the material itself, sheathing membrane may be omitted.

A-9.27.3.8.(1) Required Flashing.
Horizontal Offsets
Where a horizontal offset in the cladding is provided by a single cladding element, there is no joint between the offset and the cladding above. In this case, and provided the cladding material on the offset provides effective protection for the construction below, flashing is not required.

Changes in Substrate

In certain situations, flashing should be installed at a change of substrate: for example, where stucco cladding is installed on a wood-frame assembly, extending down over a masonry or cast-in-place concrete foundation and applied directly to it. Such an application does not take into account the potential for shrinkage of the wood frame and cuts off the drainage route for moisture that may accumulate behind the stucco on the frame construction.

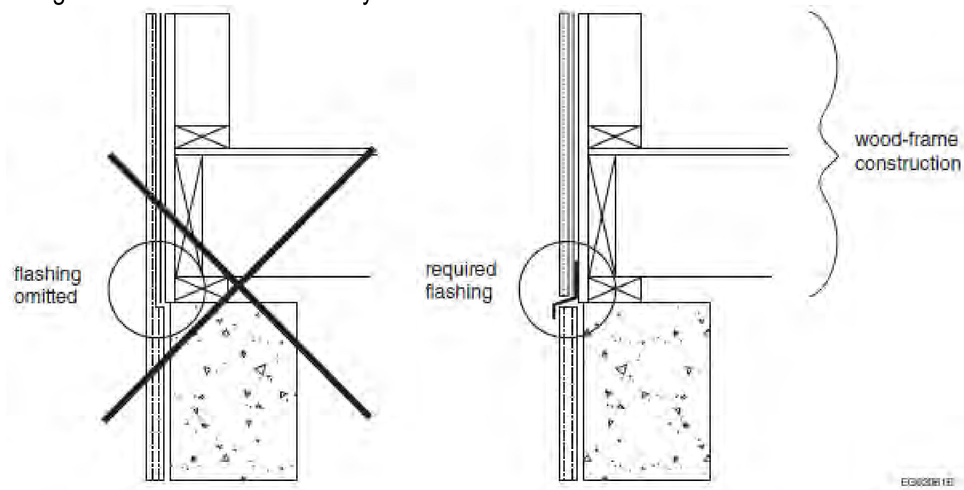


Figure A-9.27.3.8.(1)
Flashing at change in substrate

A-9.27.3.8.(3) Flashing over Curved-Head Openings. The requirement for flashing over openings depends on the vertical distance from the top of the trim over the opening to the bottom of the eave compared to the horizontal projection of the eave. In the case of curved-head openings, the vertical distance from the top of the trim increases as one moves away from the centre of the opening. For these openings, the top of the trim must be taken as the lowest height before the trim becomes vertical.
(See Figure A-9.27.3.8.(3).)

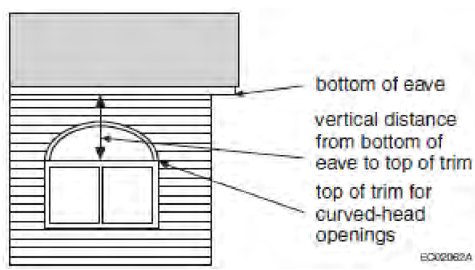


Figure A-9.27.3.8.(3)
Flashing over curved-head openings

A-9.27.3.8.(4) Flashing Configuration and Positive Drainage.
Flashing Configuration
A 6% slope is recognized as the minimum that will provide effective flashing drainage. The 10 mm vertical lap over the building element below and the 5 mm offset are prescribed to reduce transfer by capillarity and surface tension. Figure A-9.27.3.8.(4) illustrates two examples of flashing configurations.

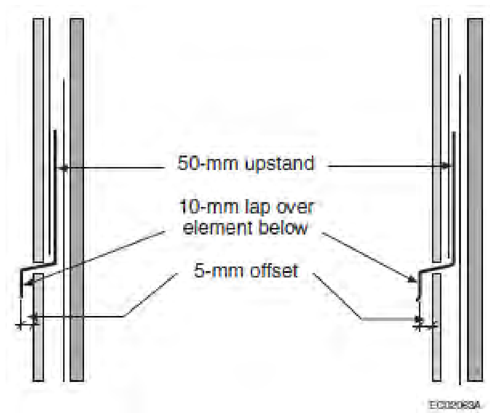


Figure A-9.27.3.8.(4)
Examples of flashing configurations showing upstands, horizontal offsets and vertical laps

Maintaining Positive Slope

Sentence 9.27.3.8.(4) requires that the minimum 6% flashing slope remain after expected shrinkage of the building frame. Similarly, Sentence 9.26.3.1.(4) requires that a positive slope remain on roofs and similar constructions after expected shrinkage of the building frame.

For Part 9 wood-frame constructions, expected wood shrinkage can be determined based on the average equilibrium moisture content (MC) of wood, within the building envelope assembly, in various regions of the City (See Table A-9.27.3.8.(4)).

Table A-9.27.3.8.(4)
Equilibrium Moisture Content for Wood
Forming Part of Note A-9.32.3.1.(1)

Regions	**Equilibrium MC, %(1)**
British Columbia and Atlantic Canada	10
Ontario and Quebec	8
Prairies and the North	7

Notes to Table A-9.27.3.8.(4):
(1) CWC 2000, “Wood Reference Handbook.”

For three-storey constructions to which Part 9 applies, cumulative longitudinal shrinkage is negligible. Shrinkage need only be calculated for horizontal framing members using the following formula (from CWC 1997, “Introduction to Wood Building Technology”):
Shrinkage = (total horizontal member height) × (initial MC – equilibrium MC) × (.002)

A-9.27.3.8.(5) Protection against Precipitation Ingress at the Sill-to-Cladding Joint. Many windows are configured in such a way that a line of sealant is the only protection against water ingress at the sill-to-cladding joint – a location that is exposed to all of the water that flows down the window. In the past, many windows were constructed with self-flashing sills – sills that extend beyond the face of the cladding and have a drip on the underside to divert water away from the sill-to-cladding joint. This sill configuration was considered to be accepted good practice and is recognized today as providing a degree of redundancy in precipitation protection.

Self-flashing sills are sills that
• slope toward the exterior where the sills have an upward facing surface that extends beyond the jambs,
• where installed over a masonry sill, extend not less than 25 mm beyond the inner face of that sill,

• incorporate a drip positioned not less than 5 mm outward from the outer face of the cladding below or not less than 15 mm beyond the inner edge of a masonry sill, and
• terminate at the jambs or, where the face of the jambs is not at least flush with the face of the cladding and the sills extend beyond the jambs, incorporate end dams sufficiently high to protect against overflow in wind-driven rain conditions.

A wind pressure of 10 Pa can raise water 1 mm. Thus, for example, if a window is exposed to a driving rain wind pressure of 200 Pa, end dams should be at least 20 mm high.

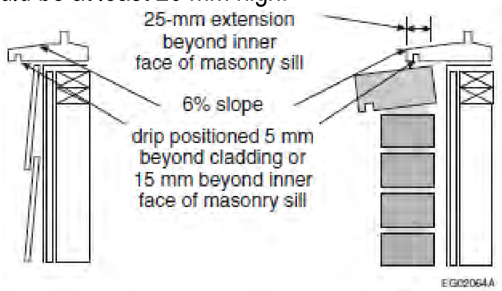


Figure A-9.27.3.8.(5)
Examples of configurations of self-flashing sills

A-9.27.4.2.(1) Selection and Installation of Sealants. Analysis of many sealant joint failures indicates that the majority
of failures can be attributed to improper joint preparation and deficient installation of the sealant and various joint components.
The following ASTM guidelines describe several aspects that should be considered when applying sealants in unprotected
environments to achieve a durable application:
• ASTM C 1193, "Use of Joint Sealants,"
• ASTM C 1299, "Selection of Liquid-Applied Sealants," and
• ASTM C 1472, "Calculating Movement and Other Effects When Establishing Sealant Joint Width."
The sealant manufacturer's literature should always be consulted for recommended procedures and materials.

A-9.27.9.2.(3) Grooves in Hardboard Cladding. Grooves deeper than that specified may be used in thicker cladding providing they do not reduce the thickness to less than the required thickness minus 1.5 mm. Thus for type 1 or 2 cladding, grooves must not reduce the thickness to less than 4.5 mm or 6 mm depending on method of support, or to less than 7.5 mm for type 5 material.

A-9.27.10.2.(2) Thickness of Grade O-2 OSB. In using Table 9.27.8.2. to determine the thickness of Grade O-2 OSB cladding, substitute "face orientation" for "face grain" in the column headings.

A-9.27.11.1.(3) and (4) Material Standards for Aluminum Cladding. Compliance with Sentence 9.27.11.1.(3) and CAN/CGSB-93.2-M, "Prefinished Aluminum Siding, Soffits, and Fascia, for Residential Use," is required for aluminum siding that is installed in horizontal or vertical strips. Compliance with Sentence 9.27.11.1.(4) and CAN/CGSB-93.1-M, "Sheet, Aluminum Alloy, Prefinished, Residential," is required for aluminum cladding that is installed in large sheets.

A-9.27.13.1.(1) Geometrically Defined Drainage Cavity. "Geometrically defined drainage cavity" (GDDC) refers to the channels, grooves or profiles cut into the insulation backing of an EIFS panel for the purpose of providing a way for water that gets behind the system to drain out. The channels, grooves or profiles of one panel need to connect to the channels, grooves or profiles of adjacent panels in order for drainage to occur consistently and uniformly across the entire EIFS. While the size of a channel, groove or profile can be verified by inspecting a single panel, the intent of Sentence 9.27.13.1.(1) is that the required drainage capacity be achieved across the entire system.

Additional information on the design and installation of EIFS can be found in
• the "EIFS Practice Manual," published by the EIFS Council of Canada, and
• the manufacturer's literature.

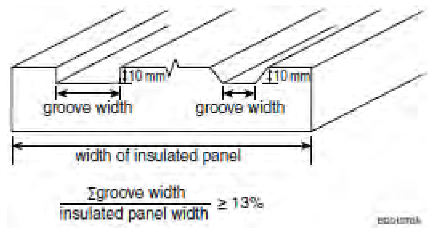


Figure A-9.27.13.1.(1)
Geometrically defined drainage cavity

A-9.27.13.2.(2)(a) Substrates for Exterior Insulation Finish Systems. The list of acceptable substrates for each type of EIFS can be found in a system's respective test report to CAN/ULC-S716.1, "Exterior Insulation and Finish Systems (EIFS) – Materials and Systems"; however, the following substrates are generally considered acceptable:
• minimum 11 mm thick exposure 1 OSB classified as PS2 exterior wall sheathing
• minimum 11 mm thick exterior-rated plywood sheathing
• minimum 12.7 mm thick exterior gypsum sheathing conforming to ASTM C 1177/C 1177M, "Glass Mat Gypsum Substrate for Use as Sheathing"
• cementitious panels
• fibre-cement panels
• concrete block
• clay masonry
• cast-in-place concrete
Note that, in some cases, the list of acceptable substrates may be limited by the EIFS manufacturer.

A-Table 9.28.4.3. Stucco Lath. Paper-backed welded wire lath may also be used on horizontal surfaces provided its characteristics are suitable for such application.

A-9.30.1.2.(1) Water Resistance. In some areas of buildings, water and other substances may frequently be splashed or spilled onto the floor. It is preferable, in such areas, that the finish flooring be a type that will not absorb moisture or permit it to pass through; otherwise, both the flooring itself and the subfloor beneath it may deteriorate. Also, particularly in food preparation areas and bathrooms, unsanitary conditions may be created by the absorbed moisture. Where absorbent or permeable flooring materials are used in these areas, they should be installed in such a way that they can be conveniently removed periodically for cleaning or replacement, i.e., they should not be glued or nailed down. Also, if the subfloor is a type that is susceptible to moisture damage (this includes virtually all of the wood-based subfloor materials used in wood-frame construction), it should be protected by an impermeable membrane placed between the finish flooring and the subfloor. The minimum degree of impermeability required by Sentence 9.30.1.2.(1) would be provided by such materials as polyethylene, aluminum foil, and most single-ply roofing membranes (EPDM, PVC).

A-9.31.6.2.(3) Securement of Service Water Heaters.

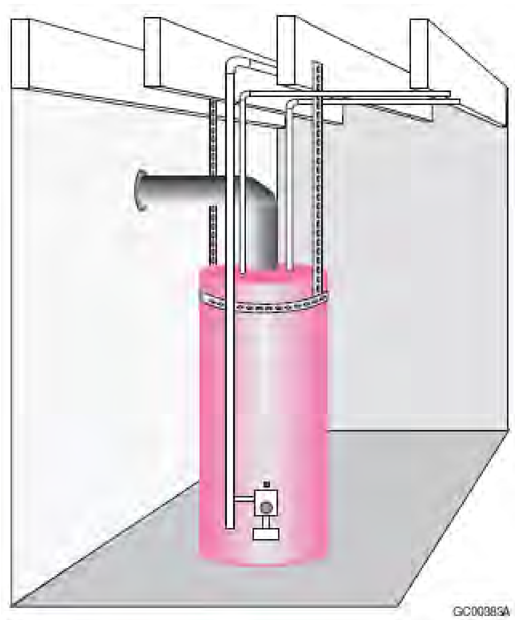


Figure A-9.31.6.2.(3)
Securement of service water heater

Seismic Bracing of Hot Water Tank
"Guidelines for Earthquake Bracing of Residential Water Heaters" is available from the California Office of the State Architect and provides more detail and alternate methods of bracing hot water tanks to resist earthquakes.

A-9.32.1.3.(2) Venting of Laundry-Drying Equipment. Sentence 9.32.1.3.(2) applies to the piping and ducting located within the wall assembly and not to the often flexible duct used to connect the appliance to the rigid exhaust vent duct.

A-9.32.3. Heating-Season Mechanical Ventilation. While ventilation strategies can have a significant impact on energy performance, ventilation is primarily a health and safety issue. Inadequate ventilation can lead to mold, high concentrations of CO_2, and other indoor air pollutants, which can lead to adverse health outcomes. Previous editions of the Building By-law relied on ventilation through the building envelope in combination with a principal exhaust fan. However, with the increased attention on the continuity of the air barrier system in buildings, builders can no longer rely on uncontrolled ventilation through the building envelope. In most buildings, mechanical systems will be required to provide adequate ventilation for occupants.

As described in Article 9.32.3.3., every dwelling unit must include a principal ventilation system. A principal ventilation system is the combination of an exhaust fan and a supply fan (or passive supply in some instances: see Sentence 9.32.3.4.(6)).

The principal ventilation system exhaust fan is separate from the requirements for a fan in every bathroom and kitchen. While a bathroom fan may be used to satisfy both the requirements for the principal ventilation exhaust fan and the requirements for a bathroom fan, the requirements for each must be met. If the fan provides this combined function of the principal ventilation exhaust fan and the bathroom fan, it will also need to have controls that conform to Sentences 9.32.3.5.(3) and (4). Unlike other bathroom fans, the principal ventilation exhaust fan is required to run continuously and should not have a control switch in a location where it may be turned off inadvertently.

A-9.32.3.4. System Supply Air.

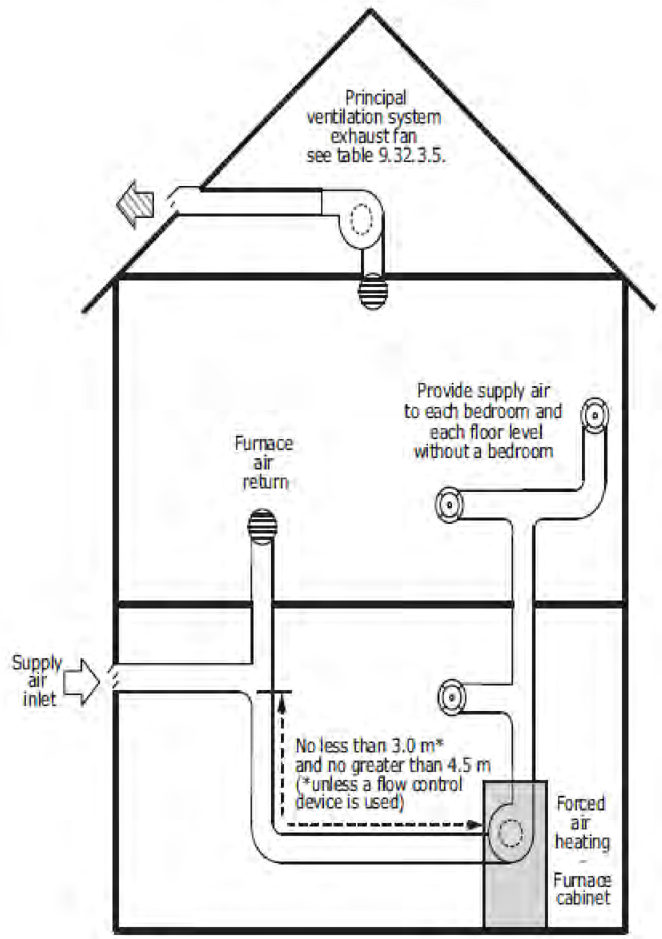


Figure A-9.32.3.4.(2)
Forced-Air Heating System Supply Air Distribution

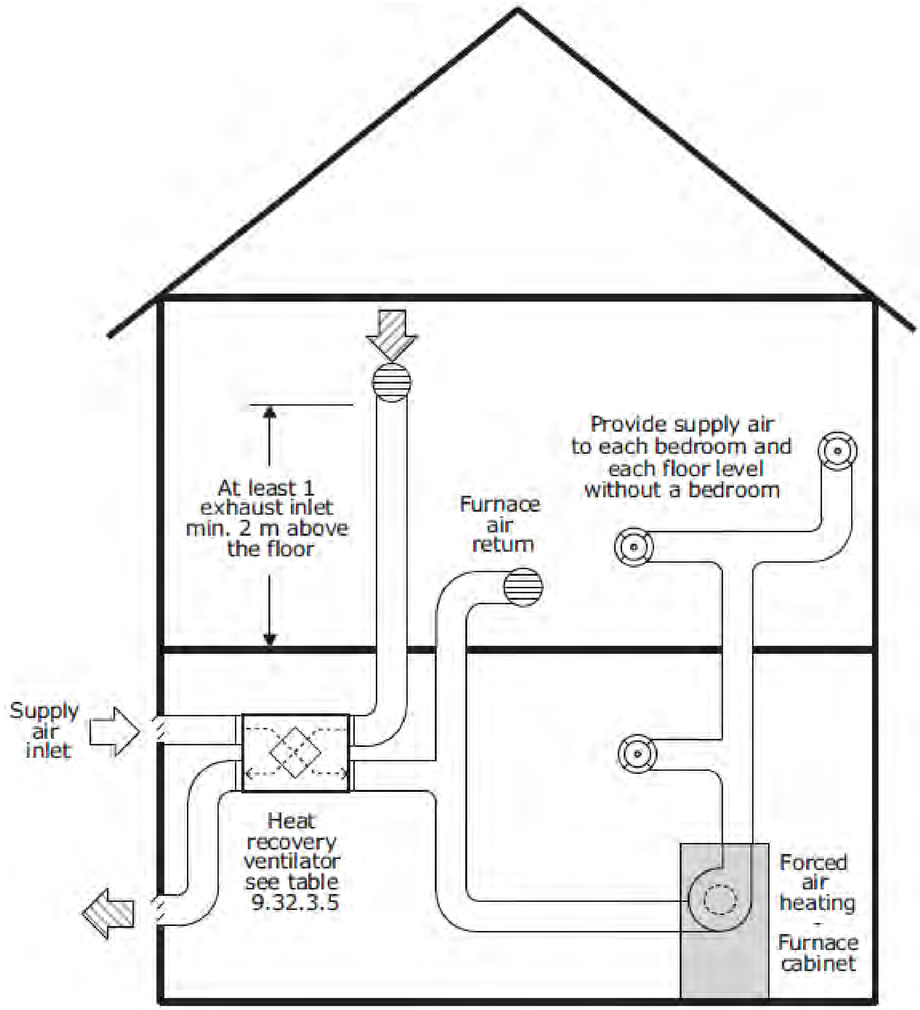


Figure A-9.32.3.4.(3)
Forced-Air Heating System with Heat Recovery Ventilator Supply Air Distribution

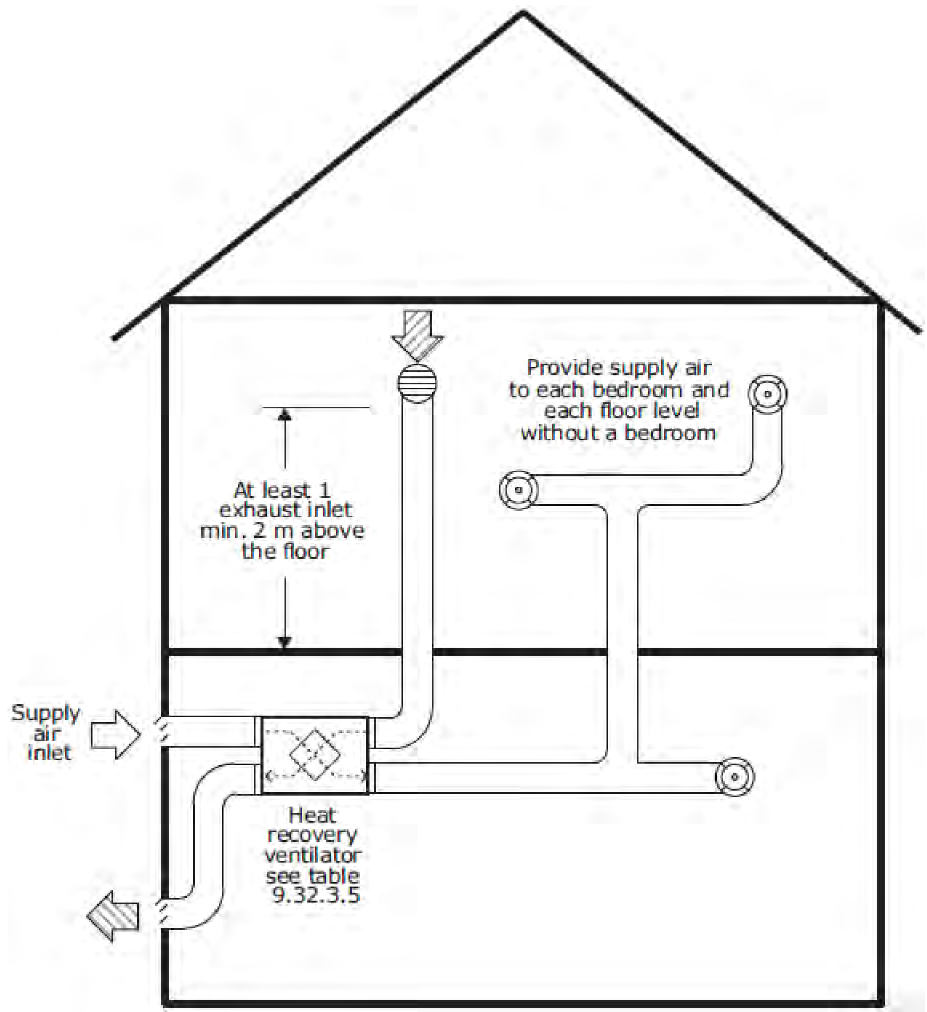


Figure A-9.32.3.4.(4)
Heat Recovery Ventilator Supply Air Distribution

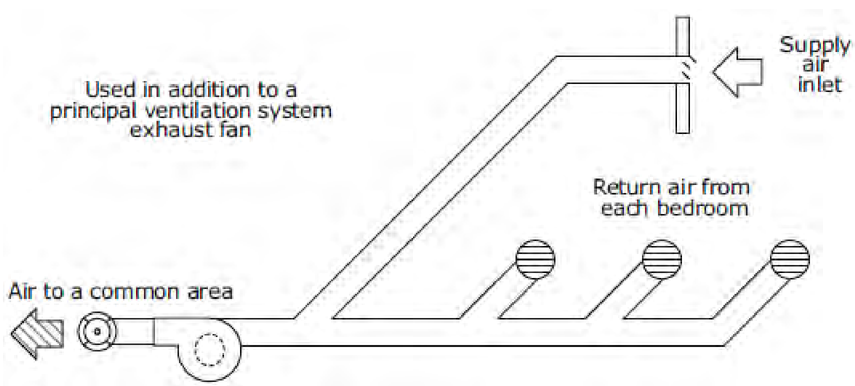


Figure A-9.32.3.4.(5)(b)(i)
Central Recirculation System Supply Air Distribution

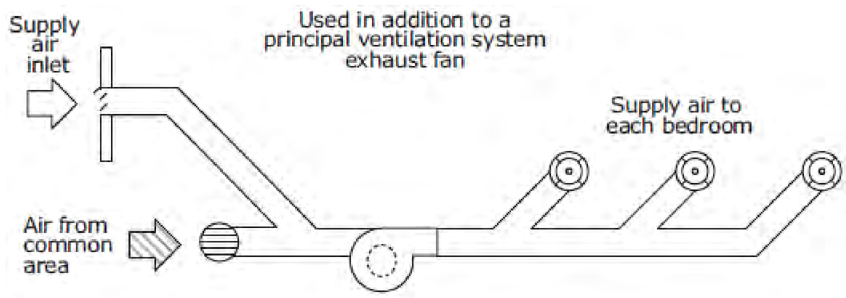
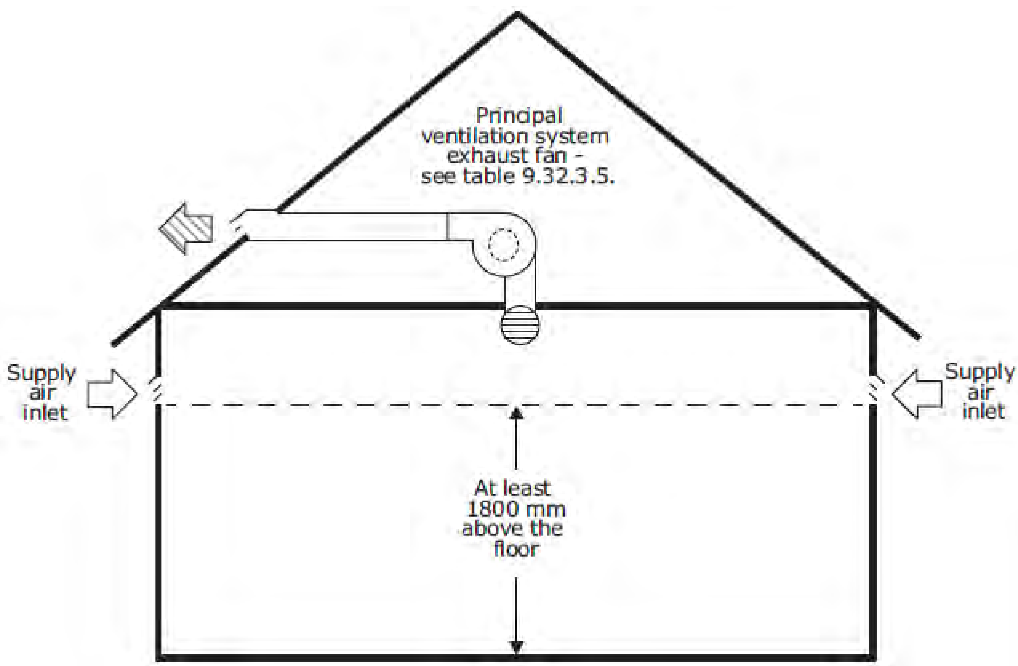


Figure A-9.32.3.4.(5)(b)(ii)



Central Recirculation System Supply Air Distribution
Figure 9.32.3.4.(6)

Passive Supply Air Distribution

A-9.32.3.4.(6)(a)(ii) Floor Area Calculation for Passive Supply Air Distribution. The floor area to be calculated for Subclause 9.32.3.4.(6)(a)(ii) does not include sun porches, enclosed verandas, vestibules, attached garages, or other spaces that are outside the building envelope and do not require ventilation supply air.

A-9.32.4.1. Naturally Aspirating Fuel-Fired Vented Appliance (NAFFVA). NAFFVA, typically appliances with draft hoods, are subject to back drafting when a negative pressure condition occurs in the dwelling. The following tables describe the conditions under which Sentence 9.32.4.1.(1) applies:

Table A-9.32.4.1.(1)-A
Vent Safety — Natural Gas and Propane

Fuel Type	Natural Gas and Propane			
Vent Type	Power Vent(3)	Direct Vent(3)	Thermal Buoyancy Chimney(2)	
Appliance Type	Furnace Boiler HWT Fireplace	HWT Fireplace Heater	Mid-Efficient F/A Furnace or Boiler(5)	Drafthood Boiler HWT(4)
Special Conditions				Located in Air-

			Barriered Room[1]
Classification	Non-NAFFVA	NAFFVA	Non-NAFFVA
9.32.4.1.(1) Applies	No	Yes	No

Notes to Table A-9.32.4.1.(1)A.:

[1] Mechanical room must be air-barriered from remainder of house with no access from within house. Room must be lined with panel products with sealed joints and all pipe and wire penetrations sealed. Effectively, the room must be finished before equipment is installed and holes drilled for pipes and wires. This option is not available for forced air furnaces as it is not possible to effectively seal the ducts.

[2] Thermal buoyancy chimneys must be within the heated envelope of the house to provide acceptable venting performance.

[3] Any power vented appliance with pressurized vent (1 pipe) or sealed combustion (2 pipe) or direct vent appliance (fireplace, heater or HWT) are non-NAFFVA.

[4] Mid-efficient (draft induced) appliances are considered NAFFVA with the exception of a boiler or HWT located in an air-barriered room.

[5] This category applies only to

a) mid-efficient forced air furnaces equipped with induced draft fans and exhaust proving switch, and

b) boilers equipped with induced draft fans and exhaust proving switch.

Table A-9.32.4.1.(1)-B
Vent Safety — Oil and Solid Fuel

Fuel Type	**Oil**			**Solid**		
Vent Type	**Thermal Buoyancy Chimney[2]**		**Direct Vent**	**Thermal Buoyancy Chimney[2]**		**Any**
Appliance Type	**Boiler HWT[4]**	**F/A Furnace Boiler HWT[3], [4]**	**F/A Furnace Boiler HWT**	**Boiler**	**F/A Furnace Boiler HWT Fireplace Heat Stove**	**Outside Boiler**
Special Conditions	Located in Air-Barriered Room[1]			Located in Air-Barriered Room[1]		
Classification	Non-NAFFVA	NAFFVA	Non-NAFFVA	Non-NAFFVA	NAFFVA[5]	N/A
9.32.4.1.(1) Applies	No	Yes	No	No	Yes[5]	No

Notes to Table A-9.32.4.1.(1)B.:

[1] Mechanical room must be air-barriered from remainder of house with no access from within house. Room must be lined with panel products with sealed joints and all pipe and wire penetrations sealed. Effectively, the room must be finished before equipment is installed and holes drilled for pipes and wires. This option is not available for forced air furnaces as it is not possible to effectively seal the ducts.

[2] Thermal buoyancy chimneys must be within the heated envelope of the house to provide acceptable venting performance.

[3] Oil-fired HWT, boilers and furnaces equipped with blocked vent switches.

[4] Sealed combustion kits can be added to oil-fired appliances but they switch to interior combustion air if intake is blocked and rely on barometrically dampered thermal buoyancy chimneys so they are considered NAFFVA.

[5] Wood-burning appliances certified for use in mobile homes and installed to mobile home installation standards are considered non-NAFFVA and Sentence 9.32.4.1.(1) does not apply to them.

A-9.32.4.2. Carbon Monoxide Alarms. Carbon monoxide (CO) is a colourless, odourless gas that can build up to lethal concentrations in an enclosed space without the occupants being aware of it. Thus, where an enclosed space incorporates or is near a potential source of CO, it is prudent to provide some means of detecting its presence. Dwelling units have two common potential sources of CO:

- fuel-fired space- or water-heating equipment within the dwelling unit or in adjacent spaces within the building, and
- attached storage garages.

Most fuel-fired heating appliances do not normally produce CO and, even if they do, it is normally conveyed outside the building by the appliance's venting system. Nevertheless, appliances can malfunction and venting systems can fail. Therefore, the provision of appropriately placed CO alarms in the dwelling unit is a relatively low-cost back-up safety measure.

Similarly, although Article 9.10.9.16. requires that the walls and floor/ceiling assemblies separating attached garages from dwelling units incorporate an air barrier system, there have been several instances of CO from garages being drawn into houses, which indicates that a fully gas-tight barrier is difficult to achieve.

When the attached storage garage is located at or below the elevation of the living space, winter season stack action will generate a continuous pressure between the garage and the dwelling unit. This pressure is capable of transferring potentially contaminated air into the house. The use of exhaust fans in the dwelling unit may further increase this risk.

A-9.33.5.3. Design, Construction and Installation Standard for Solid-Fuel-Burning Appliances. CSA B365, "Installation Code for Solid-Fuel-Burning Appliances and Equipment," is essentially an installation standard, and covers such issues as accessibility, air for combustion and ventilation, chimney and venting, mounting and floor protection, wall and ceiling clearances, installation of ducts, pipes, thimbles and manifolds, and control and safety devices. But the standard also includes a requirement that solid-fuel-burning appliances and equipment satisfy the requirements of one of a series of standards, depending on the appliance or equipment, therefore also making it a design and construction standard. It is required that cooktops and ovens as well as stoves, central furnaces and other space heaters be designed and built in conformity with the relevant referenced standard.

A-9.33.6.13. Return Air System. It is a common practice to introduce outdoor air to the house by means of an outdoor air duct connected to the return air plenum of a forced air furnace. This is an effective method and is a component of one method of satisfying the mechanical ventilation requirements of Subsection 9.32.3. However, some caution is required. If the proportion of cold outside to warm return air is too high, the resulting mixed air temperature could lead to excessive condensation in the furnace heat exchanger and possible premature failure of the heat exchanger. CAN/CSA-F326-M, "Residential Mechanical Ventilation Systems," requires that this mixed air temperature not be below 15.5°C when the outdoor temperature is at the January 2.5% value. It is also important that the outdoor air and the return air mix thoroughly before reaching the heat exchanger. Note A-9.32.3. provides some guidance on this.

A-9.33.10.2.(1) Factory-Built Chimneys. Under the provisions of Article 1.2.1.1. of Division A, certain solid-fuel-burning appliances may be connected to factory-built chimneys other than those specified in Sentence 9.33.10.2.(1) if tests show that the use of such a chimney will provide an equivalent level of safety.

A-9.34.2. Lighting Outlets. The "Canadian Electrical Code, Part I" which is adopted by the Electrical Safety Regulation, contains requirements relating to lighting that are similar to those in the Building By-law. However, the Electrical Code requirements apply only to residential occupancies, whereas many of the requirements in the Building By-law apply to all Part 9 buildings. Code users must therefore be careful to ensure that all applicable provisions of the Building By-law are followed, irrespective of the limitations in the Electrical Code.

A-9.35.2.2.(1) Garage Floor. Sources of ignition, such as electrical wiring and appliances, can set off an explosion if exposed to gases or vapours such as those that can be released in garages. This provision applies where the frequency and concentration of such releases are low. Where the garage can accommodate more than 3 vehicles, and where wiring is installed within 50 mm of the garage floor, the "Canadian Electrical Code, Part I", which is adopted by the Electrical Safety Regulation, should be consulted as it specifies more stringent criteria for wiring.

The capacity of the garage is based on standard-size passenger vehicles such as cars, mini-vans and sport utility vehicles, and half-ton trucks. In a typical configuration, the capacity of the garage is defined by the width of the garage doors – generally single or double width – which correlates to the number of parking bays.

In many constructions, floor areas adjacent to the garage are either above the garage floor level or separated from it by a foundation wall. Where the foundation wall is cast-in-place concrete and rises at least 50 mm above the garage floor, it can serve as the airtight curb. Where the foundation wall is block or preserved wood, extra measures may be

needed to provide airtightness. In many instances, the construction will be required to be airtight to conform with Sentence 9.25.3.1.(1), and in any case, must comply with Sentences 9.10.9.16.(4) and (5).
Where the space adjacent to the garage is at the same level as the garage, a 50 mm curb or partition is not needed if the wall complies with Sentences 9.10.9.16.(4) and (5), and there is no connecting door. Where there is a connecting door, if the garage is not sloped towards the exterior, it must be raised at least 50 mm off the floor or be installed so it closes against the curb. This requirement does not preclude the installation of a ramp leading from the garage floor up to the door.

In some instances, access to the basement is via a stair from the garage. In such cases, a curb must be installed at the edge of the stair well and must be sealed to the foundation wall, curb or partition between the garage and adjacent spaces.

See Figure A-9.35.2.2.(1).

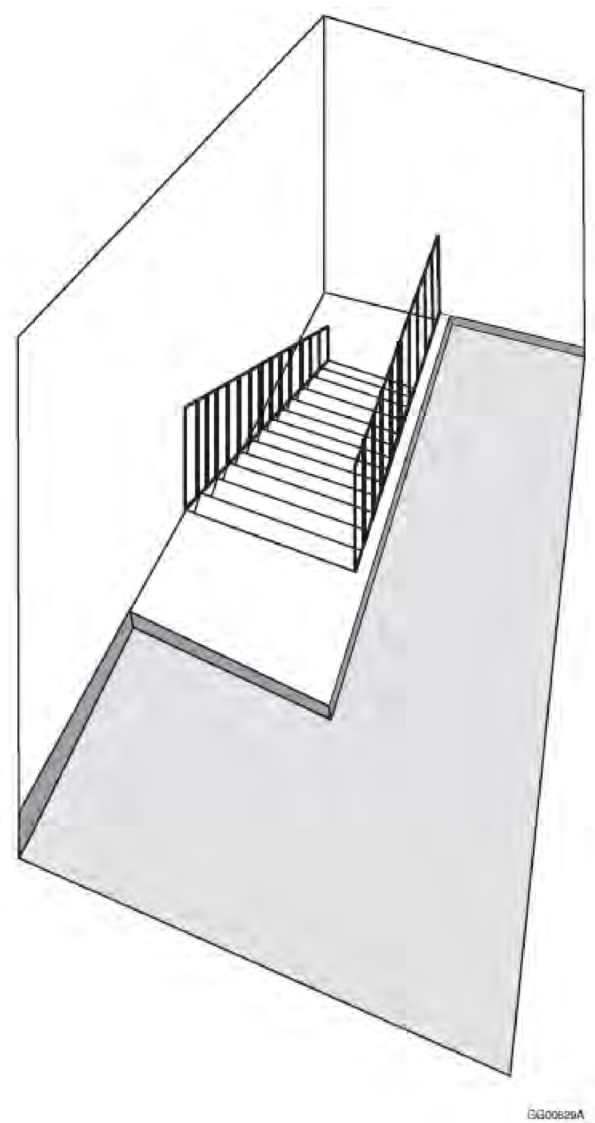


Figure A-9.35.2.2.(1)
Curb around garage floor at stairs

A-9.37.1.1. Application. The provisions of the Building By-law addressing ancillary residential units are intended to align with Provincial requirements, with minor modification to accommodate the Vancouver development context. Secondary suites, lock-off units, or other forms of housing ancillary to a primary dwelling, are intended to be treated in a uniform fashion, and rely upon a single ownership model in which the principal dwelling unit and ancillary residential unit form a single legal parcel, for which the owner bears the responsibility for the maintenance and safe function of all the contained units. As such, separation requirements normally required between separate suites of residential occupancy are relaxed due to this single ownership relationship.

It is intended that the definition reflects that an ancillary residential unit is an additional dwelling unit of limited size located within a house or row house. Many of the changes in Section 9.37. are premised on the condition of the limited size of the ancillary residential unit, which may directly or indirectly relate to issues such as occupant load, travel distance and egress dimensions.

The provisions of this By-law address only ancillary residential units in lower density forms of housing which include houses (one and two family dwellings) and row houses in which egress is non-complex, being generally direct to the exterior and at or near grade. Dwelling units that would otherwise meet the definition of ancillary dwelling unit but are in denser or more complex arrangements (such as lock-off units in apartment buildings or strata titled arrangements) should be treated as separate suites of residential occupancy, and therefore comply with the general provisions of Part 3 or Part 9 as applicable.

A-9.37.1.2. Construction Requirements. The requirements of Part 9 of the Building By-law apply to the construction of an ancillary residential unit and the alterations to a building to incorporate an ancillary residential unit, except those specifically referenced in Subsection 9.37.2.

An ancillary residential unit may be constructed in a building that has been in existence for many years that may not comply with current code requirements.

It is not the intent to retroactively apply the current By-law to all existing features in order to permit the construction of an ancillary residential unit in an existing building and the requirements of Part 11 of this By-law may facilitate the construction of such projects.

A-9.37.2.3.(1) Exit Stairs. Existing internal and external stairs that formerly served one dwelling unit may now serve both the existing dwelling unit and the new ancillary residential unit. It is not the intent to apply all current By-law exit stair requirements in order to permit the construction of an ancillary residential unit in an existing building.

A-9.37.2.6. Means of Egress. The additional occupant load created by an ancillary residential unit does not warrant increasing the width of a public corridor, common exit stair or landing used by both dwelling units. The stairs, corridors and landings formerly serving one dwelling unit are likely to be of adequate size to accommodate the occupant load of both suites.

A-9.37.2.8. Openings Near Unenclosed Exit Stairs and Ramps. Unprotected door or window openings in other fire compartments adjacent to exit stairs, ramps and confined paths of travel should be protected from the other suite to provide safe passage to a safe area.

Normally such protection as required by Part 9 would extend both vertically and horizontally beyond the adjacent openings. This is considered excessive due to required fire safety measures and the relatively short travel distances in this type of building. The application of current Part 9 requirements would in many cases require the protection of all openings in entire faces of dwelling units, which could be very restrictive. Authorities should exercise judgment with regard to deciding which openings are close enough to the exit facility to pose a problem during the early stages of a fire and require appropriate opening protection. Those openings that directly pass the means of egress are required to be protected.

A-9.37.2.13. Structural Fire Resistance of Ancillary Residential Units. The provisions of 9.37.2.13. address only the fire-resistive requirements of construction within the ancillary residential unit. The remainder of the requirements of a building, including the need for fire separations that support or separate other floor areas or portions of a building, or of the principal dwelling unit itself, continue to apply.

A-9.37.2.14. Combustible Drain, Waste and Vent Piping. Exposed combustible drain, waste and vent piping that penetrates a fire separation is required to be protected as described. This protection is not required for exposed fixture traps and arms serving fixtures within the suite provided they are not exposed from the underside of a horizontal assembly. The intent is not to require removal of existing combustible piping which, as a result of the creation of an ancillary residential unit , may now be on both sides of a rated fire separation. Rather, the intent is to protect this piping where it is exposed.

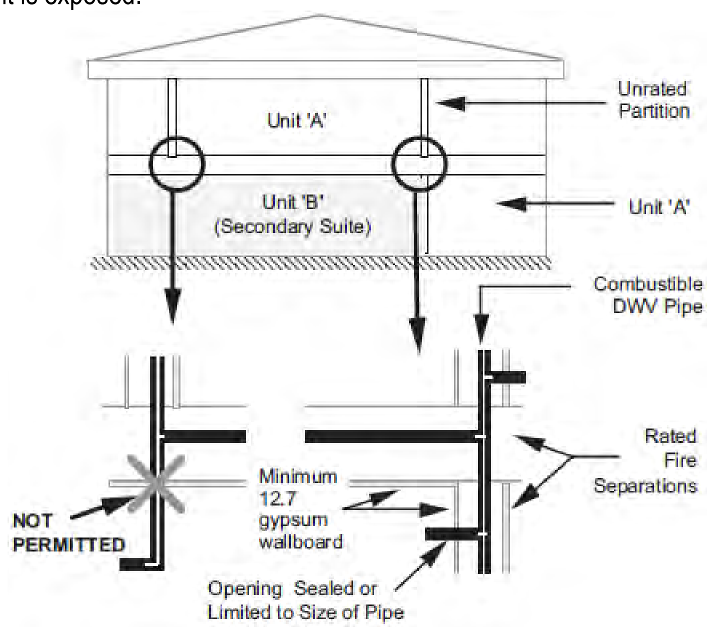


Figure A-9.37.2.14.
Combustible Drain, Waste and Vent Pipe

A-9.37.2.15 Separation of Ancillary Residential Suites Separations between an ancillary residential unit and its associated principal dwelling unit are not required to be constructed as formal fire separations. Rather, these separations may be constructed with conventional techniques that incorporate low cost materials that will provide a degree of containment for fire, smoke, and sound to the dwelling unit of origin.

Likewise, openings between principal dwelling unit and its contained ancillary residential unit must meet certain minimum construction requirements, but need not be constructed as formal fire separations.

A-9.37.2.17. Air Ducts and Fire Dampers. In order to prevent the migration of smoke from one suite to another during a fire, heating or ventilation systems incorporating ducts that serve both suites are permitted only if there is a mechanism to prevent smoke being circulated from one unit to the other. It is preferable for the secondary suite to have its own heating system independent of the rest of the building.

A-9.37.2.19. Smoke Alarms. This Article requires an interconnected photoelectric smoke alarm in each suite where fire separations having a fire-resistance rating of 30 min are used. The purpose of these interconnected alarms is to provide early warning to both suites in the event of a fire in one suite. Photoelectric type alarms are required as they are less prone to nuisance false alarms such as can occur during cooking, but careful consideration is still required as to their location.

It is important to note that these alarms are additional to the requirements of Subsection 9.10.19. and that each suite is still required to be provided with alarms in conformance with Subsection 9.10.19.

The additional smoke alarm should not be interconnected to the other smoke alarm(s) located within the same suite.

This additional smoke alarm system is not required when the fire-resistance ratings required in Articles 9.10.9.14. and 9.10.9.15. are not reduced, or when the building is sprinklered.

A-9.37.2.20. Sound Control. Meeting the By-law's level of sound transmission for secondary suites may be difficult and expensive, particularly in an existing building. As there is single ownership of both dwelling units, this requirement is not mandatory, but designers are encouraged to take the subject into consideration where feasible.

Fire and Sound Resistance Tables

<<Fire and Sound Resistance Tables to be Inserted – No changes from BCBC>>

Span Tables

<<Span Tables to be Inserted – No changes from BCBC>>

Part 10
Energy and Water Efficiency

Section 10.1. General

10.1.1. Application

10.1.1.1. Scope

1) The scope of this Part shall be as described in Subsection 1.3.3. of Division A.

10.1.1.2. Application

1) The application of this Part shall be as described in Subsection 1.3.3. of Division A.

10.1.2. Definitions

10.1.2.1. Defined Terms

1) Words that appear in italics are defined in Article 1.4.1.2. of Division A.

Section 10.2. Energy Efficiency

10.2.1. Energy Design Building Classification

10.2.1.1. Application

1) Except as permitted by Sentence (2), a *building* shall be designed and constructed in conformance with this Subsection for the purpose of energy efficiency.

2) A structure that cannot be identified by the characteristics of a *building* in this Subsection shall comply with the requirements of 10.2.1.2., or as deemed *acceptable* to the Chief Building Official.

3) To meet the energy efficiency requirements of Articles 10.2.1.2. to 10.2.1.5., the design requirements of Subsection 10.2.2. shall form an integral part of this Subsection.

4) For the purposes of Part 10 and the classification of applicable energy design requirements of a *building*, the application of these requirements are to be applied to a *building* or that portion of a *building*, which for the purposes of energy and emissions performance, is designed to function as an independent entity. (See Note A-10.2.1.1.(4).)

5) Except as permitted by Sentence (6), a balcony, including those that are enclosed, shall be designed and constructed as unconditioned ambient space, exterior to the *building* envelope, without the provision of heating, cooling, or gas connection.

6) A *building* with not more than 2 principle *dwelling units* may be provided with a gas connection serving a balcony that is not enclosed.

10.2.1.2. Buildings Without Residential or Commercial Components

1) All *buildings*, except those included in 10.2.1.3 through 10.2.1.6,

a) shall be designed in compliance with (See Note A-10.2.1.2.(1)(a).)

i) 10.2.2.2. or 10.2.2.3., or

ii) 10.2.2.2. in a *building* required to be designed to Part 9 by Division A, 1.3.3.3.,

b) **reserved**,
c) **reserved**,
d) **reserved**,
e) shall be provided with vestibules in compliance with Article 10.2.2.8.,
f) shall be provided with metering equipment in compliance with Article 10.2.2.9,
g) shall be provided with lighting in conformance with Article 10.2.2.10.,
h) **reserved**,
i) shall comply with Article 10.2.2.15. where fire places are provided, and
j) may provide exterior heated spaces in compliance with Article 10.2.2.22.

10.2.1.3. Residential Buildings of 7 Storeys or More, and Commercial Buildings (with or without residential components)

1) All *buildings* containing Group C, D, or E *Major Occupancies*, except those included in 10.2.1.4 through 10.2.1.6.,
a) shall be designed in compliance with energy and emissions performance per Article 10.2.2.5,
b) **reserved**,
c) **reserved**,
d) **reserved**,
e) shall be provided with vestibules in compliance with Article 10.2.2.8.,
f) shall be provided with metering equipment in compliance with Article 10.2.2.9,
g) shall be provided with lighting in compliance with Article 10.2.2.10.,
h) **reserved**,
i) shall comply with Article 10.2.2.15., where domestic gas fireplaces are provided,
j) shall provide airtightness testing in compliance with Article 10.2.2.21, and
k) may provide exterior heated spaces in compliance with Article 10.2.2.22.

10.2.1.4. Residential Buildings of 4 to 6 Storeys, and Mixed-Use Residential Buildings of 1 to 6 Storeys

1) Except for *buildings* included in 10.2.1.5 or 10.2.1.6, a *building* which is less than 7 *storeys* in *building height*, and which is classified as a Group C *major occupancy*, and containing no other *occupancies* (excluding Group D or E *major occupancy* on the first or second *storeys*, or Group F Division 3 (Storage Garage) *occupancy* subsidiary to the Group C major *occupancy*),
a) shall be designed in compliance with
i) energy and emissions performance per Article 10.2.2.5, or
ii) Articles 10.2.2.2. or 10.2.2.3., excluding *building* envelope trade-off and whole *building* energy modelling options, and provided with the thermal performance of Articles 10.2.2.6. and 10.2.2.7., and heat recovery ventilators in compliance with 10.2.2.17.
b) shall be provided with vestibules in compliance with Article 10.2.2.8.,
c) shall be provided with metering equipment in compliance with Article 10.2.2.9.,
d) shall be provided with lighting in compliance with Article 10.2.2.10.,
e) shall be provided with mechanical equipment in compliance with Articles 10.2.2.11. through 10.2.2.14.,
f) shall comply with Article 10.2.2.15., where domestic gas fireplaces are provided,
g) shall provide airtightness testing in accordance with Article 10.2.2.21, and
h) may provide exterior heated spaces in compliance with Article 10.2.2.22.

10.2.1.5. Residential Buildings of 1 to 3 Storeys

1) Except for *buildings* included in 10.2.1.6, a *building* which is less than 4 *storeys* in *building height*, and which is entirely classified as Group C *major occupancy*, excluding Group F Division 3 (Storage Garage) *occupancy* subsidiary to the Group C *major occupancy*,

a) shall be provided with thermal performance in compliance with Article 10.2.2.6.,
b) shall be provided with exterior closures and fenestration with thermal performance in compliance with Article 10.2.2.7.,
c) shall be provided with vestibules in compliance with Article 10.2.2.8.,
d) shall be provided with metering equipment in compliance with Article 10.2.2.9.,
e) shall be provided with lighting in compliance with Article 10.2.2.10.,
f) comply with Articles 10.2.2.11. through 10.2.2.13. where domestic hot water heating is provided,
g) shall comply with Article 10.2.2.14. where domestic gas heated furnaces or make-up air units are provided,
h) shall comply with Article 10.2.2.15. where domestic gas fireplaces are provided,
i) shall be provided with and heat recovery ventilators in compliance with Article 10.2.2.17.,
j) shall be designed with a solar photovoltaic ready pipe run in compliance with Article 10.2.2.19.,
k) shall provide documentation in compliance with Article 10.2.2.20.,
l) shall provide airtightness testing in compliance with Article 10.2.2.21, and
m) may provide exterior heated spaces in compliance with Article 10.2.2.22.

10.2.1.6. Residential Buildings with Not More Than 2 Principal Dwelling Units

1) Except as otherwise required in this Subsection, a Group C *building* of *residential* use throughout, containing not more than 2 primary *dwelling units* and their contained *ancillary residential suites* or subsidiary structures with conditioned space, shall (See Note A-10.2.1.6.(1).)

a) be designed with thermal performance in compliance-with Article 10.2.2.6.,
b) be designed with exterior closures and fenestration with thermal performance in compliance-with Article 10.2.2.7.,
c) be provided with metering equipment in compliance with Article 10.2.2.9.,
d) be provided with lighting in compliance with Article 10.2.2.10.,
e) comply with Article 10.2.2.11. through 10.2.2.13., where domestic hot water heating is provided,
f) comply with Article 10.2.2.14., where domestic gas heated furnaces or make-up air units are provided,
g) comply with Article 10.2.2.15. and 10.2.2.16., where domestic gas fireplaces are provided,
h) be provided with heat recovery ventilators in compliance with Article 10.2.2.17.,
i) be designed with a solar photovoltaic ready pipe run in compliance with Article 10.2.2.18 or 10.2.2.19.,
j) provide documentation in compliance with Article 10.2.2.20., and
k) provide airtightness testing in compliance with Article 10.2.2.21.

10.2.2. Design Measures for Energy Efficiency

10.2.2.1. Application

1) This Subsection applies to all *buildings* and parts of the *buildings* that are required to be energy efficient under Subsection 10.2.1.

10.2.2.2. ANSI/ASHRAE/IESNA 90.1

1) A *building* designed in accordance with this Article shall, be designed and constructed in accordance with ANSI/ASHRAE/IESNA 90.1, "Energy Standard for Buildings, except Low-Rise Residential Buildings", and

2) A *building* is designed in accordance with Sentence (1), shall be designed with

a) a climate zone of 4,

b) ventilation in compliance with ASHRAE 62-2001 (except addendum n), or if applicable, 6.2.2.1.3.b) of the Building By-law,

c) the 5% in Table 11.5.1.5. Building Envelope, Exception a., being replaced by 2 per cent, if designed in compliance with ASHRAE 90.1, Section 11,

d) the 5% in Table G3.1.5.a. Building Envelope, Exception 1., being replaced by 2 per cent, if designed in compliance with ASHRAE 90.1, Appendix G,

e) no requirement to comply with the Fenestration Orientation provisions of ASHRAE 90.1, Article 5.5.4.5.,

f) no requirement to comply with Automatic Receptacle Control, per ASHRAE 90.1, Article 8.4.2.

10.2.2.3. National Energy Code of Canada for Buildings

1) A *building*, other than a Part 9 *building*, designed in accordance with this Article shall be designed and constructed in accordance with the National Energy Code of Canada for Buildings (NECB), except that the provisions of this By-law shall apply where the NECB refers to the National Building Code of Canada (NBCC), and shall be designed with

a) a climate zone of 4,

b) ventilation in conformance with ASHRAE 62 (except addendum n),

c) no requirement to comply with vestibules provision of NECB Article 3.2.2.1.,

d) window-to-wall and skylight-to-roof area ratios of the reference *building* identical to area ratios of the proposed *building*, to a maximum of 40% for windows and to a maximum of 5% for skylights, identical to area ratios of the proposed *building*,

e) a vertical glazing Solar Heat Gain Coefficient which does not exceed an assembly maximum of 0.36,

f) a skylight Solar Heat Gain Coefficient for all types, which does not exceed an assembly maximum of 0.40, where the ratio of the aggregate skylight area to roof area is less than or equal to 3.0%.

10.2.2.4. Reserved.

10.2.2.5. Zero Emissions Building Plan (ZEBP) - Performance Limits

1) Except as permitted by Sentence (4), for a *building* required to comply with this Article, any energy modelling shall comply with:

a) the applicable requirements of Part 8 of the NECB, and

b) the City of Vancouver Energy Modelling Guidelines.

2) Except as permitted in Sentence (3) and (4), a *building* designed with this Article shall demonstrate the performance values of the proposed *building* comply with the limits in Table 10.2.2.5.A.

3) Compliance with the GHGI limits in Table 10.2.2.5.A is not required where a *building* can demonstrate the performance values of the proposed *building* comply with the TEUI and TEDI limits in Table 10.2.2.5.B.

4) *Buildings* and *major occupancies* designed and constructed to conform to the certification criteria for the Passive House Standard, are deemed to comply with this Article provided the design's energy model is

a) version 9 or newer of the Passive House Planning Package, and
b) prepared by a Certified Passive House Designer, or Certified Passive House Consultant.
(See Note A-10.2.2.5.(4).)

Table 10.2.2.5.A
Maximum Energy Use and Emissions Intensities
Forming part of Sentence 10.2.2.5.(2)

Occupancy Classification [1]	**Total Energy Use Intensity (kWh/m^2a)**	**Thermal Energy Demand Intensity (kWh/m^2a)**	**Greenhouse Gas Intensity ($kgCO_{2e}/m^2a$)**
Group C *occupancies* in *buildings* up to 6 *Storeys*	110	25	5.5
Group C *occupancies* in *buildings* over 6 *Storeys*, except Hotel and Motel	130	45	14
Hotel and Motel *occupancies*	170	30	14
Group D and E *occupancies*, except Office	170	30	5
Office *occupancies*	130	30	7
All other *occupancies*	Comply with ASHRAE 90.1, Section 11 (ECB) or Appendix G performance paths in accordance with Article 10.2.2.2., or NECB Part 8 performance path in accordance with Article 10.2.2.3.		

Table 10.2.2.5.B
Maximum Energy Use and Emissions Intensities
Forming part of Sentence 10.2.2.5.(3)

Occupancy Classification	**Total Energy Use Intensity (kWh/m^2a)**	**Thermal Energy Demand Intensity (kWh/m^2a)**	**Greenhouse Gas Intensity ($kgCO_{2e}/m^2a$)**
Residential *occupancies* in *buildings* over 6 *Storeys*	120	30	6
Hotel and Motel *occupancies*	140	20	8
Group D and E *occupancies*, except Office	120	20	3
Office *occupancies*	100	20	3

10.2.2.6. Building Envelope Opaque Elements

1) Except as otherwise required in this Subsection, a *building* required to comply with this Article shall be comply with the performance values in Table 10.2.2.6., between
a) heated space and unheated space,
b) heated space and exterior air,
c) heated space and exterior *soil*,
d) heating floor assemblies and heated space,

e) heating floor assemblies and unheated space,
f) heating floor assemblies and exterior air, and
g) heating floor assemblies and exterior *soil*.

Table 10.2.2.6.
Minimum Effective Thermal Resistance of Assemblies in Buildings of Group C Major Occupancy
Forming part of Sentences 10.2.2.6.(1)

Building Assembly	Assembly Minimum RSI Value (m^2K/W)
Attic Space[(1)]	8.5
Roof Joist Assemblies for residential *buildings* with not more than 2 principal *dwelling units* (Cathedral Ceilings/Flat Roofs)	4.3
Roof Assemblies other residential *buildings* with not more than 2 principal *dwelling units* (Cathedral Ceilings / Flat Roofs)	5.28
Walls (including frame crawl space walls)[(3)]	3.85
Foundation Walls	3.85
Box and Rim Joists	3.85
Concrete or Masonry Walls (other than foundation walls)	3.85
Suspended Floors (framed)	4.2
Suspended Floors (concrete slab)	4.2
Concrete Slabs on Ground at, above, or below grade (insulation under all slab area and around edge of slab)	2.5
Radiant Heating Suspended Floor Assembly Over Heated Area (insulation between heated floor and heated area below)[(2 2)]	2.5
Concrete Balconies, Eyebrows, and Exposed Slab Edge (wrapped or using manufacturer thermal break in structure)	0.42

Notes to Table 10.2.2.6.:

[(1)] The thermal resistance rating of attic space insulation may be reduced to value required for frame walls for a distance of 1200 mm from the exterior wall. A minimum nominal RSI of 3.52 m^2K/W is required above the top plate in the attic space (See Note A-10.2.2.6.)

[(2)] Not applicable when heating elements or piping are located within a concrete topping on a suspended floor assembly or within an internally heated suspended slab.

[(3)] Headers and lintels: cavities between structural members are to be fully insulated, except where a framing plan provided by the builder, architect, designer, or engineer indicates that full-depth solid headers are structurally required.

2) Insulation and the installation of insulation in a *building* designed to the requirements of Part 9 shall comply with Subsection 9.25.2. or Part 5.
3) The effective total “R” value of the opaque envelope area, the non-opaque envelope area, and the overall envelope envelope area (See Note A-10.2.2.6. on calculating effective thermal resistance of building envelope assemblies), calculated by a design professional, shall be submitted as part of an application for a *permit.*

10.2.2.7. Building Envelope Windows, Skylights, Doors and Other Glazed Products

1) Except as otherwise required in this Subsection and as permitted by Sentence (2), a *building* required to comply with this Article shall comply with the performance values in Table 10.2.2.7.(1).

Table 10.2.2.7.(1)
Maximum Thermal Transmittance of Exterior Closures and Fenestration
Forming part of Sentence 10.2.2.7.(1)

Type of Closure	Assembly Maximum USI Value (W/(m²K))
Windows and sliding doors or folding doors with glazing	1.4
Curtainwall and window wall assemblies	1.4
Storefront curtainwall, window, and door assemblies	2.27
Doors with or without glazing(1)	1.8
Doors with a required fire resistance rating	Exempt
Roof access hatches	2.9
Skylights (not larger than 1220 mm in two directions), roof windows and sloped glazing systems	2.4
Skylights larger than 1220mm in two directions	2.95
Tubular daylight devices	2.6

Notes to Table 10.2.2.7.(1):

(1) Includes doors swinging on a vertical axis with or without glazing, door transoms, and sidelites.

2) A maximum of one entry door assembly consisting of one or two leafs installed in the principle entrance of a *building*, together with attached transoms and sidelites all within a single rough opening, need not comply with Table 10.2.2.7.(1), where constructed of thermally broken metal or wood with multiple panes of glass, which may be argon filled, or coated with a low-e coating.

3) The thermal transmittance of factory glazed products within the scope of existing certification programs shall be indicated by labels applied to the products at the manufacturing location. The thermal transmittance of site glazed products and products outside the scope of existing certification programs shall be suitably documented. (See Note A-10.2.2.7.(3).)

10.2.2.8. Building Envelope Vestibules

(See Note A-10.2.2.8.)

1) Except as permitted in Sentence (2), in a *building* required to comply with this Article there shall be an enclosed vestibule in all *building* entrances separating a conditioned space from the exterior, designed such that

a) all doors opening into and out of the vestibule shall be equipped with self-closing devices,

b) the interior and exterior doors of the vestibule shall be separated by no less than 2.1 m when closed, and the floor area of each vestibule shall not exceed 4.65 m^2 or 2% of the gross conditioned floor areas for that level of the *building*,

c) for spaces having a gross conditioned floor area for that level of the *building* of 3,716.1m^2 and greater, and when the doors opening into and out of the vestibule are equipped with automatic,

electrically driven, self-closing devices, the interior and exterior doors shall be separated by no less than 4.87m.
d) the exterior envelope of a conditioned vestibule shall comply with the design requirements for a conditioned space, and
e) the interior and exterior envelope of an unconditioned vestibule shall comply with the design requirements for a semi heated space.

2) An enclosed vestibule is not required for
a) a *building* entrance with revolving doors,
b) a door not intended to be used as the *building* entrance,
c) a door opening directly to the exterior from a *dwelling unit*,
d) a *building* entrance, in a *building* less than 278.7 m^2 in gross floor area,

e) a door that opens directly to the exterior from a space that is less than 278.7 m^2 and is separate from the *building* entrance,
f) semi-heated spaces,
g) an enclosed elevator lobby for *building* entrances directly from parking garages, and
h) a *building* pursuing certification with the Passive House (PHI) standard.

10.2.2.9. Building Services Submetering

1) Every *building* shall be equipped with metering equipment capable of collecting *building* energy performance data for the *building* and for every portion of the *building* which supports a separate use or *occupancy*.

2) Submetering required by this Article shall include the following
a) hot water generated by a central hot water generation system
b) natural gas used for air handling systems in common areas, and
c) natural gas used for domestic hot water in amenity spaces, pools and spas.

10.2.2.10. Lighting in Residential Buildings
(See Note A-10.2.2.10.)

1) Where a portion of a residential *building* or a portion of a multi-use *building* located above a garage or on an adjacent grade contains more than 20 residential *suites*, the *building* shall be designed with
a) *occupancy* based lighting sensor controls, located in all *exit* stair shafts and parking garages, compatible with the requirements of Sentence 3.2.7.3.(1) of Division B, and
b) a switch near the principal entrance of each residential *suite* that
i) controls all lighting fixtures within the *suite*, except lights serving corridors, stairs, washrooms, and rooms with no exterior window.
ii) with an override on each floor, serving that floor, of a multilevel suite

2) Except as permitted by Sentence (3), permanent ancillary exterior lighting of a *building* of *residential* occupancy or the *residential* portion of a multi-use *building,* or those parts of a *building* facing a *lane*, that is required to conform to this Article shall
a) be provided with fixtures that are appropriately shielded that
i) utilize full cut-off optics or are fully shielded fore luminaires that emit over 600 lumens, or any luminaire installed along the side or back yard, and

ii) are partially shielded and utilize a diffusing cover for luminaires that emit 600 lumens or less.

b) be mounted no higher than 4 m above grade or the balcony surface it illuminates along the side yard, back yard, and similar outward facing courtyards or setbacks of the *building*,

c) be provided with dimmer and timer controls,

d) minimize lighting of adjacent exterior properties and properties across a *street*, *lane*, or *public way*,

3) Where exterior lighting is required by this By-law or other regulator enactments to provide illumination along paths of pedestrian or vehicular travel, fire department access, or equipment signage or lighting, it need not comply with the requirements of Sentence (2).

10.2.2.11. Hot Water Tank Piping

1) In a *building* required to comply with this Article, the first 3 m of non-recirculating hot water piping leading from both electrically heated and gas heated hot water tanks, and the last 1 m of piping leading to the hot water tank connection, shall have insulation with a minimum RSI value of 0.35.

10.2.2.12. Domestic Gas-Heated Hot Water Heaters

1) In a *building* required to comply with this Article, gas-heated appliances providing domestic hot water only shall have a uniform energy factor of not less than 0.78 or alternatively a thermal efficiency of not less than 90%, , as determined by the following

a) CSA P.3-04, “Testing Method for Measuring Energy Consumption and Determining Efficiencies of Gas-Fired Storage Water Heaters”,

b) CSA P.7-10, “Testing Method for Measuring Energy Loss of Gas-Fired Instantaneous Water Heaters”,

c) CSA C191-04, “Performance of electric storage tank water heaters for domestic hot water service”, or

d) CSA 4.3/ANSI Z21.10.3, “Gas Water Heaters Volume III, Storage Water Heaters, with Input Ratings above 75,000 Btu per hour, Circulating and Instantaneous”.

10.2.2.13. Domestic Gas-Heated Boilers

1) In a *building* required to comply with this Article, domestic gas-heated boilers providing heat, or heat and domestic hot water, shall have an Annual Fuel Utilization Efficiency (AFUE) rating of not less than 92 per cent, as tested using CSA P.2-07, “Testing Method for Measuring the Annual Fuel Utilization Efficiency of Residential Gas-fired Furnaces and Boilers”.

10.2.2.14. Domestic Gas-Heated Furnaces or Make Up Air Units

1) In a *building* required to comply with this Article, domestic gas-heated furnaces or make up air units shall have an Annual Fuel Utilization Efficiency (AFUE) rating of not less than 92 per cent, as tested using CSA 2.6/ANSI Z83.8, “Gas unit heaters, gas packaged heaters, gas utility heaters and gas-fired duct furnaces”.

10.2.2.15. Domestic Gas-Fired Fireplaces

(See Note A-10.2.2.15.)

1) In a *building* required to comply with this Article, domestic gas-fired fireplaces in conditioned spaces shall be equipped with

a) intermittent pilot ignition (IPI) systems,

b) on-demand ignition systems that automatically shut off within

i) 7 days of appliance non-use in a one or two family dwelling *building*, or

ii) 6 hours of appliance non-use in a multifamily dwelling, or

c) match ignition.

2) In a *building* required to comply with this Article, domestic gas-fired fireplaces shall be direct vented (Naturally Aspirating Fuel-Fired Appliances (NAFFVA) are not permitted).

3) In a *building* required to comply with this Article, domestic gas-fired fireplaces must be on a timer.

4) Where exterior gas fireplaces are provided as an ancillary equipment to a *building* required to comply with this Article, then the exterior fireplaces shall be considered as part of the *building* for the purposes of this Part.

10.2.2.16. Domestic Wood Burning Heating Appliances

1) In a *building* required to comply with this Article, and except for cooking stoves and ranges, a wood domestic burning heating appliance installed in a residential *dwelling unit* shall be tested in accordance with CAN/CSA B415.1-10 “Performance Testing of Solid-Fuel-Burning Heating Appliances” or EPA Title 40, Part 60, Subpart AAA - “Standards of Performance for New Residential Wood Heaters”, and shall

a) produce not more than 2.5 grams per hour of particulate air contaminant emissions for catalytic appliances, or

b) produce not more than 4.5 grams per hour of particulate air contaminant emissions for non-catalytic appliances.

2) Open masonry fireplaces and factory-built fireplaces are not permitted.

10.2.2.17. Domestic Heat Recovery Ventilators

1) In a *building* required to comply with this Article, each dwelling unit shall be served by a heat recovery ventilator located in

a) each dwelling *unit*, or

b) a commonly accessible location if serving multiple *dwelling units*.

2) In a *building* required to comply with this Article, components of mechanical ventilation systems not specifically described in this Subsection shall be designed, constructed and installed in accordance with good engineering practice and as described in the ASHRAE Handbooks and Standards, HRAI Digest, TECA Ventilation Guideline, Hydronics Institute Manuals or the SMACNA manuals.

3) In a *building* required to comply with this Article, a heat recovery ventilator (HRV) shall

a) be sized to run at its rated speed for continuous operation while achieving a 65 per cent sensible heat recovery efficiency (65 per cent Minimum SRE at 0°C) and be designed and tested in conformance with CAN/CSA-C439,

b) be designed and tested to meet the CSA International Standard CAN/CSA-F326-M91, “Residential Mechanical Ventilation Systems”,

c) be installed and commissioned by persons trained by the Thermal Environmental Comfort Association (TECA) or the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI) or equivalent,

d) supply outdoor air directly to the principal living area, to each bedroom, and to any *floor area* without a bedroom, including similar rooms within *ancillary residential units*, directly or indirectly, through a central recirculation system with a continuously operating fan,

e) be designed to run continuously to comply with the minimum ventilation rates of Table 9.32.3.3.A of Division B,

f) not be connected to kitchen and bathroom exhaust fans,
g) except for mechanical ducts cast into concrete structure, have exterior connected supply-air ducts and exhaust ducts insulated to not less than RSI 0.75 (R 4.25) and shall have an effective vapour barrier,
h) have balanced HRV supply and exhaust air flows within plus or minus 20 per cent of the actual normal operating exhaust capacity,
i) be labelled with tested supply and exhaust air flows for high and low settings, measured in CFM, and
j) be located in a fully serviceable space that can be readily accessed for replacement or maintenance, and
i) designed and installed to operate with an acceptable level of weather and freeze protection if not within a conditioned space, and
ii) in a *building* containing not more than two primary *dwelling units* and their contained *ancillary residential units*, be within a conditioned space and provided with direct access from at least one of the *dwelling units* that it serves.

4) In a *building* required to comply with this Article, the HRV system contractor or installer shall provide a completed Mechanical Ventilation Checklist to the Chief Building Official.

5) In a *building* required to comply with this Article, a contractor trained in the installation of energy recovery ventilators (ERV) may install an ERV in lieu of a heat recovery ventilator (HRV).

10.2.2.18. Solar Ready Pipe Run

1) In a *building* required to comply with this Article, a solar ready pipe chase, consisting of at least two 50 mm PVC pipes, capped at both ends and having at least a 20° angle measured above the horizontal level, shall extend from a location near the service water heater, to the attic space.

10.2.2.19. Solar Photovoltaic Ready Pipe Run

1) In a *building* required to comply with this Article, a solar ready pipe chase, consisting of at least one 25 mm pipe or liquid tight flexible electrical conduit or electrical metallic tubing capped at both ends and having at least a 20° angle measured above the horizontal level, shall extend from a location near the electrical panel, to the attic space.

10.2.2.20. Passive House Planning Package (PHPP), EnerGuide, or Other Energy Documentation

1) In a *building* required to comply with this Article, at the time of *permit* application, and at the time of final inspection, the owner shall provide to the Chief Building Official *acceptable* documentation, in the form of
a) a PHPP file from a Certified Passive House Consultant or Designer, or
b) an EnerGuide Rating System Audit, or
c) for *buildings* ineligible for an EnerGuide Rating System Audit, a Hot2000 file modelled in general mode and using the same baseload assumptions as Energuide for New Homes mode, or equivalent energy modelling documentation, *acceptable* to the Chief Building Official.

2) In a *building* required to comply with this article, at the time of mid-construction inspection, the owner shall provide to the Chief Building Official *acceptable* documentation, in the form of,
a) a mid-construction checklist
b) a blower door test result that achieves an *acceptable* level of performance

3) In a *building* required to comply with this Article, and where a *one family dwelling* or *two family dwelling*, with or without *ancillary residential units*, contains *conditioned space* of more than 325 m^2, including *suites* that are not strata titled, the owner shall

a) provide a calculation utilizing the EnerGuide rating system to demonstrate that the proposed home has a greenhouse gas (GHG) footprint that is no more than the greenhouse gas (GHG) footprint of a 325 m^2 home built to the minimum standards in the Building Bylaw, and

b) meet the requirements of the modeling guidelines for large homes.

10.2.2.21. Building and Dwelling Unit Airtightness Testing

1) In a *building* required to comply with this Article, the *building* and *dwelling units* shall be tested for airtightness in accordance with

a) ASTM E 779, Standard Test Method for Determining Air Leakage Rate by Fan Pressurization,

b) USACE Version 3, Air Leakage Test Protocol for Building Envelopes, or

c) airtightness protocol recognized by Natural Resources Canada for use in homes and buildings labeled under the EnerGuide for New Homes program.

2) A *building* required to comply with this Article shall have, at time of final inspection, maximum tested air leakage rates in conformance with Table 10.2.2.21., or sealed to the satisfaction of the Chief Building Official.

Table 10.2.2.21.
Maximum Tested Air Leakage Rates
Forming part of Sentence 10.2.2.21.(2)

Building Classification	Maximum Tested Air Leakage Rate
Buildings, excluding *1 or 2 Family Dwellings* and ground-oriented *dwelling units*	2.03 L/s/m² at 75 pascals
Ground-oriented *dwelling units*	3.5 air changes per hour at 50 pascals
Suites in *multi-family* buildings	1.23 L/s/m² at 50 pascals
Laneway houses and subsidiary conditioned suites less than 110 square meters floor area	Normalized leakage area of 2.1 cm2/m2 @ 10 Pa

10.2.2.22. System Requirements for Heating within Exterior Spaces

(See Note A-10.2.2.22.)

1) Any space heating or occupant heating within an exterior space associated with a *building* shall comply with the requirements of this Article.

2) The design and/or installation of space heating or occupant heating systems within exterior spaces shall be limited to spaces directly served by licensed beverage establishments or licensed food establishments.

3) Any exterior space designed with a heating system and directly served by a licensed beverage establishment or a licensed food establishment, shall prioritize the heating system design in the following order:

a) In-slab or in-floor radiant heat, using non fossil fuel or low-carbon system,

b) Electric fixed infrared radiant heat with metal-sheath element,

c) Heated seating, using non fossil fuel or low-carbon system,

d) Non-electric radiant heat using non fossil fuel system.

4) In spaces required to comply with Sentence (2), the design of exterior space heating or occupant heating systems shall comply with the following, as applicable,

a) in-slab or in-floor radiant heat system not exceeding 15W/ft^2 and incorporating zone-based controls interconnected with a centralized automatic control system with independent zone management,

b) electric radiant heat system not exceeding 18W/ft^2 and incorporating unit-based or zone-based controls, interconnected with a centralized automatic control system with independent unit or zone management,

c) heated seating system not exceeding 20W per seat and incorporating zone-based controls, interconnected with

i) individual seat shutoff, or

ii) a centralized automatic control system with independent zone management, and

d) non-electric and non-fossil fuel radiant heat system not exceeding 18W/ft^2 and incorporating unit-based controls interconnected with a centralized automatic control system with independent zone management.

Table 10.2.2.22.A
Exterior Space or Occupant Heating System Design Requirements
Forming a part of 10.2.2.22.

System Type	Maximum output	Control type	Management Requirements
In-slab or in-floor radiant heat	15 W/ft^2	Centralized automatic control system	Independent zone management
Electric radiant heat	18 W/ft^2	Centralized automatic control system	Independent unit or zone management
Heated seating	20 W per seat	Centralized automatic control system	Individual seat heater shutoff and independent zone management
Non-electric and non-fossil fuel radiant heat	18 W/ft^2	Centralized automatic control system	Independent zone management

5) Heating systems designed to sentence (3) shall include

a) an automatic shut-off (ambient temperature sensor - lockout),

b) an automatic shut-off (space temperature sensors – integral/ zone), and

c) an automatic shut-off using programmable timeclock.

6) Heated zones within a zone-based design shall not exceed 4.8 kW per zone.

7) Heating systems designed with overhead radiant systems within a space containing a ceiling or roof of adequate height, shall be designed with circulation fans interconnected to heating mode operations, with an override for independent fan operation.

8) In a space required to comply with sentence (2), any exterior space designed with a combination of systems contained in sentence (3) shall

a) comply with the specific requirements pertaining to each system, without duplication of requirements, and
b) not contain an area where the combined heating exceeds the performance requirement of the least restrictive system.

Section 10.3. Electric Vehicle Charging

10.3.1. Electric Vehicle Charging for Buildings

10.3.1.1. Electrical Service and Capacity

(See Note A-10.3.1.1.)

1) The electrical installations, including the service capacity of the installation, the number and distribution of circuits and receptacles, shall meet the requirements of the "Electrical Safety Regulation."

2) Where the requirements of section 4.14.1(a) of the Parking By-Law would cause the *dwelling unit* calculated load to exceed 200 A in *building* containing not more than 2 primary *dwelling units* only, with or without ancillary residential suites, the installation of an energized outlet for Level 2 charging may be omitted provided that a minimum nominal trade size of 21 raceway supplied with pull string leading from the *dwelling unit* panelboard to an electrical outlet box is installed in the *storage garage* or carport and is labelled to identify its intended use with the *electric vehicle supply equipment.*

3) Where an *electric vehicle energy management system* is implemented, *Chief Building Official* may specify a minimum performance standard to ensure a sufficient rate of electric vehicle charging."

10.4. Objectives and Functional Statements

10.4.1. Objectives and Functional Statements

10.4.1.1. Attribution to Acceptable Solutions

1) For the purposes of compliance with this By-law as required in Clause 1.2.1.1.(1)(b) of Division A of Division A, the objectives and functional statements attributed to the acceptable solutions in this Part shall be the objectives and functional statements listed in Table 10.4.1.1. (See Note A-1.1.1.2.(1) of Division A.)

Table 10.4.1.1.

Table 10.4.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 10
Forming part of Sentence 10.4.1.1.(1)

Acceptable Solutions	Functional Statements and Objectives[1]
10.2.2.2. ANSI/ASHRAE/IESNA 90.1	
(1)	[F85, F86-OE1]
10.2.2.3. National Energy Code of Canada for Buildings	
(1)	[F85, F86-OE1]
10.2.2.5. Building Energy and Emissions Performance	
(1)	[F85, F86-OE1]
(2)	[F85, F86-OE1]
10.2.2.6. Building Envelope Opaque Elements	
(1)	[F85-OE1]
(2)	[F85-OE1]
10.2.2.7. Windows, Glass Doors and Skylights	
(1)	[F85-OE1]
10.2.2.8. Building Envelope Vestibules	
(1)	[F85-OE1]
10.2.2.9. Sub-metering in Buildings	
(1)	[F86, OE1]
(2)	[F86, OE1]
10.2.2.10. Lighting Controls in Residential Buildings	
(1)	[F86, OE1]
10.2.2.11. Hot Water Tank Piping	
(1)	[F85-OE1]
(2)	[F85, F86-OE1]
(3)	[F100-OE1]
10.2.2.12. Domestic Gas-Heated Hot Water Heaters	

(1)	[F86-OE1]
10.2.2.13. Domestic Gas-Heated Boilers	
(1)	[F86-OE1]
10.2.2.14. Domestic Gas-Heated Furnaces	
(1)	[F86-OE1]
10.2.2.15. Domestic Gas-Fired Fireplaces	
(1)	[F86-OE1]
	[F41, F44-OS3.4]
	[F44-OH1.1]
10.2.2.16. Domestic Wood Burning Heating Appliances	
(1)	[F86-OE1]
	[F44-OS3.4]
	[F44-OH1.1]
10.2.2.17. Domestic Heat Recovery Ventilators	
(1)	[F85-OE1]
(2)	[F85-OE1]
10.2.2.20. Passive House Planning Package (PHPP), EnerGuide, or Other Energy Documentation	
(1)	[F85-OE1]
10.2.2.21. Building and Dwelling Unit Airtightness Testing	
(1)	[F85-OE1]
(2)	[F85-OE1]
10.3.1.1. Electrical Service and Capacity	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F81-OP1.2]
(3)	[F41-OE1]

Notes to Part 10
Energy and Water Efficiency

A-10.2.1.1.(4) Building or Independent Parts Thereof
The intention of sentence (4), for the purposes of Part 10, is to recognize that multiple independent structures atop a parkade, for example, can and should have their respective energy and emissions performances evaluated independently, both during design as well as operationally throughout their respective lifespans. The intention is to prevent the performance assessment of one independent structure from effecting the performance assessment of any other, thus eliminating the ability to trade-off energy and/or emissions performance(s) between independent structures.

A-10.2.1.2.(1)(a) If designing to Passive House then contact the Office of the CBO for potential recognition as being compliant with Article 10.2.1.2., where buildings and major occupancies designed and constructed to conform to the certification criteria for the Passive House Standard, may, at the discretion of the CBO, be deemed to comply with Article 10.2.1.2. provided the design's energy model is

a) version 9 or newer of the Passive House Planning Package, and
b) prepared by a Certified Passive House Designer, or Certified Passive House Consultant.

A-10.2.1.6.(1) Subsidiary Structures with Conditioned Space
The intention of this wording is to allow separate ancillary structures such as garages or workshops, with conditioned space(s), to be constructed to the same requirements of a residential *building* with not more than 2 principal *dwelling units* rather than another standard such as ASHRAE 90.1, NECB, or ZEPB (10.2.2.5.) requirements that may be triggered based on use. Conditioned space is considered to be the alteration of interior space temperature, through the provision of heating or cooling.

A-10.2.2.5.(4) Passive House (PER)
Exceedances of the published Primary Energy Renewable (PER) criterion of the Passive House Standard may be accepted as complying with this Sentence where written approval has been provided by the Passive House Institute, or where additional energy efficiency measures have been included to the satisfaction of the Chief Building Official.

A-10.2.2.6.Calculating the Effective Thermal Resistance of Building Envelope Assemblies.
The general theory of heat transfer is based on the concept of the thermal transmittance through an element over a given surface area under the temperature difference across the element.

To calculate effective thermal resistance, contributions from all portions of an assembly including heat flow through studs and insulation, must be taken into account because the same insulation product (nominal insulation value) can produce different effective thermal resistance values in different framing configurations. The resulting effective thermal resistance of an assembly also depends on the thermal properties and thickness of the building materials used and their respective location.

The following paragraphs provide the calculations to determine the effective thermal resistance values for certain assemblies and the thermal characteristics of common building materials.

<u>Calculating the Effective Thermal Resistance of an Assembly with Continuous Insulation:
Isothermal-Planes Method</u>

To calculate the effective thermal resistance of a building envelope assembly containing only continuous materials – for example, a fully insulated floor slab – simply add up the RSI values for each material. This procedure is described as the “isothermal-planes method” in the “ASHRAE Handbook – Fundamentals.”

Calculating the Effective Thermal Resistance of a Wood-frame Assembly: Isothermal-Planes and Parallel-Path Flow Methods

To calculate the effective thermal resistance of a building envelope assembly containing wood framing, RSI_{eff}, add up the results of the following calculations:

A. calculate the effective thermal resistance of all layers with continuous materials using the isothermal-planes method, and

B. calculate the effective thermal resistance of the framing portion, $RSI_{parallel}$, using the following equation, which is taken from the parallel-path flow method described in the “ASHRAE Handbook – Fundamentals”:

$$RSI_{parallel} = \frac{100}{\frac{\%\ \text{area of framing}}{RSI_F} + \frac{\%\ \text{area of cavity}}{RSI_C}}$$

where

RSI_F = thermal resistance of the framing member,

RSI_C = thermal resistance of the cavity (usually filled with insulation),

% area of framing = value between 0 and 100, and

% area of cavity = value between 0 and 100.

Calculating the Effective Thermal Resistance of a Steel-frame Assembly

The parallel-path flow method described above for wood-frame assemblies involves simple one-dimensional heat flow calculations based on two assumptions:

- that the heat flow through the thermal bridge (the stud) is parallel to the heat flow through the insulation, and
- that the temperature at each plane is constant.

Tests performed on steel-frame walls have shown that neither of these assumptions properly represents the highly two-dimensional heat flow that actually occurs. The difference between what is assumed and what actually occurs is even more significant in steel-frame assemblies. Designers should consider the potential discrepancies in such assemblies and include them as part of their evaluation and energy models.

Calculating Gross Wall Area

Where the structure of the lowest floor and rim joist assembly is above the finished ground level or where the above-grade portion of foundation walls separates conditioned space from unconditioned space, they should be included in the calculation of gross wall area. Figure A-10.2.2.6.-A shows the intended measurements for the most common type of housing construction.

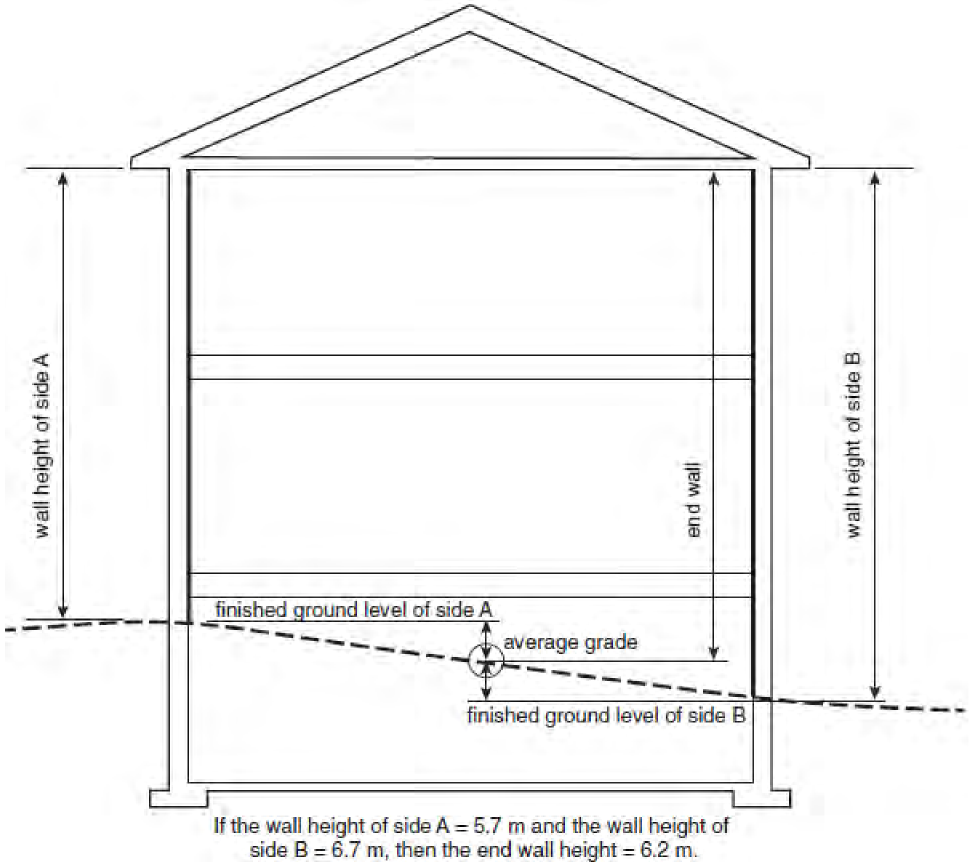
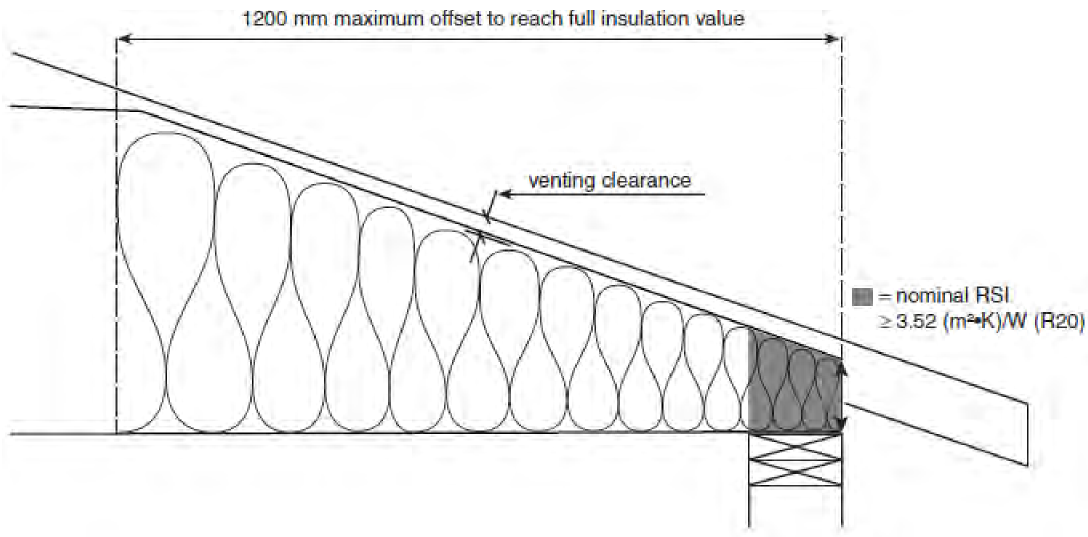


Figure A-10.2.2.6.-A
Example of interior wall height to be used in the calculation of gross wall area

Reduced Effective Thermal Resistance Near the Eaves of Sloped Roofs~~.~~
Minimum thermal resistance values for attic-type roofs are significantly higher than those for walls. The exemption in Note (1) of T-10.2.2.6. recognizes that the effective thermal resistance of a ceiling below an attic near its perimeter will be affected by roof slope, truss design and required ventilation of the attic space. It is assumed that the thickness of the insulation will be increased as the roof slope increases until there is enough space to allow for the installation of the full thickness of insulation required.

Figure A-10.2.2.6.-B
Area of ceiling assemblies in attics permitted to have reduced thermal resistance



A-10.2.2.7.(3) Building Envelope Windows, Skylights, Doors and Other Glazed Products

There are three compliance paths ('A' to 'C') available for fenestration products to comply with the energy performance requirements in Article 10.2.2.7. General guidelines are provided first, followed by the details of each compliance path.

General Requirements for Labels On Factory-Glazed Products

The U-value (either IP or SI) labeling and verification requirements for windows, doors, and skylights in British Columbia are stipulated in the Energy Efficiency Standards Regulation of the BC Energy Efficiency Act.

Labels bear the mark of a third-party verifier and follow NFRC 100-2010 or CSA A440.2-14 standards. Each product shall bear two labels: a removable "temporary" label indicating the product U-value, and a non-removable "permanent" marking or label identifying the verification entity, the product line and the manufacturer.

The organizations that verify U-values according to these standards require these labels to be applied at the factory. They do not permit labels to be applied at the jobsite without prior authorization of the verifier.

The U-value on a label is reported to two decimal places. To determine compliance, the U-value is rounded to one decimal place; for example: a USI-value of U 1.44 would be rounded to USI 1.4 and a USI-value of USI 1.45 would be rounded to USI 1.5.

General Requirements for Simulated U-value Reports

Products may comply with the By-law under a "flexibility provision" that demonstrates compliance by means of a simulated U-value report accompanied by supporting documentation. This provision provides a path by which a designer can provide “suitable documentation” of U-values for products that cannot be labeled because they are outside the scope of existing energy performance certification programs, and for imported products that do not yet have U-values determined using NFRC 100 or CSA A440.2 methods.

An electronic copy of the report and description of the chosen compliance path should be provided to the Building Official prior to sheathing inspection. A paper copy of the report must be present on-site for the Building Official at time of sheathing inspection.

Simulation reports must include the following:

1) A cover letter on the professional’s letterhead that includes:

a) the professional’s identity and contact information.

b) the street addresse(s) of the building.

c) the U-values (reported to two decimal places) for each product type, at its standard size as identified in NFRC 100 or CSA A440.2, at the actual project size, or at an average size product, depending on the compliance option.

d) verification by the registered professional that the information provided in the energy performance certification and accompanying documentation supports the U-value of the fenestration assembly or assemblies identified in the report.

e) the name, address and contact information of the fenestration product supplier(s).

f) the name, address and contact information of the glass supplier(s), if different from the fenestration product supplier(s).

g) the name, address and contact information of any individuals or firms that carried out energy performance simulations, if different from the registered professional.

h) a complete list of the supporting documentation attached to the letter.

i) the registered professional’s seal and signature.

2) An attached documentation package that includes:

a) a list of each fenestration product type, quantity, size, area, description and U-value.

b) the sizes and configurations of the simulated products as shown by frame elevations and/or shop drawings, keyed to the list.

c) a table of the area-weighting calculations performed to determine the overall average U-value of all products using Method 1 or Method 2, of Option 2 of Compliance Path C, when applicable.

d) a description of each framing system used, including manufacturer name, series, and model numbers, as well as frame material and any internal reinforcing used.

e) a complete description of the glazing, including overall glass thickness, number of panes, pane thicknesses, gap widths, low-E coating manufacturer and type, low-E coating emissivity, and surfaces to which coatings are applied, type of gap fill with percentages of inert gas, complete description of spacer by make, series, and model, and its constituent materials, and insulating glass edge sealant materials.

f) NFRC or CSA A440.2 certified test data for each system, or isotherms for each unique framing member used in each system covered by the letter, (heads, sills, jambs, mullions) as well as all reinforcing metal in mullions and perimeter frames.

Compliance Path ‘A’ (Prescriptive U-value compliance)

Compliance is demonstrated by means of verifier labels, affixed to factory-glazed products at the manufacturing location in which each individual fenestration product has a compliant U-value. Compliance is achieved if each product meets the USI-value requirements required by Article 10.2.2.7., at its standard size as identified in NFRC 100 or CSA A440.2.

When one or more products exceed the applicable USI-value in Table 10.2.2.7.(1), compliance Paths B or C may be employed.

Compliance Path ‘B’ (Labeled / Tested U-value area-weighted average compliance)

Compliance Path ‘B’ is intended for projects in which all products have U-values simulated at NFRC standard sizes.

Compliance path B requires area-weighting calculations but does not require actual size or project-specific simulation. When one or more products within Table 10.2.2.7.(1) exceed the applicable USI-value , compliance may be demonstrated by calculating the overall average USI-value by means of a tabulated USI x A reporting format. In such a table, the USI-values for the standard size of each product are to be multiplied by the area of the product to determine the average area weighted USI-value of all the products.

Under this option, standard size U-values from test and simulation reports from accredited laboratories may be used for unlabeled products. The U-value report with area-weighting calculations shall be submitted under the seal of a registered professional and may be subject to independent review at the discretion of city staff.

$$Overall\ U\ value = \frac{\Sigma U_1 A_1 \ + \cdots U_n A_n}{Total\ Area}$$

The area-weighting report shall include documentation of verified U-values by means of label reproductions or attached laboratory simulation reports. In the case of NFRC certified products, CPD numbers may be used in place of label reproductions.

Compliance Path 'C' (Simulated U-value compliance)

Compliance path 'C' is intended for projects that use products that cannot demonstrate compliance at standard size by means of labels or accredited laboratory test/simulation reports. Such products include:

- site glazed windows, doors,
- imported windows and doors not previously tested in Canada,
- curtainwalls and sloped glazing assemblies, and
- factory glazed curtainwalls and window wall assemblies.

Under this compliance path qualified professionals perform simulations for each Individual Product simulated in accordance with NFRC 100 procedures at the size and configuration defined in NFRC 100 Table 4-3, including the normative table footnotes. Individual Products are defined in NFRC 100 and may be grouped according to NFRC 100 Grouping Rules. Products that require metal reinforcing at project sizes shall be simulated with metal reinforcing. U-values may be reported using one of the following options:

Option 1 - All products conform to Table 10.2.2.7.(1) at standard sizes.

If all products are found to have USI-values that conform to Table 10.2.2.7.(1) at sizes in NFRC 100 Table 4-3, the standard size USI-values may be reported to demonstrate compliance with Article 10.2.2.7.

Option 2 - One or more products do not conform to Table 10.2.2.7.(1) at standard sizes.

Area-weighting the USI-values of products within a U-value group at actual project sizes may be employed to demonstrate compliance for that U-value group.

To comply with Option 2, area-weighted average USI-values may be computed using one of two methods:

Method 1 USI x A table of all products within a U-value group, tabulating frame size, frame area and USI-value for each individual product to compute an overall area-weighted average for all products within the U-value group.

Method 2 USI x A table of USI-values for each individual product at its average project frame size.

$$Overall\ U\ value = \frac{\Sigma U_{avg\,(1)} A_{System\ 1} + \cdots U_{avg\,(n)} A_{System\ n}}{Total\ Area}$$

Average project frame sizes shall be determined as follows:

1) Average frame sizes shall be determined for each individual product.

2) For fixed windows, the average frame size shall be based on averaging the width and height of all fixed daylight opening sizes for the fixed product type.

3) For curtain wall framing at single storey height, the average frame size shall be based on averaging the width and height of all fixed daylight opening sizes for the Window Wall product type.

4) For single panel operable windows and swinging doors, the average frame size shall be the average of all single panel operable product frame sizes of the same operator type.

5) For multiple panel side hinged products (swinging doors, folding doors), the average frame size shall be based on averaging the width and height of all panel sizes for the Swinging Door with Frame product type.

6) For sliding doors, the average frame size and number of panels will depend on the number of sliding door tracks. (The fixed lite of a sliding door shall be considered a panel.)

a) For two-track sliding doors, a two-panel door configuration shall be simulated having a frame size shall be based on two average size panels.

b) For three-track sliding doors, a three-track, three-panel door configuration shall be simulated having a frame size based on three average size panels.

c) For four-track sliding doors, a four-track, four-panel door configuration shall be simulated having a frame size based on four average size panels. (Etc.)

d) Simulations shall include two jambs, head and sill simulations with the glass in each panel position, and one interlock for each panel-panel joint of the configuration.

7) For individual unit (single lite) skylights, the average frame size shall be the average of all frame sizes of the same product type.

8) For skylights with more than one lite, the average frame size shall be based on averaging the width and height of all daylight opening sizes for the Sloped Glazing product type at the solarium-sunroom configuration in NFRC 100 Table 4-3 Note 3.

A-10.2.2.8 Vestibules

The intention of the vestibule requirements within 10.2.2.8. are to recognize that vestibules are breeches within a building's envelope and are the last line of defense against the interaction between a building's interior conditioned space and the ambient conditions. The vestibule design requirements are intended to minimize the transference of air and associated energy properties through the opening of these breeches, with or without the assistance of pressure differentials from internal sources such as stack effect or elevator operation, or external pressures such as wind load. Vestibules are therefore to be enclosed spaces without direct access by stairwells and elevators.

Specified distances between interior and exterior vestibule doors support typical daily operation. These specified minimum separation distances are to be deemed the vestibule's maximum separation distances as well, however, under circumstances deemed problematic by the CBO, these maximum distances may be extended by 30cm increments until the design issue is resolved. For example, a 7 foot minimum spacing may not be possible due to interference from a structural column, in which case an application may be requested for an 8 foot separation. No request for a 9 foot separation will be considered without review of the 7 foot and 8 foot separation scenarios.

A-10.2.2.10 Exterior Lighting in Residential Buildings

10.2.2.10.(1)(b) Master Switch The objective is to require a master switch that will permit non-essential lighting to be turned off when an occupant leaves the premises. As this was only intended to consider residential portions of a building, it is considered acceptable to consider each portion of the building structure located above the parkade slab constructed to Article 3.2.1.2. on an individual basis given that the cost-effectiveness of such energy saving features would not be as significant for smaller structures with proportionally larger exterior wall and roof surface areas relative to their volume.

10.2.2.10.(2) Exterior Lighting A growing body of evidence exists that identifies that excessive amounts of nighttime lighting (frequently referred to as light pollution) may be potentially harmful to the environment and to human wellbeing. Poorly controlled night time lighting in urbanized areas has been widely documented to have significant effects on the environment, such as increased skyglow, and physiological and behavioral changes to individual organisms. Research suggests that excessive nighttime lighting may be detrimental to human health.

Consequently, Sentences 10.2.2.10.(2) attempts to limit the quantity and quality of exterior lighting of buildings to reduce the impact and consequences of external lighting. Interior lighting emitted through glazed openings is also a concern, but this is largely dependent upon human activity, and it is not presently considered as part of these requirements. Nonetheless, it can be seen that conceptually this would also have similar effect as exterior lighting, so an effort should be made to minimize the potential for lighting trespass where possible.

The key components of Sentence 10.2.2.10.(2) requirements are the requirements for appropriate lighting fixtures that eliminate the upwards emission of light, and cast more of the illumination produced across the intended surfaces. Horizontal emission of lighting across the property line is more challenging due to the varying heights of a given building, but measures should be taken to reduce the potential and extent of lighting trespass to the limits specified. Additionally, the reflectance of adjacent surfaces that may be illuminated must also be considered as these also contribute to the total lighting emitted into adjacent properties. The orientation, reflectance, and illumination of the adjacent surfaces should be evaluated to limit backscatter or unintended reflectance.

To increase the likelihood of meeting the requirements, designers opt to

- Choose light fixtures that minimize backlight, uplight, and glare (BUG). Light fixtures with a BUG rating of UO are optimal.

- Choose luminaires with the lowest possible intensity for the task needed
- Consider warmer tones of 2500-3000K to reduce impact. A practical maximum temperature is 4000K.

10.2.2.10.(3) External Illumination Understanding that there may be periodic needs to provide external illumination, the requirements of 10.2.2.10.(3) serve to exempt lighting specifically intended to enhance security, safety and improve visibility for limited periods of time.

A-10.2.2.15. Gas Fireplaces

Interior and exterior fireplaces connected to building services are to be included as part of the building for the purposes of meeting the energy targets of Part 10 of the Building By-law. The building performance model is to incorporate such features per the requirements of the City of Vancouver Modelling Guidelines.

A-10.2.2.17. Heat Recovery in Dwelling Units.

Whereas Section 9.32. addresses the effectiveness of mechanical ventilation systems in dwelling units from a health and safety perspective, Article 10.2.2.17. is concerned with their functioning from an energy efficiency perspective.

The requirements of Subsection 9.32.3. can be met using one of several types of ventilation equipment, among them heat-recovery ventilators (HRVs), which are typically the system of choice in cases where heat recovery from the exhaust component of the ventilation system is required. As such, Article 10.2.2.17. should be read in conjunction with the provisions in Subsection 9.32.3. that deal with HRVs.

Efficiency of Heat-Recovery Ventilators (HRVs)~~.~~

HRVs are required to be tested in conformance with CAN/CSA-C439, “Rating the Performance of Heat/Energy-Recovery Ventilators,” under different conditions to obtain a rating.

The performance of an HRV product and its compliance with Article 10.2.2.17. can be verified using the sensible heat recovery at the 0°C test station (i.e. location where the temperature is measured) published in the manufacturer’s literature or in product directories, such as HVI’s Certified Home Ventilating Products Directory. Any energy model output must also demonstrate an SRE (%) that meets or exceeds the requirement of this By-law.

The rating of HRVs also depends on the flow rate used during testing. Therefore, the minimum flow rate required in Section 9.32. needs to be taken into consideration when selecting an HRV product.

Servicability of Heat Recovery Ventilators

Clause 10.2.2.17.(3)(j) identifies that heat recovery ventilators and similar devices form an integral part of the building ventilation and requires inspection,maintenance, repair, and cleaning from time to time to ensure that the building air quality remains within the original design parameters. In order to perform such regular maintenance or more extensive maintenance in the event of the failure of an HRV or similar device, the mechanical components of an Heat Recovery Ventilator are to be located and installed so as to provide a worker with adequate space and access to unit to conduct maintenance on the unite or replace it. Unusually tight, distant, or convoluted access may lead to regular maintenance being skipped, or lead to other significant challenges or costs for services and replacement.

A-10.2.2.21. Building Airtightness Testing Requirements

The intent of this testing is to quantify the airtightness level of the air barrier system, not airtightness of the building at in-service operating conditions

<u>Air Barrier Assembly Testing</u>

Air barrier assemblies are subjected to structural loading due to mechanical systems, wind pressure and stack effect. In addition, they may be affected by physical degradation resulting from thermal and structural movement. Where local climatic data and building conditions exceed these limits, the maximum building height and sustained 1-in-50 hourly wind pressure values are permitted to be extrapolated beyond the listed ranges to apply to any building height, in any location, provided the air barrier assembly in question has been tested to the specific building site and design parameters.

<u>Air Barrier System Approaches</u>

For an air barrier system to be effective, all critical junctions and penetrations addressed in must be sealed using either an interior or exterior air barrier approach or a combination of both.

Where the air barrier and vapour barrier functions are provided by the same layer, it must be installed toward the warm (in winter) side of the assembly or, in the case of mass walls such as those made of cast-in place concrete, provide resistance to air leakage through much of the thickness of the assembly. Where these functions are provided by separate elements, the vapour barrier is required to be installed toward the interior of the assembly while the airtight element can be installed toward the interior or exterior depending on its vapour permeance.

A-10.2.2.22 System Requirements for Heating within Exterior Spaces.

The use of the terms “licensed beverage establishment” and “licensed food establishment” are meant to clarify how the allowance of 10.2.2.22 is limited to business-licensed establishments where the primary use is the consumption of food or beverages while seated.

The intention of Article 10.2.2.22 is not to require exterior heating, rather it is meant to minimize energy use and emissions when choosing the option of providing some level of occupant heating within an exterior space. The City of Vancouver recognizes a number of options however the prioritization of these options must also take into account their viability with existing and potential site conditions. Sentence 10.2.2.22.(2) is intended to be understood as “first consider the viability of option (a), either in whole or in part, then consider the viability of option (b) in whole or in part, then consider option (c)”, and so on. If the most viable solution is a mixed system then this would be encouraged, but if the best, most viable solution is a single option then proceed with that option. Designers wishing to consider a unique system, such as using waste heat, are encouraged to do so and should contact the CBO’s office if any customized system design does not easily fall into the options provided.

The control items within sentence 10.2.2.22.(4) are meant to assist with the efficient operation of the heating system. It is important to note that exterior spaces are not intended to operate as if they are interior conditioned spaces. The maximum recommended temperature for exterior spaces with heating systems is 18C, and so the ambient and space temperature sensors should be set accordingly. The ambient sensor is intended to prevent the heating system from operating during warm weather while the space temperature sensors are meant to accommodate naturally occurring temperature variations across adjacent zones (direct sun vs shade), thus allowing independent zone control operation. The space temperature sensors may override the ambient sensor to prevent zones from either overheating or over cooling. The timeclock will satisfy the mandatory requirement of not operating exterior heating systems after the establishment’s hours of operation. At no point should the controls system automatically activate exterior space heating.

Zoned systems are most likely to be electric radiant and so are limited to 4,800 W (240V @ 20 amp). At the maximum allowable intensity of 18 W/ft^2 this would equate to 266 ft^2 per zone, however less energy intensive systems would be allowed to cover a larger area, for example, a 15 W/ft^2 system would allow 320 ft^2 per zone.

For multi-system design scenarios, sentence 10.2.2.22.(6) is intended to clarify the options and opportunities this may provide. The total energy intensity of a combined system shall not exceed the highest allowable intensity of the system types involved. Example: where an overhead electric radiant system is allowed to operate at 18 W/ft^2, a combined system of in-slab heating with an overhead radiant system cannot be designed to exceed a combined total operation of 18 W/ft^2. This scenario allows in-slab heating at 8 W/ft^2 while limiting the overhead heating to 10 W/ft^2, or the possibility of 5 W/ft^2 and 13 W/ft^2 respectively. This concept allows one system to be used during warmer weather with the option for a secondary system as a top-up during colder weather.

A-10.3.1.1. Electric Vehicle Charging for Buildings
The Canadian Electrical Code, Part I contains the requirements of electric vehicle charging systems, the requirements of Rule 86-300(2) and (3) recognize the use of load management technologies via the manual transfer or automated control in a branch circuit that supplies the electric vehicle supply equipment load and other loads. This Rule requires that, where the electric vehicle supply equipment load and other loads are installed, only one load can be operated at any one time and the branch circuit must be based on the calculated demand in accordance with Section 8.

All references to the electrical installation including receptacle, supply equipment and rating of voltage and ampere in Article 10.3.1.1. are intended to align with the requirements of SAE AC Level 2 charging requirements, whether in applying load managed solutions or separate branch circuits for each charging point. In addition to the requirements of Article 10.3.1.1., the installation of electric vehicle charging systems and electric vehicle supply equipment must meet the requirements of the Canadian Electrical Code, Part I and the manufacturer’s instructions.

PART 11
EXISTING BUILDINGS

Section 11.1. General

11.1.1. Application

11.1.1.1. Scope

1) The scope of this Part shall be as described in Subsection 1.3.3. of Division A.

11.1.1.2. Application

1) The application of this Part shall be as described in Subsection 1.3.3. of Division A.

11.1.2. DEFINITIONS

11.1.2.1. Defined Terms

1) Words that appear in italics are defined in Article 1.4.1.2. of Division A.

Section 11.2. Upgrade application

11.2.1. Upgrade requirements

11.2.1.1. Upgrade objectives

1) An *alteration* to an *existing building* shall trigger upgrading of the *existing building* to meet the following objectives

a) all unsafe *conditions* shall be corrected to an *acceptable* level,

b) all new materials and *construction* work shall comply with this By-law,

c) the *building* shall be upgraded to an *acceptable* level of

i) fire, life and health safety,

ii) structural safety,

iii) non-structural safety,

iv) accessibility for persons with disabilities, and

v) energy and water efficiency,

d) any significant extension of the design life of an *existing building* beyond its original design life shall require upgrading to an *acceptable* level,

e) an *alteration* to an individual *suite* within an *existing building* will not trigger upgrades within any other *suites* except where the *alteration* creates non-conformity with the By-law within such other *suites*, and

f) the level of life safety and *building* performance shall not be decreased below the existing level.

11.2.1.2. General Requirements
(See Note A-11.2.1.2.)

1) Where *construction* of *existing buildings* occurred before the effective date of this By-law, reconstruction or *alteration* of *existing buildings* is not a requirement of this By-law, except as required by Articles 11.2.1.3. to 11.2.1.11. inclusive.

2) Except as permitted by Sentences (3) to (9) , and Articles 11.2.1.3. to 11.2.1.11., where an *alteration* is made to an *existing building*, the *alteration* shall comply with this By-law and the *existing building* shall be

a) upgraded to an *acceptable* level as defined in the *existing building* Upgrade Mechanism Model in Division B Appendix A, except that existing lighting exceeding the Lighting Power Density of ASHRAE 90.1-2016 shall be removed within existing spaces of a *suite* within the scope of a *project*,
b) upgraded to the satisfaction of the *Chief Building Official* where the *owner* demonstrates that the design levels, as defined by the Upgrade Mechanism Model in Division B Appendix A, present a hardship for the *owner,* or
c) upgraded to the satisfaction of the Chief Building Official through an alternative upgrades, that demonstrate equivalent improvement where specific characteristics of the building are intended to be retained.

3) Except as required by Sentence (9) and changes of *major occupancy* in a small *suite*, where an *alteration* does not involve an *addition* or a change in *major occupancy*, further upgrading to an *existing building* is not a requirement of this By-law provided
a) *construction* or a full upgrade of the *building* occurred by means of a *building permit* issued on or after April 1, 2014,
b) all *unsafe conditions* are corrected to the satisfaction of the *Chief Building Official*, and
c) all new work is in compliance with this By-law.

4) Where a voluntary upgrade for fire alarm systems, *sprinkler systems*, *exits*, *accessibility*, seismic work, washrooms or kitchens for *single room accommodations*, energy efficiency or *building* envelope repair is carried out, no further upgrade of the *building* is required except that, where other work is included in the application, the upgrade requirement will only be based on the non-voluntary work proposed.

5) Where *building* envelope repair involves more than 60% of an opaque portion of a *building* face, the *building* envelope on the entire vertical section of that *building* face shall be replaced and upgraded to the thermal resistance and air-tightness requirements of Part 10, except where
a) the scope of work is limited to the replacement of windows
b) the *building* is two *storeys* in *building height* or less and is required to comply with Part 9 per Division A, Article 1.3.3.3., or
c) the *building* face has heritage merit and is required to be retained as part of an approved retention plan.

6) Where a building is altered and includes a *post disaster building* as defined in Table 4.1.2.1., or where there is a major *addition* to a post disaster *building*, the entire *building* shall be upgraded to design upgrade levels F4, S4, N4, A4 and E4 as detailed in the Upgrade Mechanism Model in Division B Appendix A.

7) Where there is a temporary change of major occupancy to an assembly occupancy for an arts and culture indoor event in a building which is classified as Group D offices, Group E retail, Group F Division 2 production or rehearsal studio, wholesale, warehouse, or factory, or Group F Division 2 artist studio without living accommodations, the upgrade requirements shall be based solely on Section 11.6.

8) Where there is a change of *major occupancy* in a *building*, and the aggregate area of the change in *major occupancy* within any 5 year period is greater than 50% of the *building area* in a one *storey building* or greater than 100% of the *building area* in a *building* of more than one *storey*, the entire *building* shall be upgraded to design upgrade levels F4, S4, N4, A4 and E3 as detailed in the Upgrade Mechanism Model in Division B Appendix A except where
a) the change in *major occupancy* is to a single suite and the work does not exceed 5% of the *building area* or more than 100 m^2 in area, or
b) such upgrades are in conflict with an *approved* heritage retention plan.

9) The upgrade requirements for energy efficiency to *existing buildings* shall conform to the upgrade mechanism model in Division B Appendix A for energy efficiency except for
a) *buildings* designed and constructed in conformance with ASHRAE 90.1-2007 or as deemed acceptable to the *Chief Building Official*,
b) *buildings* designed and constructed in conformance with Article 9.25.2.1. Division B of Building By-law No. 9419, and

c) *buildings* where the *alteration* is limited to the upgrade of energy related specific equipment, as listed in Table 11.2.1.2., provided the replacement equipment complies with industry standards for "high efficiency".
d) *multi-family buildings* not more than 3 storeys in *building height* may comply with the energy efficiency upgrade requirements of Table 11.2.1.4.(2)

Table 11.2.1.2.
Energy Related Equipment

Equipment Type	Specific Equipment
Basic *Building* Systems	Boilers
	Furnaces
	Hot Water Tanks
	Lighting Systems
	Energy Reduction Sensors (occupant, light, etc.)
Renewable Energy Systems	Photovoltaic system
	Solar Thermal system
	Biofuel-based Energy system
	Geothermal Heating system
	Geothermal Electric system
	Wave & Tidal Power system
High Performance Energy Systems	Ground Source Heat Pump system
	Air Source Heat Pump system
	Waste Heat Recovery system

11.2.1.3. Sprinkler Installation Requirements for the Addition of Dwelling Units in Multi-family Buildings
(See Note A-11.2.1.3.)
1) Except as provided in Sentence (2) and Sentence 11.2.1.4.(3), where an *alteration* to an *existing building* creates or adds one or more *dwelling units*, the *building* shall be *sprinklered* in conformance with Table 11.2.1.3.
2) Where the *alteration* in Sentence (1) involves the *addition* of existing floor space to an existing *dwelling unit*, and that converted space is greater than 50% of the *floor area* of the original *dwelling unit*, the altered *dwelling unit* shall be considered as a new *dwelling unit* and the *building* shall be *sprinklered* in conformance with Table 11.2.1.3.
3) If sprinklers are required by Table 11.2.1.3., they shall be installed throughout the *storey* on which the new *dwelling unit* is to be located and all *storeys* below the new *dwelling unit*.

Table 11.2.1.3.
Sprinkler Installation Determination Where Dwelling Units are Added

Existing Dwelling Units	New DUs[(1)] Added Over Any 5 year Period[(2)]				
	1	**2-3**	**4-5**	**6**	**>6**
0-1	Spr R[(3)]	Spr R	Spr R	Spr R	Spr R
2-4	-	Spr R	Spr R	Spr R	Spr R
5-10	-	-	Spr R	Spr R	Spr R
11-20	-	-	-	Spr R	Spr R
>20	-	-	-	-	Spr R

Notes to Table 11.2.1.3.
(1) Dwelling Units
(2) The creation of dwelling units over the previous 5 years from the date of the proposed building permit application.
(3) Sprinklers Required.

11.2.1.4. Upgrade Requirements for a Residential Building Containing not more than Two Principal Dwelling Units

1) Except as permitted by Subsection 11.4, an *alteration* or *addition* to a residential *building* containing not more than two principal *dwelling units* shall comply with this By-law, and the existing portions of *building* shall be upgraded to an *acceptable* level as determined by Tables 11.2.1.4.-A, 11.2.1.4.-B, and 11.2.1.4.-C.

Table 11.2.1.4.(1)-A
Fire and Life Safety Upgrade requirements for Residential Buildings containing not more than Two Principal Dwelling Units
Forming part of Sentence 11.2.1.4.(1)

Scope of Work	Smoke Alarms[1]	CO Alarms[2]	Guards[3]	Spatial Separation[4]
Renovation	Y	Y	Y	N
Relocation	Y	Y	Y	Y
Horizontal Addition Floor Area				
up to 25%	Y	Y	Y	N
over 25%	Y	Y	Y	Y
Vertical Addition Floor Area				
up to 25%	Y	Y	Y	N
over 25%	Y	Y	Y	Y

Notes to Table 11.2.1.4.(1)-A:
[1] Smoke Alarms: to be installed in conformance with Subsections 3.2.4. and 9.10.19. as applicable.
[2] CO Alarms: to be installed in conformance with Subsections 6.2.4. and 9.32.4. as applicable.
[3] Guards: all unsafe guards to be upgraded to the satisfaction of the *Chief Building Official*.
[4] Spatial Separation: Spatial separation of the building shall comply with Subsections 3.2.3., 910.14 or 9.10.15. as applicable; or as permitted by Section 11.3.

Table 11.2.1.4.(1)-B
Egress and Exit Upgrade requirements for Residential Buildings containing not more than Two Principal Dwelling Units
Forming part of Sentence 11.2.1.4.(1)

Scope of Work	Means of Egress[1]	Handrails[2]	Exit Exposure[3]	Stair Dimensions[4]	Building Services[5]	Falling Hazards[6]
Renovation	N	Y	N	N	N	N
Relocation	Y	Y	Y	Y	Y	Y
Horizontal Addition Floor Area						
up to 25%	Y	N	N	N	N	Y
over 25%	Y	Y	Y	Y	Y	Y
Vertical Addition Floor Area						
up to 25%	Y	Y	N	N	N	Y
over 25%	Y	Y	Y	Y	Y	Y

Notes to Table 11.2.1.4.(1)-B:
[1] Means of Egress: confirm that access to exit (9.9.9.) and means of escape (9.9.10.) from all floor areas is compliant with regards to travel distance and fire separation (where applicable).
[2] Handrails: all unsafe handrails to be upgraded to the satisfaction of the *Chief Building Official*.
[3] Exit Exposure: Exits to be confirmed to be compliant with regards to exit exposure where applicable.
[4] Stair Dimensions: Existing stairs in means of egress to comply with the dimensional requirements of Subsection 9.8.2.
[5] Building Services: Restrain building service piping, conduit, and *appliances* to resist lateral movement due to earthquake.
[6] Falling hazards: Restrain falling hazards within 3 m of the egress path to resist lateral movement due to earthquake.

Table 11.2.1.4.(1)-C
Floor Area Upgrade Requirements for Residential Buildings containing not more than Two Principal Dwelling Units
Forming part of Sentence 11.2.1.4.(1)

Scope of Work	Flame Spread[1]	Floor Fire Separations[2]	Suite Fire Separations[3]	Lighting & Emergency Lights[4]	Door Hardware[5]
Renovation	N	N	N	N	N
Relocation	Y	Y	Y	Y	Y
Horizontal Addition Floor Area					
up to 25%	N	N	N	N	N
over 25%	Y	Y	Y	Y	Y
Vertical Addition Floor Area					
up to 25%	N	N	N	Y	N
over 25%	Y	Y	Y	Y	Y

Notes to Table 11.2.1.4.(1)-C:
(1) Flame Spread: Exposed wall and ceiling finishes of egress routes to meet the requirements of Subsection 9.10.17. in exits
(2) Floor Fire separations: Floor and occupied roof assemblies to be fire rated per Article 9.10.8.1.
(3) Suite Fire Separations (where applicable): Residential suites to be provided with a fire separation in accordance with Article 9.10.9.14. and Section 9.37.
(4) Lighting & Emergency Lights (where applicable): Lighting and emergency lighting to be provided in means of egress in accordance with Subsection 9.9.12.
(5) Door Hardware: Door hardware within existing floor areas to be made adaptable as per Subsection 3.8.5.

2) Where an *alteration* or *addition* is made to an existing residential building, containing not more than two principal *dwelling units,* the energy efficiency of a the building shall be upgraded to an *acceptable* level in conformance with Table 11.2.1.4.(2)

Table 11.2.1.4.(2)
Energy Efficiency Upgrade Requirements for Residential Buildings containing not more than Two Principal Dwelling Units
Forming part of Sentence 11.2.1.4.(2)

Alteration construction ($) value	EnerGuide Assessment[1]	Air tightness upgrades[2]	Attic and Sloped Roof Insulation[3]	E6 - Upgrade Mechanism Model[4]
≥$20,000	Y	N	N	N
≥$75,000	Y	Y	Y	N

Notes to Table 11.2.1.4.(2):
(1) An EnerGuide Assessment completed within the last 4 years must be submitted, a post-construction assessment must also be completed where the cost of construction exceeds $75,000.
(2) Where EGH>5 air changes per hour, air sealing is required.
(3) Where attic insulation <R12 (2.11RSI), increase to R28 (4.93RSI); where attic insulation ≥R12 (2.11RSI), increase to R40 (7.04RSI); Insulation in existing attics shall not exceed R43.7 (7.7RSI). All flat roof and cathedral ceiling insulation shall be upgraded to ≥R14 (2.47RSI).
(4) Reconstruction is defined in the Upgrade Mechanism Model in Appendix A Division B Part 11. A reconstruction project must meet the Part 10 energy efficiency requirements as per E6 in Table A-11.2.1.2.-C.

3) Where an *alteration* is made to an existing residential *building* containing not more than two principal *dwelling units*, that creates one or more new principal *dwelling units* or increases the size of an existing *dwelling unit*, a *sprinkler system* shall be installed

a) throughout the *building*, where the value of the *alteration* exceeds 50% of the replacement value of the *existing building*, (See Note A-11.2.1.4.(3)(a).)
b) throughout any *storey* on which a new principal *dwelling unit* is created, and all *storeys* below, or
c) throughout any *storey* on which an *alteration* to the *building* increases the aggregate area of an existing *dwelling unit* and the converted space is greater than 50% of the *floor area* of the original *dwelling unit*.

4) Where *building* envelope repair involves more than 60% of an opaque portion of a *building* face, the *building* envelope on the entire vertical section of that *building* face shall be replaced and upgraded to the thermal resistance and air-tightness requirements of Part 10, except where

a) the scope of work is limited to the replacement of windows
b) the *building* is two *storeys* in *building height* or less and is required to comply with Part 9 per Division A, Article 1.3.3.3., or
c) the *building* face has heritage merit and is required to be retained as part of an approved heritage retention plan.

11.2.1.5. Self-contained Separated Spaces
(See Note A-11.2.1.5)

1) Where an *alteration* to a *building* is a self-contained volumetric space that is separated from the remainder of the *building* by a *non-combustible* vertical *fire separation* with a 2 h *fire resistance rating*, the upgrade requirements of this Part do not apply to the remainder of the *building* provided

a) the self-contained volumetric space is upgraded in conformance with this By-law,
b) the self-contained volumetric space does not exit through the remainder of the *building*,
c) the *building area* of the self-contained volumetric space is not larger than 10% of the existing *building area*,
d) a *non-combustible* vertical *fire separation* with a 2h *fire resistance rating* is constructed as a continuous vertical *fire separation* from the *building foundation* to the underside of the roof sheathing, and
e) the self-contained volumetric space does not reduce the existing structural capacity of the *building*.

11.2.1.6. Relocated Buildings

1) Where a *building* is relocated from another municipality to the *City*, from another lot within the *City* or within its existing lot, the *building* shall be upgraded to Design Upgrade Levels F4, S4, N4, A4 and E4, as determined by the Upgrade Mechanism Model in Division B Appendix A.

11.2.1.7. Relocated Property Lines

1) Where property lines are relocated closer to a *building*, the *building* shall be upgraded to conform to the spatial requirements, fire department access requirements and *means of egress* requirements of this By-law or the applicant shall demonstrate that the relocated property lines and the *existing building* configuration comply with this By-law.

11.2.1.8. Demolished Buildings

1) Where a *building* is being demolished in whole or in part, the *demolition* work shall conform to the requirements of Part 8 and any part of the *building* that remains after *demolition* shall be upgraded in conformance with Article 11.2.1.2.

11.2.1.9. Damaged Buildings

1) Where a *building* has been damaged, all work necessary to reconstruct the damaged portions of the *building* shall conform to this By-law and the Fire By-law and the remainder of the *building* shall be upgraded in conformance with Article 11.2.1.2.

11.2.1.10. Fire Department Order

1) Where an order issued under the Fire By-law requires upgrading of a *building*, the *Chief Building Official* may allow deviations from this By-law.

11.2.1.11. Specific Upgrade Requirements for Float Homes and Marinas

1) Except as permitted by Sentence (2), where a *marina* is altered, all new work shall comply with Subsection 12.2.2. and the marina shall be upgraded to an acceptable level as determined by the Upgrade Mechanism Model in Division B Appendix A.
2) Except as required by Sentence (3); Sentences 12.2.2.7.(1), and 12.2.2.8.(1) need not apply to a *marina*.
3) Where the total value of the *alteration* to a *marina* exceeds 50% of the value of the *marina* as determined at the application stage for the *alteration*, then the *marina* shall comply with Subsection 12.2.2.
4) Where a *float home* is altered
a) new work shall comply with Subsection 12.2.2. of Division B and this By-law, and
b) the *float home* shall be upgraded to an *acceptable* level in accordance with Article 11.2.1.4.
5) A *marina* shall have an *occupancy* classification as specified in Sentences 12.2.2.1.(4) and (5).

Section 11.3. Alternative Compliance Measures for Existing Conditions to Assist Rehabilitation

11.3.1. APPLICATION

11.3.1.1. Application of Alternative Compliance Measures for Existing Conditions
(See Note A-11.3.1.1.)
1) Except as permitted in Sentence (3), the alternative compliance measures provided in this Section are to be applied to existing conditions only and are not to be applied to new construction (new construction must comply with the requirements of this By-law).
2) Where the *building* is a *heritage building*, the alternative compliance measures in Section 11.5 may be applied to existing conditions.
3) The alternative compliance measures provided in Subsection 11.3.2. do not apply to newly constructed *buildings*.
4) *Alterations* to newly constructed *buildings*, as determined by Sentence (3), shall comply with Parts 1 to 10 of Division B in Book I and Parts 1 to 2 of Division B in Book II.

11.3.1.2. Conditions for Using Alternative Compliance Measures
1) Where a *building* or a portion of a *building* is required to comply with this By-law under Subsection 11.2.1., the provisions contained in this Section may be applied as alternative compliance measures to those requirements contained elsewhere in this By-law, under the conditions specified in Sentences (2) to (7), provided the *building* was originally constructed pursuant to a *building permit* issued prior to July 1, 1994.
2) Except for *additions,* and new *construction*, where Subsection 3.2.2. requires that the *construction* of a *building* be *noncombustible*, the applicable Article in Subsection 11.3.2. may be applied as an alternative provided all of the requirements of the Article have been met.
3) Except for *additions* and new *construction*, where the spatial separation and exposure protection requirements of Subsection 3.2.3. require that the exterior wall *construction* of a *building* to be *noncombustible*, Subsection 11.3.3. may be applied.
4) Where the fire containment measures of a *building* are deficient, Subsections 11.3.4. and 11.3.6. may be used as an alternative.
5) Where the *exits* in a *building* are deficient, Subsections 11.3.5. and 11.3.6. may be used as an alternative.
6) Where a *building* is *sprinklered* throughout, the applicable relaxations of Subsection 11.3.6. may be applied as an alternative.
7) Where a *building* is a *heritage building*, alternate compliance measures as detailed in Section 11.5. may be applied.

11.3.2. CONSTRUCTION AND BUILDING SAFETY ALTERNATIVES

11.3.2.1. Group A1 up to 600 Auditorium Occupants

1) A Group A, Division 1 *occupancy* having an *occupant load* of no more than 600 may be permitted within the *first storey* and second *storey* of a *building* provided the *building* conforms to Sentences (2) and (3).

2) A *building* referred to in Sentence (1) may be of *heavy timber construction or noncombustible construction used singly or in combination*, and

a) floor assemblies shall be *fire separations*

i) with a *fire-resistance rating* not less than 1 h, or

ii) of *heavy timber construction* with a *fire-resistance rating* not less than 1 h, and

b) *loadbearing* walls, columns and arches shall

i) have a *fire-resistance rating* not less than that required for the supported assembly, or

ii) be of *heavy timber construction* with a *fire-resistance rating* not less than 1 h.

3) A *building* referred to in Sentence (1) shall

a) be provided with a fire alarm and detection system conforming to Subsection 3.2.4., notwithstanding any exemptions permitted by Article 3.2.4.1.,

b) be provided with lighting and emergency power systems conforming to Subsection 3.2.7.,

cd) be upgraded to provide all *exit* locations with a maximum travel distance of 22.5 m for *sprinklered buildings* and 15 m for unsprinklered *buildings*,

d) except as permitted in Subsection 11.3.3., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.,

e) be structurally upgraded to the design upgrade level S3 as defined in the Upgrade Mechanism Model in Division B Appendix A,

f) except as permitted in Subsections 11.3.4. and 11.3.6., be upgraded to comply with the fire containment requirements within a *floor area* conforming to this By-law, and

g) except as permitted in Subsections 11.3.5. and 11.3.6. and as required by Clause (d), be upgraded to provide *exit* systems conforming to Section 3.4.

11.3.2.2. Group A1 up to 300 Auditorium Occupants

1) A Group A, Division 1 *occupancy* having an auditorium *occupant load* of no more than 300, may be permitted within the *first storey* and second *storey* of a *building*, provided the *building* conforms to Sentences (2) and (3).

2) A *building* referred to in Sentence (1) may be of *combustible construction* or *noncombustible construction* used singly, or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

c) *loadbearing* walls, columns and arches supporting an assembly shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) A building referred to in Sentence (1) shall

a) be provided with a fire alarm and detection system conforming to Subsection 3.2.4., notwithstanding any exemptions permitted by Article 3.2.4.1.,

b) be provided with lighting and emergency power systems conforming to Subsection 3.2.7.,

c) be upgraded to provide all exit locations with a maximum travel distance of 22.5 m for *sprinklered buildings* and 15 m for unsprinklered *buildings*,

d) except as permitted in Subsection 11.3.3., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.,

e) be structurally upgraded to the design upgrade level S3 as defined in the Upgrade Mechanism Model in Division B Appendix A,

f) except as permitted in Subsections 11.3.4. and 11.3.6., be upgraded to comply with the fire containment requirements within a *floor area* conforming to this By-law, and

g) except as permitted in Subsections 11.3.5. and 11.3.6. and as required by Clause (d), be upgraded to provide *exit* systems conforming to Section 3.4.

11.3.2.3. Group A2 in Building More Than 3 Storeys

1) A Group A, Division 2 *occupancy* may be permitted within the first 3 *storeys* of a *building* which is more than three *storeys* in *building height*, provided the *building* conforms to Sentence (2), and provided

a) where the *occupancy* is located on the third *storey* or where the *building area* exceeds 400 m², the entire *building* shall be *sprinklered* or

b) where the *occupancy* is located on the *first storey* or second *storey*, the *building* shall be *sprinklered* up to and including the *storey* containing the Group A2 *occupancy*.

2) A *building* referred to in Sentence (1) shall conform to Sentence 11.3.2.4.(2).

11.3.2.4. Group A2 Up to 3 Storeys

1) A Group A, Division 2 *occupancy* may be permitted in a *building* no more than three *storeys* in *building height*, provided

a) the *building* conforms to the construction requirements of Sentences (2) and (3), and

b) the entire *building* is *sprinklered*, where

i) the *building area* exceeds 400 m², or

ii) the *occupancy* is located on the third *storey*.

2) A *building* referred to in Sentence (1) may be of *combustible* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min,

b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, except that in a *building* not more than 1 *storey* in *building height*, the *fire-resistance rating* is permitted to be waived provided the roof assembly is constructed as a *fire-retardant-treated wood* roof system conforming to Article 3.1.14.1., and the *building area* is not more than

i) 800 m² if facing one street,

ii) 1 000 m² if facing 2 streets, or

iii) 1 200 m² if facing 3 streets, and

d) loadbearing walls, columns and arches supporting an assembly required to have a fire-resistance rating shall

i) have a fire-resistance rating not less than 45 min, or

ii) be of noncombustible construction.

3) A *building* referred to in Sentence (1) shall

a) be provided with a fire alarm and detection system conforming to Subsection 3.2.4., notwithstanding any exemptions permitted by Article 3.2.4.1.,

b) be provided with lighting and emergency power systems conforming to Subsection 3.2.7.,

c) except as permitted in Subsection 11.3.3., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.,

d) be structurally upgraded to the design upgrade level S3 as defined in the Upgrade Mechanism Model in Division B Appendix A,

e) except as permitted in Subsections 11.3.4. and 11.3.6., be upgraded to comply with the fire containment requirements within a *floor area* conforming to this By-law, and

f) except as permitted in Subsections 11.3.5. and 11.3.6., be upgraded to provide *exit* systems conforming to Section 3.4.

11.3.2.5. Group B2 Ambulatory Occupants

1) A Group B, Division 2 *occupancy* containing only occupants that are capable of walking up or downstairs unaided may be permitted within the first 3 *storeys* of a *building*, provided the entire *building* is *sprinklered* and conforms to Sentences (2) and (3).

2) A *building* referred to in Sentence (1) may be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,
b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, and
c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) A *building* referred to in Sentence (1) shall

a) be provided with a fire alarm and detection system conforming to Subsection 3.2.4. where the *building* contains more than 2 *storeys* including *storeys* below grade or where the *building area* exceeds 250 m^2 regardless of the *occupant load*,
b) be provided with lighting and emergency power systems conforming to Subsection 3.2.7.,
c) except as permitted in Subsection 11.3.3., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.,
d) be structurally upgraded to the design upgrade level S3 as defined in the Upgrade Mechanism Model in Division B Appendix A,
e) except as permitted in Subsections 11.3.4. and 11.3.6., be upgraded to comply with the fire containment requirements within a *floor area* conforming to this By-law, and
f) except as permitted in Subsections 11.3.5. and 11.3.6., be upgraded to provide *exit* systems conforming to Section 3.4.

11.3.2.6. Group B2 Non-ambulatory Occupants

1) A Group B, Division 2, non-ambulatory *occupancy* may be permitted only within a *storey* of a *building* which has direct or ramped access to ground level, provided the entire *building* is *sprinklered* and conforms to Sentences (2) and (3).

2) A *building* referred to in Sentence (1) may be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,
b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, and
c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) A *building* referred to in Sentence (1) shall

a) be provided with a fire alarm and detection system conforming to Subsection 3.2.4.,
b) be provided with lighting and emergency power systems conforming to Subsection 3.2.7.,
c) except as permitted in Subsection 11.3.3., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.,
d) be structurally upgraded to the design upgrade level S3 as defined in the Upgrade Mechanism Model in Division B Appendix A,
e) except as permitted in Subsections 11.3.4. and 11.3.6., be upgraded to comply with the fire containment requirements within a *floor area* conforming to this By-law, and
f) except as permitted in Subsections 11.3.5. and 11.3.6., be upgraded to provide *exit* systems conforming to Section 3.4.

11.3.2.7. Group C More Than 3 Storeys

1) A Group C *occupancy* may be permitted in a *building* more than 3 *storeys* in *building height* provided the entire *building* is *sprinklered* and conforms to Sentences (2) to (4).

2) A *building* referred to in Sentence (1) shall have a maximum height of less than 18 m measured between *grade* and the uppermost floor level of the top *storey*,

3) A *building* referred to in Sentence (1) may be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,
b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 1 h, and
c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

4) A *building* referred to in Sentence (1) shall
a) be provided with a fire alarm and detection system conforming to Subsection 3.2.4.,
b) be provided with lighting and emergency power systems conforming to Subsection 3.2.7.,
c) except as permitted in Subsection 11.3.3., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.,
d) be structurally upgraded to the design upgrade level S3 as defined in the Upgrade Mechanism Model in Division B Appendix A,
e) except as permitted in Subsections 11.3.4. and 11.3.6., be upgraded to comply with the fire containment requirements within a *floor area* conforming to this By-law, and
f) except as permitted in Subsections 11.3.5. and 11.3.6., be upgraded to provide *exit* systems conforming to Section 3.4.

11.3.2.8. Group D Occupancies

1) A Group D *occupancy* may be permitted in a *building* that exceeds 3 *storeys* in *building height* provided that the entire *building* is *sprinklered* and conforms to Sentence (2) to (4).

2) A *building* referred to in Sentence (1) may be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,
b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 1 h,
c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, except that in a *building* not more than 1 *storey* in *building height*, the *fire-resistance rating* is permitted to be waived provided the roof assembly is constructed as a *fire-retardant-treated wood* roof system conforming to Article 3.1.14.1. and the *building area* is not more than
i) 2 400 m² if facing one *street*,
ii) 3 000 m² if facing 2 *streets*, or
iii) 3 600 m² if facing 3 *streets*, and
d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) Notwithstanding the requirements of Sentence (2), the floor, mezzanine, and roof assemblies, are permitted to have a fire-resistance rating of 45 min provided
a) it is not more than 6 *storeys* in *building height*, and
b) it has a *building area* not more than the value in Table 11.3.2.8.

Table 11.3.2.8.
Maximum Building Area, Group D, up to 6 Storeys
Forming part of Sentence 11.3.2.8.(2)

No. of Storeys	Maximum Area, m²		
	Facing 1 *Street*	Facing 2 *Street*	Facing 3 *Street*
1	not limited	not limited	not limited
2	7 200	not limited	not limited
3	4 800	6 000	7 200
4	3 600	4 500	5 400
5	2 880	3 600	4 320
6	2 400	3 000	3 600

4) A *building* referred to in Sentence (1) shall

a) be provided with a fire alarm and detection system conforming to Subsection 3.2.4., notwithstanding any exemptions permitted by Article 3.2.4.1.,

b) Be provided with lighting and emergency power systems conforming to Subsection 3.2.7.,

c) except as permitted in Subsection 11.3.3., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.,

d) be structurally upgraded to the design upgrade level S3 as defined in the Upgrade Mechanism Model in Division B Appendix A,

e) except as permitted in Subsections 11.3.4. and 11.3.6., be upgraded to comply with the fire containment requirements within a *floor area* conforming to this By-law, and

f) except as permitted in Subsections 11.3.5. and 11.3.6., be upgraded to provide exit systems conforming to Section 3.4.

11.3.2.9. Group E Occupancies

1) A Group E *occupancy* may be permitted in a *building* conforming to Sentences (2) to (5) except that where the *building* exceeds 1000 m^2 in *building area* or 3 *storeys* in *building height* the entire *building* shall be *sprinklered*.

2) A *building* referred to in Sentence (1), that is not more than 4 *storeys* in *building height* and the *building area* is no more than 1800 m^2 is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, provided

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,

b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

c) roof assemblies shall have a *fire-resistance rating* not less than 45 min, except that in a *building* not more than 1 *storey* in *building height*, the *fire-resistance rating* is permitted to be waived provided the roof assembly is of *noncombustible construction* or is constructed as a *fire-retardant-treated wood* roof system conforming to Article 3.1.14.1.,

d) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*, and

e) *loadbearing* walls, columns and arches supporting a *fire separation* shall have a *fire-resistance rating* not less than that required for the *fire separation*.

3) A *building* referred to in Sentence (1), that is not more than 6 *storeys* in *building height* and the *building area* conforms to Table 11.3.2.9., is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, provided

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

4) A *building* referred to in Sentence (1), is permitted to be of *noncombustible construction*, provided

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1.5 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

5) A *building* referred to in Sentence (1) shall be upgraded as follows

a) where required to have a sprinkler system, the *building* shall be provided with a fire alarm and detection system conforming to Subsection 3.2.4.,

b) be provided with lighting and emergency power systems conforming to Subsection 3.2.7.,

c) except as permitted in Subsection 11.3.3., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.,

d) be structurally upgraded to the design upgrade level S3 as defined in the Upgrade Mechanism Model in Division B Appendix A,
e) except as permitted in Subsections 11.3.4. and 11.3.6., be upgraded to comply with the fire containment requirements within a *floor area* conforming to this By-law, and
f) except as permitted in Subsections 11.3.5. and 11.3.6., be upgraded to provide *exit* systems conforming to Section 3.4.

Table 11.3.2.9.
Maximum Building Area, Group E, Existing Building
Forming part of Sentence 11.3.2.9.(2)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	Unlimited	Unlimited	Unlimited
2	7 500	Unlimited	Unlimited
3	5 000	6 250	7 500
4	3 750	4 688	5 625
5	3 000	3 750	4 500
6	2 500	3 125	3 750

11.3.2.10. Group F2 or F3 Occupancies

1) A Group F, Division 2 or 3 *occupancy* may be permitted in a *building*, provided that the *building* conforms to Sentences (2) to (5) except that where the *building* exceeds 1000 m^2 in *building area*, or 2 *storeys* in *building height*, the entire *building* shall be *sprinklered*.

2) A *building* referred to in Sentence (1) and in conformance with Table 11.3.2.10.is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, provided

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,
b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,
c) roof assemblies shall be
 i) *noncombustible construction*, or
 ii) *combustible construction* with a *fire-resistance rating* of no less than 45 min in *buildings* with a *building area* no greater than 4800 m^2, and
 iii) *combustible construction* constructed as a *fire-retardant-treated wood* roof system conforming to Article 3.1.14.1. in a *building of* not more than 1 *storey* in *building height*,
d) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall
 i) have a *fire-resistance rating* not less than 45 min, or
 ii) be of *noncombustible construction*, and
e) *loadbearing* walls, columns and arches supporting a *fire separation* shall have a *fire-resistance rating* not less than that required for the *fire separation*.

3) A *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, provided

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,
b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and
c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

4) A *building* referred to in Sentence (1), is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, provided

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1.5 h,
b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

5) A *building* referred to in Sentence (1) shall be upgraded as follows

a) Where required to have a sprinkler system, the building shall be provided with a fire alarm and detection system conforming to Subsection 3.2.4.,

b) Be provided with lighting and emergency power systems conforming to Subsection 3.2.7.,

c) be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3., except as permitted in Subsection 11.3.3.,

d) be structurally upgraded to the design upgrade level S3 as defined in the Upgrade Mechanism Model in Division B Appendix A,

e) except as permitted in Subsections 11.3.4. and 11.3.6., be upgraded to comply with the fire containment requirements within a *floor area* conforming to this By-law, and

f) except as permitted in Subsections 11.3.5. and 11.3.6., be upgraded to provide *exit* systems conforming to Section 3.4.

Table 11.3.2.10.
Maximum Building Area, Group F, Division 2 or 3, Existing Building
Forming part of Sentence 11.3.2.10.(2)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	9 000	11 250	13 500
2	4 500	5 625	6 750
3	3 000	3 750	4 500
4	2 250	2 812	3 375
5	1 800	2 250	2 700
6	1 500	1 875	2 250

11.3.2.11. Combustible Construction for Minor Repairs

(See Article 1.5.2.9. of Division C.)

11.3.2.12. Open Air Repair and Storage Garages

1) *Open-air storeys* of a *storage garage* or *repair garage* located below *grade* need not be *sprinklered*.

11.3.3. SPATIAL SEPARATION ALTERNATIVES

11.3.3.1. General

1) Except for *additions* and new *construction*, where the exterior wall of a *building* is required by Parts 3 and 9 to be of *noncombustible construction*, the provisions of this Subsection may be used as an alternative compliance measure to the spatial separation requirements of Parts 3 and 9.

11.3.3.2. Exterior Wall Construction

1) In a *building* of Group B or C *occupancy*, existing *combustible construction* may be retained in an existing exterior wall provided

a) the wall has at least a 1 h *fire-resistance rating*,

b) the *building* is *sprinklered*, and

c) all voids in the wall are completely filled with *noncombustible* insulation and fire stopped.

2) In a *building* of other than Group B or C *occupancy*, existing *combustible construction* may be retained in an existing exterior wall provided the wall has at least a 1 h *fire-resistance rating*, and

a) the *building* is sprinklered, or

b) all voids in the wall are completely filled with *noncombustible insulation* and fire stopped.

3) When an existing exterior wall requires a 2 h *fire-resistance rating*, existing *combustible construction* may be retained provided

a) the wall has at least a 1 h *fire-resistance rating*,
b) the *building* is *sprinklered*, and
c) all voids in the wall are completely filled with *noncombustible* insulation and fire stopped.

11.3.3.3. Exterior Cladding

1) Existing *combustible* cladding may be retained provided

a) the *building* is *sprinklered* using fast-response heads,
b) the exterior cladding is treated with *acceptable* exterior quality fire retardant intumescent paint, (See Note A-11.3.3.3.(1)(b).) and
c) all exterior windows contain wired or safety glass in steel frames.

11.3.3.4. Existing Unprotected Openings

1) Where the *limiting distance* is less than 900 mm, existing *unprotected openings* may be retained, provided

a) the openings are constructed of glass block, wired glass, tempered glass or laminated safety glass, and the *building* is *sprinklered* using fast-response heads,
b) the openings are constructed of glass block, wired glass, tempered glass or laminated safety glass in operable frames, the *building* is *sprinklered* using fast-response and openings are protected with close spaced sprinkler in accordance with Sentence 3.2.3.13.(5).
c) *acceptable* self-closing fire protection shutters are installed at the existing opening locations, where the fire shutter operation is not obstructed by the openable window, and where the opening is not required for an escape function as outlined in Article 9.9.10.1.

2) Where a *limiting distance* is 900 mm or more, existing *unprotected openings* which have a total area exceeding the values listed in or extrapolated from Tables 3.2.3.1.B, 3.2.3.1.C, 3.2.3.1.D or 3.2.3.1.E, may be retained, provided

a) the openings are constructed of glass blocks or wired glass in fixed frames, or
b) the *building* is *sprinklered* with fast-response heads.

3) Where *construction* on an *existing building* consists of renovation where the *exposing building face* is not being altered, the existing *unprotected openings* of that *building* face may be retained and no additional protection shall be required provided

a) the work consists of a interior work only,
b) no additional principal dwelling units are being added,
c) the openings on the vertical building face are less than 10% of the entire exposing building face, and
d) the limiting distance is greater than 600 mm.

4) Notwithstanding the requirements of this Article, the replacement of existing windows that do not substantially alter the existing spatial separation configuration by more than 2% shall not require additional protection provided that the openings are constructed of glass block, wired glass, tempered glass or laminated safety glass. (See Note A-11.3.3.4.(4).)

11.3.4. ALTERNATIVES FOR FIRE CONTAINMENT AND SEPARATION

11.3.4.1. Public Corridors

1) Existing *public corridor* walls, serving Group A Division 2, D, E, F Division 2 and F Division 3 *occupancies*, required to have a *fire-resistance rating* exceeding 45 min may be terminated at the underside of a 30 min ceiling membrane, where the *public corridors* are equipped with *acceptable* smoke detectors connected to the *building* fire alarm system.

11.3.4.2. Occupancy and Suite Separations

1) Existing vertical *occupancy fire separations* and *suite fire separations* in Group A Division 2, D, E, F Division 2 and F Division 3 occupancies, need not exceed a 1 h *fire-resistance rating* provided *acceptable smoke detectors* are installed on each side of such separations and are connected to the *building* fire alarm system.

2) Existing floor assemblies required by Sentence 3.3.1.1.(5) to be *fire separations*, need not exceed a 1 h *fire-resistance rating* provided the *suite* is *sprinklered.*

11.3.4.3. Alternative to 20 Minute Doors

1) An existing door assembly may be retained in place of a required door assembly with a 20 min *fire-protection rating* provided

a) a solid core wood door has a minimum thickness of no less than 45 mm, or

b) a hollow core or panel type suite door has a layer of gypsum wallboard on the *suite* side covered by a minimum 0.9 mm thick sheet steel which extends over the edges of the door.

11.3.5. ALTERNATIVES FOR EXITS

11.3.5.1. General

1) Except as permitted in Articles 11.3.5.2. and 11.3.5.3. and in Subsection 11.3.6., every *floor area* or other space shall be served with *exits* in conformance with Section 3.4.

11.3.5.2. Openings in an Exit Enclosure

1) A maximum of 2 *suite* doors or 2 room doors per *storey* may be located within an *exit* enclosure provided

a) the *exit* enclosure is not required to have a *fire-resistance rating* of more than 1 h,

b) the *suites* or rooms have a second and separate *means of egress*, and

c) the *suite* or room doors have a *fire-protection rating* of 45 min, are self-closing and self-latching and do not lock automatically.

2) *Exit* stairs shall be enclosed as required in Subsection 3.4.4. except that existing *exit* enclosures may have

a) wired glass set in steel frames conforming to Article 3.1.8.14. only in the portion of the enclosure which faces a *public corridor*, and

b) in sprinklered *buildings*, *acceptable* hold-open devices actuated by *smoke detectors* and the *building* fire alarm system.

11.3.5.3. Group C Single Exit

1) A single *exit* is permitted from an existing non-*sprinklered dwelling unit* provided

a) the *exit* is an exterior doorway located no more than 1.5 m above adjacent ground level,

b) the total area served by the *exit* door does not exceed 100 m^2,

c) the maximum travel distance within the *dwelling unit* does not exceed 15 m, and

d) it is not necessary to travel up or down more than one *storey* to reach the *exit* door, or the uppermost floor level opens from a common area to an unenclosed balcony or deck no more than 6 m above adjacent ground level.

11.3.6. ALTERNATIVES FOR SPRINKLERED BUILDINGS

11.3.6.1. General

1) The alternative compliance measures in Articles 11.3.6.2. to 11.3.6.9. may be used in a *building* where

a) the *building* is sprinklered in conformance with Subsection 3.2.5., and

b) the *building* has a fire alarm system in conformance with Subsection 3.2.4.

11.3.6.2. Group C and D Fire Containment

1) The *fire separation* between a Group C or D *occupancy* and the remainder of a *building* which is no more than 3 *storeys* in *building height* need not exceed a *fire-resistance rating* of 45 min.
2) Existing lath and plaster, properly restored to its original condition, may be *accepted* by the *Chief Building Official* as meeting the *fire separation* requirements in Sentence (1).

11.3.6.3. Occupancy Separations
1) The existing *fire-resistance rating* for an *occupancy* separation in a *building* need not exceed 1 h when the By-law requires 2 h for new *construction* and 45 min when the By-law requires 1 h for new *construction*.

11.3.6.4. Flame Spread Rating
1) The *flame-spread rating* for an existing wall or ceiling finish may be increased to 300 for no more than 25% of the wall or ceiling area, provided the wall or ceiling has no exposed foamed plastic.

11.3.6.5. Fire Dampers
1) Where a *fire separation* is permitted to have a 45 min *fire-resistance rating*, a *fire damper* is not required for existing *noncombustible* ducts less than 0.065 m^2 in cross-sectional area.

11.3.6.6. Plastic Sprinkler Piping
1) Plastic sprinkler piping may penetrate a vertical *fire separation* provided
a) the piping and its installation are listed by an *acceptable* testing agency, and
b) the piping is tightly fitted or fire stopped to maintain the integrity of the separation.

11.3.6.7. Smoke-Venting in High Buildings
1) Existing means of venting which are capable of removing smoke to aid firefighting may penetrate exterior openings and existing shafts in adjacent fire compartments.

11.3.6.8. Alternatives for Dead-end Public Corridors
1) In a *building* provided with a *sprinkler system* with fast-response heads, existing *public corridors* which have *smoke detectors* installed and connected to the fire alarm system may contain existing dead-end *public corridors* of lengths not exceeding 10 m to the nearest exit in Group C *occupancies* and 15 m to the nearest *exit* in Group D, Group E, Group F Divisions 2 and Group F Division 3 *occupancies*.
2) In a *building* containing *exits* conforming to Article 11.3.6.9., one existing dead-end *public corridor* per floor may be permitted provided
a) the existing dead-end *public corridor* does not exceed the lengths specified in Sentence (1),
b) each *exit* stair serving the existing dead-end *public corridor* contains a smoke barrier between each *storey*, which prevents smoke from entering stairways and allows access to other stairways, and which may have a door equipped with an *acceptable* hold-open device actuated by a local *smoke detector* circuit, and
c) the entire *building* is *sprinklered* with fast-response heads.

11.3.6.9. Alternatives for Exits
1) Existing open *exit* stairways located at the ends of *public corridors* need not be enclosed provided
a) the *building* does not exceed 3 *storeys* in *building height*,
b) there is a smoke barrier located within each *public corridor* approximately midway between the *exit* stairways, which
i) has a door provided with an *acceptable* hold-open device actuated by the fire alarm system and *smoke detectors* on that floor,
ii) is constructed of tempered or wired glass, or has a *fire-protection rating* of no less than 20 min, and
iii) is designed to retard the passage of smoke,
c) the *public corridor* contains no dead-ends,

d) the *public corridor* on both sides of the smoke barrier is continuously pressurized, and
e) the entire *building* is *sprinklered* with fast-response heads.

2) Wired glass in steel frame exposure protection for exterior fire escapes need not be provided in an *existing building* provided

a) there is at least one *exit* enclosure which conforms to this By-law and which leads directly to the exterior of the *building*,
b) access to the fire escape is by means of a full-size door at each floor level,
c) the fire escape leads directly to *grade* level or leads to *grade* level by means of an interior stair enclosure no less than 750 mm in width,
d) a sprinkler head is located on the ceiling adjacent to and within 1 500 mm of each opening requiring protection, and
e) the entire *building* is *sprinklered* with fast-response heads.

3) Where a *building* is provided with a *sprinkler system* with fast-response heads, existing *exit* doors may be retained provided they do not swing over stairs or significantly impede safe egress and the *Chief Building Official* is satisfied that the existing *exit* door swing and existing *exit* and corridor widths substantially comply with the requirements of Section 3.4.

4) Existing egress stairs with rectangular treads in straight flights, other than those serving seating areas, may be retained provided that

a) existing tread and riser dimensions within a *flight* comply with Table 11.3.6.9.(4),

Table 11.3.6.9.(4)
Dimensions of Existing Stairs
Forming Part of Sentence 11.3.6.9.(4)

	Maximum (mm)	**Minimum (mm)**
Rise	205	125
Run	355	200

b) existing treads and landings shall
i) be dimensionally uniform,
ii) have a finish that is slip resistant,
iii) have nosings with distinct colour contrast for the full width of the leading edge of each tread visible in both direction of travel, and
iv) have no projecting stair nosing, rakeback, or combination thereof, exceeding 38 mm or angle of more than 30 degrees from the vertical,
c) lighting is provided to
i) an average level of not less than 100 lx at floor or tread level, and
ii) the minimum value of the illumination required by (i) shall be not less than 20 lx,
d) emergency lighting is provided to
i) an average level of illumination of not less than 20 lx at floor or tread level,
ii) a minimum value of the illumination required by (i) shall be not less than 2 lx, and
iii) provided with emergency power in accordance with Article 3.2.7.4.,
e) handrails are provided conforming to the requirements of Article 3.4.6.5., and
f) tread and landings of exterior egress stairs are designed to be free of ice and snow accumulations.

11.3.7. Alternatives for Accessibility

11.3.7.1. Protection on Accessible Floor Areas

1) Every *floor area* that is not *sprinklered* throughout and that has an *accessible* path of travel shall
a) be served by an elevator
i) conforming to Sentences 3.2.6.5.(4) to (6),

ii) protected against fire in conformance with Clauses 3.2.6.5.(3)(b) or (c), and
iii) in a *building* over 3 *storeys* in *building height*, protected against smoke movement so that the hoistway will not contain more than 1% per cent by volume of contaminated air from a fire floor during a period of 2 h after the start of a fire, assuming an outdoor temperature equal to the January design temperature on a 2.5% per cent basis determined in conformance with Subsection 1.1.3.,

b) be divided into at least 2 zones by *fire separations* conforming to Sentences (2), (3) and 3.1.8.5.(6) so that (See Note A-3.3.1.7.(1)(b))

i) *persons with disabilities* can be accommodated in each zone, and
ii) the travel distance from any point in one zone to a doorway leading to another zone shall be not more than the value for travel distance permitted by Sentence 3.4.2.5.(1) for the *occupancy* classification of the zone,

(See also Sentence 3.1.8.5.(6) for requirements regarding the passage of smoke.)

c) in the case of *residential occupancies*, be provided with balconies conforming to Sentence (4),
d) have an *accessible* exterior exit at ground level, or
e) have a ramp conforming to Subsection 3.8.3. leading to ground level.

(See Note A-11.3.7.1.(1).)

2) Except as permitted by Sentence (3), the *fire separations* referred to in Clause (1)(b) shall have a *fire-resistance rating* not less than 1 h.

3) The *fire-resistance rating* of the *fire separations* referred to in Clause (1)(b) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or
b) the floor assembly below the *floor area*, if there is no floor assembly above.

4) A balcony required by Clause (1)(c) shall

a) have direct *access* from the *suite* or *floor area*,
b) be not less than 1.5 m deep from the outside face of the exterior wall to the inside edge of the balcony, and
c) provide not less than 2 m^2 of balcony space for each *accessible* sleeping room or bed space.

5) The floor area on either side of a horizontal exit conforming to Article 3.4.6.10. is permitted to be considered as a zone in applying the requirements of Clause (1)(b).

11.3.8. ALTERNATIVES FOR BUILDING SYSTEMS

11.3.8.1. Location of Exhaust Vents in a Building Containing not more than 2 Principal Dwelling Units

1) In a *building* containing not more than 2 principal *dwelling units*, exhaust vents serving heating and air conditioning equipment and similar appliances, other than direct vented fireplaces, shall

a) not terminate within

(i) 1.2 m horizontally of an adjacent property line,
(ii) 1.8 m vertically of the underside of a soffit above, or
(iii) 1.2 m horizontally of any soffit vent above,

b) be located as high as possible, and
c) be directed upwards and away from the source *building* with

(i) a vertical discharge through the roof, or
(ii) a minimum 3” diameter vent in a side discharge configuration with a 45° or 60° elbow termination.

Section 11.4. Alternative Compliance Measures for the Conversion of Existing Buildings

11.4.1. APPLICATION

11.4.1.1. Alternative Compliance Measures for Existing Conditions

1) The alternative compliance measures for conversions in this Section apply to existing conditions only and do not apply to new work, which must conform to the requirements for new *construction* in this By-law.
2) Except as required by this Section, the alternative compliance measures in Section 11.3. may be applied to existing conditions for conversions.
3) Except as required by this Section, where a *building* is a *heritage building*, the *acceptable* solutions in Section 11.5 may be applied to existing conditions for conversions.

11.4.2. CONVERSION OF AN EXISTING RESIDENTIAL BUILDING CONTAINING NOT MORE THAN TWO PRINCIPAL DWELLING UNITS INTO A COMMUNITY CARE FACILITY, GROUP RESIDENCE OR CHILD CARE FACILITY

11.4.2.1. General Requirements

1) An existing residential *building* containing not more than two principal *dwelling units* may be converted or partially converted into a *community care facility*, *group residence* or *child care facility* provided
- a) the *occupant load* does not exceed
  - i) 10 residents in a *community care facility*,
  - ii) 6 residents in a *group residence*, or
  - iii) 8 *children* in a *child care facility*,
- b) the *building* containing a *community care facility* or *group residence* is
  - i) separated from a residential *building* containing not more than one principal *dwelling unit* by a *fire separation* with a *fire resistance rating* of 1 h,
  - ii) separated from a residential *building* containing not more than two principal *dwelling units* by a *fire separation* with a *fire resistance rating* of 2 h,
  - iii) completely *sprinklered*, and
  - iv) equipped with a fire alarm system, emergency lights and *smoke* and *heat detectors* installed throughout the *building*.
- c) the *child care facility* conforms with Clauses 3.1.2.5.(3)(a) and (b),
- d) firefighter access conforms with this By-law,
- e) the *building area* is no more than 300 m^2,
- f) all *unsafe conditions* are corrected to the satisfaction of the *Chief Building Official*, and
- g) the *building* shall be upgraded to conform to upgrade design levels F2, S2, N2, A2 as defined in the Upgrade Mechanism Model in Division B Appendix A and the energy upgrade requirements of Article 11.2.1.4.

11.4.2.2. Alternative Compliance Measures

1) The alternative compliance measures contained in Sentences (2) to (11) inclusive may be applied to the conversion or partial conversion of an existing residential *building* containing not more than two principal *dwelling units* into a *community care facility*, *group residence* or *child care facility*.
2) For the purposes of determining *building height*, a residential *building* containing not more than one principal *dwelling unit* constructed pursuant to a *building permit* issued prior to July 01, 1994 which is four *storeys* or less in height may be considered as 3 *storeys* in *building height*.
3) Existing exterior wood-frame walls may be retained instead of required *noncombustible construction*, provided
- a) a minimum 45 min *fire-resistance rating* is provided, and
- b) all voids are filled with mineral wool or fibreglass batts.

4) *Combustible* exterior cladding materials may be used instead of required *noncombustible* cladding provided the cladding
- a) has a *flame-spread rating* of no more than 25,

b) is underlaid with a minimum layer of 12.7 mm exterior gypsum board sheathing, and
c) is composed of
i) aluminum panels,
ii) fire-retardant treated wood panels,
iii) fire-retardant treated cedar shakes or shingles, or
iv) vinyl siding.

5) Where exterior walls and openings are required by Subsections 3.2.3. or 9.10.14. to have exposure protection, existing openings need only conform to Article 11.3.3.4.

6) If one interior *exit* stair is no less than 900 mm wide, a second interior *exit* stair which is no less than 750 mm wide may be permitted.

7) The *flame-spread rating* of the existing interior finish of a *means of egress* need not exceed 150.

8) Ducts passing through *fire separations* need not be equipped with fire dampers if
a) the duct opening is less than 150 cm^2 in cross-sectional area, or
b) the duct work is constructed entirely of sheet steel and the duct opening is no more than 1 000 cm^2 in cross-sectional area.

9) Manual stations are not required if the fire alarm system and the sprinkler water flow alarm are designed in accordance with Article 3.2.4.8.

10) An existing exterior wall opening adjacent to an exterior *exit* stair or fire escape need not conform to Article 3.2.3.13. if the opening is glazed with wired or tempered glass in an aluminum or wood frame.

11) A single *exit* from a *dwelling unit* need not conform to Sentence 3.3.4.3.(3) if
a) the *exit* serves only one *dwelling unit*, and
b) the vertical floor elevation from the uppermost floor level to the adjacent ground level does not exceed 6 m.

11.4.3. CONVERSION OF A PORTION OF A SUITE INTO AN ANCILLARY RESIDENTIAL UNIT

11.4.3.1. Alternative Compliance Measures

1) Except as required in Sentences (2) and (3), where an existing building containing not more than two principal *dwelling units* is altered to create an *ancillary residential suite*, the *existing building* shall conform to the requirements of Section 9.37, except as permitted by Table 11.4.3.1., provided the *building* was constructed under a *building permit* issued on or prior to June 22, 2004. (See Note A-11.4.3.1.(1).)

2) Where the *alteration* in Sentence (1) includes an *addition*, the *addition* shall conform to the requirements of this By-law.

3) Where an *existing building* was constructed with a *building permit* issued on or after June 22, 2004, the *existing building* and the *alteration* shall conform to Part 9.37 of Division B.

4) Notwithstanding the requirements of Sentence 9.34.1.1.(1), circuits and receptacles in the *ancillary residential suite* shall have a minimum of
a) two kitchen counter duplex receptacles
i) supplied by two appliance circuits, and
ii) wired on single circuits or a split circuit,
b) two duplex receptacles located on different walls in each bedroom, and
c) three duplex receptacles located on different walls in the living area.

5) Notwithstanding the requirements of Sentence 9.34.1.1. (1)
a) where a single existing panel board is located in a common area within the *building* accessible to all occupants of the *building*, the panel board may supply electrical loads for both the principal dwelling and the *ancillary* residiential *suite*,
b) any electrical range and equipment loads provided for the *ancillary residential suite* shall be calculated with demand factors in conformance with Sentence 9.34.1.1.(2), and
c) general circuit branch wiring may be interconnected between outlets located in the principal dwelling and the *ancillary residential suite*.

Table 11.4.3.1.
Fire Safety Requirements for Ancillary Residential Suite Conversions
Forming Part of Article 11.4.3.1.

Item	Item Details	Alternative compliance measure
Spatial Separation	Existing windows and doors	Original openings may remain and new openings to conform to Part 9
Fire Containment within a Principal *Dwelling Unit*	Separation between a principal *dwelling unit* and its contained *ancillary residential units*	16 mm (5/8”) type ‘X’ GWB or 12.5 mm (½”) Type ‘C’ GWB on wood or steel studs at maximum 600 mm on centre. Stud cavity to be filled with minimum 90 mm (3 ½”) mineral wool insulation. Caulk joints where floor and ceiling meet wall GWB. Use resilient acoustic channels where possible.
	Ducts common to both units through *suite* separations	*Fire dampers* not required if sheet metal ducting extends a minimum of 1800 mm (6’-0”) beyond the suite separation and the opening is firecaulked. Acoustic insulation is to be used within the common duct extending a minimum of 1500 mm (60”) from either side of the suite separation.
	Plumbing and sprinkler plastic piping that penetrate fire separations	Shall be tightly fitted, cast in place, or caulked
	Suite entry doors between the principal *dwelling unit* and its contained *ancillary residential unit*	Existing solid core doors and frames with or without wired glass in good condition. Doors to be provided with positive latching hardware and self-closing devices
	Solid Blocking	Solid blocking may be omitted for doors described in Sentence 9.7.5.2.(9) where the interior wall finish adjacent the door is in place prior to the construction of an *ancillary residential suite*.
Exits	Egress from each *dwelling unit*	In combination with the Egress Windows requirement of Sentence 9.9.10.1., at least one conforming *exit* is required from the principal dwelling and one from the *ancillary residential suite.*
	Windows adjacent to *exits*	No requirements where the suite is sprinklered
Fire Department Access	Access Path	Existing path designated for fire department is permitted to be minimum 860 mm
Flame Spread Rating	*Exits*	≤150
	Remainder of *building*	No requirement
Sprinklers		Sprinklers are not required provided the value of the alteration is less than or equal to 50% of the replacement(1) value of the existing building.
Heating Systems	Furnace room enclosure	No separation required but provide proper combustion air and required clearances from all equipment (2)
Smoke Alarms	Entire *building*	Interconnected *smoke alarms* to be provided outside every bedroom and at least one on every *storey*. Installed by permanent connections to an electrical circuit in conformance with Subsection 9.10.19. Division B. Provided with battery backup and manual

		silencing devices which will silence the alarm in conformance with Article 9.10.19.6. of Division B. Carbon Monoxide detectors to be provided in accordance with the 9.32.4.2.[3]
Stairs and Handrails	Entire *building*	Existing stairs to comply with Section 9.8, excepting the following dimensions: tread depth 235-355 mm, rise 125-200 mm and run 210-355 mm, unless considered to present an *unsafe condition* as determined by the *Chief Building Official*. All existing stairs to have at least one handrail in conformance with Subsection 9.8.7
Guardrail Protection	Entire *building*	Existing *guards* may be retained provided they are structurally sound, non-climbable and ≥900 mm high.
Existing Headroom	Entire *building*	May be reduced to 1980 mm over 80% of the *suite* area and all egress routes.
Unsafe Conditions	Entire *building*	Any condition within or around the building which could cause undue hazard or risk to persons to be corrected as directed by the *Chief Building Official*.
Sound Separation	Between the principal *dwelling unit* and its contained *ancillary residential suites*	Not required. Fill cavity spaces of *suite* separation with mineral wool

Notes to Table 11.4.3.1.:
[1] See Note A-11.2.1.4.(3)(a).
[2] The Gas Code places restrictions on locating gas furnaces adjacent to sleeping rooms or bathrooms.
[3] See Note A-11.4.3.1.(1) Interconnected Smoke Alarms and Carbon Monoxide Detectors

6) For the purposes of determining *building height*, an *existing building* containing not more than two principal *dwelling units* constructed pursuant to a *building permit* issued on or prior to June 22, 2004 which is four *storeys* or less in height may be considered as 3 *storeys* in *building height* where the *project* is limited to the creation of a new *ancillary residential unit*.

11.4.4. ENCLOSURE OF AN EXTERIOR OPEN BALCONY IN AN EXISTING RESIDENTIAL BUILDING

11.4.4.1. Alternative Compliance Measures

1) An existing open balcony may be converted to an enclosed balcony if

a) required *suite fire separations* are provided,
b) spatial separations conform to this By-law,
c) travel distances conform to this By-law,
d) *guards* conform to this By-law,
e) exhaust ducts conform to this By-law,
f) light and natural ventilation are maintained and conform to this By-law,
g) all new structural work conforms to Part 4,
h) high building measures (smoke-free refuge areas) are maintained,
i) the existing door assembly separating the *suite* from the existing open balcony is maintained, and

j) the *suite* is upgraded to an *acceptable* level as defined in the Upgrade Mechanism Model in Division B Appendix A.

11.4.5. CONVERSION OF SPACE IN AN EXISTING GROUP F DIVISION 2 BUILDING INTO ARTIST LIVE/WORK STUDIOS

11.4.5.1. Alternative Compliance Measures

1) *Artist live/work studios* are permitted in an *existing building* classified as a Group F, Division 2 *occupancy* if

a) the *building* is *sprinklered* with fast-response heads,
b) all *suites* are separated from the remainder of the *building* by a *fire separation* with a 1 h *fire resistance rating* and all floors are separated from each other by a *fire separation* with a 1 h *fire resistance rating*, except that a 45 min *fire-resistance rating* or existing lath and plaster in good repair is *acceptable* in a *building* less than 4 *storeys* in *building height*,
c) the *exit* systems conform to Section 3.4., except as permitted in Subsections 11.3.5. and 11.3.6.,
d) all *public corridors* conform to Article 3.3.1.4., except as permitted in Subsections 11.3.4. and 11.3.6.,
e) the emergency lighting conforms to Subsection 3.2.7.,
f) a fire alarm and detection system conforming to Subsection 3.2.4. is installed in the *building*,
g) if dust or fumes are produced in a studio
  i)the *building* complies with the Fire By-law, and
  ii)the *building* is heated by hot water, electrical equipment, or elevated gas-fired forced-air heaters,
h) if flammable or *combustible* liquids or gases are stored or used in a studio, the *building* complies with the Fire By-law and the British Columbia Gas Safety Act,
i) *service rooms* and storage rooms located outside of a studio conform to Section 3.6.,
j) the floor assembly is designed for a minimum live load of 3.6 kPa and the *building* conforms to the structural upgrade level S3 as defined in the upgrade mechanism model within Division B Appendix A,
k) a studio complies with the sound transmission requirements of Section 5.9.,
l) light and ventilation for the studio sleeping area complies with Parts 5 and 6,
m) shared washroom facilities comply with the requirements of the Standards of Maintenance By-law for lodging houses, and
n) the *building* is upgraded to an *acceptable* level as defined in the upgrade mechanism model in Division B Appendix A.

2) For the purpose of determining *occupancy* classification, *artist live/work studios* shall be considered to have an *occupancy* classification as defined in Articles 3.1.3.3. and 3.1.3.4.

11.4.6. CONVERSION OF AN EXISTING HOTEL TO SINGLE ROOM ACCOMMODATION

11.4.6.1. Alternative Compliance Measures

1) *Single room accommodation* is permitted in an *existing building* classified as a Group C major *occupancy* (hotel) if

a) all *suites* are separated from the remainder of the *building* by a *fire separation* with a 1 h *fire resistance rating* and all floors are separated from each other by a *fire separation* with a 1 h *fire resistance rating*, except that a 45 min *fire-resistance rating* or existing lath and plaster in good repair is acceptable if the *building* is less than 4 *storeys* in *building height*,
b) the *exit* systems conform to Section 3.4., except as permitted in Subsections 11.3.5. and 11.3.6.,
c) all *public corridors* conform to Article 3.3.1.4., except as permitted in Subsections 11.3.4. and 11.3.6.,
d) the emergency lighting conforms to Subsection 3.2.7.,

e) a fire alarm and detection system conforming to Subsection 3.2.4. is installed throughout the *building*,
f) the floor assembly is designed for a minimum live load of 2.4 kPa,
g) notwithstanding Clause (j), the building conforms to the structural upgrade level S3 as defined in the upgrade mechanism model in Division B Appendix A,
h) shared washroom facilities comply with the requirements of the Standards of Maintenance By-law for lodging houses,
i) the *suites* comply with the sound transmission requirements of Section 5.9 of Division B, and
j) the *building* is upgraded to an *acceptable* level as defined in the upgrade mechanism model in Division B Appendix A.

11.4.7. CONVERSION OF AN EXISTING NON-STRATA BUILDING TO A STRATA PROPERTY

11.4.7.1. Alternative Compliance Measures

1) Except as permitted by Sentence (2), an *existing building* or parcel may be converted into 2 or more strata lots, if the entire *building* is
a) upgraded to design upgrade levels F4, S4, N4, A4 and E4 as detailed in the upgrade mechanism model in Division B Appendix A, and
b) fully *sprinklered*.

2) An *existing* parcel containing one or more buildings, may be converted into 2 or more strata lots, if the *existing buildings* are not otherwise altered, and
a) upgraded to comply with the exposure requirements of Subsection 3.2.3.,
b) upgraded to comply with the fire department access path of travel in accordance with Articles 3.2.5.5. and 3.2.5.6.,
b) upgraded to design upgrade levels S4 and N4, as detailed in the upgrade mechanism model in Division B Note A-11.2.1.2., and
d) fully *sprinklered*.

(See Note A-11.4.7.1.(2).)

Section 11.5. Alternative Compliance Measures for Heritage Buildings

11.5.1. APPLICATION

11.5.1.1. Alternative Compliance Measures

1) This Subsection provides alternative compliance measures for the restoration and rehabilitation of *heritage buildings*.

2) The alternative compliance measures provided in Table 11.5.1.1. apply to existing conditions only and do not apply to new work which must conform to the requirements for new *construction* in other Parts of this By-law.

3) Notwithstanding Article 11.2.1.6, relocation of a *heritage building* may conform to the upgrade requirements for spatial separation outlined in Table 11.5.1.1.

4) Site-built and custom-built replica wood doors, wood framed windows and wood framed skylights, intended to preserve the *heritage* look of a *building* that separated conditioned space and unconditioned space from the exterior, are exempt from the provisions of Subsection 9.7.4. and Article 5.10.2.2. provided the replica
a) complies with Clause 9.7.5.1.(1)(a) or (b) as applicable,
b) does not create an *unsafe condition*, and
c) is *acceptable* to the *Chief Building Official*.

Table 11.5.1.1.
Alternate Compliance Measures for Heritage Buildings
Forming part of Sentence 11.5.1.1.(2)

No.	By-law Requirement	Alternate Compliance Method
1	*Fire Separations* Sentence 3.1.3.1.(1) and Table 3.1.3.1.; Subsection 9.10.9. 2 h *fire separation* required between some *major occupancies*.	Except for F1 *occupancies*, 1 h *fire separation* is *acceptable*, if the *building* is *sprinklered*.
2	**Fire Separations** Sentence 3.1.3.1.(1) and 3.1.3.1.; Subsection 9.10.9. 1 h *fire separation* required between some *major occupancies*.	1/2 h *fire separation* is *acceptable* if the *building* is *sprinklered*.
3	*Noncombustible Construction* Subsection 3.1.5. and Article 9.10.6.1. All materials used in *noncombustible construction* must be *noncombustible* unless otherwise permitted.	1. Roofs may be of *combustible construction* provided the *building* is *sprinklered*. 2. Up to 10% gross *floor area* to a maximum of 10% of any one *floor area* may be of *combustible construction* provided the *building* is *sprinklered*.
4	*Fire-resistance Rating* Sentence 3.1.7.1.(1); Article 9.10.3.1. Where a material, assembly of materials or structural member is required to have a *fire-resistance rating* it shall be tested in accordance with CAN/ULC-S101.	A *fire-resistance rating* may also be used based on: 1. HUD No. 8 Guideline on Fire Ratings of Archaic Materials and Assemblies. 2. Fire Endurance of Protected Steel Columns and Beams, DBR Technical Paper No. 194. 3. Fire Endurance of Unit Masonry Walls, DBR Technical Paper No. 207. 4. Fire Endurance of Light-Framed and Miscellaneous Assemblies, DBR Technical Paper No. 222.
5	**Rating of Supporting Construction** Article 3.1.7.5.; Article 9.10.8.3. Supporting assemblies to have *fire resistance rating* at least equivalent to that of the supported floor.	Heavy timber construction is permitted to have a *fire resistance rating* less than would be required by the By-law provided the *building*: (a) is *sprinklered*, and (b) does not exceed 6 *storeys* in *building height*.
6	**Continuity of** *Fire Separations* Sentence 3.1.8.3.(1) and 3.1.8.3.(2); Article 9.10.9.2. *Fire separations* are required to be continuous above the ceiling space.	*Fire separations* are not required to be continuous above the ceiling space where: (a) the ceiling space is *non-combustible construction*, (b) both *fire compartments* are *sprinklered*, or (c) the ceiling has a minimum rating of 30 minutes.
7	**Wired Glass** Sentences 3.1.8.5.(1) and 3.1.8.14.(2); Articles 9.10.13.1. and 9.10.13.5. 6 mm wired glass in steel frame required in *fire separations*.	For fixed transoms or sidelights, 6 mm wired glass fixed to a wood frame of at least 50 mm thickness with steel stops is permitted in a required *fire separation*.
8	*Mezzanines* Sentences 3.2.1.1.(3) to 3.2.1.1.(6); Article 9.10.4.1. *Mezzanines* enclosing more than 10% above the horizontal plane are considered	Enclosed *mezzanines* may be up to 40% of the *storey* in which they occur and not be considered a *storey* in *building height* if the *building* is *sprinklered*.

	as *storey* in *building height*.	
9	*Building Height* Articles 3.2.2.20. to 3.2.2.88. *Noncombustible construction* required for *buildings* over 3 *storeys* in *building height*.	*Buildings* may be of *combustible construction* up to 6 *storeys* provided: (a) the *building* is *sprinklered* (b) the *building* contains Group C, D, E, F2 or F3 *occupancies*, and (c) floor assemblies not required to exceed 1 h *fire separation* requirements may be of *heavy timber construction*.
10	**Spatial Separation** Subsection 3.2.3.; Subsection 9.10.14. The area of *unprotected opening* shall not exceed the limits in Tables 3.2.3.1.A to 3.2.3.1.E	The area of existing *unprotected opening* is not limited provided: (a) the *limiting distance* is a minimum 1 m, (b) the *building* has a supervised *sprinkler system* in conformance with Sentence 3.2.4.10.(3), (c) the existing *unprotected openings* are protected with close spaced sprinklers per clause 11.3.3.4.(b), and (d) the *sprinkler system* is designed to notify the fire department in conformance with Sentence 3.2.4.8.(4).
11	**Construction of** ***Exposing Building Face*** Article 3.2.3.7.; Article 9.10.14.5. The *exposing building face* is required to have a *fire-resistance rating* and/or be of *noncombustible construction*.	*Exposing building face* is not required to have a *fire resistance rating* if the *building* is *sprinklered*. Also, the *exposing building face* is not required to be of *noncombustible construction* if it is protected by an exterior *sprinkler system* conforming to NFPA 13.
12	**Roof Covering Rating** Sentence 3.1.15.2.(1) Class A, B or C roof covering in conformance with CAN/ULC-S107 required.	For existing roofs not covered by a Class A, B or C roofing, a manually operated deluge system in accordance with NFPA 13 is permitted.
13	*Smoke Alarms* Sentences 3.2.4.21.(5) and 3.2.4.21.(6); Sentence 9.10.18.3.(1) *Smoke alarms* are required to be connected to an electric circuit.	*Smoke alarms* may be battery operated in a residential *building* containing not more than one principal *dwelling unit*.
14	*Interconnected Floor Space* Subsection 3.2.8.; Sentence 9.10.1.3.(6)	1. Open stairs in *buildings* of maximum 4 *storeys* in *building height* need not comply with Subsection 3.2.8. provided: (a) the *building* contains a Group C or D *occupancy*, (b) the *building* is *sprinklered* with fast-response sprinklers, (c) corridors opening into the *interconnected floor space* are separated from the *interconnected floor space* by a *fire separation* with the rating required for the corridor, and (d) *smoke detectors* are installed in the rooms opening into the *interconnected floor space* and the *smoke detectors* are connected to the fire alarm system. 2. Open stairs in *buildings* of maximum 3 *storeys* in *building height*, or the first 2 *storeys* and basement, need not comply with Subsection 3.2.8. provided: (a) the *building* contains a Group C or D *occupancy*, (b) the *building* is *sprinklered* with fast-response sprinklers, (c) *smoke detectors* are installed in the rooms opening into the *interconnected floor space* and the *smoke detectors* are connected to the fire alarm system, and (d) at least one *means of egress* is not through the *interconnected floor space*.

15	**Separation of** ***Suites*** Article 3.3.1.1.; Article 9.10.9.13., Article 9.10.9.14. *Suites* are required to be separated from adjoining *suites* by 3/4 h or 1 h rated *fire separations*.	Existing *fire separations* of 30 min, such as wood lath and plaster in good condition, are *acceptable* in *sprinklered buildings* not exceeding 6 *storeys* in *building height*.
16	**Corridor** ***Fire Separation*** Article 3.3.1.4.; Article 9.10.9.15. *Public corridors* are required to be separated from the remainder of the *building* by a *fire separation* having a *fire resistance rating* of at least 3/4 h.	Existing corridors with 30 min *fire-resistance ratings*, such as wood lath and plaster in good condition, are *acceptable* in *residential occupancies* provided the *building*: (a) does not exceed 6 *storeys* in *building height*, and (b) is fully *sprinklered* with fast-response sprinklers.
17	**Corridor Width** Articles 3.3.1.9. and Subsection 3.4.3.; Article 9.9.3.3. *Public corridors* and *exit* corridors are permitted to have a minimum width of 1 100 mm.	*Public corridors* and *exit* corridors are permitted with a minimum width of 800 mm provided: (a) the *occupant load* of the *building* is maximum 20 people, and (b) the *building* does not exceed 3 *storeys* in *building height*.
18	**Door Swing** Articles 3.3.1.10. and 3.4.6.12.; Article 9.9.6.5. Doors required to swing in the direction of *exit* travel.	Second egress door from a room is not required to swing in the direction of *exit* travel provided: (a) the *building* is *sprinklered* and the system is supervised in conformance with Sentence 3.2.4.9.(2), and (b) the *occupant load* of the *building* is a maximum of 100 people.
19	**Stairs, Ramps, Handrails and** ***Guards*** Article 3.3.1.14., Article 3.3.1.16., Article 3.3.1.18., Article 3.4.6.4., Article 3.4.6.6.; Section 9.8.	Existing conditions that do not comply fully with the requirements are permitted if they are *acceptable* to the *Chief Building Official*.
20	**Transparent Doors and Panels** Article 3.3.1.19.; Article 9.6.1.4. Glass in doors and sidelights are required to be protected by *guards* and to be safety glass.	Existing glass or transparent panels that do not comply fully with the requirements are permitted if sufficiently discernible or *guards* are provided in hazardous situations.
21	**Dead-end Corridors** Sentence 3.3.1.9.(7); Article 9.9.7.3. Dead-end corridors are permitted to a maximum length of 6 m.	1. Dead-end corridors are permitted to a maximum length of 10 m in Group C occupancies provided: (a) the *building* is *sprinklered* with fast-response sprinklers, and (b) *smoke detectors* are installed in the corridor system. 2. Dead-end corridors are permitted to a maximum of 15 m in length in Group D, E, F2 and F3 *occupancies* provided: (a) the *building* is *sprinklered* with fast-response sprinklers, and (b) *smoke detectors* are installed in the corridor system.
22	***Exits*** Article 3.4.2.1.; Article 9.9.8.2. *Floor areas* shall be served by not fewer than 2 *exits* except as permitted by Sentence 3.4.2.1.(2)	*Floor areas* may be served by a single *exit* within the limits of Sentence 3.4.2.1.(2) provided: (a) the *building* does not exceed 3 *storeys* in *building height*, (b) the *building* is *sprinklered* with fast-response sprinklers, and (c) all *floor areas* are protected by a system of *smoke detectors* connected to a fire alarm system.
23	**Reduction of** ***Exit*** **Width** Sentence 3.4.3.3.(2); Article 9.9.6.1. Swinging doors in their swing shall not reduce the effective width of *exit* stairs and	Existing swinging doors in their swing are permitted to reduce the effective width of *exit* stairs and landings to a minimum of 550 mm provided: (a) they serve Group C or D *occupancies*,

	landings to less than 750 mm.	(b) the *building* does not exceed 4 *storeys* in *building height*, and (c) the *building* is *sprinklered*.
24	*Fire Separation* **of** *Exits* Article 3.4.4.1.; Subsection 9.9.4. Article 3.4.4.1.; Subsection 9.9.4. *Exits* are required to be separated from the remainder of the *floor area* by a *fire separation* having a *fire-resistance rating* of not less than 3/4 h.	1. *Buildings* of 3 *storeys* or less may have *exits* that are separated by a *fire separation* that does not have a *fire-resistance rating* provided: (a) the *building* is *sprinklered* with fast-response sprinklers, and (b) the *sprinkler system* is supervised in accordance with Sentence 3.2.4.9.(2). 2. *Buildings* not exceeding 6 *storeys* in *building height* may have *exits* that are separated by a 45 min *fire separation* provided the *building* is *sprinklered*.
25	***Exits* Through Lobbies** Article 3.4.4.2.; Article 9.9.8.5. Rooms adjacent to the lobby are required to be separated by a *fire separation*.	Rooms adjacent to the lobby are not required to be separated by a *fire separation* provided: (a) the *floor area* is *sprinklered* with fast-response sprinklers, and (b) *smoke detectors* are installed in the adjacent rooms.
26	**Rooms Opening into an *Exit*** Sentence 3.4.4.4.(7); Article 9.9.5.9. *Service rooms* and ancillary rooms are not permitted to open directly into an *exit*.	*Service rooms* and ancillary rooms may open directly into an *exit* provided: (a) the rooms are *sprinklered* with fast-response sprinklers, and (b) weather stripping is installed on the doors to prevent the passage of smoke.
27	**Illumination of *Exit* Signs** Sentences 3.4.5.1.(2) and 3.4.5.1.(4); Sentences 9.9.11.3.(2) to 9.9.11.3.(6) *Exit* signs are required to be illuminated continuously while the *building* is occupied.	Where *exit* signage may compromise historic appearances, or authenticity of displays, *exit* signs may be installed to light only on an emergency condition, such as by the fire alarm system or due to power failure.
28	**Clearance from *Exit* Doors** Sentence 3.4.6.11.(1); Article 9.9.6.6. Stair risers shall not be closer than 300 mm from an *exit* door.	Except as permitted in Sentences 3.4.6.10.(2) or 9.9.6.6.(2), existing *exit* doors shall not extend beyond the first riser.
29	**Fire Escapes** Subsection 3.4.7.; Sentence 9.9.2.1.(2) Fire escapes are required to conform to Subsection 3.4.7.	Existing fire escapes that do not completely conform to Subsection 3.4.7. are *acceptable* provided: (a) the fire escapes are *acceptable*, and (b) the *building* is *sprinklered*.
30	**Fire Escape** *Construction* 3.4.7.2.; Sentence 9.9.2.1.(2)	Existing *combustible* fire escapes are permitted if the *building* is permitted to be of *combustible construction* by Part 3, Part 9 or by this table.
31	**Protection of Fire Escapes** Article 3.4.7.4.; Sentence 9.9.2.1.(2) Openings in the exterior wall adjacent to the fire escape are required to be protected by closures.	Existing openings in the exterior wall adjacent to the fire escape are not required to be protected by closures provided: (a) the *building* is *sprinklered*, and (b) a sprinkler head is located within 1.5 m of the opening required to be protected by Article 3.4.7.4.
32	*Vertical Service Space* Article 3.6.3.1. *Vertical service spaces* are required to be separated from the adjacent *floor area* by a rated *fire separation*.	Existing *vertical service spaces* that do not completely conform to the rated *fire separation* requirements are *acceptable* provided the *vertical service spaces* are *sprinklered*.
33	**Height and Area of Rooms** Subsection 3.7.1.; Section 9.5. The height and area of rooms are required to comply to minimum dimension	Existing rooms are not required to comply to the minimum dimension requirements of Subsection 3.7.1. or Section 9.5.

	requirements.	
34	**Washroom Requirements** Subsection 3.7.2.; Section 9.31. *Buildings* are required to be provided with a minimum number of washroom fixtures.	Existing facilities are not required to completely comply to the requirements of Subsection 3.7.2. or Section 9.31. provided it is *acceptable* to the *Chief Building Official*.
35	**Access for Persons with Disabilities** Section 3.8.	Sentences 3.8.1.1.(3) and 3.8.4.1.(1) shall apply to *existing buildings*.
36	**Seismic Anchorage of Exterior Decoration** Subsection 4.1.8.	Existing exterior decorations are not required to fully comply to the anchorage requirements of Subsection 4.1.8. provided: (a) adequate means of protection is provided, or (b) there is no exposure to the public.
37	**Mechanical Systems** Part 6 and Part 7	Existing mechanical systems in buildings are not required to fully comply to the requirements of Parts 6 or 7 provided: (a) it is not an *unsafe condition*, and (b) it is *acceptable* to the *Chief Building Official*.
38	**Energy and Water Efficiency** Parts 9, 10 and 11	The existing level of energy and water efficiency in a building is not required to comply with the requirements of Parts 9, 10 or 11 provided the level of energy efficiency is acceptable to the *Chief Building Official*.

Section 11.6. Temporary Buildings and Occupancies

11.6.1. APPLICATION

11.6.1.1. Application

1) The alternative compliance measures in this Section apply to

a) *arts and culture indoor events* in *existing buildings*,
b) temporary *buildings*,
c) special event facilities in *existing* or temporary *buildings*, and
d) temporary emergency shelters in *existing buildings*.

2) Subject to the provisions of Article 1.6.7.3. of Division C, "temporary" in this Section means

a) in relation to special event facilities, no more than two months,
b) in relation to temporary *buildings*, no more than one year, and
c) in relation to emergency shelters, no more than one year.

11.6.1.2. Alternative Compliance Measures

1) Section 11.3. may be applied to existing conditions, except as defined in Subections 11.6.2. and 11.6.3.
2) The alternative compliance measures in Section 11.5 may be applied to existing conditions in a *heritage building*, except as defined in Subections 11.6.2. and 11.6.3.
3) The alternative compliance measures provided in Table 11.6.3.1. apply to *existing buildings* used for *arts and culture indoor events* and do not apply to new work, which must conform to the requirements for new *construction* in other Parts of this By-law.
4) The alternative compliance measures provided in Table 11.6.3.1. apply to *existing buildings* used as *temporary special event* facilities and temporary emergency shelters and to temporary buildings and do not apply to new work, which must conform to the requirements for new *construction* in other Parts of this By-law.

11.6.2. ARTS AND CULTURE INDOOR EVENT

11.6.2.1. Alternative Compliance Measures

1) Where the *occupancy* of an *existing building* or portion of an *existing building* is classified as Group D offices, Group E retail, Group F Division 2 production or rehearsal studio, wholesale, warehouse, or factory, or Group F Division 2 *artist studio* without living accommodations, the *major occupancy* may be changed to a temporary Group A Division 2 *major occupancy* for an *arts and culture indoor event* if

a) the maximum *occupant load* is no more than 250 persons,

b) the *arts and culture indoor event* is located in the *first storey* or the *storey* below the *first storey* and has at least one *exit* that conforms to Clauses 3.8.3.19.(1)(d) or (e),

c) emergency lighting is provided

i) inside washrooms or, in the case of a single toilet room, immediately outside the entrance door and visible under the closed toilet room door, and

ii) in locations leading from the *arts and culture indoor event* to the *street* as described in Sentence 3.2.7.3.(1),

d) portable fire extinguishers are installed in accordance with the Fire By-law, with at least one extinguisher at the main entrance and at each egress door leading from the *arts and culture indoor event floor area*,

e) an *approved* fire emergency procedures and security plan with *approved* maximum *occupant load* is posted beside each portable extinguisher at the main entrance and at each egress door leading from the *arts and culture indoor event*,

f) the *building* is equipped with a fire alarm system, or *supervisory staff* are designated to monitor egress and *exit* doors and to carry out an emergency evacuation in accordance with *approved* fire emergency procedure, and

g) the *storey* below the *first storey* used for an *arts and culture indoor event* is equipped with a *sprinkler system*,

h) the *arts and culture indoor event* has at least one *accessible* entrance, and

i) the *arts and culture indoor event* has a *means of egress* in accordance with Article 3.8.3.19.

2) The floor of a *building* used for an *arts and culture indoor event* shall be

a) constructed of concrete supported by solid ground without suspended slab, or

b) certified by a *registered professional*, after a structural review, to be safe for *assembly occupancy* and designed to a minimum specified uniformly distributed *live load* of 4.8 kPa.

3) Cooking which generates grease-laden vapour is not permitted at an *arts and culture indoor event*, unless commercial cooking and ventilation equipment, installed under *permit* and conforming with Article 6.2.2.7., is used.

4) An *approved* maximum *occupant load* from the Vancouver Fire and Rescue Services, and a Vancouver Police Department security assessment shall be obtained for *arts and culture indoor events* in accordance with Table 11.6.2.1.

5) The number of *exits*, designated *supervisory staff*, and *exit* signs for *arts and culture indoor events* shall be provided in accordance with Table 11.6.2.1.

Table 11.6.2.1.
Requirements for Arts and Culture Indoor Events
Forming part of Article 11.6.2.1.

Occupant Load **for Event**	*Occupant Load* **Approval Required**(1)	**Minimum number of** *Exits* **Required**	*Exit* **Signage Required**	*Supervisory Staff* **at Egress/***Exit* **Door Required**(2)	**VPD Security Assessment Required**(5)
≤ 60 people for private SOL(3) or dry event(4)	Yes	1	No	1	No
≤ 60 people for public SOL	Yes	1	No	1	Yes

61-250 people for private SOL(3) dry event(4) or public SOL(3)	Yes	2	Yes	2	Yes

Notes to Table 11.6.2.1.:
(1) Vancouver Fire and Rescue Services will assess and approve the maximum temporary *occupant load* for *arts and culture indoor events*.
(2) *Supervisory staff* is required to monitor all egress/*exit* doors. One *supervisory staff* must be provided at each required *exit* door at all times.
(3) SOL means Special Occasion License issued by the British Columbia Liquor Control and Licensing Branch.
(4) Dry event means an event at which there is no liquor service.
(5) VPD means Vancouver Police Department.

11.6.3. SPECIAL EVENT FACILITIES, EMERGENCY SHELTERS AND TEMPORARY BUILDINGS

11.6.3.1. Alternative Compliance Measures

1) Table 11.6.3.1. provides alternative compliance measures for
a) temporary use of *buildings* as special events facilities and emergency shelters, and
b) temporary *buildings*.

Table 11.6.3.1.
Alternate Acceptable Solutions for Temporary Special Events Facilities, Emergency Shelters and Temporary Buildings
Forming part of Sentence 11.6.3.1.(1)

No.	By-law Requirement Division B	Alternate Compliance Measures
1	Flame Resistance 3.1.6.5.	Fabric tent material may conform to a) NFPA 701, “Standard Methods of Fire Tests for Flame Propagation of Textiles and Films”, 2004 edition, or b) Certification of Registered Flame Resistant Product certified by the California Department of Forestry and Fire Protection, Office of the State Fire Marshall.
2	Fire Separation under Tiers of Seats 3.3.2.2.	A *fire separation* between the space and the seats is not required provided a) the only occupied space beneath the bleacher seating is used as a pedestrian walkway for access to the bleacher seating, b) the occupied space is not used for storage, signage must be posted in the space beneath the bleacher seating that reads “No Storage Permitted in This Area”, and c) cleanup crews must clean up debris from the space beneath the bleacher seating at the end of each day.
3	Handrails 3.4.6.5.	Handrail extensions for temporary *buildings* may extend vertically downward not less than 300 mm beyond the top and bottom of the stairway.
4	Guards 3.4.6.6.	Openings greater than 100 mm may be permitted in *guards* where a) the *guard* serves stairs that are used only by staff or work force volunteers, and b) a triangular space created by the stair tread, stair rise, and the underside of the *guard*, provided the opening will not permit the passage of a sphere greater than 200 mm, in egress stairs that serve bleacher seating. Member, attachment or openings located between 140 mm and 900 mm above the level being protected by the *guard* may be permitted where a) the *guard* serves stairs that are used only by staff or work force volunteers, and b) rosettes in the vertical posts of scaffolding type bleachers have been installed.
5	Treads and Risers 3.4.6.8.	In locations where it is not practical for persons with disabilities to work, stairs with no public access, may have a) runs of not less than 250 mm between successive steps, b) risers between successive treads not less than 125 mm and not more than 190 mm,

		and c) open risers.
6	Direction of Door Swing 3.4.6.12. Door Release Hardware 3.4.6.16.	Tent exit doors may be equipped with fabric flaps, tie straps, zippers, or VELCRO brand or equivalent hook and loop fasteners in lieu of doors that swing on a vertical axis provided a) a minimum of two *exit* doors are be provided for each tent, b) the *occupant load* of the tent does not exceed 60, and c) security personnel are trained for emergency evacuation procedures, and remain in the vicinity of the *exit* at all times. Temporary sliding gates may be used as *exit* doors provided a) gates are left open during normal operating hours and always manned by security personnel, b) gates are closed during non-operating hours, and locked with chains and a padlock, c) operational procedures are in place to ensure that the chains and padlock are removed during operating hours, and d) security personnel are trained for emergency evacuation procedures.
7	Environment Separation Part 5	Part 5 does not apply.
8	Commercial Cooking Equipment 6.2.2.7.	26 gauge galvanized sheet metal kitchen exhaust ducts with seams are permitted provided clean-out access panels are provided at all elbow locations and at 6 m spacing for straight runs.
9	Faucets and Shower Head Efficiency 10.3.1.1.	No restriction required.
10	Water Closet Efficiency 10.3.1.2.	No restriction required.
11	Urinal Efficiency 10.3.1.2.	All urinals shall conform to CSA B45 "Plumbing Fixtures" and shall have an average water consumption not exceeding 3.8 litres per flush cycle.
12	Sanitary Connection 2.4.2.1. Book II	Portable water closets that form part of a temporary facility need not be connected to the *sanitary drainage system*.
13	Storm Drainage Connection 2.4.2.4. Book II	Roofs and paved areas need not be connected to the storm drainage system

11.6.3.2. Additional Requirements for Emergency Shelters

1) Notwithstanding the provisions of this By-law, a temporary emergency shelter is permitted in an *existing building*, except that there shall be

a) no cooking in the *building*, other than food re-heated by microwave,
b) no less than one staff for each 20 shelter spaces on duty at all times,
c) no more than one shelter bed for every 3.7 m^2 of *floor area* or, if bunk beds are provided, no more than two shelter beds for every 3.7 m^2 of *floor area*,
d) aisles no less than 900 mm wide on both sides of every shelter bed,
e) at least 2 *means of egress*,
f) *exit* signs on all *exit* doors,
g) additional directional *exit* signs, in any circumstance where *exit* signs over *exit* doors are not visible from any location in the shelter,
h) *exit* signs which comply with Subsection 3.4.5.,
i) *smoke alarms* conforming to Article 3.2.4.20. installed throughout the entire *building*,

j) at least one water closet for every 20 shelter spaces,
k) at least one lavatory for every 5 water closets, and
l) all staff shall have training in first aid and emergency evacuations.

11.7 Alterations for Building Energy and Emissions Performance

11.7.1 Energy Retrofit Design Building Classification

11.7.1.1. Application to Existing Buildings

1) Except as permitted by Sentence (2), *alterations* to a *building* shall be in conformance with this Subsection for the purposes of energy and emissions performance.

2) A structure that cannot be identified by the characteristics of a *building* in this Subsection shall comply with the requirements of 11.7.1.2., or as deemed *acceptable* to the Chief Building Official.

3) Except as permitted in Sentences (4), (5) and 11.7.1.2 through 11.7.1.6, *alterations* to a *building* shall comply with

a) Alterations clauses within ANSI/ASHRAE/IES 90.1, "Energy Standard for Buildings Except Low-Rise Residential Buildings" and 10.2.2.2.,
b) 10.2.2.3. and *alteration* language supporting NECB 2015 (See Note A-11.7.1.1.(3).), or
c) 10.2.2.5. and *alteration* language supporting NECB 2015 (See Note A-11.7.1.1.(3).).

4) Where a *building* contains one or more major occupancies that conform to Subsection 10.2.2.5., the remaining major occupancies shall comply with Clause (3)(a) or (b).

5) Spaces never previously occupied, shall be designed and constructed to new *building* requirements, in compliance with

a) Article 10.2.2.3, if the *building* was designed or upgraded to NECB, or
b) Article 10.2.2.2.,

(See Note A-11.7.1.1.(5).)

6) The design requirements of Subsection 10.2.2. shall form an integral part of this Subsection, except where otherwise indicated.

11.7.1.2. Buildings Without Residential or Commercial Components

1) Alterations to systems or components of all *buildings*, except those included in 11.7.1.3 through 11.7.1.6, shall comply with

a) Article 10.2.1.2.,
b) Articles 10.2.2.6 through 10.2.2.22. as applicable, and
c) the *alteration* requirements of
i) Clause 11.7.1.1.(3)(a) except as required by Clause (ii), or
ii) Clause 11.7.1.1.(3)(b) where the building was designed or upgraded to NECB.

11.7.1.3. Residential Buildings of 7 Stories or More, and Commercial Buildings (with or without residential components)

1) Alterations to systems or components of all *buildings* containing Group C, D, or E *Major Occupancies*, except those included in 11.7.1.4 through 11.7.1.6., shall comply with

a) Article 10.2.1.3.,
b) Articles 10.2.2.6 through 10.2.2.20. as applicable,
c) the airtightness performance of Article 10.2.2.21. for reconstruction projects,
d) Article 10.2.2.22. as applicable, and
e) the *alteration* requirements of Clause 11.7.1.1.(3)(c).

11.7.1.4. Residential Buildings of 4 to 6 Storeys, and Mixed-Use Residential Buildings of 1 to 6 Storeys

1) Except for *buildings* included in 11.7.1.5 or 11.7.1.6, *alterations* to systems or components of a *building* described in Sentence 10.2.1.4.(1), shall comply with

a) Article 10.2.1.4.,
b) Articles 10.2.2.6 through 10.2.2.20. as applicable,
c) the airtightness performance per Article 10.2.2.21. for reconstruction projects,
d) Article 10.2.2.22. as applicable, and
e) the *alteration* requirements of
  i) Clause 11.7.1.1.(3)(a) and the thermal performance of Articles 10.2.2.6. and 10.2.2.7., and heat recovery ventilators per Article 10.2.2.17 unless the *building* was designed or upgraded to NECB,
  ii) Clause 11.7.1.1.(3)(b), and thermal performance per Articles 10.2.2.6. and 10.2.2.7., and heat recovery ventilators per Article 10.2.2.17., or
  iii) Clause 11.7.1.1.(3)(c).

11.7.1.5. Residential Buildings of 1 to 3 Storeys

1) Except as otherwise required in this Subsection, *alterations* to systems or components of a *building*, described in Sentence 10.2.1.5.(1), shall comply with

a) Article 10.2.1.5.,
b) the thermal performance per Articles 10.2.2.6., except where in a building envelope *alteration* increasing envelope thickness to achieve required RSI-value(s) is deemed prohibitive by the CBO, the *building* design may
  i) achieve a minimum nominal RSI of 2.5 W/m^2K in the affected assemblies with heat transfer, air leakage and condensation control per Section 9.25, and
  ii) trade-off the remaining unachieved envelope performance with other building systems or components to achieve equivalent energy performance outcomes, acceptable to the CBO,
d) 10.2.2.7. through 10.2.2.11. as applicable,
e) domestic hot water heater per Article 10.2.2.12. except an energy factor value of greater than 0.62 may be used,
f) 10.2.2.13. through 10.2.2.20. as applicable,
g) Article 10.2.2.21 except an airtightness performance of 5.0 ACH may be used for reconstruction projects, and
h) Article 10.2.2.22. as applicable.

11.7.1.6. Residential Buildings with Not More Than 2 Principal Dwelling Units

1) Except as otherwise required in this Subsection, *alterations* to systems or components of a *building*, described in Sentence 10.2.1.6.(1), shall comply with

a) Article 10.2.1.6.,
b) the thermal performance of Articles 10.2.2.6., except where in a building envelope *alteration* increasing envelope thickness to achieve required RSI-value(s) is deemed prohibitive by the CBO, the *building* design may
  i) achieve a minimum nominal RSI of 2.5 W/m^2K in the affected assemblies with heat transfer, air leakage and condensation control per Section 9.25, and
  ii) trade-off the remaining unachieved envelope performance with other building systems or components to achieve equivalent energy performance outcomes, acceptable to the CBO,
c) Articles 10.2.2.7. through 10.2.2.11 as applicable,
d) Article 10.2.2.12 except with an energy factor value greater than 0.62,
e) Articles 10.2.2.13 through 10.2.2.20. as applicable, and
f) the maximum tested air leakage rates per Article 10.2.2.21. for reconstruction projects only.

NOTES TO PART 11
EXISTING BUILDINGS

A-11.2.1.2. EXISTING BUILDING UPGRADE MECHANISM

BACKGROUND AND INTENT. When work is carried out to an existing building, the Building By-law requires that the building be upgraded to an "acceptable" level. On April 20, 2004 Council approved a new model for determining the "acceptable" level of Building By-law upgrade for existing buildings undergoing alterations under the City's building permit process.

Prior to April 20, 2004, the Upgrade Mechanism Model was based primarily on construction values. The new Upgrade Mechanism Model determines the required "acceptable" level of upgrade for an existing building using the concept of "Project Types and Categories of Work".

The intent of the Upgrade Mechanism Model is to provide a road map for building owners and designers to determine the required level of Building By-law upgrade for the existing portion of a building as a function of the project types and the related categories of work.

The Upgrade Mechanism Model is not generally intended for existing residential buildings containing not more than two principal dwelling units. The general upgrade requirement for these types of buildings is defined in Article 11.2.1.4.of Division B.

VOLUNTARY BUILDING BY-LAW UPGRADES. Where a voluntary upgrade for fire alarm systems, sprinkler systems, exits, accessibility, seismic work, building envelope repair, energy efficiency, or water efficiency is performed, it is not the intent of this By-law to require the owner to further upgrade the building provided no other work is included in the project. If other work is included in the project, the upgrade requirement will only be based on the non-voluntary work proposed.

PROCEDURE FOR USING THE UPGRADE MECHANISM MODEL

The following steps outline a recommended procedure for using the Upgrade Mechanism Model.

STEP 1 – Determine Any Other Requirements that may be Applicable. Other Building By-law requirements may be applicable to the existing building project. Review the Overall Conditions for the Upgrade Mechanism Model to determine if other requirements are applicable.

STEP 2 – Determine the appropriate Project Type(s) and Related Category or Categories of Work as a function of the scope of work for the alteration.

If the renovation includes more than one category of work or project type, then the most restrictive upgrade levels from each project type would be applied.

Table A-11.2.1.2.-A
Project Types and Related Categories of Work

Project Type	**Rehabilitation** (*See Flow Chart No. 1*)	**Change of Major Occupancy** (*See Flow Chart No. 2*)	**Addition** (*See Flow Chart No. 3*)

Categories of Work	**V**oluntary Upgrade **R**epair/**S**mall Suite **M**inor Renovation **M**ajor Renovation **R**econstruction	**C**hange of Major Occupancy Classification **C**hange of Major Occupancy Classification to a Small Suite	**M**ajor Horizontal Addition **M**inor Horizontal Addition **M**ajor Vertical Addition **M**inor Vertical Addition

STEP 3 – Determine the Required Design Upgrade Level Based on the Category of Work for the Project

The required upgrade levels for fire, life & health safety; structural safety; non-structural safety; accessibility for persons with disabilities; and energy efficiency are to be determined using each of the applicable project type flow charts and the related category of work

For Rehabilitation Type Projects use Flow Chart No. 1.
For Change of Major Occupancy Type Projects use Flow Chart No. 2.
For Addition Type Projects use Flow Chart No. 3.

NOTE: Where a project involves more than one category of work, the most restrictive upgrade level, as determined from each category of work, shall determine the upgrade design level.

STEP 4 – Determine the objective and acceptable solution for the most restrictive upgrade level for fire, life and health safety; structural safety; non-structural safety; accessibility for persons with disabilities; and energy efficiency. The most restrictive upgrade levels are the design upgrade levels that are to be applied to the existing building.

The model is based on incremental upgrade levels for each of the fire, life and health safety (F), structural safety (S); non-structural safety (N); accessibility (A); and energy (E) objectives. For each of the upgrade levels, the model states the objective of the upgrade level as well as the corresponding acceptable solution that is deemed to meet the intended objective of the applicable upgrade level. The objective statement and acceptable solution for each F, S, N and A upgrade level is defined in Table A-11.2.1.2.-B. The objective statement and acceptable solution for each E upgrade level is defined in Table A-11.2.1.2.-C.

The alternative acceptable solution for energy efficiency requires that the determined E design upgrade level from Flow Chart No 1 is used to enter Table A-11.2.1.2.-C to determine the Objective Statement and review the list of options of alternative acceptable solutions. Within Table A-11.2.1.2.-C and the appropriate E Level section, the user selects one alternative acceptable solution from within the Building System chosen by the user to be upgraded. Only one (1) of the solutions in the Alternative acceptable solutions Options column in Table A-11.2.1.2.-C is required to meet the objective. It is up to the user to determine which system in the Building System column and corresponding upgrade solution in the Alternative acceptable solution Option column shall be chosen to satisfy the objective. Within any 5 year period, when an alternative acceptable solution has been used previously within the project area, then that option is not permitted to be used as an alternative acceptable solution.

PROJECT TYPES AND THEIR RELATED CATEGORIES OF WORK

The Upgrade Mechanism Model is based on the following defined three Project Types and related Categories of Work as illustrated in Table A-11.2.1.2.-A. If the renovation includes more than one category of work or project type, then the most restrictive upgrade levels from all the applicable project types would be applied.

Table A-11.2.1.2.-A
Project Types and Related Categories of Work

Project Type	**Rehabilitation** (*See Flow Chart No. 1*)	**Change of Major Occupancy** (*See Flow Chart No. 2)*	**Addition** (*See Flow Chart No. 3*)
Categories of Work	**V**oluntary Upgrade **R**epair/**S**mall Suite **M**inor Renovation **M**ajor Renovation **R**econstruction	**C**hange of Major Occupancy Classification **C**hange of Major Occupancy Classification to a Small Suite	**M**ajor Horizontal Addition **M**inor Horizontal Addition **M**ajor Vertical Addition **M**inor Vertical Addition

REHABILITATION PROJECT TYPE (Flow Chart No. 1)

Voluntary Building By-law Upgrades – Voluntary Building By-law upgrades are limited to alterations that directly contribute to the improvement of the fire alarm, sprinkler, exit, accessibility, seismic, building envelope, and energy or water efficiency systems in an existing building.

REPAIR – Repair pertains to a limited scope of interior or exterior renovation work to replace existing building components with functionally equivalent components. Repair work may not include work that increases the usable floor area of a building, creates an interconnected floor space, supports an addition or change of use, or the consolidation of more than one existing suite into a single tenant space. For Repairs, an E1 level of energy upgrade shall be applied.

SMALL SUITE – The upgrade trigger for a Small Suite pertains to limited renovation work within a small suite as defined in Division A, Article 1.4.1.2. Small Suite work may include reconfiguration of the interior space of the suite, but may not include work on more than level (storey or mezzanine), interconnected floor spaces, exterior renovations, or the consolidation of more than one existing suite into a single new tenant space. For Small suite renovations, an E2 level of energy upgrade shall be applied.

MINOR RENOVATION – Minor renovation means a project whose scope of work includes construction limited to the improvement, renovation, reconfiguration, or refurbishment of a single suite contained within a single tenant space and those demising walls shared with the adjoining suites, but does not include the public or common floor areas of the building.

Minor renovations may include the following:

- Reconfiguration of the interior space of the suite which may occupy multiple levels in a building,
- Retention of existing interconnected floor spaces that do not create new connections to previously unconnected floor areas,
- Retention of existing mezzanines that do not add floor area,
- Renovation in adjacent suites to the extent necessary to support the relocation of shared demising walls, and
- Exterior renovations pertaining to the subject suite.

Where the renovation includes a new interconnected floor space, this work would not be considered to be a minor renovation. New mezzanines are considered to be additions.

MAJOR RENOVATION – Major renovations means work within multiple tenant spaces that is not otherwise considered a minor renovation. Major renovations may include (singly or in combination): Interior re-configuration of multiple tenant spaces, creation of interconnected floor spaces, exterior alterations, or alterations that create a new tenant space. However, where such renovation includes a change of major occupancy classification or a new mezzanine, this work would not be considered solely as a major renovation. New mezzanines are considered to be additions.

RECONSTRUCTION - Reconstruction means the extensive removal of the majority of construction to expose the building's primary structure on interior and exterior walls, floors and roof with only the primary structural elements remaining in place (building skeleton). Reconstruction also includes substantial reconfiguration of the interior floor space. Where work, which might otherwise be considered as reconstruction, is undertaken solely to facilitate the repair or the abatement of a health hazard of a building, then such work need not be considered a reconstruction and would be considered a repair, minor renovation or a major renovation as defined in this By-law.

Reconstruction project typically include:

- extensive renovations throughout the entire building and the building is gutted.
- the removal of the majority of drywall and plaster from the interior walls.
- the removal of the majority of drywall, plaster, insulation and exterior cladding from the exterior walls,
- the removal of floor and roof membranes and coverings.

FLOW CHART NO. 1

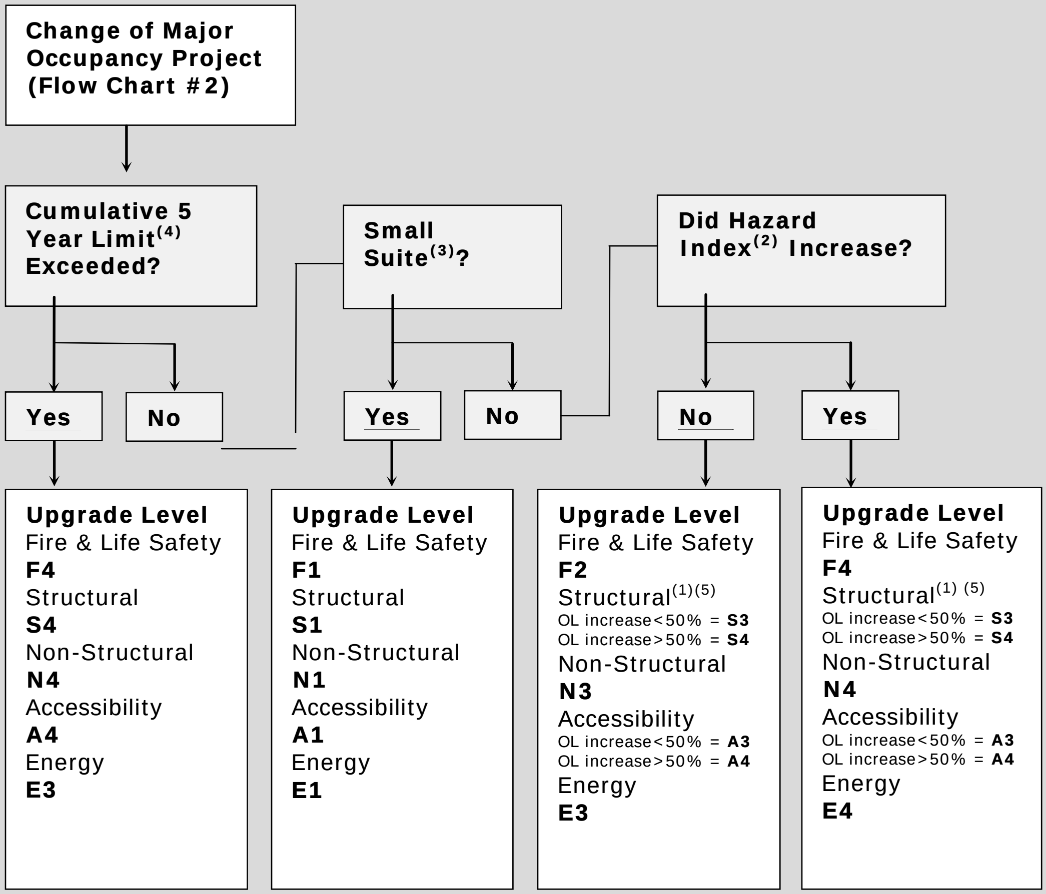
Rehabilitation Project (Flow Chart #1)

Voluntary Upgrade	**Repair / Small Suite**[1]	**Minor Renovation**	**Major Renovation**	**Reconstruction**
Upgrade Level	**Upgrade Level**	**Upgrade Level**	**Upgrade Level**	**Upgrade Level**
Fire & Life Safety **NA**	Fire & Life Safety **F1**	Fire & Life Safety **F1**	Fire & Life Safety **F2**	Fire & Life Safety **F4**
Structural **NA**	Structural **S1**	Structural **S2**[2]	Structural **S2**[2]	Structural **S4**
Non-Structural **NA**	Non-Structural **N1**	Non-Structural **N1**	Non-Structural **N3**	Non-Structural **N4**
Accessibility **NA**	Accessibility **A1**	Accessibility **A2**	Accessibility **A3**	Accessibility **A4**
Energy **NA**	Energy **E1 / E2**[3]	Energy **E2**	Energy **E4**	Energy **E6**

Change of Major Occupancy Classification – Change of major occupancy classification means a change of use within a building, a suite, or its constituent floor areas where the proposed use is outside of the currently defined uses of the existing major occupancy classification permitted for the building, the suite, or its constituent floor areas.

Small Suite Change of Major Occupancy Classification – Small suite change of major occupancy classification means a change of use within a small suite, or the constituent floor areas of a small suite, where the occupant load for the entire suite does not exceed 60 persons and the small suite is limited to a Group A, Division 2, Group D, Group E, Group F, Division 2 (wholesale showroom), or Group F, Division 3 major occupancy.

FLOW CHART NO. 2



Notes to Flow Chart No. 2:

(1.) Occupant load (OL) increase is based on the proposed occupant load for the entire building versus the current occupant load for the entire building. The OL change may be assessed in a comparative manner by considering only those areas undergoing a change of major occupancy, where the occupant load of the remainder of the building cannot otherwise reasonably be assessed. Occupant loads are to be determined by the acceptable solutions in Subsection 3.1.17. of Division B.

(2.) The Hazard Index may be determined by the Hazard Index Table A-11.2.1.2.-D. or other methodology as deemed acceptable to the Chief Building Official.

(3.) For small suites, the small suite must be separated on the suite side of the suite separation with at least two layers of gypsum wall board (GWB). Where only one layer exists, then an additional layer of GWB must be added to the suite side only. The additional layer of GWB may be any type of GWB with a minimum thickness of 13 mm.

(4.) The cumulative 5 year limit is triggered when there is a change of major occupancy in an existing building and the aggregate area of the change in major occupancy including the current work within any 5 year period is greater than 50% of the building area (as defined in Article 1.4.1.2. of Division A) in a building of not more than one storey, or the aggregate area of the change in major occupancy within any 5 year period is greater than 100% of the building area (as defined in Article 1.4.1.2. of Division A) in a building of more than one storey.

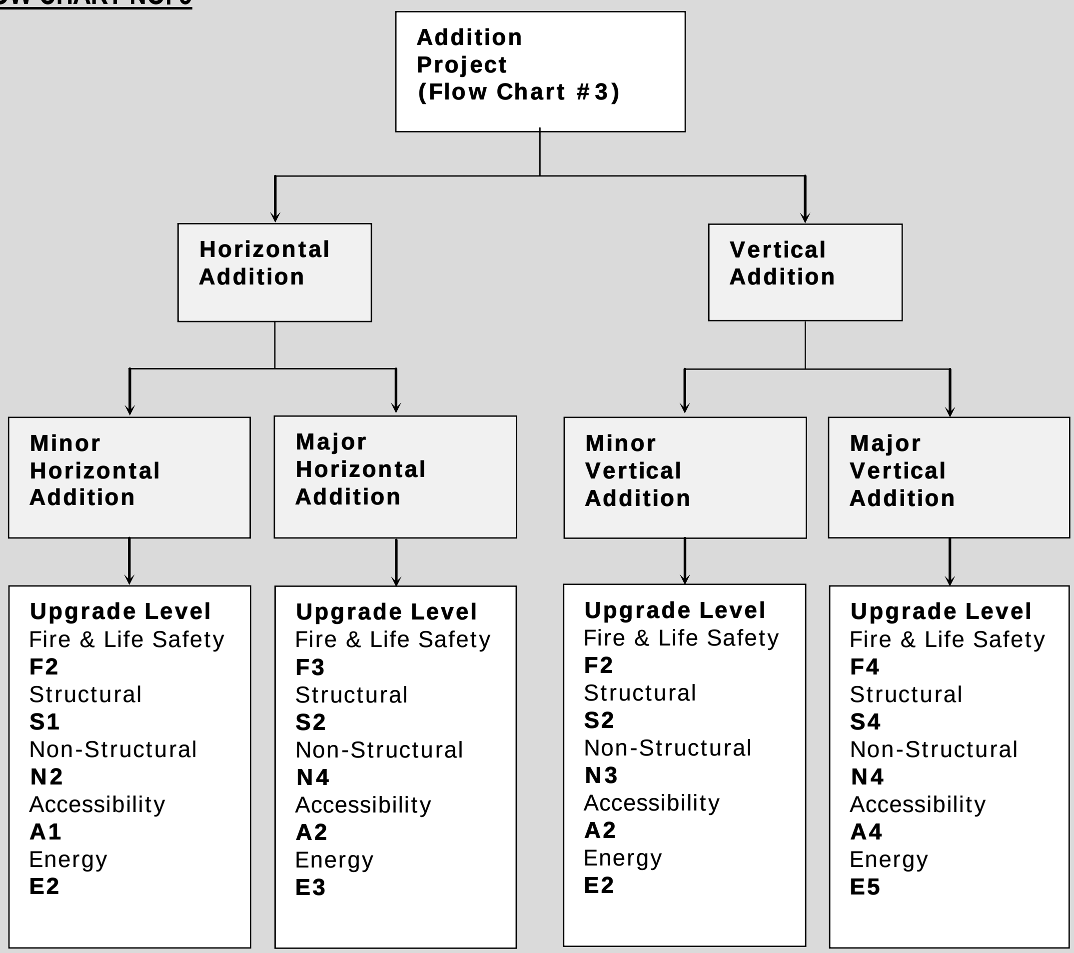
(5.) Where there is a change of major occupancy and the structural load paths or structural design criteria are altered then it must be demonstrated that the existing building has the structural capacity to carry the increase in load or the building shall be structurally upgraded to carry the increase in live load.

ADDITION PROJECTS (Flow Chart No. 3)

Horizontal Addition – Horizontal additions include both "minor" and "major" horizontal additions. A minor horizontal addition is any expansion of a floor area beyond the extents of the existing floor area in which it is located by not more than 25 per cent of the existing building area, or by not more than 500 m² in aggregate floor area. A major horizontal addition is any expansion of a floor area beyond the extents of the existing floor area that exceeds the limits permitted by a minor horizontal addition. Any construction creates new floor area that in-fills existing roof or deck areas, or is superimposed over existing building structure or floor area is not considered a horizontal addition.

Vertical Addition – Vertical additions include both "minor" and "major" vertical additions. A minor vertical addition is the addition of new floor area (storey, mezzanine, decks or other roof areas intended for occupancy) that in-fills existing unoccupied roof or deck areas, or is superimposed over existing building structure or floor area, with an aggregate floor area increase of not more than 25 per cent of the building area, or by not more than 500 m² in aggregate floor area. A major vertical addition is an addition that increases the aggregate floor areas or mezzanine area increase that exceeds the limits permitted by a minor vertical addition.

<u>FLOW CHART NO. 3</u>



DESIGN UPGRADE LEVEL TABLES

Table A-11.2.1.2.-B
DESIGN UPGRADE LEVELS FOR FIRE, LIFE AND HEALTH SAFETY (F), STRUCTURAL SAFETY(S), NON-STRUCTURAL SAFETY (N), and ACCESSIBILITY (A)

DESIGN LEVEL(1)	OBJECTIVE STATEMENT	ALTERNATIVE ACCEPTABLE SOLUTIONS

F1	Exiting to be reviewed to ensure that the exits do not present an unsafe condition.	**Project Area -** Exits to be upgraded with respect to number, capacity, and fire separations only.
S1	Proposed work must not have an adverse effect on the structural capacity of the existing structure.	**Entire Building -** Proposed work must not reduce the structural integrity of the existing building.
N1	Project area to be reviewed to ensure safety from overhead falling hazards.	**Project Area -** Restrain all ceiling supporting frames, T-bars assemblies, ceiling gypsum wall boards, all overhead mechanical ducts, and equipment, overhead electrical conduits and lights
A1	The proposed work must not adversely affect the existing accessibility level of the building.	**Project Area -** Existing level of accessibility must be maintained throughout the project area. No additional accessibility enhancements are required.
F2	Existing building to meet the fire & life safety requirements of the Building By-law within the project area and have conforming exits leading from the project area to an acceptable open space.	**Project Area -** Alarms and detectors (only where existing devices are provided), emergency lights, access to exit, exits, exit signs, and exit lights. **Public Area** (leading from project area to an acceptable open space) - emergency lights, exit signs, access to exit, exits, and flame spread ratings.
S2	Limited structural upgrade required in order to provide minimum protection to building occupants during a seismic event within the project area.	**Project Area -** Non-structural elements and falling hazards must be restrained to resist lateral loads due to earthquakes within the project area.
N2	Project area and means of egress to be reviewed to ensure safety from overhead falling hazards.	**Project Area Means of Egress -** Restrain interior partition walls. Restrain all ceiling supporting frames, T-bars assemblies, ceiling gypsum wall boards, all overhead mechanical ducts, and equipment, overhead electrical conduits and lights. Restrain cladding veneer, parapets, canopies and ornaments over exit and extended to 5 m on either side of exit
A2	A limited level of upgrade shall be provided within the project area to ensure access for persons with disabilities.	**Project Area** - door clearances, door hardware, and areas of refuge.
F3	Existing building to meet fire, life and health safety requirements within the project area. Existing building to meet fire, life & health safety requirements within the public areas.	**Project Area** – Alarms & detectors (only where existing devices are provided), emergency lighting, access to exit, exits, exit signs, exit lights, flame spread ratings, floor assemblies & supports, occupancy separation, standpipes and sprinklers, washrooms. **Public Area -** Alarms & detectors (only where existing devices are provided), emergency lighting, access to exit, exits, exit signs, exit lights. **Entire Building** – Fire fighter's access.
S3	The building structure shall be upgraded to an acceptable level in order to provide a minimum level of property and life safety to unreinforced masonry or other buildings having less than 30 percent of the current required seismic resistance. Falling hazards that may impact adjacent properties and over public ways must be addressed.	**Entire Building** — Building to be upgraded to resist 50 percent of the current By-law specified lateral force levels, where the building is evaluated as having less than 30 percent of the current required seismic resistance. Restrain falling hazards from major building components such as cantilevered walls, parapets, exterior ornaments, towers, chimneys, or other appendages, which could impact adjacent properties and public ways to resist forces due to a seismic event.

N3	Building exits and to acceptable open space to be reviewed to ensure safety from overhead falling hazards.	**Entire Building Exits -** Restrain interior partition walls. Restrain ceiling supporting frames, T-bars assemblies, ceiling gypsum wall boards, overhead mechanical equipment and services, overhead electrical equipment and services. Restrain falling hazards to resist forces due to a seismic event from non-structural elements including cladding, veneer, cornices, canopies, awnings, and ornaments over exit and extended to 5 m on either side of exit.
A3	The existing building shall be upgraded to an acceptable level in order to ensure complete access within the project area as well as access to the remainder of the building.	**Project Area —** Door clearances, door hardware, accessible washrooms, and areas of refuge. **Public Area —** Door clearances, door hardware, areas of refuge, washrooms, ramps, and elevators.
F4	Entire building to substantially meet the intent of health, fire and life safety requirements of the VBBL as well as provide protection to adjacent property.	**Entire Building —** Alarms & detectors, emergency lighting, access to exit, exits, exit signs, exit lights, flame spread ratings, firefighting access & water supply, floor assemblies & support, spatial separation, occupancy separation, standpipes & sprinklers, washrooms, high building requirements, lighting levels, sound transmission classifications, ventilation, building envelope review, and radio antenna systems.
S4	The entire building structure shall be brought up to an acceptable level in order to meet seismic requirements of the VBBL.	**Entire Building —** Building to be upgraded to resist 75 percent of the current By-law specified lateral force levels, where the building is evaluated as having less than 60 percent of the current required seismic resistance.
N4	Entire Building and to acceptable open space to be reviewed to ensure safety from overhead falling hazards.	**Entire Building —** Restrain all interior partition walls. Restrain all ceiling supporting frames, T-bars assemblies, ceiling gypsum wall boards, overhead mechanical equipment and services, overhead electrical equipment and services. Restrain exterior falling hazards to resist forces due to a seismic event from cladding, veneer, cornices, parapets, canopies, awnings, and ornaments attached to the exterior of the building.
A4	The existing building shall be upgraded in order to provide the minimum accessibility requirements of the VBBL.	**Entire Building —** Building to meet accessibility provisions of the current VBBL.

Notes to Table A-11.2.1.2.-B:
(1) Where there is one or more upgrade level(s) within the same category preceding the design upgrade level in Table A-11.2.1.2.-B, then the design upgrade level shall also include all of the preceding upgrade levels. For example, where the design upgrade level is F3, then all of the upgrade requirements under F2 and F1 also apply.

TABLE A-11.2.1.2.-C
Alternative acceptable solutions for Energy Efficiency

General Objective Statement: Improve the energy and GHG emissions performance of *buildings*, systems or components. **Solution Location:** E1 through E5 - Project Location. E6 and E7 – Building Location		
E Level	**Building**	**Alternative Acceptable Solution Options**(1) (Choose one)

<table>
<tr><th></th><th>System</th><th></th></tr>
<tr><td colspan="3">E1 Level Objective Statement: Review and maintain, or upgrade, basic efficiency of equipment or components.</td></tr>
<tr><td rowspan="4">E1</td><td>Envelope</td><td>1) Reduce air leakage of all Glazing & Doors (per 5.4.3.2 of ASHRAE 90.1-2016)
2) Upgrade all Opaque Doors performance (per 5.5.3.6 of ASHRAE 90.1-2016)</td></tr>
<tr><td>HVAC(3)</td><td>1) Upgrade Dead Band settings (per 6.4.3.1.2 of ASHRAE 90.1-2016)
2) Upgrade Set-point Overlap Restrictions (per 6.4.3.2 of ASHRAE 90.1-2016)
3) Upgrade Off-Hour Controls (per 6.4.3.3 of ASHRAE 90.1-2016)
4) Upgrade Ventilation System Controls (per 6.4.3.4 of ASHRAE 90.1-2016)
5) Upgrade Heat Pump Auxiliary Heat Controls (per 6.4.3.5 of ASHRAE 90.1-2016)
6) Upgrade Freeze Protection and Snow/Ice Melting Systems (per 6.4.3.7 of ASHRAE 90.1-2016)
7) Upgrade Ventilation Controls For High-Occupancy Areas (per 6.4.3.8 of ASHRAE 90.1-2016)
8) Upgrade DDC Controls (per 6.4.3.10 of ASHRAE 90.1-2016)
9) Inspect and remediate HVAC Insulation (per 6.4.4.1 of ASHRAE 90.1-2016)
10) Inspect and remediate Duct and Plenum Leakage (per 6.4.4.2 of ASHRAE 90.1-2016)
11) Upgrade Heat and Cool Limitation (per 6.5.2.1 of ASHRAE 90.1-2016)</td></tr>
<tr><td>SWH(4)</td><td>1) Upgrade all SWH Piping Insulation (per 7.4.3 of ASHRAE 90.1-2016)</td></tr>
<tr><td>Lighting</td><td>1) Upgrade internal Exit Signs to not exceed 5W per face
2) Functional Testing (per 9.4.3 of ASHRAE 90.1-2016)</td></tr>
<tr><td colspan="3">E2 Level Objective Statement: Review and maintain, or upgrade, basic efficiency of sub-systems.</td></tr>
<tr><td rowspan="4">E2(2)</td><td>Envelope</td><td>1) Reduce air leakage of all Loading Dock Doors (per 5.4.3.3 of ASHRAE 90.1-2016)
2) Upgrade all Floor Insulation (per 5.5.3.4 of ASHRAE 90.1-2016)
3) Reduce total Skylight Fenestration/Glazing Area to 3% of gross roof area (per 5.5.4.2.2 of ASHRAE 90.1-2016)</td></tr>
<tr><td>HVAC(3)</td><td>1) Upgrade Chilled Water Plant Monitoring (per 6.4.3.11 of ASHRAE 90.1-2016)
2) Upgrade Economizer Fault Detection and Diagnostics (per 6.4.3.12 of ASHRAE 90.1-2016)
3) Clean and Balance all Air Systems (per 6.7.2.3.2 of ASHRAE 90.1-2016)
4) Balance all Hydronic Systems (per 6.7.2.3.3 of ASHRAE 90.1-2016)
5) Remove Wood-Burning Fireplace unit
6) Replace gas fireplace pilot light with electronic ignition unit with energy rating over 50
7) Install makeup air supply per code to balance exhaust fan(s) over 300 cfm</td></tr>
<tr><td>SWH(4)</td><td>1) Upgrade SWH system Temperature Controls (per 7.4.4.1 of ASHRAE 90.1-2016)
2) Upgrade SWH system Temperature Maintenance Controls (per 7.4.4.2 of ASHRAE 90.1-2016)
3) Upgrade SWH system Outlet Temperature Controls (per 7.4.4.3 of ASHRAE 90.1-2016)
4) Upgrade SWH system Circulating Pump Controls (per 7.4.4.4 of ASHRAE 90.1-2016)
5) Upgrade Pool systems (per 7.4.5 of ASHRAE 90.1-2016)
6) Upgrade pipe risers to incorporate Heat Traps (per 7.4.6 of ASHRAE 90.1-2016)</td></tr>
<tr><td>Lighting</td><td>1) Upgrade to Local Control (per 9.4.1.1.(a) of ASHRAE 90.1-2016)
2) Upgrade to Restricted to Manual ON (per 9.4.1.1.(b) of ASHRAE 90.1-2016)
3) Upgrade to Restricted to Partial Automatic ON (per 9.4.1.1.(c) of ASHRAE 90.1-2016)
4) Upgrade to Bilevel Lighting Control (per 9.4.1.1.(d) of ASHRAE 90.1-2016)
5) Upgrade all Automatic Daylighting Responsive Controls for Sidelighting (per</td></tr>
</table>

		9.4.1.1.(e) of ASHRAE 90.1-2016) **6)** Upgrade all Automatic Daylighting Controls for Toplighting (per 9.4.1.1.(f) of ASHRAE 90.1-2016) **7)** Upgrade to incorporate Automatic Partial OFF (per 9.4.1.1.(g) of ASHRAE 90.1-2016) **8)** Upgrade to incorporate Automatic Full OFF (per 9.4.1.1.(h) of ASHRAE 90.1-2016) **9)** Upgrade to incorporate Scheduled Shutoff (per 9.4.1.1.(i) of ASHRAE 90.1-2016) **10)** Upgrade to control Parking Garage Lighting (per 9.4.1.3 of ASHRAE 90.1-2016) **11)** Upgrade to incorporate Additional Controls for Special Applications (per 9.4.1.3 of ASHRAE 90.1-2016) **12)** Exterior Lighting Control (per 9.4.1.7 of ASHRAE 90.1-2016) **13)** Reduce total Skylight Fenestration/Glazing Area to 3% of gross roof area (per 5.5.4.2.2. of ASHRAE 90.1-2016)
	Exterior or Patio Heating	**1)** Remove exterior space heating system **2)** Upgrade energy intensity (per 10.2.2.22.(3)) and system controls per 10.2.2.22.(4)
E3 Level Objective Statement: Review and improve energy performance of systems.		
E3(2)	Envelope	**1)** Provide a Building Envelope Assessment Report, to be signed and sealed by a design professional, report to include: effective R-value, blower test, list of upgrades to achieve a compliance rating using COMcheck(5) software (latest version). **2)** Reduce air leakage of all Fenestration & Doors (per 5.4.3.2 of ASHRAE 90.1-2016) **3)** Upgrade all Below-Grade Wall Insulation (per 5.5.3.3 of ASHRAE 90.1-2016) **4)** Inspect and remediate all ceiling space and floor space equipment and services including ductwork, plumbing, insulation, penetrations, dampers, valves, coils, pans and drains. **5)** Inspect and remediate all floor/crawl space services (ducts, plumbing, insulation, penetrations, drains etc)
	HVAC(3)	**1)** Provide an HVAC System Assessment Report, to be signed and sealed by a design professional. Report to include: systems reviews, upgrade and re-commissioning options, with estimates for energy savings and cost paybacks. **2)** Upgrade all ducts, plenums, and insulation (per 6.4.4 of ASHRAE 90.1-2016); inspect and remediate HVAC Insulation (per 6.4.4.1 of ASHRAE 90.1-2016); and inspect and remediate Duct and Plenum Leakage (per 6.4.4.2 of ASHRAE 90.1-2016) **3)** Incorporate Exhaust Air Recovery systems (per 6.5.6.1 of ASHRAE 90.1-2016) **4)** Incorporate a Service Water Heating Recovery system (per 6.5.6.2 of ASHRAE 90.1-2016) **5)** Upgrade all Kitchen Exhaust and Replacement Air systems (per 6.5.7.2 of ASHRAE 90.1-2016) **6)** Upgrade all Laboratory Exhaust and Replacement Air systems (per 6.5.7.3 of ASHRAE 90.1-2016) **7)** Balance all systems (per 6.7.2.3 of ASHRAE 90.1-2016)
	SWH(4)	**1)** Provide an HVAC System Assessment Report, to be signed and sealed by a design professional • Report to include: systems reviews, upgrade and re-commissioning options, with estimates for energy savings and cost paybacks. **2)** Upgrade SWH system Controls (per 7.4.4 of ASHRAE 90.1-2016)
	Lighting	**1)** Provide a comprehensive Lighting System Assessment Report to be signed and sealed by a design professional • Report to include: systems reviews, upgrade options, with estimates for

		energy savings and cost paybacks. **2)** Upgrade total Exterior Lighting Power (per 9.4.2 of ASHRAE 90.1-2016) of the suite. **3)** Meet the interior lighting power allowance by the Building Area Method (per 9.5 of ASHRAE 90.1-2016) **4)** Meet the interior lighting power allowance by the Space-by-Space Method (per 9.6 of ASHRAE 90.1-2016)
	Exterior or Patio Heating	**1)** Remove exterior space heating system **2)** Upgrade energy intensity, system and unit/zone controls (per 10.2.2.22.(3) and (4)), and circulation fans (per 10.2.2.22.(5))
E4 Level Objective Statement: Review and improve energy performance of larger systems.		
E4(2)	Envelope	**1)** Reduce air leakage of entire Building Envelope (per 5.4.3 of ASHRAE 90.1-2016) **2)** For single retail/tenant spaces < 500 m^2) Perform an Air Leakage / Blower test and remediate **3)** Upgrade all Roof Insulation (per 5.5.3.1 of ASHRAE 90.1-2016) **4)** Upgrade all Above-Grade Wall Insulation (per 5.5.3.2 of ASHRAE 90.1-2016) **5)** For single retail/tenant spaces < 500 m^2) Replace storefront window(s) to meet the By-law. **6)** Reduce total vertical Fenestration/Glazing Area to 40% of gross wall area (per 5.5.4.2.1 of ASHRAE 90.1-2016) **7)** Upgrade all Fenestration/Glazing Performance (per 5.5.4.3 and 5.5.4.4 of ASHRAE 90.1-2016) **8)** Inspect and remediate roof systems including membrane, parapets, scuppers, drains, gutters, downspouts and drains.
	HVAC(3)	**1)** Upgrade all Zone Thermostatic Controls (per 6.4.3.1 of ASHRAE 90.1-2016) **2)** Upgrade HVAC to incorporate Economizers (per 6.5.1 of ASHRAE 90.1-2016) **3)** Upgrade Heat Rejection Equipment (per 6.5.5 of ASHRAE 90.1-2016) **4)** Upgrade to Air and Service Water Heating Heat Recovery systems (per 6.5.6 of ASHRAE 90.1-2016) **5)** Upgrade entire Radiant Heating system (per 6.5.8 of ASHRAE 90.1-2016) **6)** (Re-)Commission all systems (per 6.7.2.4 of ASHRAE 90.1-2016)
	SWH(4)	**1)** Upgrade all Service Water Heating Equipment Efficiency (per 7.4.2 of ASHRAE 90.1-2016)
	Lighting	**1)** Lighting Control (per 9.4.1 of ASHRAE 90.1-2016)
	Exterior or Patio Heating	**1)** Remove exterior space heating system **2)** Upgrade exterior space heating system (per 10.2.2.22)
E5 Level Objective Statement: Review and bring to present VBBL energy requirements, entire system(s) affected by vertical addition.		
E5(2)	Envelope	**1)** Upgrade insulation levels of entire Building Envelope (Opaque Areas) (per 5.5.3 of ASHRAE 90.1-2016) **2)** Upgrade all Fenestration/Glazing (per 5.5.4 of ASHRAE 90.1-2016)
	HVAC(3)	**1)** Upgrade all HVAC Controls, Insulation and Leakage (per 6.4 of ASHRAE 90.1-2016)
	SWH(4)	**1)** Upgrade Service Water Heating system to meet the Mandatory Provisions (per 7.4 of ASHRAE 90.1-2016)
	Lighting	**1)** Upgrade Lighting system to meet the Mandatory Provisions (per 9.4 of ASHRAE 90.1-2016)
E6 Level Objective Statement: Reconstruct entire building systems to meet energy efficiency requirements of present Vancouver Building By-Law.		
E6	Envelope	**1)** Upgrade all aspects of Building Envelope (per Section 5 of ASHRAE 90.1-2016)

	HVAC[3]	**1)** Upgrade all aspects of HVAC (per Section 6 of ASHRAE 90.1-2016)
	SWH[4]	**1)** Upgrade all aspects of SWH (per Section 7 of ASHRAE 90.1-2016)
	Lighting	**1)** Upgrade all aspects of Lighting (per Section 9 of ASHRAE 90.1-2016)
E7 Level Objective Statement: Reconstruct building to meet energy efficiency requirements of present Vancouver Building By-Law.		
E7	Energy	**1)** Upgrade existing building (per VBBL 1.3.3.7 Energy Use)

Notes to Table A-11.2.1.2.-C:
(1) References to ASHRAE 90.1 in Table A-11.2.1.2.-C can be considered guidance for determining the scope of work when applying the upgrade requirements to low-rise multi-family projects, otherwise these projects may apply the energy upgrade requirements of Table 11.2.1.4, per the options provided within Sentence 11.2.1.2.(9)(d).

(2) BOMA BESt (Path 1) may be substituted as the solution for upgrade level E2. BOMA BESt (Path 2) may be substituted as the solution for upgrade levels E3, E4 or E5. BOMA BESt is a Canadian industry standard for commercial building sustainability certification. Official certification documentation produced by BOMA would be required for acceptance as an alternative acceptable solution option.

The intent of the inclusion of the BOMA BESt rating system is to recognise the efforts made towards improved building performance. BOMA BESt Path 1 or Path 2 will be accepted provided

a) the BOMA BESt certification is administered by BOMA,
b) BOMA BESt Path 1 - BOMA BESt (Level 1, 2, 3, 4) provides proof of a valid Certification and ongoing commissioning per BOMA's BESt Practice Q.3 (Preventative Maintenance Program), and

c) BOMA BESt Path 2 - BOMA BESt (Level 1-AL2, 2, 3, 4) provides proof of a first-time Certification (to at least Level 1 with an ASHRAE Level 2 audit) within the previous 18 months, or a valid Certification and an increase in BOMA BESt's Energy Performance Benchmark Scale by at least one level within the previous 18 months, or advancing Certification (from one level to another) within the previous 18 months.

Proof means in the form of official certified documentation produced by BOMA, or a single Commissioning/Energy Report developed and provided by a qualified consultant, contractor, or other expert in this specialized field.

(3) HVAC – Heating, Ventilating and Air Conditioning
(4) SWH – Service Water Heating
(5) COMcheck – software developed by the US Department of Energy for use with ASHRAE 90.1-2016 Building Envelope Trade-Off option

HAZARD INDEX TABLE

The hazard index for various building uses are indicated in Table A-11.2.1.2.-D.

The required level of Building By-law upgrade for a Change of Major Occupancy Type projects is dependent on whether or not the Hazard Index has increased for the proposed alteration. Hazard Index ratings are intended to reflect the level of fire and life safety risk to occupants for various building uses. Hazard index ratings range from 1 to 6, such that a hazard index of rating of 6 represents the highest risk to occupants.

Table A-11.2.1.2.-D
Hazard Index Table

Group A Division 1	
Building Use	**Hazard Index**
Dinner Theatres	5
Live Theatres	5
Motion Picture Theatres	5
Opera Houses	5

Television Studios (With Audience)	5
Group A Division 1	
Building Use	**Hazard Index**
Art Galleries	4
Auditoria	4
Billiard Halls, Amusement Arcades	4
Bowling Alleys	4
Churches	4
Clubs, Lodges (Non-Residential)	4
Community Halls	4
Concert Halls	4
Court Rooms	4
Dance Halls	4
Daycare Centres	4
Exhibition Halls (Without Sales)	4
Exhibition Halls (With Sales)	See Group E
Gymnasia (Multi-Purpose)	4
Gymnasia (Athletic)	4
Lecture Halls	4
Libraries	4
Licensed Beverage Establishments	4
Licensed Clubs, Lodges	4
Museums	4
Passenger Stations/Depots	4
Recreational Piers	4
Restaurants (Seating Over 17)	4
Schools, Colleges	4
Undertaking Premises	4
Group A Division 3	
Building Use	**Hazard Index**
Arenas (No Occupancy On Activity Surface)	4
Armouries (No Occupancy On Activity Surface)	4
Enclosed Stadia or Grandstand	4
Ice Rinks (No Occupancy On Activity Surface)	4
Indoor Swimming Pools	4
Group A Division 4	

Building Use	**Hazard Index**
Amusement Park Structures	3
Bleachers	3
Grandstands (Open)	3
Reviewing Stands	3
Stadia (Open)	3
Group B, Division 1	
Building Use	**Hazard Index**
Detention Facilities (Minimum Security)	5
Detention Facilities (All other types of security)	6
Police Station with Detention (not meeting Article 3.1.2.4.)	4
Group B, Division 2	
Building Use	**Hazard Index**
Hospital, Nursing Home, Geriatric, Sanitarium (Immobile)	5
Hospital, Nursing Home, Geriatric, Sanitarium (Non-Ambulatory)	5
Psychiatric Hospitals (Maximum Confinement)	5
Psychiatric Hospitals (Minimum Confinement)	4
Police Station with Detention (Meeting Article 3.1.2.4.)	3
Group B, Division 3	
Building Use	**Hazard Index**
To be added – use OBC data	
Group C	
Building Use	**Hazard Index**
Apartments	4
Clubs, Residential	4
Colleges Residential	4
Congregate Care Housing for Seniors	5
Convents	4
Dormitories/Hotels	4
Hotels	5
Detached Houses (1 or 2 Family)	2
Live/work units	5
Monasteries	4
Retirement Homes	4
Schools, Residential	4
Group D	

Building Use	Hazard Index
Advertising and Sales Offices	3
Automatic Bank Deposit	4
Barber/Hairdresser Shops	4
Beauty Parlours	4
Branch Banks	4
Car Rental Premises	3
Chiropractic Offices	4
Communications Offices (Telephone Exchange)	4
Communications Offices (Telex)	4
Communications Offices (Courier)	3
Computes Centres	4
Construction Offices	3
Costume Rental Premises	4
Dental Offices (Denture Clinic)	4
Dental Offices (General)	4
Dental Offices (Surgical/Anaesthesia)	5
Dry Cleaning Depots	4
Dry Cleaning Premises (Self-Serve)	4
Health/Fitness Clubs	4
Laundries (Self-Serve)	4
Massage Parlours	4
Medical Offices (Examination)	4
Medical Offices (Surgical Anaesthesia)	5
Offices (Business)	3
Offices (Charitable)	3
Offices (Legal/Accounting)	3
Offices (Design)	4
Pharmacy Offices	4
Photographic Studios	4
Physiotherapy Offices	4
Police Stations (No Detention)	4
Printing and Duplicating	5
Public Saunas	4
Radio Stations (No Audience)	4
Small Tool Rental Premises	4

Suntan Parlours	4
Veterinary Offices	4
Group E	
Building Use	**Hazard Index**
Automotive/Hardware Department Store	5
China Shops	4
Department Stores	5
Electrical Stores (Fixtures)	3
Exhibition Halls (With Sales)	5
"Fast Food" Outlets	4
Feed and Seed Stores	5
Flea Markets	5
Flower Shops	4
"Food" and Vegetable Markets	4
Garden Shops	4
"Gas" Bars	5
Gift Shops	4
Home Improvement Stores	5
Kitchen/Bathroom Cupboards Stores	4
Plumbing Stores (Fixtures/Accessories)	3
"Pop" Shops	4
Restaurants (Not More Than 30 Persons)	4
Shopping Malls	5
Stationery/Office Supply Stores	4
Stores (Art)	4
Stores (Baked Goods)	4
Stores (Beer)	4
Stores (Book)	4
Stores (Camera)	4
Stores (Candy)	4
Stores (Clothing)	4
Stores (Drugs)	4
Stores (Electronic)	4
Stores (Floor Coverings)	5
Stores (Food)	3
Stores (Furniture/Appliances)	4

Stores (Hardware)	5
Stores (Health)	4
Stores (Hobby)	4
Stores (Jewellery)	3
Stores (Paint/Wallpaper)	5
Stores (Pet)	4
Stores (Records/Tapes)	4
Stores (Spirits)	5
Stores (Toys)	5
Stores (Variety)	4
Stores (Video Sales/Rental)	4
Supermarket	4
Group F, Division 1	
Building Use	**Hazard Index**
All Uses	6
Group F, Division 2	
Building Use	**Hazard Index**
Aircraft Hangars	5
Abattoirs	4
Bakeries	5
Body Shop	5
Candy Plants	4
Cold Storage Plants with Flammable Refrigerant	5
Cold Storage Plants with Non-flammable Refrigerant and	4
Dry Cleaning Establishments (non-flammable or non-explosive)	4
Electrical Substations	4
Factories (High Fire Load)	5
Freight Depots (High Fire Load)	5
Laboratories (High Fire Load)	5
Laundries (not self-serve)	4
Manufacturer Sales (High Fire Load)	5
Mattress Factories	4
Meat Packing Plants	4
Packaging Manufacturers (Cellulose)	4
Packaging Manufacturers (Noncombustible)	3
Packaging Manufacturers (Plastics)	5

Paper Processing Plants (Wet)	5
Plaining Mills	5
Printing Plants	4
Public Heritage Buildings	3
Repair Garages	5
Sample Display Rooms (High Fire Load)	5
Self Service Storage Buildings	4
Service Stations (no spray painting)	5
Storage Rooms (High Fire Load)	5
Television Studios (no audience)	4
Tire Storage	5
Warehouse (High Fire Load)	5
Welding Shops	5
Wholesale Rooms (High Fire Load)	5
Wood Working Factories	5
Workshops (High Fire Load)	5
Group F, Division 3	
Building Use	**Hazard Index**
Creameries	2
Factories (Low Fire Load)	3
Freight Depots (Low Fire Load)	3
Laboratories (Low Fire Load)	3
Manufacturers Sales (Low Fire Load)	3
Power Plants	4
Public Heritage Buildings	3
Sample Display Rooms (Low Fire Load)	3
Storage Garages	3
Storage Rooms (Low Fire Load)	3
Warehouse (Low Fire Load)	3
Wholesale Rooms (Low Fire Load)	3
Workshops (Low Fire Load)	3

A-11.2.1.3 Sprinkler Installation Determination Where Dwelling Units Are Added. Table 11.2.1.3. provides a matrix that determines sprinkler upgrades for existing unsprinklered or partially sprinklered buildings. The location of the newly created dwelling unit will determine the extent of the sprinkler coverage for the subject building.

A-11.2.1.4.(3)(a) Replacement Value. The term “replacement value” is used as a baseline for determining the applicability of specific upgrade requirements. The term refers to an assessed cost to replace the structure in its current state, the net asset value. This is similar to what would be considered the ‘book value’ in financial terms, in that it considers the depreciated cost of the asset. This is not intended to be an assessment of the construction, planning, and ancillary costs that could be incurred if the structure in question was built as new construction.

A-11.2.1.5. Self-contained Separated Spaces. The self-contained space provisions of Article 11.2.1.5. are intended to be applied to modest upgrades or minor additions to existing buildings where the normal application of the upgrade requirements Part 11 would be onerous. It is not intended that these provisions be utilized for the construction of additions of substantial size relative to the original building construction, or the conversion or substantial reconstruction of a heritage structure. Such structures should be upgraded in conformance with the general provisions of Part 11 as applicable to the intended scope of work.

A-11.3.1.1. Application of Alternative Compliance Measures for Existing Conditions
This Article is not intended to be applied to new construction. In general, it is the purpose of Sections 11.3 to 11.5 to facilitate retention of existing conditions where the existing construction is not being substantially modified and the conditions of construction of the building do not otherwise affect their compliance. If there is new construction, this is subject to the general requirements pertaining to new construction in this By-law. Furthermore, “new work” (as opposed to existing construction) may include not only new construction, but could also consist of converted floor areas that feature newly occupied areas or spaces, areas of increased occupant load or net new floor area, or the altering of existing floor space beyond its original configuration to support new uses or occupancy.

A-11.3.3.3.(1)(b) Intumescent Paint. Experience has shown that maintenance considerations of fire retardant intumescent paint are not well understood by applicants. To be effective, multiple coats are required at installation time for complete and proper application. Proper surface preparation is also a significant portion of the work and imperative to prevent pre-mature delamination. This preparation and application period could span several days based on existing surfaces and re-coat durations. Then there is the curing time needed prior to the application of any exterior finish coat. Exterior finish coat(s) will likely be necessary as most intumescent coatings are not suitable for prolonged exterior exposure. As well, there could be a detailed installation and inspection process to confirm the installation. Experienced labour is a major factor in the process.

Another consideration is exposure to weather effects; particularly water can lead to cracking and delamination of the coating systems. As well, product information has stated that fire-resistive coatings are not intended for exterior exposures or interior environments exposed to freeze/thaw conditions. This exposure can lead to severe cracking and delamination. This could lead to expensive re-application.

Ongoing maintenance and re-application due to weather degradation or mechanical damage is another significant consideration. Product and care information must be provided to new owners or tenants when there is a change of use or ownership. This must be provided in the strata information, maintenance manuals and guaranteed by restrictive covenant against the property’s deed.

A-11.3.3.4.(4) Window Replacement. The provisions of Sentence 11.3.3.4.(4) are intended to facilitate voluntary window replacements to higher energy efficient products as part of a renovation project. As modern windows may have slightly different dimensional requirements, this Sentence allows for minor variations that do not substantially affect the existing spatial condition of the existing building. This means that the location, orientation, and size of the windows may not change, excepting minor dimensional variations to the extent necessary to accommodate the new window.

A-11.3.7.1.(1) Temporary Refuge for Persons with Disabilities. These measures are intended to provide temporary refuge for persons with disabilities. It is acknowledged, however, that the measures cannot provide absolute safety for all occupants in the fire area. It may, therefore, be necessary to develop special arrangements in the fire safety plan to evacuate persons with disabilities from these areas. Details for a suitable plan are contained in the Fire By-law.

The protected elevator referred to in Clause 11.3.7.1.(1)(a) is intended to be used by firefighters as a means for evacuating persons with disabilities. It is not intended that this elevator be used by persons with disabilities as a means of egress without the assistance of firefighters.

If an estimate is to be made of the number of persons with disabilities in a floor area who can be accommodated in each zone in Clause 11.3.7.1.(1)(b), this estimate may be based on Table 3.8.2.3., which is used to determine the minimum number of spaces to be provided for wheelchair occupants in fixed seating areas. If more precise information is available, it should be used for sizing the zones.

For residential occupancies, the choices of protection include the option to provide an accessible balcony, but it is not required that balconies be the chosen means of protection.

A-11.4.3.1.(1) Interconnected Smoke Alarms and Carbon Monoxide Detectors
Concern has been expressed to the interconnection requirement of smoke alarms served by different electrical panels if the panels do not share a common ground. The concern is a current could be generated through the interconnecting wires and false alarms could result. Interconnected smoke alarms must be powered off the same (main) electrical panel so that a common ground and reliable operation is achieved.

11.4.7.1.(2) Bare Lands Strata Conversions. It is the general intent of the strata conversions requirements of this By-law to require upgrades to existing buildings where they undergo subdivision under the provincial Strata Act. In cases where the land is being subdivided, and existing buildings are not being internally subdivided into separate strata lots, then the extent of the upgrades may be limited to upgrades addressing the external where there is no other intent to alter the buildings. These upgrades could include, but are not limited to, risks associated with the partial or total collapse of the existing buildings, overhead fall hazards, and fire exposure to or from adjacent buildings and the egress and access routes. ‘S4’and ‘N4’ are the appropriate upgrade categories, but as with all existing buildings, there may be a need to consider the impacts of site specific features which could constitute a hardship. Such cases should be evaluated by appropriately trained professionals, and alternative measures discussed with the *Chief Building Official*.

A-11.7.1.1.(3) Alteration Language Supporting NECB 2015
The term “alteration language” is used in Section 11.7 to describe the design upgrade requirements pertaining to the energy efficiency performance of buildings that are being altered from their existing condition. These requirements are fully described in the living document available on the City of Vancouver website and which is updated from time to time.

This document contains an introduction that clarifies Intent, Implementation, Scope, and Application and is reproduced here for convenience. By-law users are reminded of the need to keep up to date with the current requirements.

Alteration Language to Support the Application of the NECB 2015

Version: May 8, 2019

ACKNOWLEDGEMENT

The City of Vancouver would like to acknowledge the permission granted by ASHRAE for use of their alteration language, from the ASHRAE 90.1-2016 standard, as the foundation for this document.

ASHRAE’s willingness to support consistency within a jurisdiction with multiple energy standards is very much appreciated.

INTENT

The intention of this document is to provide building rehabilitation requirements to support the NECB in a manner consistent with the existing requirements pertaining to the ASHRAE 90.1-2016 standard.

With the implementation of NECB 2015 within Vancouver's Building Bylaw on June 3, 2019, this document provides the minimum requirements for alterations to existing buildings designed and constructed to NECB 2011 and those buildings subject to this document through 11.7 of Division B.

SCOPE

This document pertains to the application of the Vancouver Building Bylaw, specifically:

- the alteration of existing buildings;
  - designed to NECB 2011,
  - designed to ZEBP (10.2.2.5), or
  - subject to 11.7.1.1(3)(c) requirements.

APPLICATION

This document applies to the alteration of any and all building components with prescriptive requirements listed within NECB 2015, with the exception of Solar Heat Gain Coefficient requirements being applicable to the City of Vancouver only.

DEFINITIONS

Alteration means a replacement or *addition* to a *building* or its *systems* and *equipment*; routine maintenance, *repair*, and service or a change in a building's use classification or category shall not constitute an *alteration*.

Equipment means devices for comfort conditioning, electric power, lighting, transportation, or *service water*, including but not limited to, furnaces, boilers, air conditioners, heat pumps, chillers, water heaters, lamps, luminaires, ballasts, elevators, escalators, or other devices or installations.

Existing building means a *building* or portion thereof that was previously occupied or approved for *occupancy* by the *authority having jurisdiction*.

Existing system means a *system* or *systems* previously installed in an *existing building*.

Fenestration area means the total area of the *fenestration* measured using the rough opening and including the glazing, *sash*, and *frame*. For doors where the glazed vision is less than 50% of the door area, the *fenestration area* is the glazed vision area. For all other doors, the *fenestration area* is the door area.

Solar Heat Gain Coefficient (SHGC)* means the ratio of the solar heat gain entering the *space* through the *fenestration area* to the incident radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the *space*.

*All SHGC references within this document apply to the City of Vancouver only

Space means an enclosed *space* within a *building*.

System means a combination of *equipment* and auxiliary devices (e.g., controls, accessories, interconnecting means, and terminal elements) by which energy is transformed so it performs a specific function such as HVAC, *service water*, or lighting.

1.1 General

1.1.1 Instructions

This document shall be read in conjunction with NECB 2015. Words that appear in italics are defined in this document unless already defined within NECB 2015. All references to Parts are referring to the Parts within NECB 2015.

1.1.1.1 Additions to *Existing Buildings*. An extension or increase in the floor area or height of a building outside of the *existing building envelope* shall be considered *additions* to *existing buildings* and shall comply with 1.2 of this document.

1.1.1.2 *Alterations* of *Existing Buildings*. *Alterations* of *existing buildings* shall comply with 1.2 of this document.

1.1.1.3 Replacement of Portions of *Existing Buildings*. Portions of a *building envelope*, heating, ventilating, air-conditioning, *service water*, power, lighting, and other *systems* and *equipment* that are being replaced shall be considered as *alterations* of *existing buildings* and shall comply with 1.2 of this document.

1.2 Compliance

1.2.1 Compliance Paths

1.2.1.1 Additions to *Existing Buildings*. Additions to *existing buildings* shall comply with either the provisions of Parts 3, 4, 5, 6, and 7, or Part 8.

Exception: When an *addition* to an *existing building* cannot comply by itself, trade-offs will be allowed by modification to one or more of the existing components of the *existing building*. Modelling of the modified components of the *existing building* and *addition* shall employ the procedures of NECB's Part 8; the *addition* shall not increase the energy consumption of the *existing building* plus the *addition* beyond the energy that would be consumed by the *existing building* plus the *addition* if the *addition* alone did comply.

1.2.1.2 *Alterations* of *Existing Buildings*. *Alterations* of *existing buildings* shall comply with the provisions of Parts 3, 4, 5, 6, and 7, or Part 8.

Exception:

a. A *building* that has been specifically designated as a Heritage building by the *authority having jurisdiction*, need not comply with these requirements.

2.1 Building Components and *Systems*

2.1.1 Building Envelope (supports Part 3 of the NECB 2015)

2.1.1.1 Envelope *Alterations*. *Alterations* to the *building envelope* shall comply with the requirements of Part 3 for insulation, air leakage, and *fenestration* applicable to those specific portions of the building that are being altered. Fenestration must also comply with the SHGC values of 10.2.2.3 of the Vancouver Building Bylaw.

Exceptions: The following *alterations* need not comply with these requirements, provided such *alterations* will not increase the energy usage of the building:

a. Installation of storm windows or glazing panels over existing glazing, provided the storm window or glazing panel contains a low-emissivity coating. However, a low-emissivity coating is not required where the existing glazing already has a low-emissivity coating. Installation is permitted to be either on the inside or outside of the existing glazing.
b. Replacement of glazing in existing sash and frame provided the U-factor and *SHGC* (Vancouver only) will be equal to or lower than before the glass replacement.
c. *Alterations* to roof, wall, or floor cavities that are insulated to full depth with insulation having a minimum nominal value of R-3.0/in.
d. *Alterations* to walls and floors, where the existing structure is without framing cavities and no new framing cavities are created.
e. Roof recovering
f. Removal and replacement of a roof membrane where there is existing roof insulation integral to or below the roof deck.
g. Replacement of existing doors that separate a conditioned *space* from the exterior shall not require the installation of a vestibule or revolving door, provided that an existing vestibule that separates a conditioned *space* from the exterior shall not be removed.
h. Replacement of existing fenestration, provided that the area of the replacement fenestration does not exceed 25% of the total *fenestration area* of an *existing building* and that the U-factor and *SHGC* (Vancouver only) will be equal to, or lower than before the fenestration replacement.

2.1.2 Lighting (supports Part 4 of the NECB 2015)

2.1.2.1 Lighting *Alterations*. For the *alteration* of any lighting *system* in an interior *space*, that *space* shall comply with the lighting power density (LPD) requirements of Part 4 and the automatic shut- off requirements of 4.2.2.1.(20) as applicable to that *space*.

For the *alteration* of any lighting *system* for the exterior of a building application, that lighting *system* shall comply with the lighting power density (LPD) allowances of Part 4 applicable to the area illuminated by that lighting *system* and the applicable control requirements of 4.2.4.

Exceptions:

a. *Alterations* that involve 20% or less of the connected lighting load in a *space* or area need not comply with these requirements provided that such *alterations* do not increase the installed lighting power.
b. Lighting *alterations* that only involve replacement of lamps plus ballast/drivers or only involve one-for-one luminaire replacement need only comply with LPD requirement and 4.2.2.1(20).
c. Routine maintenance and repair situations.

2.1.3 HVAC (supports Part 5 of the NECB 2015)

2.1.3.1 Additions to *Existing Buildings*. Mechanical *equipment* and *systems* serving the heating, cooling, or ventilating needs of additions to *existing buildings* shall comply with the requirements of Part 5.

Exception: When HVAC to an addition is provided by existing HVAC *systems* and *equipment*, such *existing systems* and *equipment* shall not be required to comply with Part 5. However, any new *systems* or *equipment* installed must comply with specific requirements applicable to those *systems* and *equipment*.

2.1.3.2 *Alterations* to Heating, Ventilating, and Air Conditioning in *Existing Buildings*

2.1.3.2.1 New HVAC *equipment* as a direct replacement of existing HVAC *equipment* shall comply with the specific minimum efficiency requirements of Part 5, applicable to that *equipment*.

2.1.3.2.2 New cooling *systems* installed to serve previously uncooled *spaces* shall comply with 5.1.1.3.

2.1.3.2.3 *Alterations* to existing cooling *systems* shall not decrease economizer capability unless the *system* complies with 5.2.2.8 and 5.2.2.9,

2.1.3.2.4 New and replacement ductwork shall comply with 5.2.2 and,

2.1.3.2.5 New and replacement piping shall comply with 5.2.5.

Exceptions: Compliance shall not be required:

a. for *equipment* that is being modified or repaired but not replaced, provided that such modifications and/or repairs will not result in an increase in the annual energy consumption of the *equipment* using the same energy type;
b. where a replacement or *alteration* of *equipment* requires extensive revisions to other *systems*, *equipment*, or elements of a building, and such replaced or altered *equipment* is a like-for-like replacement, or better;
c. for a refrigerant change of existing *equipment*;
d. for the relocation of existing *equipment*; or
e. for ducts and pipes where there is insufficient *space* or access to meet these requirements.

2.1.4 Service Water *Systems* (supports Part 6 of the NECB 2015)

2.1.4.1 Additions to *Existing Buildings*. Service water *systems* and *equipment* shall comply with the requirements of Part 6.

Exception: When the service water *system* to an addition is provided by existing service water *systems* and *equipment*, such *systems* and *equipment* shall not be required to comply with Part 6. However, any new *systems* or *equipment* installed must comply with specific requirements applicable to those *systems* and *equipment*.

2.1.4.2 *Alterations* to *Existing Buildings*. Building service water *systems equipment* installed as a direct replacement for *existing building* service water *system equipment* shall comply with the requirements of Part 6 applicable to the *equipment* being replaced. New and replacement piping shall comply with 6.2.3.

Exception: Compliance shall not be required where there is insufficient *space* or access to meet these requirements.

2.1.5 Power (supports Part 7 of the NECB 2015)

2.1.5.1 Addition to *Existing Buildings*. *Equipment* installed in addition to *existing buildings* shall comply with the requirements of Part 7.

2.1.5.2 ***Alterations* to *Existing Buildings*.**

Exception: Compliance shall not be required for the relocation or reuse of existing *equipment* at the same site.

2.1.5.3 *Alterations* to building service *equipment* or *systems* shall comply with the requirements of this section applicable to those specific portions of the building and its *systems* that are being altered.

2.1.5.4 Any new *equipment* subject to the requirements of this section that is installed in conjunction with the *alterations*, as a direct replacement of existing *equipment* shall comply with the specific requirements applicable to that *equipment*.

A-11.7.1.1.(5) Spaces Never Previously Occupied
Spaces "never previously occupied" shall be designed and constructed to "new building" requirements, and must comply with all applicable new construction requirements within the applicable standard/code (ASHRAE 90.1, NECB, ZEBP), rather than the *alteration* language supporting the applicable standard/code. No length of unoccupied period can downgrade the design requirements, for a space's first occupancy, from full code to *alteration* requirements.

Part 12
Float Homes and Marinas

Section 12.1. General

12.1.1. Application

12.1.1.1. Application

1) The application of this Part shall be as described in Subsection 1.3.3. of Division A.

12.1.2. Definitions

12.1.2.1. Defined Terms

1) Words that appear in italics are defined in Article 1.4.1.2. of Division A. Section 12.2. Design and Construction

12.2. Design and Construction

12.2.1. Existing Float Homes and Marinas

12.2.1.1. Specific Upgrade Requirements

1) See Article 11.2.1.11. for *alterations* to existing *float homes* and *marinas*.

12.2.2. New Float Homes and Marinas

12.2.2.1. Construction Requirements

1) A *marina walkway* shall be protected against fire spread and collapse in accordance with NFPA 303, "Fire Protection Standard for Marinas and Boatyards". (See Note A-12.2.2.1.(1).)
2) A *float home* shall be designed and constructed in accordance with the British Columbia Float Home Standard. (See Note A-12.2.2.1.(2).)
3) In addition to this Part, the requirements of Parts 3 to 9 shall apply to the design and *construction* of any structure or installation forming part of a *marina*.
4) Except as required by Sentence (5), a *marina* shall have an *occupancy* classification of *Group F Division 3*.
5) Despite the provisions of Sentence (4), a *marina* equipped with a fueling station shall have an *occupancy* classification of *Group F Division 2*.

12.2.2.2. Potable Water Supply for Marinas

1) The *potable* water connection at a *marina* shall be located not more than 300 m from any *water craft*.
2) Each moorage space for a *liveaboard vessel* or *float home* shall be provided with a *potable* water connection.
3) Where *potable* water is supplied to a dockside, watering point, or *water craft* connection, the *potable* water supply and each berth connection shall be protected with a *backflow preventer*.
4) A *marina* shall meet the requirements of Book II Plumbing Systems, regarding potable water supply.

12.2.2.3. Sewer Discharge for Float Homes and Marinas

1) Each moorage space for a *liveaboard vessel* or *float home* shall be provided with a *sanitary sewer* connection.

2) *Sewage* shall be discharged into an *acceptable sanitary sewer*.
3) Every *owner* or operator of a *marina* shall provide an easily accessible pump-out connection for visiting vessels and non *liveaboard vessels*.
4) *Pump-out facilities* shall be discharged into the *sanitary sewer*, and shall be designed, operated, and maintained to prevent any discharge of *sewage* onto docks or into the adjacent water.
5) A *sewer* pipe shall be located beside or underneath the surface of any *marina walkway* and shall not be submerged below water.
6) A marina shall meet the requirements of Book II Plumbing Systems, regarding sewage discharge.

12.2.2.4. Lighting for Marinas

1) All areas throughout a *marina* shall be illuminated to a minimum average level of 50 lux at the level of all *marina walkways*, and at angles and intersections at changes of level where there are stairs or ramps.
2) The minimum value of the illumination required by Sentence (1) shall be not less than 10 lx.

12.2.2.5. Marina Walkways and Ramps Serving Float Homes and Marinas

1) A floating *marina walkway* which provides access to the shore shall be at least 2 m wide.
2) A floating *marina walkway* which provides access to *water craft* shall be at least 750 mm wide.
3) An inclined *marina walkway* shall have a non-skid surface and handrails on both sides conforming to Article 9.8.7.4.
4) Life rings, assist poles, and ladders from docks into the water shall be provided at intervals not exceeding 30 m along the length of all *marina walkways*.

12.2.2.6. Washroom Facilities for Marinas

1) Separate washroom facilities shall be
- a) provided for each sex, and
- b) located within a 300 m walking distance from any *watercraft* moored at the *marina*.

2) The washroom facilities in Sentence (1) shall consist of a minimum of one water closet and one hand basin for males and one water closet and one hand basin for females for each 100 moorage spaces or part thereof, except that
- a) up to one half of the total number of water closets required for males may be substituted with urinals, and
- b) a marina with less than 10 moorage spaces shall be provided with one universal washroom having one water closet and one wash basin.

12.2.2.7. Shower Facilities for Marinas

1) A *marina* providing moorage space to *water craft* which are not *liveaboard vessels* or *float homes* shall provide separate shower facilities for each sex in accordance with Sentence (2).
2) A minimum of one shower for males and one shower for females shall be provided for each 100 moorage spaces or part thereof.

12.2.2.8. Laundry Facilities for Marinas

1) Every *owner* or operator of a *marina* providing moorage space to *water craft* which are not *liveaboard vessels* or *float homes* shall provide a laundry room in accordance with Sentences (2) and (3).
2) Laundry facilities in a *marina* shall include a washing and drying machine.
3) Laundry facilities in a *marina* shall not be located in a washroom.

Notes to Part 12
Float Homes and Marinas

A-12.2.2.1.(1). Reference Standards. This By-law makes reference to the NFPA 303 standard for the purposes of identifying appropriate design requirements to protect a marina or float home against the spread of fire and collapse. Under the design criteria outlined in the NFPA 303 standard, it is identified that fixed fire suppression equipment shall be provided in accordance with various standards including:
- NFPA 13, "*Standard for the Installation of Sprinkler Systems*";
- NFPA 14, "*Standard for the Installation of Standpipe and Hose Systems*";
- NFPA 24, "*Standard for the Installation of Private Fire Service Mains and Their Appurtenances*"; and
- NFPA 25, "*Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*".

Designs in accordance with NFPA 303 must therefore also consider the requirements these referenced standards as part of their design in order to be deemed compliant with the provisions of this By-law.

A-12.2.2.1.(2). Float Home Standard. The BC Float Home Standard referenced by this By-law, has references to both the NFPA 303 and NFPA 307 design standards as they pertain to marina fire protection. These standards in turn include references in their appendix material to NFPA 80A – "Recommended Practice for Protection of Buildings from Exterior Fire Exposures". Designers may consider design solutions that satisfy NFPA 80A, which may be sufficient to address some aspects of the protection of marinas or float homes from fire exposure. Nonetheless, both marinas and float homes must still be designed to the appropriate spatial separation requirements of Part 3 or Part 9 of this By-law, as the requirements of the BC Float Homes standard require that float homes be designed to Part 9, and the permitted exceptions do not waive the spatial separation requirements of this By-law.

Appendix C
Climatic and Seismic Information for Building Design in Vancouver

This Appendix is included for explanatory purposes only and does not form part of the requirements of this By-law except as referenced from Division A, Sentence 1.1.3.1.(1).

Introduction

The great diversity of climate in British Columbia has a considerable effect on the performance of buildings; consequently, building design must reflect this diversity. This Appendix briefly describes how climatic design values are computed and provides recommended design data for a number of cities, towns, and lesser populated locations. Through the use of such data, appropriate allowances can be made for climate variations in different localities of British Columbia and the By-law can be applied regionally.

The climatic design data presented in Table C-2 are based on weather observations collected by the Atmospheric Environment Service, Environment Canada. The data were researched and analyzed by Environment Canada.

Recommended climatic design values for locations not listed can be obtained by contacting the Atmospheric Environment Service, Environment Canada, 4905 Dufferin Street, Downsview, Ontario M3H 5T4, (416) 739-4365. It should be noted, however, that these recommended values may differ from the legal requirements set by the City of Vancouver.

The information on seismic hazard in spectral format given in Table C-3 has been provided by the Geological Survey of Canada of Natural Resources Canada. Information for municipalities not listed can be obtained at www.earthquakescanada.nrcan.gc.ca or by writing to the Geological Survey of Canada at 7 Observatory Crescent, Ottawa, Ontario K1A 0Y3, or at P.O. Box 6000, Sidney, B.C. V8L 4B2.

General

The choice of climatic elements tabulated in this Appendix and the form in which they are expressed have been dictated largely by the requirements for specific values in several sections of this Code. These elements include the Ground Snow Loads, Wind Pressures, Design Temperatures, Heating Degree-Days, One-Day and 15-Minute Rainfalls, the Annual Total Precipitation values and Seismic Data. The following notes briefly explain the significance of these particular elements in building design, and indicate which weather observations were used and how they were analyzed to yield the required design values.

Table C-2 lists design weather recommendations and elevations for Vancouver. Elevations have been added to Table C-2 because of their potential to significantly influence climatic design values.

Since interpolation from the values in Table C-2 to other locations may not be valid due to local and other effects, Environment Canada will provide climatic design element recommendations where necessary. Local effects are particularly significant in mountainous areas, where the values apply only to populated valleys and not to the mountain slopes and high passes, where very different conditions are known to exist.

Changing and Variable Climates

Climate is not static. At any location, weather and climatic conditions vary from season to season, year to year, and over longer time periods (climate cycles). This has always been the case. In fact, evidence is mounting that the climates of Canada are changing and will continue to change significantly into future. When estimating climatic design loads, this variability can be considered using appropriate statistical analysis, data records spanning sufficient periods, and meteorological judgement. The analysis generally assumes that the past climate will be representative of the future climate.

Past and ongoing modifications to atmospheric chemistry (from greenhouse gas emissions and land use changes) are expected to alter most climatic regimes in the future despite the success of the most ambitious greenhouse gas mitigation plans.(1) Some regions could see an increase in the frequency and intensity of many weather extremes, which will accelerate weathering processes. Consequently, many buildings will need to be designed, maintained and operated to adequately withstand ever changing climatic loads.

Similar to global trends, the last decade in Canada was noted as the warmest in instrumented record. Canada has warmed, on average, at almost twice the rate of the global average increase, while the western Arctic is warming at a rate that is unprecedented over the past 400 years.(1) Mounting evidence from Arctic communities indicates that rapid changes to climate in the North have resulted in melting permafrost and impacts from other climate changes have affected nearly every type of built structure. Furthermore, analyses of Canadian precipitation data shows that many regions of the country have, on average, also been tending towards wetter conditions.(1) In the United States, where the density of climate monitoring stations is greater, a number of studies have found an unambiguous upward trend in the frequency of heavy to extreme precipitation events, with these increases coincident with a general upward trend in the total amount of precipitation. Climate change model results, based on an ensemble of global climate models worldwide, project that future climate warming rates will be greatest in higher latitude countries such as Canada.(2)

In this By-law, future climatic design data projections have been provided based upon climate modelling by the Pacific Climate Impacts Consortium. Given the inherent uncertainty of making future prediction, the provided values can not necessarily be seen to be a wholly accurate prediction of future occurrences. Rather, these projections are intended to be a baseline guide for designers to wishing to consider how their building systems designs will perform in the near future. It is cautioned that complete data is not presently available for all variables, and those values related to snow and wind pressures are derived from fewer data points and are therefore less reliable.

January Design Temperatures

A building and its heating system should be designed to maintain the inside temperature at some pre-determined level. To achieve this, it is necessary to know the most severe weather conditions under which the system will be expected to function satisfactorily. Failure to maintain the inside temperature at the pre-determined level will not usually be serious if the temperature drop is not great and if the duration is not long. The outside conditions used for design should, therefore, not be the most severe in many years, but should be the somewhat less severe conditions that are occasionally but not greatly exceeded.

The January design temperatures are based on an analysis of January air temperatures only. Wind and solar radiation also affect the inside temperature of most buildings and may need to be considered for energy-efficient design.

The January design temperature is defined as the lowest temperature at or below which only a certain small percentage of the hourly outside air temperatures in January occur. In the past, a total of 158 stations with records from all or part of the period 1951-66 formed the basis for calculation of the 2.5 and 1% January temperatures. Where necessary, the data were adjusted for consistency. Since most of the temperatures were observed at airports, design values for the core areas of large cities could be 1 or 2°C milder, although the values for the outlying areas are probably about the same as for the airports. No adjustments were made for this urban island heat effect. The design values for the next 20 to 30 years will probably differ from these tabulated values due to year-to-year climate variability and global climate change resulting from the impact of human activities on atmospheric chemistry.

The design temperatures were reviewed and updated using hourly temperature observations from 480 stations for a 25-year period up to 2006 with at least 8 years of complete data. These data are consistent with data shown for

Canadian locations in the 2009 Handbook of Fundamentals[3] published by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). The most recent 25 years of record were used to provide a balance between accounting for trends in the climate and the sampling variation owing to year-to-year variation. The 1% and 2.5% values used for the design conditions represent percentiles of the cumulative frequency distribution of hourly temperatures and correspond to January temperatures that are colder for 8 and 19 hours, respectively, on average over the long term.

The 2.5% January design temperature is the value ordinarily used in the design of heating systems. In special cases, when the control of inside temperature is more critical, the 1% value may be used. Other temperature-dependent climatic design parameters may be considered for future issues of this document.

July Design Temperatures

A building and its cooling and dehumidifying system should be designed to maintain the inside temperature and humidity at certain pre-determined levels. To achieve this, it is necessary to know the most severe weather conditions under which the system is expected to function satisfactorily. Failure to maintain the inside temperature and humidity at the pre-determined levels will usually not be serious if the increases in temperature and humidity are not great and the duration is not long. The outside conditions used for design should, therefore, not be the most severe in many years, but should be the somewhat less severe conditions that are occasionally but not greatly exceeded.

The summer design temperatures in this Appendix are based on an analysis of July air temperatures and humidities. Wind and solar radiation also affect the inside temperature of most buildings and may, in some cases, be more important than the outside air temperature. More complete summer and winter design information can be obtained from Environment Canada.

The July design dry-bulb and wet-bulb temperatures were reviewed and updated using hourly temperature observations from 480 stations for a 25-year period up to 2006. These data are consistent with data shown for Canadian locations in the 2009 Handbook of Fundamentals[3] published by ASHRAE. As with January design temperatures, data from the most recent 25-year period were analyzed to reflect any recent climatic changes or variations. The 2.5% values used for the dry- and wet-bulb design conditions represent percentiles of the cumulative frequency distribution of hourly dry- and wet-bulb temperatures and correspond to July temperatures that are higher for 19 hours on average over the long term.

Heating Degree-Days

The rate of consumption of fuel or energy required to keep the interior of a small building at 21°C when the outside air temperature is below 18°C is roughly proportional to the difference between 18°C and the outside temperature. Wind speed, solar radiation, the extent to which the building is exposed to these elements and the internal heat sources also affect the heat required and may have to be considered for energy-efficient design. For average conditions of wind, radiation, exposure, and internal sources, however, the proportionality with the temperature difference generally still holds.

Since the fuel required is also proportional to the duration of the cold weather, a convenient method of combining these elements of temperature and time is to add the differences between 18°C and the mean temperature for every day in the year when the mean temperature is below 18°C. It is assumed that no heat is required when the mean outside air temperature for the day is 18°C or higher.

Although more sophisticated computer simulations using other forms of weather data have now almost completely replaced degree-day-based calculation methods for estimating annual heating energy consumption, degree-days remain a useful indicator of relative severity of climate and can form the basis for certain climate-related Code requirements.

The degree-days below 18°C were compiled for 1 300 stations for the 25-year period ending in 2006. This analysis period is consistent with the one used to derive the design temperatures described above and with the approach used by ASHRAE.(3)

A difference of only one Celsius degree in the mean annual temperature will cause a difference of 250 to 350 in the Celsius degree-days. Since differences of 0.5 of a Celsius degree in the mean annual temperature are quite likely to occur between two stations in the same town, heating degree-days cannot be relied on to an accuracy of less than about 100 degree-days.

Heating degree-day values for the core areas of larger cities can be 200 to 400 degree-days less (warmer) than for the surrounding fringe areas. The observed degree-days, which are based on daily temperature observations, are often most representative of rural settings or the fringe areas of cities.

Climatic Data for Energy Consumption Calculations
The climatic elements tabulated in this Appendix represent commonly used design values but do not include detailed climatic profiles, such as hourly weather data. Where hourly values of weather data are needed for the purpose of simulating the annual energy consumption of a building, they can be obtained from multiple sources, such as Environment Canada, Natural Resources Canada, the Regional Conservation Authority and other such public agencies that record this information. Hourly weather data are also available from public and private agencies that format this information for use with annual energy consumption simulation software; in some cases, these data have been incorporated into the software.

Snow Loads
The roof of a building should be able to support the greatest weight of snow that is likely to accumulate on it in many years. Some observations of snow on roofs have been made in Canada, but not enough to form the basis for estimating roof snow loads throughout the country. Similarly, observations of the weight, or water equivalent, of the snow on the ground have not been available in digital form in the past. The observations of roof loads and water equivalents are very useful, as noted below, but the measured depth of snow on the ground is used to provide the basic information for a consistent set of snow loads.

The estimation of the design snow load on a roof from snow depth observations involves the following steps:
- (a) The depth of snow on the ground, which has an annual probability of exceedance of 1-in-50, is computed.
- (b) The appropriate unit weight is selected and used to convert snow depth to loads, S_s.
- (c) The load, S_r, which is due to rain falling on the snow, is computed.
- (d) Because the accumulation of snow on roofs is often different from that on the ground, adjustments are applied to the ground snow load to provide a design snow load on a roof.

The annual maximum depth of snow on the ground has been assembled for 1 618 stations for which data has been recorded by the Atmospheric Environment Service (AES). The period of record used varied from station to station, ranging from 7 to 38 years. These data were analyzed using a Gumbel extreme value distribution fitted using the method of moments(4) as reported by Newark et al.(5) The resulting values are the snow depths, which have a probability of 1-in-50 of being exceeded in any one year.

The unit weight of old snow generally ranges from 2 to 5 kN/m^3, and it is usually assumed in Canada that 1 kN/m^3 is the average for new snow. Average unit weights of the seasonal snow pack have been derived for different regions across the country(6) and an appropriate value has been assigned to each weather station. Typically, the values average 2.01 kN/m^3 east of the continental divide (except for 2.94 kN/m^3 north of the treeline), and range from 2.55 to 4.21 kN/m^3 west of the divide. The product of the 1-in-50 snow depth and the average unit weight of the seasonal snow pack at a station is converted to the snow load (SL) in units of kilopascals (kPa).

Except for the mountainous areas of western Canada, the values of the ground snow load at AES stations were normalized assuming a linear variation of the load above sea level in order to account for the effects of topography. They were then smoothed using an uncertainty-weighted moving-area average in order to minimize the uncertainty due to snow depth sampling errors and site-specific variations. Interpolation from analyzed maps of the smooth normalized values yielded a value for each location in Table C-2, which could then be converted to the listed By-law values (S_s) by means of an equation in the form:

$$S_s = \text{smooth normalized} + bZ$$

where b is the assumed rate of change of SL with elevation at the location and Z is the location's elevation above mean sea level (MSL). Although they are listed in Table C-2 to the nearest tenth of a kilopascal, values of S_s typically have an uncertainty of about 20%. Areas of sparse data in northern Canada were an exception to this procedure. In these regions, an analysis was made of the basic SL values. The effects of topography, variations due to local climates, and smoothing were all subjectively assessed. The values derived in this fashion were used to modify those derived objectively.

For the mountainous areas of British Columbia, a more complex procedure was required to account for the variation of loads with terrain and elevation. Since the AES observational network often does not have sufficient coverage to detail this variability in mountainous areas, additional snow course observations were obtained from the provincial government of British Columbia. The additional data allowed detailed local analysis of ground snow loads on a valley-by-valley basis. Similar to other studies, the data indicated that snow loads above a critical or reference level increased according to either a linear or quadratic relation with elevation. The determination of whether the increase with elevation was linear or quadratic, the rate of the increase and the critical or reference elevation were found to be specific to the valley and mountain ranges considered. At valley levels below the critical elevation, the loads generally varied less significantly with elevation. Calculated valley- and range-specific regression relations were then used to describe the increase of load with elevation and to normalize the AES snow observations to a critical or reference level. These normalized values were smoothed using a weighted moving-average.

Tabulated values cannot be expected to indicate all the local differences in S_s. For this reason, especially in complex terrain areas, values should not be interpolated from Table C-2 for unlisted locations. The values of S_s in the Table apply for the elevation and the latitude and longitude of the location, as defined by the Gazetteer of Canada. Values at other locations can be obtained from Environment Canada.

The heaviest loads frequently occur when the snow is wetted by rain, thus the rain load, S_r, was estimated to the nearest 0.1 kPa and is provided in Table C-2. When values of S_r are added to S_s, this provides a 1-in-50-year estimate of the combined ground snow and rain load. The values of S_r are based on an analysis of about 2 100 weather station values of the 1-in-50-year one-day maximum rain amount. This return period is appropriate because the rain amounts correspond approximately to the joint frequency of occurrence of the one-day rain on maximum snow packs. For the purpose of estimating rain on snow, the individual observed one-day rain amounts were constrained to be less than or equal to the snow pack water equivalent, which was estimated by a snow pack accumulation model reported by Bruce and Clark.(7)

The results from surveys of snow loads on roofs indicate that average roof loads are generally less than loads on the ground. The conditions under which the design snow load on the roof may be taken as a percentage of the ground snow load are given in Subsection 4.1.6. The By-law also permits further decreases in design snow loads for steeply sloping roofs, but requires substantial increases for roofs where snow accumulation may be more rapid due to such factors as drifting. Recommended adjustments are given in the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

The ground snow load values, S_s, were updated for this edition of the By-law using a similar approach to the one used for the ground snow load update in the 1990 NBC, which was the basis for the 1992 British Columbia Building Code. The Gumbel extreme value distribution was fitted to the annual maxima of daily snow depth observations made at over 1 400 weather stations, which were compiled from 1990 onward – to as recently as 2012 for some stations – to calculate the 50-year return period snow depth. The 50-year ground snow load was then calculated for each weather station by combining the 50-year snow pack depth with the assigned snow pack density. The S_s values for each location in Table C-2 were compared with the updated weather station values and revised accordingly.

Annual Total Precipitation

Total precipitation is the sum in millimetres of the measured depth of rainwater and the estimated or measured water equivalent of the snow (typically estimated as 0.1 of the measured depth of snow, since the average density of fresh snow is about 0.1 that of water).

The average annual total precipitation amounts in Table C-2 have been interpolated from an analysis of precipitation observations from 1 379 stations for the 30-year period from 1961 to 1990.

Annual Rainfall

The total amount of rain that normally falls in one year is frequently used as a general indication of the wetness of a climate, and is therefore included in this Appendix. See also Moisture Index below.

Rainfall Intensity

Roof drainage systems are designed to carry off rainwater from the most intense rainfall that is likely to occur. A certain amount of time is required for the rainwater to flow across and down the roof before it enters the gutter or drainage system. This results in the smoothing out of the most rapid changes in rainfall intensity. The drainage system, therefore, need only cope with the flow of rainwater produced by the average rainfall intensity over a period of a few minutes, which can be called the concentration time.

In Canada, it has been customary to use the 15-minute rainfall that will probably be exceeded on an average of once in 10 years. The concentration time for small roofs is much less than 15 minutes and hence the design intensity will be exceeded more frequently than once in 10 years. The safety factors in Book II (Plumbing Systems) of this By-law will probably reduce the frequency to a reasonable value and, in addition, the occasional failure of a roof drainage system will not be particularly serious in most cases.

The rainfall intensity values were updated for the 2014 edition of the By-law using observations of annual maximum 15-minute rainfall amounts from 485 stations with 10 or more years of record, including data up to 2007 for some stations. Ten-year return period values – the 15-minute rainfall having a probability of 1-in-10 of being exceeded in any year – were calculated by fitting the annual maximum values to the Gumbel extreme value distribution[(4)] using the method of moments. The updated values are compiled from the most recent short-duration rainfall intensity-duration-frequency (IDF) graphs and tables available from Environment Canada.

It is very difficult to estimate the pattern of rainfall intensity in mountainous areas, where precipitation is extremely variable and rainfall intensity can be much greater than in other types of areas. Many of the observations for these areas were taken at locations in valley bottoms or in extensive, fairly level areas.

One-Day Rainfall

If for any reason a roof drainage system becomes ineffective, the accumulation of rainwater may be great enough in some cases to cause a significant increase in the load on the roof. In previous editions of this information, it had been common practice to use the maximum one-day rainfall ever observed for estimating the additional load. Since the length of record for weather stations is quite variable, the maximum one-day rainfall amounts in previous editions often reflected the variable length of record at nearby stations as much as the climatology. As a result, the maximum values often differed greatly within relatively small areas where little difference should be expected. The current values have been standardized to represent the one-day rainfall amounts that have 1 chance in 50 of being exceeded in any one year or the 1-in-50-year return value one-day rainfalls.

The one-day rainfall values were updated using daily rainfall observations from more than 3 500 stations with 10 years or more of record, including data up to 2008 for some stations. The 50-year return period values were calculated by fitting the annual maximum one-day rainfall observations to the Gumbel extreme value distribution using the method of moments.(4)

Rainfall frequency observations can vary considerably over time and space. This is especially true for mountainous areas, where elevation effects can be significant. In other areas, small-scale intense storms or local influences can produce significant spatial variability in the data. As a result, the analysis incorporates some spatial smoothing.

Moisture Index (MI)
Moisture index (MI) values were developed through the work of a consortium that included representatives from industry and researchers from NRC.(1) The MI is an indicator of the moisture load imposed on a building by the climate and is used in Part 9 to define the minimum levels of protection from precipitation to be provided by cladding assemblies on exterior walls.

It must be noted, in using MI values to determine the appropriate levels of protection from precipitation, that weather conditions can vary markedly within a relatively small geographical area. Although the values provided in the Table give a good indication of the average conditions within a particular region, some caution must be exercised when applying them to a locality that is outside the region where the weather station is located.

MI is calculated from a wetting index (WI) and a drying index (DI).

Wetting Index (WI)
To define, quantitatively, the rainwater load on a wall, wind speed and wind direction have to be taken into consideration in addition to rainfall, along with factors that can affect exposure, such as nearby buildings, vegetation and topography. Quantitative determination of load, including wind speed and wind direction, can be done. However, due to limited weather data, it is not currently possible to provide this information for most of the locations identified in the Table.

This lack of information, however, has been shown to be non-critical for the purpose of classifying locations in terms of severity of rain load. The results of the research indicated that simple annual rainfall is as good an indicator as any for describing rainwater load. That is to say, for Canadian locations, and especially once drying is accounted for, the additional sensitivity provided by hourly directional rainfall values does not have a significant effect on the order in which locations appear when listed from wet to dry.

Consequently, the wetting index (WI) is based on annual rainfall and is normalized based on 1 000 mm.

Drying Index (DI)
Temperature and relative humidity together define the drying capacity of ambient air. Based on simple psychrometrics, values were derived for the locations listed in the Table using annual average drying capacity normalized based on the drying capacity at Lytton, B.C. The resultant values are referred to as drying indices (DI).

Determination of Moisture Index (MI)
The relationship between WI and DI to correctly define moisture loading on a wall is not known. The MI values provided in the Table are based on the root mean square values of WI and 1-DI, with those values equally weighted. This is illustrated in Figure C-1. The resultant MI values are sufficiently consistent with industry's understanding of climate severity with respect to moisture loading as to allow limits to be identified for the purpose of specifying where additional protection from precipitation is required.

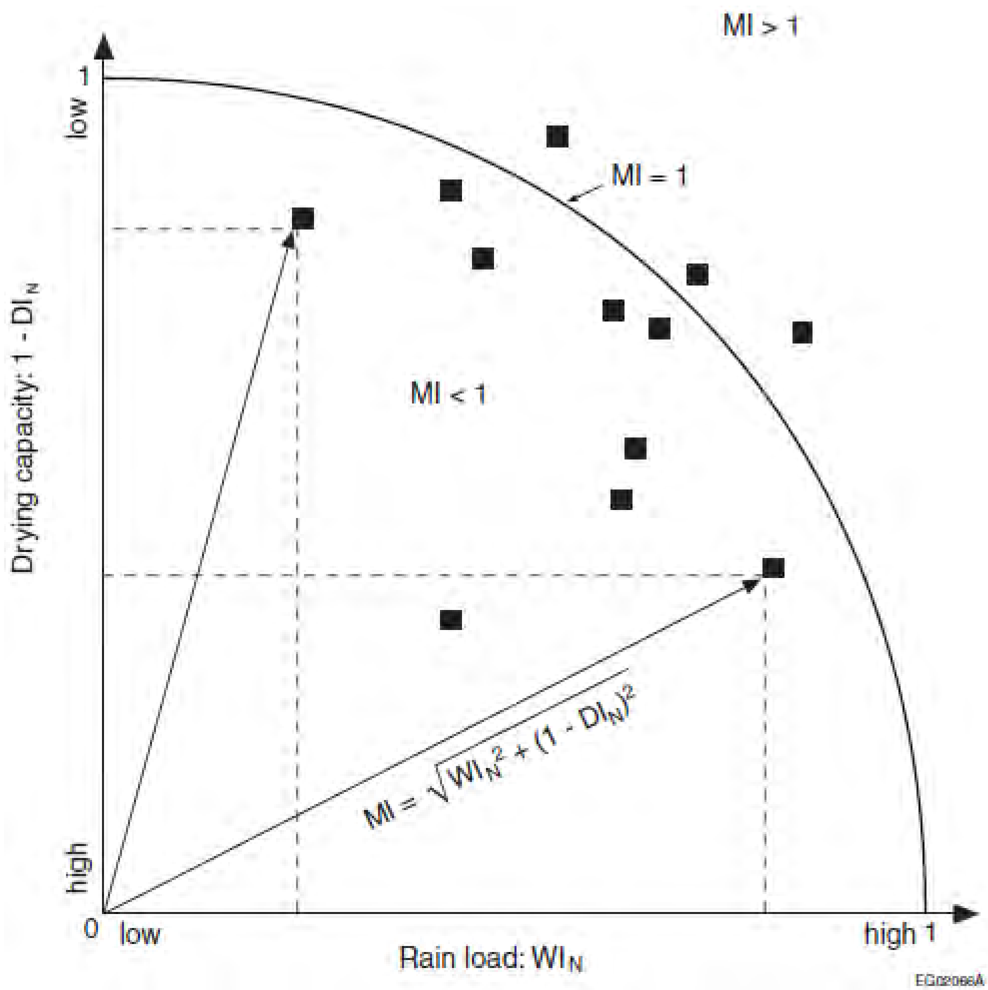


Figure C-1
Derivation of moisture index (MI) based on normalized values for wetting index (WI) and drying index (DI)
Note to Figure C-1:
(1) MI equals the hypotenuse of the triangle defined by W_{IN} and $1\text{-}D_{IN}$

Driving Rain Wind Pressure (DRWP)

The presence of rainwater on the face of a building, with or without wind, must be addressed in the design and construction of the building envelope so as to minimize the entry of water into the assembly. Wind pressure on the windward faces of a building will promote the flow of water through any open joints or cracks in the facade.

Driving rain wind pressure (DRWP) is the wind load that is coincident with rain, measured or calculated at a height of 10 m. The values provided in the Table represent the loads for which there is 1 chance in 5 of being reached or exceeded in any one year, or a probability of 20% within any one year. Approximate adjustments for height can be made using the values for C_e given in Sentence 4.1.7.3.(5) as a multiplier.

Because of inaccuracies in developing the DRWP values related to the averaging of extreme wind pressures, the actual heights of recording anemometers, and the use of estimated rather than measured rainfall values, the values are considered to be higher than actual loads.[8][9] Thus the actual probability of reaching or exceeding the DRWP in a particular location is less than 20% per year and these values can be considered to be conservative.

DRWP can be used to determine the height to which wind will drive rainwater up enclosed vertical conduits. This provides a conservative estimate of the height needed for fins in window extrusions and end dams on flashings to control water ingress. This height can be calculated as:

$$\text{height of water, mm} = \text{DRWP}/10, \text{Pa}$$

Note that the pressure difference across the building envelope may be augmented by internal pressures induced in the building interior by the wind. These additional pressures can be estimated using the information provided in the Commentary entitled Wind Load and Effects of the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)."

Wind Effects

All structures need to be designed to ensure that the main structural system and all secondary components, such as cladding and appurtenances, will withstand the pressures and suctions caused by the strongest wind likely to blow at that location in many years. Some flexible structures, such as tall buildings, slender towers and bridges, also need to be designed to minimize excessive wind-induced oscillations or vibrations.

At any time, the wind acting upon a structure can be treated as a mean or time-averaged component and as a gust or unsteady component. For a small structure, which is completely enveloped by wind gusts, it is only the peak gust velocity that needs to be considered. For a large structure, the wind gusts are not well correlated over its different parts and the effects of individual gusts become less significant. The "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)" evaluates the mean pressure acting on a structure, provide appropriate adjustments for building height and exposure and for the influence of the surrounding terrain and topography (including wind speed-up for hills), and then incorporate the effects of wind gusts by means of the gust factor, which varies according to the type of structure and the size of the area over which the pressure acts.

The wind speeds and corresponding velocity pressures used in the By-law are regionally representative or reference values. The reference wind speeds are nominal one-hour averages of wind speeds representative of the 10 m height in flat open terrain corresponding to Exposure A or open terrain in the terminology of the "User's Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)." The reference wind speeds and wind velocity pressures are based on long-term wind records observed at a large number of weather stations across Canada.

Reference wind velocity pressures in previous versions of the By-law since 1961 were based mostly on records of hourly averaged wind speeds (i.e. the number of miles of wind passing an anemometer in an hour) from over 100 stations with 10 to 22 years of observations ending in the 1950s. The wind pressure values derived from these measurements represented true hourly wind pressures.

The reference wind velocity pressures were reviewed and updated for the 2014 edition of the By-law. The primary data set used for the analysis comprised wind records compiled from about 135 stations with hourly averaged wind speeds and from 465 stations with aviation (one- or two-minute average) speeds or surface weather (ten-minute average) speeds observed once per hour at the top of the hour; the periods of record used ranged from 10 to 54 years. In addition, peak wind gust records from 400 stations with periods of record ranging from 10 to 43 years were used. Peak wind gusts (gust durations of approximately 3 to 7 seconds) were used to supplement the primary once-per-hour observations in the analysis.

Several steps were involved in updating the reference wind values. Where needed, speeds were adjusted to represent the standard anemometer height above ground of 10 m. The data from years when the anemometer at a station was installed on the top of a lighthouse or building were eliminated from the analysis since it is impractical to adjust for the effects of wind flow over the structure. (Most anemometers were moved to 10 m towers by the 1960s.) Wind speeds of the various observation types – hourly averaged, aviation, surface weather and peak wind gust – were adjusted to account for different measure durations to represent a one-hour averaging period and to account for differences in the surface roughness of flat open terrain at observing stations.

The annual maximum wind speed data was fitted to the Gumbel distribution using the method of moments[(4)] to calculate hourly wind speeds having the annual probability of occurrence of 1-in-10 and 1-in-50 (10-year and 50-year return periods). The values were plotted on maps, then analyzed and abstracted for the locations in Table C-2.

The wind velocity pressures, q, were calculated in Pascals using the following equation:

$$q = \frac{1}{2}\rho V^2$$

where r is an average air density for the windy months of the year and V is wind speed in metres per second. While air density depends on both air temperature and atmospheric pressure, the density of dry air at 0°C and standard atmospheric pressure of 1.2929 kg/m^3 was used as an average value for the wind pressure calculations. As explained by Boyd[(10)], this value is within 10% of the monthly average air densities for most of Canada in the windy part of the year.

As a result of the updating procedure, the 1-in-50 reference wind velocity pressures remain unchanged for most of the locations listed in Table C-2; both increases and decreases were noted for the remaining locations. Many of the decreases resulted from the fact that anemometers at most of the stations used in the previous analysis were installed on lighthouses, airport hangers and other structures. Wind speeds on the tops of buildings are often much higher compared to those registered by a standard 10 m tower. Eliminating anemometer data recorded on the tops of buildings from the analysis resulted in lower values at several locations.

Hourly wind speeds that have 1 chance in 10 and 50[(1)] of being exceeded in any one year were analyzed using the Gumbel extreme value distribution fitted using the method of moments with correction for sample size. Values of the 1-in-30-year wind speeds for locations in the Table were estimated from a mapping analysis of wind speeds. The 1-in-10- and 1-in-50-year speeds were then computed from the 1-in-30-year speeds using a map of the dispersion parameter that occurs in the Gumbel analysis.[(4)]

Table C-1 has been arranged to give pressures to the nearest one-hundredth of a kPa and their corresponding wind speeds. The value of "q" in kPa is assumed to be equal to 0.00064645 V^2, where V is given in m/s.

Table C-1
Wind Speeds

q	V	q	V	q	V	q	V
kPa	m/s	kPa	m/s	kPa	m/s	kPa	m/s
0.15	15.2	0.53	28.6	0.91	37.5	1.29	44.7
0.16	15.7	0.54	28.9	0.92	37.7	1.30	44.8
0.17	16.2	0.55	29.2	0.93	37.9	1.31	45.0
0.18	16.7	0.56	29.4	0.94	38.1	1.32	45.2

[1]Wind speeds that have a one-in-"n"-year chance of being exceeded in any year can be computed from the one-in-10 and one-in-50 return values in the Table using the following equation:

$$V_{1/N} = \frac{1}{1.4565}\left\{V_{1/50} + 0.4565V_{1/10} + \frac{V_{1/50} - V_{1/10}}{1.1339} \times \ln\frac{-0.0339}{\ln(1-1/n)}\right\}$$

0.19	17.1	0.57	29.7	0.95	38.3	1.33	45.4
0.20	17.6	0.58	30.0	0.96	38.5	1.34	45.5
0.21	18.0	0.59	30.2	0.97	38.7	1.35	45.7
0.22	18.4	0.60	30.5	0.98	38.9	1.36	45.9
0.23	18.9	0.61	30.7	0.99	39.1	1.37	46.0
0.24	19.3	0.62	31.0	1.00	39.3	1.38	46.2
0.25	19.7	0.63	31.2	1.01	39.5	1.39	46.4
0.26	20.1	0.64	31.5	1.02	39.7	1.40	46.5
0.27	20.4	0.65	31.7	1.03	39.9	1.41	46.7
0.28	20.8	0.66	32.0	1.04	40.1	1.42	46.9
0.29	21.2	0.67	32.2	1.05	40.3	1.43	47.0
0.30	21.5	0.68	32.4	1.06	40.5	1.44	47.2
0.31	21.9	0.69	32.7	1.07	40.7	1.45	47.4
0.32	22.2	0.70	32.9	1.08	40.9	1.46	47.5
0.33	22.6	0.71	33.1	1.09	41.1	1.47	47.7
0.34	22.9	0.72	33.4	1.10	41.3	1.48	47.8
0.35	23.3	0.73	33.6	1.11	41.4	1.49	48.0
0.36	23.6	0.74	33.8	1.12	41.6	1.50	48.2
0.37	23.9	0.75	34.1	1.13	41.8	1.51	48.3
0.38	24.2	0.76	34.3	1.14	42.0	1.52	48.5
0.39	24.6	0.77	34.5	1.15	42.2	1.53	48.6
0.40	24.9	0.78	34.7	1.16	42.4	1.54	48.8
0.41	25.2	0.79	35.0	1.17	42.5	1.55	49.0
0.42	25.5	0.80	35.2	1.18	42.7	1.56	49.1
0.43	25.8	0.81	35.4	1.19	42.9	1.57	49.3
0.44	26.1	0.82	35.6	1.20	43.1	1.58	49.4

0.45	26.4	0.83	35.8	1.21	43.3	1.59	49.6
0.46	26.7	0.84	36.0	1.22	43.4	1.60	49.7
0.47	27.0	0.85	36.3	1.23	43.6	1.61	49.9
0.48	27.2	0.86	36.5	1.24	43.8	1.62	50.1
0.49	27.5	0.87	36.7	1.25	44.0	1.63	50.2
0.50	27.8	0.88	36.9	1.26	44.1	1.64	50.4
0.51	28.1	0.89	37.1	1.27	44.3	1.65	50.5
0.52	28.4	0.90	37.3	1.28	44.5	1.66	50.7

Table C-2
Climatic Design Data for Selected Locations in Vancouver

Location	Elev., m	Design Temperature: January 2.5% °C	January 1% °C	July 2.5% Dry °C	July 2.5% Wet °C	Degree-Days Below 18°C	15 Min. Rain, mm	One Day Rain, 1/50, mm	Ann. Rain, mm	Moist. Index	Ann. Tot. Ppn., mm	Driving Rain Wind Pressures, Pa, 1/5	Snow Load, kPa, 1/50 Ss	Snow Load, kPa, 1/50 Sr	Hourly Wind Pressures, kPa 1/10	Hourly Wind Pressures, kPa 1/50
Vancouver (General)	120	-6	-8	28	20	2925	10	107	1325	1.44	1400	160	1.9	0.3	0.35	0.45
Vancouver (2020s)	120	-4	-6	30	22	2471	n/a	117	1350	n/a	n/a	n/a	0.8	n/a	0.36	0.43
Vancouver (2050s)	120	-2	-4	32	24	2102	n/a	127	1371	n/a	n/a	n/a	1.7	n/a	0.36	0.43

Seismic Hazard
The parameters used to represent seismic hazard for specific geographical locations are the 5% damped horizontal spectral acceleration for 0.2, 0.5, 1.0, 2.0, 5.0 and 10.0 second periods, the horizontal Peak Ground Acceleration (PGA) and the horizontal Peak Ground Velocity (PGV), with all values given for a 2%-probability of being exceeded in 50 years. The six spectral parameters are deemed sufficient to define spectra closely matching the shape of the Uniform Hazard Spectra (UHS). Hazard values are mean values based on a statistical analysis of the earthquakes that have been experienced in Canada and adjacent regions.[11] The seismic hazard values were updated for this edition of the By-law by updating the earthquake catalogue, revising the seismic source zones, adding fault sources for the Cascadia subduction zone and certain other active faults, revising the Ground Motion Prediction Equations (GMPEs),[12] and using a probabilistic model to combine all inputs.

For most locations, the new GMPEs are the most significant reason for changes in the hazard results from the 2014 By-law. One exception is for areas of western Canada for which adding the Cascadia subduction source contribution to the model probabilistically causes the most significant change. For locations in western Canada, the seismic hazard at long periods has increased significantly for areas affected by the Cascadia interface. For other areas, the explicit inclusion of fault sources, such as those in Haida Gwaii, has also affected the estimated hazard.

Further details regarding the representation of seismic hazard can be found in the Commentary on Design for Seismic Effects in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B).”

Table C-3
Seismic Design Data for Selected Locations in Vancouver

Location	Seismic Data							
	$S_a(0.2)$	$S_a(0.5)$	$S_a(1.0)$	$S_a(2.0)$	$S_a(5.0)$	$S_a(10.0)$	PGA	PGV
Burnaby (General)[(1)]	0.768	0.673	0.386	0.236	0.076	0.027	0.333	0.500
North Vancouver[(1)]	0.794	0.699	0.399	0.243	0.077	0.027	0.345	0.518
Richmond[(1)]	0.885	0.787	0.443	0.266	0.083	0.029	0.383	0.578
Vancouver (City Hall)	0.848	0.751	0.425	0.257	0.080	0.029	0.369	0.553
Vancouver (Granville & 41 Ave)	0.863	0.765	0.432	0.261	0.081	0.029	0.375	0.563

Notes to Table C-3:
(1) Data for regions immediately adjoining Vancouver provided here for context.
(2~~1~~) See the paragraph dealing with Sentence 4.1.8.4.(1) in the Commentary entitled Design for Seismic Effects in the “User’s Guide – NBC 2015, Structural Commentaries (Part 4 of Division B)” for guidance regarding sites in the Yukon and the British Columbia panhandle that are close to active faults.

References

1. Environment Canada, Climate Trends and Variation Bulletin: Annual 2007, 2008.
2. Intergovernmental Panel on Climate Change (IPCC), Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (Eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pp., 2007.
3. American Society of Heating, Refrigerating, and Air-conditioning Engineers, Handbook of Fundamentals, Chapter 14 – Climatic Design Information, Atlanta, GA, 2009.
4. Lowery, M.D. and Nash, J.E., A comparison of methods of fitting the double exponential distribution. J. of Hydrology, 10 (3), pp. 259–275, 1970.
5. Newark, M.J., Welsh, L.E., Morris, R.J. and Dnes, W.V. Revised Ground Snow Loads for the 1990 NBC of Canada. Can. J. Civ. Eng., Vol. 16, No. 3, June 1989.
6. Newark, M.J. A New Look at Ground Snow Loads in Canada. Proceedings, 41st Eastern Snow Conference, Washington, D.C., Vol. 29, pp. 59-63, 1984.
7. Bruce, J.P. and Clark, R.H. Introduction to Hydrometeorology. Pergammon Press, London, 1966.
8. Skerlj, P.F. and Surry, D. A Critical Assessment of the DRWPs Used in CAN/CSA-A440-M90. Tenth International Conference on Wind Engineering, Wind Engineering into the 21st Century, Larsen, Larose & Livesay (eds), 1999 Balkema, Rotterdam, ISBN 90 5809 059 0.
9. Cornick, S., Chown, G.A., et al. Committee Paper on Defining Climate Regions as a Basis for Specifying Requirements for Precipitation Protection for Walls. Institute for Research in Construction, National Research

Council, Ottawa, April 2001.
10. Boyd, D.W. Variations in Air Density over Canada. National Research Council of Canada, Division of Building Research, Technical Note No. 486, June 1967.
11. Adams, J., Halchuk, S., Allen, T.I., and Rogers, G.C. Fifth Generation seismic hazard model and values for the 2015 National Building Code of Canada. Geological Survey of Canada Open File, 2014.
12. Atkinson, G. M. and Adams J. Ground motion prediction equations for application to the 2015 Canadian national seismic hazard maps, Can. J. Civ. Eng. 40, 988–998, 2013.

Table C-4 [Deleted.]

Table C-5
Required Performance of Windows and Doors in Part 9 Buildings[(1)]
Forming part of Appendix C

Location	Climatic Data		Specified Loads			NAFS		
	1/5 DRWP	1/50 HWP	DRWP	Wind Load		Required Fenestration Performance		
	Pa	kPa	Pa	Pa	(psf)	DP	PG	Water Resist.
Vancouver	160	0.45	160	911	19.03	960	20	180

Notes to Table C-5:
(1) Table C-5 may not be used for skylights. (See Sentence 9.7.4.3.(1).)

Appendix D
Fire Performance Rating

This Appendix is included for explanatory purposes only and does not form part of the requirements except as defined in Division A, Sentence 1.1.3.1.(1). The bold face reference numbers that introduce each item do not relate to specific requirements in this Division.

Section D-1 General

The content of this Appendix was prepared on the recommendations of the Standing Committee on Fire Protection, which was established by the Canadian Commission on Building and Fire Codes (CCBFC) for this purpose.

D-1.1. Introduction

D-1.1.1. Scope

1) This fire-performance information is presented in a form closely linked to the performance requirements and the minimum materials specifications of this By-law.

2) The ratings have been assigned only after careful consideration of all available literature on assemblies of common building materials, where they are adequately identified by description. The assigned values based on this information will, in most instances, be conservative when compared to the ratings determined on the basis of actual tests on individual assemblies.

3) The fire-performance information set out in this Appendix applies to materials and assemblies of materials that comply in all essential details with the minimum structural design standards described in Part 4. Additional requirements, where appropriate, are described in other Sections of this Appendix.

4) Section D-2 assigns fire-resistance ratings for walls, floors, roofs, columns and beams related to CAN/ULC-S101, “Fire Endurance Tests of Building Construction and Materials,” and describes methods for determining these ratings.

5) Section D-3 assigns flame-spread ratings and smoke developed classifications for surface materials related to CAN/ULC-S102, “Test for Surface Burning Characteristics of Building Materials and Assemblies,” and CAN/ULC-S102.2, “Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.”

6) Section D-4 describes noncombustibility in building materials when tested in accordance with CAN/ULC-S114, “Test for Determination of Non-Combustibility in Building Materials.”

7) Section D-5 contains requirements for the installation of fire doors and fire dampers in fire-rated stud wall assemblies.

8) Section D-6 contains background information regarding fire test reports, obsolete materials and assemblies, assessment of archaic assemblies and the development of the component additive method.

D-1.1.2. Referenced Documents

1) Where documents are referenced in this Appendix, they shall be the editions designated in Table D-1.1.2.

Table D-1.1.2.
Documents Referenced in Appendix D, Fire-Performance Ratings

Issuing Agency	Document Number(1)	Title of Document(2)	By-law Reference
ANSI	A208.1-2009	Particleboard	D-3.1.1.
ASTM	C 330/C 330M-13	Lightweight Aggregates for Structural Concrete	D-1.4.3.

ASTM	C 840-13	Application and Finishing of Gypsum Board	D-2.3.9.
ASTM	C 1396/C 1396M-14	Gypsum Board	D-1.5.1. D-3.1.1.
CCBFC	NRCC 30629	Supplement to the National Building Code of Canada 1990	D-6.2. D-6.3. D-6.4.
CGSB	4-GP-36M-1978	Carpet Underlay, Fiber Type	D-3.1.1.
CGSB	CAN/CGSB-4.129-97	Carpets for Commercial Use	D-3.1.1.
CGSB	CAN/CGSB-11.3-M87	Hardboard	D-3.1.1.
CGSB	CAN/CGSB-92.2-M90	Trowel or Spray Applied Acoustical Material	D-2.3.4.
CSA	A23.1-14/A23.2-14	Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete	D-1.4.3.
CSA	A23.3-14	Design of Concrete Structures	D-2.1.5. D-2.6.6. D-2.8.2.
CSA	CAN/CSA-A82-14	Fired Masonry Brick Made from Clay or Shale	D-2.6.1.
CSA	A82.22-M1977	Gypsum Plasters	D-3.1.1.
CSA	CAN/CSA-A82.27-M91	Gypsum Board	D-1.5.1. D-3.1.1.
CSA	A82.30-M1980	Interior Furring, Lathing and Gypsum Plastering	D-1.7.2. D-2.3.9. D-2.5.1.
CSA	A165.1-14	Concrete Block Masonry Units	D-2.1.1.
CSA	O86-14	Engineering Design in Wood	D-2.11.2.
CSA	O112.10-08	Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure)	D-2.3.6.
CSA	O121-08	Douglas Fir Plywood	D-3.1.1.
CSA	O141-05	Softwood Lumber	D-2.3.6. D-2.4.1.
CSA	O151-09	Canadian Softwood Plywood	D-3.1.1.
CSA	O153-13	Poplar Plywood	D-3.1.1.
CSA	O325-07	Construction Sheathing	D-3.1.1.
CSA	O437.0-93	OSB and Waferboard	D-3.1.1.
CSA	S16-14	Design of Steel Structures	D-2.6.6.

NFPA	80-2013	Fire Doors and Other Opening Protectives	D-5.2.1.
ULC	CAN/ULC-S101-14	Fire Endurance Tests of Building Construction and Materials	D-1.1.1. D-1.12.1. D-2.3.2.
ULC	CAN/ULC-S102-10	Test for Surface Burning Characteristics of Building Materials and Assemblies	D-1.1.1.
ULC	CAN/ULC-S102.2-10	Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies	D-1.1.1. D-3.1.1.
ULC	CAN/ULC-S112.2-07	Fire Test of Ceiling Firestop Flap Assemblies	D-2.3.10. D-2.3.11.
ULC	CAN/ULC-S114-05	Test for Determination of Non-Combustibility in Building Materials	D-1.1.1. D-4.1.1. D-4.2.1.
ULC	CAN/ULC-S702-09	Mineral Fibre Thermal Insulation for Buildings	D-2.3.4. D-2.3.5. D-2.6.1.
ULC	CAN/ULC-S703-09	Cellulose Fibre Insulation for Buildings	D-2.3.4.
ULC	CAN/ULC-S706-09	Wood Fibre Insulating Boards for Buildings	D-3.1.1.

Notes to Table D-1.1.2.:
(1) Some documents may have been reaffirmed or reapproved. Check with the applicable issuing agency for up-to-date information.
(2) Some titles have been abridged to omit superfluous wording.

D-1.1.3. Applicability of Ratings
The ratings shown in this document apply if more specific test values are not available. The construction of an assembly that is the subject of an individual test report must be followed in all essential details if the fire-resistance rating reported is to be applied for use with this By-law.

D-1.1.4. Higher Ratings
The *Chief Building Official* may allow higher fire-resistance ratings than those derived from this Appendix, where supporting evidence justifies a higher rating. Additional information is provided in summaries of published test information and the reports of fire tests carried out by NRC, which are included in Section D-6, Background Information.

D-1.1.5. Additional Information on Fire Rated Assemblies
Assemblies containing materials for which there is no nationally recognized standard are not included in this Appendix. Many such assemblies have been rated by Underwriters Laboratories (UL), Underwriters' Laboratories of Canada (ULC), QAI Laboratories (QAI), or Intertek Testing Services NA Ltd. (ITS).

D-1.2. Interpretation of Test Results
D-1.2.1. Limitations
1) The fire-performance ratings set out in this Appendix are based on those that would be obtained from the standard methods of test described in the By-law. The test methods are essentially a means of comparing the performance of one building component or assembly with another in relation to its performance in fire.

2) Since it is not practicable to measure the fire resistance of constructions in situ, they must be evaluated under some agreed test conditions. A specified fire-resistance rating is not necessarily the actual time that the assembly would endure in situ in a building fire, but is that which the particular construction must meet under the specified methods of test.
3) Considerations arising from departures in use from the conditions established in the standard test methods may, in some circumstances, have to be taken into account by the designer and the *Chief Building Official*. Some of these conditions are covered at present by the provisions of the By-law.
4) For walls and partitions, the stud spacings previously specified as 16 or 24 inch have been converted to 400 and 600 mm, respectively, for consistency with other metric values; however, the use of equivalent imperial dimensions for stud spacing is permitted.

D-1.3. Concrete

D-1.3.1. Aggregates in Concrete

Low density aggregate concretes generally exhibit better fire performance than natural stone aggregate concretes. A series of tests on concrete masonry walls, combined with mathematical analysis of the test results, has allowed further distinctions between certain low density aggregates to be made.

D-1.4. Types of Concrete

D-1.4.1. Description

1) For purposes of this Appendix, concretes are described as Types S, N, L, L_1, L_2, L40S, $L_1$20S or $L_2$20S as described in Sentences (2) to (8).
2) Type S concrete is the type in which the coarse aggregate is granite, quartzite, siliceous gravel or other dense materials containing at least 30% quartz, chert or flint.
3) Type N concrete is the type in which the coarse aggregate is cinders, broken brick, blast furnace slag, limestone, calcareous gravel, trap rock, sandstone or similar dense material containing not more than 30% of quartz, chert or flint.
4) Type L concrete is the type in which all the aggregate is expanded slag, expanded clay, expanded shale or pumice.
5) Type L_1 concrete is the type in which all the aggregate is expanded shale.
6) Type L_2 concrete is the type in which all the aggregate is expanded slag, expanded clay or pumice.
7) Type L40S concrete is the type in which the fine portion of the aggregate is sand and low density aggregate in which the sand does not exceed 40% of the total volume of all aggregates in the concrete.
8) Type $L_1$20S and Type $L_2$20S concretes are the types in which the fine portion of the aggregate is sand and low density aggregate in which the sand does not exceed 20% of the total volume of all aggregates in the concrete.

D-1.4.2. Determination of Ratings

Where concretes are described as being of Type S, N, L, L_1 or L_2, the rating applies to the concrete containing the aggregate in the group that provides the least fire resistance. If the nature of an aggregate cannot be determined accurately enough to place it in one of the groups, the aggregate shall be considered as being in the group that requires a greater thickness of concrete for the required fire resistance.

D-1.4.3. Description of Aggregates

1) The descriptions of the aggregates in Type S and Type N concretes apply to the coarse aggregates only. Coarse aggregate for this purpose means that retained on a 5 mm sieve using the method of grading aggregates described in CSA A23.1/A23.2, “Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.”
2) Increasing the proportion of sand as fine aggregate in low density concretes requires increased thicknesses of material to produce equivalent fire-resistance ratings. Low density aggregates for Type L and Types L-S concretes used in loadbearing components shall conform to ASTM C 330/C 330M, “Lightweight Aggregates for Structural Concrete.”

3) Non-loadbearing low density components of vermiculite and perlite concrete, in the absence of other test evidence, shall be rated on the basis of the values shown for Type L concrete.

D-1.5. Gypsum Board

D-1.5.1. Types of Gypsum Board

1) Where the term "gypsum board" is used in this Appendix, it is intended to include – in addition to gypsum board – gypsum backing board and gypsum base for veneer plaster as described in

a) CAN/CSA-A82.27-M, "Gypsum Board," or
b) ASTM C 1396/C 1396M, "Gypsum Board."

2) Where the term "Type X gypsum board" is used in this Appendix, it applies to special fire-resistant board as described in

a) CAN/CSA-A82.27-M, "Gypsum Board," or
b) ASTM C 1396/C 1396M, "Gypsum Board."

D-1.6. Equivalent Thickness

D-1.6.1. Method of Calculating

1) The thickness of solid-unit masonry and concrete described in this Appendix shall be the thickness of solid material in the unit or component thickness. For units that contain cores or voids, the Tables refer to the equivalent thickness determined in conformance with Sentences (2) to (10).

2) Where a plaster finish is used, the equivalent thickness of a wall, floor, column or beam protection shall be equal to the sum of the equivalent thicknesses of the concrete or masonry units and the plaster finish measured at the point that will give the least value of equivalent thickness.

3) Except as provided in Sentence (5), the equivalent thickness of a hollow masonry unit shall be calculated as equal to the actual overall thickness of a unit in millimetres multiplied by a factor equal to the net volume of the unit and divided by its gross volume.

4) Net volume shall be determined using a volume displacement method that is not influenced by the porous nature of the units.

5) Gross volume of a masonry unit shall be equal to the actual length of the unit multiplied by the actual height of the unit multiplied by the actual thickness of the unit.

6) Where all the core spaces in a wall of hollow concrete masonry or hollow-core precast concrete units are filled with grout, mortar, or loose fill materials such as expanded slag, burned clay or shale (rotary kiln process), vermiculite or perlite, the equivalent thickness rating of the wall shall be considered to be the same as that of a wall of solid units, or a solid wall of the same concrete type and the same overall thickness.

7) The equivalent thickness of hollow-core concrete slabs and panels having a uniform thickness and cores of constant cross section throughout their length shall be obtained by dividing the net cross-sectional area of the slab or panel by its width.

8) The equivalent thickness of concrete panels with tapered cross sections shall be the cross section determined at a distance of 2 t or 150 mm, whichever is less, from the point of minimum thickness, where t is the minimum thickness.

9) Except as permitted in Sentence (10), the equivalent thickness of concrete panels with ribbed or undulating surfaces shall be

a) t_a for s less than or equal to 2 t,
b) $t + (4\ t/s - 1)(t_a - t)$ for s less than 4 t and greater than 2 t, and
c) t for s greater than or equal to 4 t

where

t = minimum thickness of panel,
t_a = average thickness of panel (unit cross-sectional area divided by unit width), and
s = centre to centre spacing of ribs or undulations.

10) Where the total thickness of a panel described in Sentence (9), exceeds 2 t, only that portion of the panel which is less than 2 t from the non-ribbed surface shall be considered for the purpose of the calculations in Sentence (9).

D-1.7. Contribution of Plaster or Gypsum Board Finish to Fire Resistance of Masonry or Concrete

D-1.7.1. Determination of Contribution

1) Except as provided in Sentences (2), (3), (4) and (5), the contribution of a plaster or gypsum board finish to the fire resistance of a masonry or concrete wall, floor or roof assembly shall be determined by multiplying the actual thickness of the finish by the factor shown in Table D-1.7.1., depending on the type of masonry or concrete to which it is applied. This corrected thickness shall then be included in the equivalent thickness as described in Subsection D-1.6.

Table D-1.7.1.
Multiplying Factors for Masonry or Concrete Construction

Type of Surface Protection	Type of Masonry or Concrete			
	Solid Clay Brick, Unit Masonry and Monolithic Concrete, Type N or S	Cored Clay Brick, Clay Tile, Monolithic Concrete, Type L40S and Unit Masonry, Type $L_1$20S	Concrete Unit Masonry, Type L_1 or $L_2$20S and Monolithic Concrete, Type L	Concrete Unit Masonry, Type L_2
Portland cement-sand plaster or lime sand plaster	1	0.75	0.75	0.50
Gypsum-sand plaster, wood fibred gypsum plaster or gypsum board	1.25	1	1	1
Vermiculite or perlite aggregate plaster	1.75	1.5	1.25	1.25

2) Where a plaster or gypsum board finish is applied to a concrete or masonry wall, the calculated fire-resistance rating of the assembly shall not exceed twice the fire-resistance rating provided by the masonry or concrete because structural collapse may occur before the limiting temperature is reached on the surface of the non-fire-exposed side of the assembly.

3) Where a plaster or gypsum board finish is applied only on the non-fire-exposed side of a hollow clay tile wall, no increase in fire resistance is permitted because structural collapse may occur before the limiting temperature is reached on the surface of the non-fire-exposed side of the assembly.

4) The contribution to fire resistance of a plaster or gypsum board finish applied to the non-fire-exposed side of a monolithic concrete or unit masonry wall shall be determined in conformance with Sentence (1), but shall not exceed 0.5 times the contribution of the concrete or masonry wall.

5) When applied to the fire-exposed side, the contribution of a gypsum lath and plaster or gypsum board finish to the fire resistance of masonry or concrete wall, floor or roof assemblies shall be determined from Table D-2.3.4.-A or D-2.3.4.-D.

D-1.7.2. Plaster

1) Gypsum plastering shall conform to CSA A82.30-M, “Interior Furring, Lathing and Gypsum Plastering.”

2) Portland cement-sand plaster shall be applied in 2 coats: the first coat containing 1 part Portland cement to 2 parts sand by volume, and the second coat containing 1 part Portland cement to 3 parts sand by volume.
3) Plaster finish shall be securely bonded to the wall or ceiling.
4) The thickness of plaster finish applied directly to monolithic concrete without metal lath shall not exceed 10 mm on ceilings and 16 mm on walls.
5) Where the thickness of plaster finish on masonry or concrete exceeds 38 mm, wire mesh with 1.57 mm diam wire and openings not exceeding 50 mm by 50 mm shall be embedded midway in the plaster.

D-1.7.3. Attachment of Gypsum Board and Lath
Gypsum board and gypsum lath finishes applied to masonry or concrete walls shall be secured to wood or steel furring members in conformance with Article D-2.3.9.

D-1.7.4. Sample Calculations
The following examples are included as a guide to the method of calculating the fire resistance of concrete or hollow masonry walls with plaster or gypsum board protection:

Example (1)
A 3 h fire-resistance rating is required for a monolithic concrete wall of Type S aggregate with a 20 mm gypsum-sand plaster finish on metal lath on each face.
a) The minimum equivalent thickness of Type S monolithic concrete needed to give a 3 h fire-resistance rating = 158 mm (Table D-2.1.1.).
b) Since the gypsum-sand plaster finish is applied on metal lath, Sentence D-1.7.1.(5) does not apply. Therefore, the contribution to the equivalent thickness of the wall of 20 mm gypsum-sand plaster on each face of the concrete is 20 × 1.25 = 25 mm (see Sentences D-1.7.1.(1) to (4)).
c) The total contribution of the plaster finishes is 2 × 25 = 50 mm.
d)The minimum equivalent thickness of concrete required is 158 mm - 50 mm = 108 mm.
e) From Table D-2.1.1., the 108 mm equivalent thickness of monolithic concrete gives a contribution of less than 1.5 h. This is less than half the rating of the assembly so that the conditions in Sentence D-1.7.1.(2) are not met. Thus the equivalent thickness of monolithic concrete must be increased to 112 mm to give 1.5 h contribution.
f) The total equivalent thickness of the plaster finishes can then be reduced to 158 mm - 112 mm = 46 mm.
g) The total actual thickness of the plaster finishes required is therefore 46 mm ÷ 1.25 = 37 mm (Sentences D-1.7.1.(1) to (4)) or 18.5 mm on each face.
h) Since the thickness of the plaster finish on each face exceeds 16 mm, metal lath is still required (Sentence D-1.7.2.(4)).
i) Since this wall is symmetrical with plaster on both faces, the contribution to fire resistance of the plaster finish on either face is limited to one-quarter of the wall rating by virtue of Sentence D-1.7.1.(2). Under these circumstances, the conditions in Sentence D-1.7.1.(4) are automatically met.

Example (2)
A 2 h fire-resistance rating is required for a hollow masonry wall of Type N concrete with a 12.7 mm Type X gypsum board finish on each face.
a) Since gypsum board is used, Sentence D-1.7.1.(5) applies. The 12.7 mm gypsum board finish on the fire-exposed side is, therefore, assigned 25 min by using Table D-2.3.4.-A.
b) The fire resistance required of the balance of the assembly is 120 min – 25 min = 95 min.
c) Interpolating between 1.5 h and 2 h in Table D-2.1.1. for 95 min fire resistance, the equivalent thickness for hollow masonry units required is 95 mm + (18 mm × 5/30) = 95 mm + 3 mm = 98 mm.
d) The contribution to the equivalent thickness of the wall of the 12.7 mm gypsum board finish on the non-fire-exposed side using Table D-1.7.1. = 12.7 × 1.25 = 16 mm.
e) Equivalent thickness required of concrete masonry unit = 98 - 16 = 82 mm.

f) The fire-resistance rating of a concrete masonry wall having an equivalent thickness of 82 mm = 1 h for 73 mm + (9 mm × 30/22) = 1 h 12 min.

As this is more than 1 h, the conditions of Sentence D-1.7.1.(2) are met and the rating of 2 h is justified.

Example (3)

A 2 h fire-resistance rating is required for a hollow masonry exterior wall of Type $L_2$20S concrete with a 15.9 mm Type X gypsum board finish on the non-fire-exposed side only.

a) According to Table D-2.1.1., the minimum equivalent thickness for Type $L_2$20S concrete masonry units needed to achieve a 2 h rating is 94 mm.

b) Since gypsum board is not used on the fire-exposed side, Sentence D-1.7.1.(5) does not apply.

The contribution to the equivalent thickness of the wall by the 15.9 mm Type X gypsum board finish applied on the non-fire-exposed side is 15.9 × 1 ≈ 16 mm (see Sentence D-1.7.1.(1) and Table D-1.7.1.).

c) Therefore, the equivalent thickness required of the concrete masonry unit is 94 − 16 = 78 mm.

d) The contribution to fire resistance of a 78 mm $L_2$20S concrete hollow masonry unit is 85 min.

The contribution of the Type X gypsum board finish is 120 − 85 = 35 min, which does not exceed half the 85 min contribution of the masonry unit or 42.5 min, so that the conditions in Sentence D-1.7.1.(4) are met.

e) The rating of the wall (120 min) is less than twice the contribution of the masonry unit (170 min) so that the conditions in Sentence D-1.7.1.(2) are also met.

D-1.8. Tests on Floors and Roofs

D-1.8.1. Exposure to Fire

All tests relate to the performance of a floor assembly or floor-ceiling or roof-ceiling assembly above a fire. It has been assumed on the basis of experience that fire on top will take a longer time to penetrate the floor than one below, and that the fire resistance in such a situation will be at least equal to that obtained from below in the standard test.

D-1.9. Moisture Content

D-1.9.1. Effect of Moisture

1) The moisture content of building materials at the time of fire test may have a significant influence on the measured fire resistance. In general, an increase in the moisture content should result in an increase in the fire resistance, though in some materials the presence of moisture may produce disruptive effects and early collapse of the assembly.

2) Moisture content is now controlled in standard fire test methods and is generally recorded in the test reports. In earlier tests, moisture content was not always properly determined.

D-1.10. Permanence and Durability

D-1.10.1. Test Conditions

The ratings in this Appendix relate to tested assemblies and do not take into account possible changes or deterioration in use of the materials. The standard fire test measures the fire resistance of a sample building assembly erected for the test. No judgment as to the permanence or durability of the assembly is made in the test.

D-1.11. Steel Structural Members

D-1.11.1. Thermal Protection

Since the ability of a steel structural member to sustain the loading for which it was designed may be impaired because of elevated temperatures, measures shall be taken to provide thermal protection. The fire-resistance ratings, as established by the provisions of this Appendix, indicate the time periods during which the effects of heat on protected steel structural members are considered to be within acceptable limits.

D-1.12. Restraint Effects

D-1.12.1. Effect on Fire-Resistance Ratings

In fire tests of floors, roofs and beams, it is necessary to state whether the rating applies to a thermally restrained or thermally unrestrained assembly. Edge restraint of a floor or roof, structural continuity, or end restraint of a beam can significantly extend the time before collapse in a standard test. A restrained condition is one in which expansion or rotation at the supports of a load-carrying element resulting from the effects of fire is resisted by forces or moments external to the element. An unrestrained condition is one in which the load-carrying element is free to thermally expand and rotate at its supports.

Whether an assembly or structural member can be considered thermally restrained or thermally unrestrained depends on the type of construction and location in a building. Guidance on this subject can be found in Appendix A of CAN/ULC-S101, “Fire Endurance Tests of Building Construction and Materials.” Different acceptance criteria also apply to thermally unrestrained and thermally restrained assemblies. These are described in CAN/ULC-S101.

The ratings for floors, roofs, and beams in this Appendix meet the conditions of CAN/ULC-S101, “Fire Endurance Tests of Building Construction and Materials,” for thermally unrestrained specimens. In a thermally restrained condition, the structural element or assembly would probably have greater fire resistance, but the extent of this increase can be determined only by reference to behavior in a standard test.

(2)

Section D-2 Fire-Resistance Ratings

D-2.1. Masonry and Concrete Walls

D-2.1.1. Minimum Equivalent Thickness for Fire-Resistance Rating

The minimum thicknesses of unit masonry and monolithic concrete walls are shown in Table D-2.1.1. Hollow masonry units and hollow-core concrete panels shall be rated on the basis of equivalent thickness as described in Subsection D-1.6.

Table D-2.1.1.
Minimum Equivalent Thicknesses(1) of Unit Masonry and Monolithic Concrete Walls
Loadbearing and Non-Loadbearing, mm

Type of Wall	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Solid brick units (80% solid and over), actual overall thickness	63	76	90	108	128	152	178
Cored brick units and hollow tile units (less than 80% solid), equivalent thickness	50	60	72	86	102	122	142
Solid and hollow concrete masonry units, equivalent thickness							
Type S or N concrete(2)	44	59	73	95	113	142	167
Type $L_1$20S concrete	42	54	66	87	102	129	152
Type L_1 concrete	42	54	64	82	97	122	143

Type L_220S concrete	42	54	64	81	94	116	134
Type L_2 concrete	42	54	63	79	91	111	127
Monolithic concrete and concrete panels, equivalent thickness							
Type S concrete	60	77	90	112	130	158	180
Type N concrete	59	74	87	108	124	150	171
Type L40S or Type L concrete	49	62	72	89	103	124	140

Notes to Table D-2.1.1.:
(1) See definition of equivalent thickness in Subsection D-1.6.
(2)(2) Hollow concrete masonry units made with Type S or N concrete shall have a minimum compressive strength of 15 MPa based on net area, as defined in CSA A165.1, "Concrete Block Masonry Units."

D-2.1.2. Applicability of Ratings

1) Ratings obtained as described in Article D-2.1.1. apply to either *loadbearing* or *non-loadbearing* walls, except for walls described in Sentences (2) to (6).

2) Ratings for walls with a thickness less than the minimum thickness prescribed for *loadbearing* walls in this By-law apply to *non-loadbearing* walls only.

3) Masonry cavity walls (consisting of 2 *wythes* of masonry with an air space between) that are loaded to a maximum allowable compressive stress of 380 kPa have a fire resistance at least as great as that of a solid wall of a thickness equal to the sum of the equivalent thicknesses of the 2 *wythes*.

4) Masonry cavity walls that are loaded to a compressive stress exceeding 380 kPa are not considered to be within the scope of this Appendix.

5) A masonry wall consisting of 2 types of masonry units, either bonded together or in the form of a cavity wall, shall be considered to have a fire-resistance rating equal to that which would apply if the whole of the wall were of the material that gives the lesser rating.

6) A *non-loadbearing* cavity wall made up of 2 *precast* concrete panels with an air space or insulation in the cavity between them shall be considered to have a fire-resistance rating as great as that of a solid wall of a thickness equal to the sum of the thicknesses of the 2 panels.

D-2.1.3. Framed Beams and Joists

Beams and joists that are framed into a masonry or concrete fire separation shall not reduce the thickness of the fire separation to less than the equivalent thickness required for the fire separation.

D-2.1.4. Credit for Plaster Thickness

On monolithic walls and walls of unit masonry, the full plaster finish on one or both faces multiplied by the factor shown in Table D-1.7.1. shall be included in the wall thickness shown in Table D-2.1.1., under the conditions and using the methods described in Subsection D-1.7.

D-2.1.5. Walls Exposed to Fire on Both Sides

1) Except as permitted in Sentence (2), portions of *loadbearing* reinforced concrete walls, which do not form a complete fire separation and thus may be exposed to fire on both sides simultaneously, shall have minimum dimensions and minimum cover to steel reinforcement in conformance with Articles D-2.8.2. to D-2.8.5.

2) A concrete wall exposed to fire from both sides as described in Sentence (1) has a fire-resistance rating of 2 h if the following conditions are met:

a) its equivalent thickness is not less than 200 mm,
b) its aspect ratio (width/thickness) is not less than 4.0,
c) the minimum thickness of concrete cover over the steel reinforcement specified in Clause (d) is not less than 50 mm,
d) each face of the wall is reinforced with both vertical and horizontal steel reinforcement in conformance with either Clause 10 or Clause 14 of CSA A23.3, "Design of Concrete Structures,"
e) the structural design of the wall is governed by the minimum eccentricity (15 + 0.03h) specified in Clause 10.15.3.1 of CSA A23.3, "Design of Concrete Structures," and
f) the effective length of the wall, kl_u, is not more than 3.7 m

where
k = effective length factor obtained from CSA A23.3, "Design of Concrete Structures,"
l_u = unsupported length of the wall in metres.

D-2.2. Reinforced and Prestressed Concrete Floor and Roof Slabs

D-2.2.1. Assignment of Rating

1) Floors and roofs in a fire test are assigned a fire-resistance rating which relates to the time that an average temperature rise of 140°C or a maximum temperature rise of 180 °C at any location is recorded on the unexposed side, or the time required for collapse to occur, whichever is the lesser. The thickness of concrete shown in Table D-2.2.1.-A shall be required to resist the transfer of heat during the fire resistance period shown.

Table D-2.2.1.-A
Minimum Thickness of Reinforced and Prestressed Concrete Floor or Roof Slabs, mm

Type of Concrete	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Type S concrete	60	77	90	112	130	158	180
Type N concrete	59	74	87	108	124	150	171
Type L40S or Type L concrete	49	62	72	89	103	124	140

2) The concrete cover over the reinforcement and steel tendons shown in Table D-2.2.1.-B shall be required to maintain the integrity of the structure and prevent collapse during the same period.

Table D-2.2.1.-B
Minimum Concrete Cover over Reinforcement in Concrete Slabs, mm

Type of Concrete	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Type S, N, L40S or L concrete	20	20	20	20	25	32	39
Prestressed concrete slabs Type S, N, L40S or L concrete	20	25	25	32	39	50	64

D-2.2.2. Floors with Hollow Units

The fire resistance of floors containing hollow units may be determined on the basis of equivalent thickness as described in Subsection D-1.6.

D-2.2.3. Composite Slabs

1) For composite concrete floor and roof slabs consisting of one layer of Type S or N concrete and another layer of Type L40S or L concrete in which the minimum thickness of both the top and bottom layers is not less than 25 mm, the combined fire-resistance rating may be determined using the following expressions:

a) when the base layer consists of Type S or N concrete,

$$R = 0.00018t^2 + \frac{8.7}{t}$$

b) when the base layer consists of Type L40S or L concrete,

$$R - 0.0001t^2 + 0.0002dt - 0.0001d^2 + \frac{6.4}{t}$$

where
R = fire resistance of slab, h,
T = total thickness of slab, mm, and
d = thickness of base layer, mm.

2) If the base course described in Sentence (1) is covered by a top layer of material other than Type S, N, L40S or L concrete, the top course thickness may be converted to an equivalent concrete thickness by multiplying the actual thickness by the appropriate factor listed in Table D-2.2.3.-A. This equivalent concrete thickness may be added to the thickness of the base course and the fire-resistance rating calculated using Table D-2.2.1.-A.

3) The minimum concrete cover under the main reinforcement for composite concrete floor and roof slabs with base slabs less than 100 mm thick shall conform to Table D-2.2.3.-B For base slabs 100 mm or more thick, the minimum cover thickness requirements of Table D-2.2.1.-B shall apply.

4) Where the top layer of a 2-layer slab is less than 25 mm thick, the fire-resistance rating for the slab shall be calculated as though the entire slab were made up of the type of concrete with the lesser fire resistance.

Table D-2.2.3.-A
Multiplying Factors for Equivalent Thickness

Top Course Material	Base Slab Normal Density Concrete (Type S or N)	Base Slab Low Density Concrete (Type L40S or L)
Gypsum board	3	2.25
Cellular concrete (mass density 400 – 560 kg/m^3)	2	1.50
Vermiculite and perlite concrete (mass density 560 kg/m^3 or less)	1.75	1.50
Portland cement with sand aggregate	1	0.75
Terrazzo	1	0.75

Table D-2.2.3.-B
Minimum Concrete Cover under Bottom Reinforcement in Composite Concrete Slabs, mm

Base Slab Concrete Type	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Reinforced concrete							
Type S, N, L40S or L	15	15	20	25	30	40	55
Prestressed concrete							
Type S	20	25	30	40	50	65	75
Type N	20	20	25	35	45	60	70
Type L40S or L	20	20	25	30	40	50	60

D-2.2.4. Contribution of Plaster Finish

1) The contribution of plaster finish securely fastened to the underside of concrete may be taken into account in floor or roof slabs under the conditions and using the methods described in Subsection D-1.7.
2) Plaster finish on the underside of concrete floors or roofs may be used in lieu of concrete cover referred to in Sentence D-2.2.1.(2) under the conditions and using the methods described in Subsection D-1.7.

D-2.2.5. Concrete Cover

1) In prestressed concrete slab construction, the concrete cover over an individual tendon shall be the minimum thickness of concrete between the surface of the tendon and the fire-exposed surface of the slab, except that for ungrouted ducts the assumed cover thickness shall be the minimum thickness of concrete between the surface of the duct and the bottom of the slab. For slabs in which several tendons are used, the cover is assumed to be the average of those of individual tendons, except that the cover for any individual tendon shall be not less than half of the value given in Table D-2.2.1.-B nor less than 20 mm.
2) Except as provided in Sentence (3), in post-tensioned prestressed concrete slabs, the concrete cover to the tendon at the anchor shall be not less than 15 mm greater than the minimum cover required by Sentence (1). The minimum concrete cover to the anchorage bearing plate and to the end of the tendon, if it projects beyond the bearing plate, shall be 20 mm.
3) The requirements of Sentence (2) do not apply to those portions of slabs not likely to be exposed to fire, such as the ends and tops.

D-2.2.6. Minimum Dimensions for Cover

Minimum dimensions and cover to steel tendons of prestressed concrete beams shall conform to Subsection D-2.10.

D-2.3. Wood and Steel Framed Walls, Floors and Roofs

D-2.3.1. Maximum Fire-Resistance Rating

The fire-resistance rating of walls constructed of wood studs or cold-formed-steel studs, of floors constructed of wood joists, wood I-joists, pre-manufactured wood trusses, cold-formed steel joists or open web steel joists, and of roofs constructed of wood joists, pre-manufactured metal-plate-connected wood trusses or open web steel joists can be determined for ratings of not more than 90 min from the information in this Subsection.

D-2.3.2. Loadbearing Conditions

1) The fire-resistance ratings derived from the information in this Subsection apply to loadbearing and non-loadbearing wood-framed and cold-formed-steel-framed walls, and to loadbearing floors and roofs, as specifically described in this Subsection.

2) Loadbearing conditions shall be as defined in CAN/ULC-S101, “Fire Endurance Tests of Building Construction and Materials.”

D-2.3.3. Limitations of Component Additive Method

(See Section D-6, Background Information.)

1) The fire-resistance rating of a framed assembly depends primarily on the time during which the membrane on the fire-exposed side remains in place.

2) The assigned times in Sentences D-2.3.4.(2), (3) and (4) are not intended to be construed as the fire-resistance ratings of the individual components of an assembly, nor are they intended to be construed as times that are applicable or acceptable for use beyond the method and systems described in this Subsection. These assigned times are the individual contributions of each component to the overall fire-resistance rating of an assembly, which is permitted to be derived using the component additive method described in this Subsection.

3) The fire-resistance rating calculated by the component additive method cannot be increased by installing membranes in multiple layers, other than as specified in Tables D-2.3.4.-A, D-2.3.4.-B, and D-2.3.4.-C.

D-2.3.4. Method of Calculation

1) In the component additive method, the fire-resistance rating of a framed assembly is calculated by adding the time assigned in Sentence (2) for the membrane on the fire-exposed side to the time assigned in Sentence (3) for the framing members and then adding any time assigned in Sentence (4) for additional protective measures, such as the inclusion of insulation or of reinforcement for a membrane. For loadbearing walls where resilient metal channels are installed with a single layer of gypsum board membrane in accordance with Table D-2.3.4.-A, the fire-resistance rating determined using this method of calculation must be reduced by 10 min.

2) The times to be used in the component additive method that have been assigned to membranes on the fire-exposed side of the assembly, which are partly based on their ability to remain in place during fire tests, are listed in Tables D-2.3.4.-A, D-2.3.4.-B, D-2.3.4.-C and D-2.3.4.-D. (This is not to be confused with the fire-resistance rating of the membrane, which also takes into account the rise in temperature on the unexposed side of the membrane. [See Sentence D-2.3.3.(2).])

Table D-2.3.4.-A
Time Assigned to Protective Membranes on Fire-Exposed Side of Wood-Framed and Cold-Formed-Steel-Framed Walls

Description of Finish	Time, min	
	Loadbearing Walls	Non-Loadbearing Walls
11.0 mm Douglas Fir plywood phenolic bonded	–	10(1)
14.0 mm Douglas Fir plywood phenolic bonded	–	15(1)
12.7 mm Type X gypsum board	25(2)	25
15.9 mm Type X gypsum board	40(2)	40(3)
Double 12.7 mm Type X gypsum board(4)	50	80

Notes to Table D-2.3.4.-A:

(1) Applies to stud cavities filled with mineral wool conforming to CAN/ULC-S702, “Mineral Fibre Thermal Insulation for Buildings,” and having a mass per unit area of not less than 2 kg/m^2, with no additional credit for insulation according to Table D-2.3.4.-G.

(2)[2] Applies only to wood-framed walls.

(2)[3] Applies only to steel-framed walls.

(2)[4] Resilient metal channels are permitted to be installed at a spacing of 400 mm o.c. with no effect on the rating of the wall assembly.

Table D-2.3.4.-B
Time Assigned to Gypsum Board Membranes on Fire-Exposed Side of Floors

Description of Finish	Resilient Metal Channels[1]	Time, min	
		Floors with Wood or Steel Joists	Floors with Open-Web Steel Joists
12.7 mm Type X gypsum board	Spaced ≤ 400 mm o.c.[2]	25[3]	–
15.9 mm Type X gypsum board		40	–
12.7 mm Type X gypsum board	–	25[4]	25
15.9 mm Type X gypsum board		40[4]	40
Double 12.7 mm Type X gypsum board	Spaced ≤ 400 mm o.c.[5]	50[3]	–
Double 12.7 mm Type X gypsum board	Spaced at 600 mm o.c.[6]	45[3]	–
Double 15.9 mm Type X gypsum board	Spaced ≤ 600 mm o.c.[6]	60[3]	–

Notes to Table D-2.3.4.-B:
[1] See Figures A-9.10.3.1.-A, A-9.10.3.1.-B and A-9.10.3.1.-D in Note A-9.10.3.1. for the attachment of single and double layers of gypsum board to resilient metal channels.
[2] Resilient metal channels must be installed to achieve the stated rating.
[3] Applies to wood joists, wood trusses, wood I-joists and cold-formed steel joists (C-shaped joists).
[4] Applies to wood joists and pre-fabricated metal-plate-connected wood trusses.
[5] Resilient metal channels must be installed or gypsum board must be applied directly to the structural members, which must be spaced not more than 400 mm o.c.
[6] Resilient metal channels are permitted to be installed with no effect on the rating of the floor assembly. Gypsum board is also permitted to be directly applied to the structural members.

Table D-2.3.4.-C
Time Assigned to Gypsum Board Membranes on Fire-Exposed Side of Roofs

Description of Finish	Time, min[1]
12.7 mm Type X gypsum board	25
15.9 mm Type X gypsum board	40

Notes to Table D-2.3.4.-C:
([1] Applies to wood joists, pre-fabricated metal-plate-connected wood trusses, and open-web steel joists with ceiling supports spaced ≤ 400 mm o.c.

Table D-2.3.4.-D
Time Assigned for Contribution of Lath and Plaster Protection on Fire-Exposed Side

Type of Lath	Plaster Thickness, mm	Type of Plaster Finish		
		Portland Cement and Sand[1] or Lime and Sand	Gypsum and Sand or Gypsum Wood Fibre	Gypsum and Perlite or Gypsum and Vermiculite
		Time, min[2]		
9.5 mm gypsum	13	–	35	55
	16	–	40	65
	19	–	50	80[3]
Metal	19	20	50	80[3]
	23	25	65	80[3]
	26	30	80	80[3]

Notes to Table D-2.3.4.-D:
[1] For mixture of Portland cement-sand plaster, see Sentence D-1.7.2.(2).
(2)[2] Applies to loadbearing and non-loadbearing wood studs or non-loadbearing cold-formed-steel studs, to floors constructed of wood joists or open-web steel joists, and to roofs constructed of wood joists, pre-manufactured metal-plate-connected wood trusses, or open-web steel joists.

(2)[3] Values shown for these membranes have been limited to 80 min because the fire-resistance ratings of framed assemblies derived from these Tables must not exceed 1.5 h.

3) The times to be used in the component additive method that have been assigned to wall framing members and to floor and roof framing members are listed in Tables D-2.3.4.-E and D-2.3.4.-F respectively.

Table D-2.3.4.-E
Time Assigned for Contribution of Wood-Framed or Cold-Formed-Steel-Framed Walls

<table>
<tr><th rowspan="2">Description of Frame</th><th colspan="2">Time, min</th></tr>
<tr><th>Loadbearing Walls</th><th>Non-Loadbearing Walls</th></tr>
<tr><td>Wood studs spaced ≤ 400 mm o.c.</td><td colspan="2" rowspan="3">20
15
10</td></tr>
<tr><td>Wood studs spaced ≤ 600 mm o.c.</td></tr>
<tr><td>Cold-formed-steel studs spaced ≤ 400 mm o.c.</td></tr>
<tr><td>Cold-formed-steel studs spaced ≤ 600 mm o.c.</td><td>10</td><td>–</td></tr>
</table>

Table D-2.3.4.-F
Time Assigned for Contribution of Wood or Steel Frame of Floors and Roofs

Description of Frame		Time, min
Type of Assembly	Structural Members	
Floor(1)	Wood joists, wood I-joists, wood trusses and cold-formed-steel joists spaced ≤ 600 mm o.c.	10(2)
	Open-web steel joists with ceiling supports spaced ≤ 400 mm o.c.	
Roof	Wood joists spaced ≤ 400 mm o.c.	10
	Open-web steel joists with ceiling supports spaced ≤ 400 mm o.c.	10
	Wood truss assemblies [metal-plate-connected] spaced ≤ 600 mm o.c.	5

Notes to Table D-2.3.4.-F:

(1) Resilient metal channels are permitted to be installed with no effect on the rating of the floor assembly.

(2) Applies only to floor structural members that are protected by a membrane.

4) Preformed insulation of glass, rock or slag fibre and cellulose fibre insulation provide additional protection to wood studs by shielding the studs from exposure to the fire and thus delaying the time of collapse. The use of preformed glass fibre, preformed rock or slag fibre and dry-blown cellulose insulation material does not decrease the rating of wall assemblies with the membranes identified in Table D-2.3.4.-A. Similarly, the use of preformed glass fibre, preformed rock or slag fibre and cellulose insulation material does not decrease the rating of floor assemblies constructed with wood joists, wood trusses, wood I-joists and cold-formed-steel floor joists (C-shaped joists), provided the insulation is not in direct contact with the membranes identified in Table D-2.3.4.-B. The use of reinforcement in the membrane exposed to fire also adds to the fire resistance by extending the time to failure. Table D-2.3.4.-G shows the time increments that may be added to the fire resistance if these features are incorporated in the assembly.

Table D-2.3.4.-G
Time Assigned for Additional Protection

Description of Additional Protection	Time, min
Add to the fire-resistance rating of wood stud walls, sheathed with gypsum board or lath and plaster, if the spaces between the studs are filled with preformed insulation of rock or slag fibres conforming to CAN/ULC-S702, “Mineral Fibre Thermal Insulation for Buildings,” and with a mass per unit area of not less than 1.22 kg/m^2 of wall surface	15(1)
Add to the fire-resistance rating of non-loadbearing wood stud walls, sheathed with gypsum board or lath and plaster, if the spaces between the studs are filled with preformed insulation of glass fibres conforming to CAN/ULC-S702, “Mineral Fibre Thermal Insulation for Buildings,” and having a mass per unit area of not less than 0.6 kg/m^2 of wall surface	5(2)
Add to the fire-resistance rating of loadbearing wood stud walls sheathed with gypsum board if the spaces between the studs are filled with insulation of cellulose fibres conforming to CAN/ULC-S703, “Cellulose Fibre Insulation for Buildings,” and having a density of not less than 50 kg/m^3	10

Add to the fire-resistance rating of plaster on gypsum lath ceilings if 0.76 mm diam wire mesh with 25 mm by 25 mm openings or 1.57 mm diam diagonal wire reinforcing at 250 mm o.c. is placed between lath and plaster	30
Add to the fire-resistance rating of plaster on gypsum lath ceilings if 76 mm wide metal lath strips are placed over joints between lath and plaster	10
Add to the fire-resistance rating of plaster on 9.5 mm thick gypsum lath ceilings (Table D-2.3.4.-D) if supports for lath are 300 mm o.c.	10
Add to the fire-resistance rating of floor assemblies if the spaces between the structural members are filled with preformed insulation of rock or slag fibres conforming to CAN/ULC-S702, "Mineral Fibre Thermal Insulation for Buildings," and having a mass per unit area of not less than 1.22 kg/m^2 of floor surface	5(2)
Add to the fire-resistance rating of floor assemblies if the spaces between the structural members are filled with wet-blown cellulose fibres conforming to CAN/ULC-S703, "Cellulose Fibre Insulation for Buildings," and having a density of not less than 50 kg/m^3	5(2)(3)
Add to the fire-resistance rating of floor assemblies where the floor topping on the unexposed side of the floor assemblies consists of concrete not less than 38 mm thick	5(2)

Notes to Table D-2.3.4.-G:

(1) Applies to wood-framed walls only.

(2)(2) Applies to wood joists, wood trusses, wood I-joists and cold-formed-steel joists (C-shaped joists).

(2)(3) Applies to cellulose fibre:

(i) for wood joists, wood I-joist and wood trusses–that is spray-applied with a minimum density of 50 kg/m^3, a minimum depth of 90 mm on the underside of the subfloor, and of 90 mm on the sides of the structural members;

(ii) for cold-formed-steel joists–that is spray-applied with a minimum density of 50 kg/m^3 and a minimum thickness of 90 mm on the underside of the subfloor, of 90 mm on the sides of the structural members, and of 13 mm on the underside of the bottom flange other than at resilient metal channel locations.

5) Cellulose fibre insulation conforming to CAN/ULC-S703, "Cellulose Fibre Insulation for Buildings," applied in conformance with CAN/CGSB-92.2-M, "Trowel or Spray Applied Acoustical Material," does not affect the fire-resistance rating of a non-loadbearing cold-formed-steel stud wall assembly, provided that it is sprayed to either face of the wall cavity.

D-2.3.5. Considerations for Various Types of Assemblies

1) Interior vertical fire separations are to be rated for exposure to fire on each side (see Sentence 3.1.7.3.(2)). The method described in this Subsection applies when a membrane is provided on both sides of the assembly. However, in the calculation of the fire-resistance rating of such an assembly using this method, no additional contribution to fire resistance is to be assigned for a membrane on the non-fire-exposed side, since its contribution is already accounted for in the values assigned to the other components of the assembly.

2) Exterior wall assemblies required to have a fire-resistance rating are required to be rated for exposure to fire from the interior side only (see Sentence 3.1.7.3.(3)). When deriving a fire-resistance rating for such wall assemblies using the method described in this Subsection, only wood studs with a single layer of gypsum board or non-loadbearing cold-formed-steel studs conforming to Table D-2.3.4.-E may be used. Such walls must have a membrane on the exterior side of the stud consisting of plywood, oriented strandboard or gypsum sheathing and exterior cladding. Additional materials are also permitted between the required sheathing and cladding. The spaces between the studs are to be filled with insulation conforming to CAN/ULC-S702, "Mineral Fibre Thermal Insulation for Buildings," and having a mass per unit area of not less than 1.22 kg/m^2 of wall surface. However, in the calculation of the fire-resistance rating of such an assembly, no additional contribution to fire resistance is to be assigned for a membrane on the non-fire-exposed side, since its contribution is already accounted for in the values assigned to the other components of the assembly.

3) In the case of a floor or roof assembly, the By-law only requires testing for fire exposure from below. Floors or roofs must have an upper flooring or roofing membrane in accordance with Table D-2.3.5.

Table D-2.3.5.
Flooring or Roofing Membranes

Type of Assembly	Structural Members	Subfloor or Roof Deck	Finished Flooring or Roofing
Floor	Wood or open-web steel joists(1) and metal-plate-connected wood trusses(1)	12.5 mm plywood or 15.5 mm oriented strandboard or 17 mm T & G softwood or 14 mm phenolic-bonded Douglas Fir plywood (no finished flooring required)	Hardwood or softwood flooring on building paper Resilient flooring, parquet floor, felted synthetic fibre floor coverings, carpeting, or ceramic tile on 8 mm thick panel-type underlay Ceramic tile on 30 mm mortar bed
	Open-web steel joists(1)	50 mm reinforced concrete or 50 mm concrete on metal lath or formed steel sheet or 40 mm reinforced gypsum-fibre concrete on 12.7 mm gypsum board	Finish flooring
	Wood joists, wood I-joists, wood trusses and cold-formed-steel joists	minimum 15.5 mm T & G plywood or minimum 15.5 mm oriented strandboard	No requirement
Roof	Wood or open-web steel joists(1) and wood trusses(1)	12.5 mm plywood or 15.5 mm oriented strandboard or 17 mm T & G softwood or 14 mm phenolic-bonded Douglas Fir plywood (no finished flooring required)	Finish roofing material with or without insulation
	Open-web steel joists(1)	50 mm reinforced concrete or 50 mm concrete on metal lath or formed steel sheet or 40 mm reinforced gypsum-fibre concrete on 12.7 mm gypsum board	Finish roofing material with or without insulation

Notes to Table D-2.3.5.:
(1) Applies to single layer of gypsum board membrane, and lath and plaster.

4) Insulation used in the cavities of a wood joist or metal-plate-connected wood truss floor assembly with a single layer of gypsum board will not reduce the assigned fire-resistance rating of the assembly, provided:

a) the insulation is preformed of rock, slag or glass fibre conforming to CAN/ULC-S702, “Mineral Fibre Thermal Insulation for Buildings,” and having a mass per unit area of not more than 1.1 kg/m^2 and is installed adjacent to the bottom edge of the framing member, directly above steel furring channels,

b) the gypsum board ceiling membrane is attached to

i) wood trusses in conformance with Sentence D-2.3.9.(2) by way of steel furring channels spaced not more than 400 mm o.c., and the channels are secured to each bottom truss member with a double strand of 1.2 mm galvanized steel wire, or

ii) wood joists by way of resilient metal or steel furring channels spaced not more than 400 mm o.c. in conformance with Sentences D-2.3.9.(2) and (3), and

c) a steel furring channel is installed midway between each furring channel mentioned in Clause (b) to provide additional support for the insulation.

5) Except as required in Sentence D-2.3.5.(4), resilient metal or steel furring channels may be used to attach a gypsum board ceiling membrane to a floor assembly using wood joists, metal-plate-connected wood trusses and open-web steel joists, or to a roof assembly. The channels must be made of galvanized steel not less than 0.5 mm thick spaced not more than 600 mm o.c. perpendicular to the framing members, with an overlap of not less than 100 mm at splices and a minimum end clearance between the channels and walls of 15 mm.

D-2.3.6. Framing Members

1) The values shown in Tables D-2.3.4.-A, D-2.3.4.-B, D-2.3.4.-D and D-2.3.12. apply to membranes supported on framing members installed in their conventional orientation and spaced in conformance with Tables D-2.3.4.-E and D-2.3.4.-F.

2) Wood studs and wood roof framing members are to be not less than 38 mm by 89 mm. Wood floor joists are to be not less than 38 mm by 184 mm, except where they are used in an assembly from Table D-2.3.4.-D or from Table D-2.3.5. that uses a single layer of gypsum board as the lower (ceiling) membrane, in which case, wood floor joists are to be not less than 38 mm by 89 mm.

3) Wood roof trusses are to consist of wood chord and web framing members not less than 38 mm by 89 mm and metal connector plates fabricated from galvanized steel not less than 1 mm in nominal thickness with projecting teeth not less than 8 mm long.

4) Wood floor trusses are to consist of:

a) metal-plate-connected wood trusses that are not less than 305 mm deep with wood chord and web framing members not less than 38 mm by 64 mm and metal connector plates fabricated from galvanized steel not less than 1 mm in nominal thickness with projecting teeth not less than 8 mm long;

b) metal-web wood trusses that are not less than 286 mm deep with wood chords not less than 38 mm by 64 mm and V-shaped webs made from galvanized steel not less than 1 mm in nominal thickness with plate areas having teeth not less than 8 mm long; or

c) fingerjoined wood trusses that are not less than 330 mm deep with fingerjoined connections, chord members not less than 38 mm by 64 mm, and web members not less than 38 mm by 38 mm glued together with a R-14 phenol-resorcinol resin conforming to CSA O112.10, “Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).”

5) Wood I-joists are to be not less than 241 mm deep with flanges that are not less than 38 mm by 38 mm and an oriented strandboard or plywood web that is not less than 9.5 mm thick.

6) The dimensions for dressed lumber given in CSA O141, “Softwood Lumber,” are to be used for wood studs, joists, I-joists and trusses.

7) Cold-formed-steel studs for non-loadbearing walls are to consist of galvanized steel that is not less than 0.5 mm thick and not less than 63 mm wide, and have a flange that is not less than 31 mm wide.

8) Cold-formed-steel studs in non-loadbearing wall assemblies are to be installed with not less than a 12 mm clearance between the top of the stud and the top of the runner to allow for expansion in the event of a fire. Where the studs are required to be attached for alignment purposes during erection, they must be attached to the bottom runners only.

9) Cold-formed-steel studs for loadbearing walls are to consist of galvanized steel that is not less than 0.912 mm thick but not greater than 1.52 mm thick, with a C-shaped cross-section not less than 92 mm deep by 41 mm wide and 12.7 mm stiffening lips.

10) Cold-formed-steel studs in loadbearing wall assemblies are to be installed with diagonal cross-bracing.

11) Cold-formed-steel floor joists (C-shaped joists) are to be not less than 41 mm wide × 203 mm deep × 1.22 mm material thickness.

12) The allowable spans for wood joists listed in the Span Tables in Part 9 are provided for floors supporting specific occupancies.

D-2.3.7. Plaster Finish

The thickness of plaster finish shall be measured from the face of gypsum or metal lath.

D-2.3.8. Edge Support for Gypsum Board in Wall Assembly

Gypsum board installed over framing or furring in a wall assembly shall be installed so that all edges are supported, except that 15.9 mm Type X gypsum board may be installed horizontally with the horizontal joints unsupported when framing members are at 400 mm o.c. maximum.

D-2.3.9. Membrane Fastening

1) Except as provided in Sentences (2) to (5), Table D-2.3.4.-B and Sentence D-2.3.5.(5), the application of lath and plaster finish shall conform to CSA A82.30-M, “Interior Furring, Lathing and Gypsum Plastering,” and of gypsum board finish shall conform to ASTM C 840, “Application and Finishing of Gypsum Board.”

2) Where a membrane referred to in Table D-2.3.4.-A, D-2.3.4.-B, D-2.3.4.-C , D-2.3.4.-D or D-2.3.12. is applied to steel framing or furring, fasteners shall penetrate not less than 10 mm through the metal.

3) Except as provided in Sentence (4), where a membrane referred to in Table D-2.3.4.-A, D-2.3.4.-B, D-2.3.4.-C, D-2.3.4.-D or D-2.3.12. is applied to wood framing or furring, minimum fastener penetrations into wood members shall conform to Table D-2.3.9. for the time assigned to the membrane.

Table D-2.3.9.
Membrane Fastening

Type of Membrane	Minimum Penetration of Fasteners for Membrane Protection on Wood Framing, mm					
	5-25	30-35	40	50	55-70	80
	Time,(1) min					
Single layer	20	29	32	–	–	–
Double layer	20	20	20	29	35	44
Gypsum lath	20	20	23	23	29	29

Notes to Table D-2.3.9.:
(1) Assigned contributions of membranes to fire resistance are listed in Tables D-2.3.4.-A, D-2.3.4.-B, D-2.3.4.-C, D-2.3.4.-D and D-2.3.12.

4) Where a membrane is applied in 2 layers, the fastener penetrations described in Table D-2.3.9. shall apply to the base layer. Fasteners for the face layer shall penetrate not less than 20 mm into wood supports.

5) In a double layer application of gypsum board on wood supports, fastener spacing shall conform to ASTM C 840, “Application and Finishing of Gypsum Board.”

D-2.3.10. Ceiling Membrane Openings – Combustible Construction

1) Except as permitted in Article D-2.3.12., where a floor or roof assembly of combustible construction is assigned a fire-resistance rating on the basis of this Subsection and incorporates a ceiling membrane described in Table D-2.3.4.-B, D-2.3.4.-C or D-2.3.4.-D, the ceiling membrane may be penetrated by openings leading to ducts within concealed spaces above the membrane provided:

a) the assembly is not required to have a fire-resistance rating in excess of 1 h,

b) the area of any openings does not exceed 930 cm^2 (see Sentence (2)),

c) the aggregate area of openings does not exceed 1% of the ceiling area of the fire compartment,

d) the depth of the concealed space above the ceiling is not less than 230 mm,

e) no dimension of any opening exceeds 310 mm,

f) supports are provided for openings with any dimension exceeding 150 mm where framing members are spaced greater than 400 mm o.c.,

g) individual openings are spaced not less than 2 m apart,

h) the ducts above the membrane are sheet steel and are supported by steel strapping firmly attached to the framing members, and

i) the clearance between the top surface of the membrane and the bottom surface of the ducts is not less than 100 mm.

2) Where an individual opening permitted in Sentence (1) exceeds 130 cm^2 in area, it shall be protected by

a) a fire stop flap conforming to CAN/ULC-S112.2, “Fire Test of Ceiling Firestop Flap Assemblies,” that activates at a temperature approximately 30°C above the normal maximum temperature that occurs in the ducts, whether the air duct system is operating or shut down, or

b) thermal protection above the duct consisting of the same materials as used for the ceiling membrane, mechanically fastened to the ductwork and extending 200 mm beyond the opening on all sides (see Article D-2.3.10.).

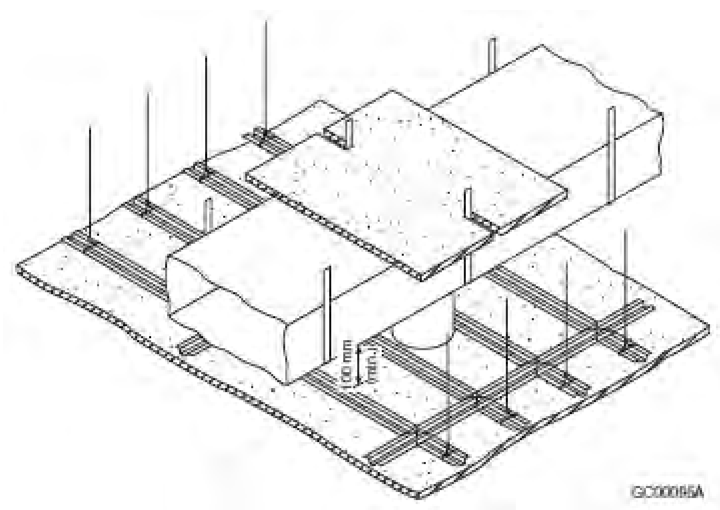


Figure D-2.3.10.
Thermal protection above a duct

D-2.3.11. Ceiling Membrane Openings – Noncombustible Construction

1) Except as permitted in Article D-2.3.12., where a floor or roof assembly of noncombustible construction is assigned a fire-resistance rating on the basis of this Subsection and incorporates a ceiling membrane described in Table D-2.3.4.-B, D-2.3.4.-C or D-2.3.4.-D, the ceiling membrane may be penetrated by openings leading to ducts located within concealed spaces provided:

a) the area of any opening does not exceed 930 cm^2 (see Sentence (2)),

b) the aggregate area of openings does not exceed 2% of the ceiling area of the fire compartment,

c) no dimension of any opening exceeds 400 mm,
d) individual openings are spaced not less than 2 m apart,
e) openings are located not less than 200 mm from major structural members such as beams, columns or joists,
f) the ducts above the membrane are sheet steel and are supported by steel strapping firmly attached to the framing members, and
g) the clearance between the top surface of the membrane and the bottom surface of the duct is not less than 100 mm.

2) Where an individual opening permitted in Sentence (1) exceeds 130 cm^2 in area, it shall be protected by
a) a fire stop flap conforming to CAN/ULC-S112.2, "Fire Test of Ceiling Firestop Flap Assemblies," that activates at a temperature approximately 30°C above the normal maximum temperature that occurs in the ducts, whether the air duct system is operating or shut down, or
b) thermal protection above the duct consisting of the same materials as used for the ceiling membrane, mechanically fastened to the ductwork and extending 200 mm beyond the opening on all sides (see Article D-2.3.10.).

D-2.3.12. Ceiling Membrane Rating

Where the fire-resistance rating of a ceiling assembly is to be determined on the basis of the membrane only and not of the complete assembly, the ratings may be determined from Table D-2.3.12., provided no openings de1745scribed in Articles D-2.3.10. and D-2.3.11. are located within the ceiling membrane.

Table D-2.3.12.
Fire-Resistance Rating for Ceiling Membranes

Description of Membrane	Fire-Resistance Rating, min
15.9 mm Type X gypsum board with ≥ 75 mm mineral wool batt insulation above board	30
19 mm gypsum-sand plaster on metal lath	30
Double 14.0 mm Douglas Fir plywood phenolic bonded	30
Double 12.7 mm Type X gypsum board	45
25 mm gypsum-sand plaster on metal lath	45
Double 15.9 mm Type X gypsum board	60
32 mm gypsum-sand plaster on metal lath	60

D-2.3.13. Membrane Penetrations in Combustible and Noncombustible Construction

1) Where a wall, floor or roof assembly is assigned a fire-resistance rating on the basis of this Subsection and includes a membrane or membranes described in Table D-2.3.4.-A, D-2.3.4.-B, D-2.3.4.-C, D-2.3.4.-D or D-2.3.12., penetrations of the membrane or membranes must be fire stopped in conformance with the applicable requirements in Article 3.1.9.1. or Sentence 9.10.9.6.(1).

D-2.3.14. Beams

1) Where a steel beam is included with an open-web steel joist and is protected by the same continuous ceiling, the beam is assumed to have a fire-resistance rating equal to that assigned to the rest of the assembly.
2) The ratings in this Subsection assume that the construction to which the beam is related is a normal one and does not carry unusual loads from the floor or slab above.

D-2.3.15. Wired Glass Assembly Support

1) Openings in a vertical fire separation having a fire-resistance rating of not more than 1 h are allowed to be protected by wired glass assemblies, provided the wired glass is

a) not less than 6 mm thick;

b) reinforced by a steel wire mesh in the form of diamonds, squares or hexagons having dimensions of

i) approximately 25 mm across the flats, using wire of not less than 0.45 mm diameter, or

ii) approximately 13 mm across the flats, using wire of not less than 0.40 mm diameter, the wire to be centrally embedded during manufacture and welded or intertwined at each intersection;

c) set in fixed steel frames with metal not less than 1.35 mm thick and providing a glazing stop of not less than 20 mm on each side of the glass; and

d) limited in area so that

i) individual panes are not more than 0.84 m^2, with neither height nor width more than 1.4 m, and

ii) the area not structurally supported by mullions is not more than 7.5 m^2.

2) It is intended that the structural mullions referred to in Subclause (1)(d)(ii) will not distort or be displaced to the extent that there would be a failure of the wired glass closure during the period for which a closure in the fire separation would be expected to function. Hollow structural steel tubing not less than 100 mm square filled with a Portland cement-based grout will satisfy the intent of the Subclause.

D-2.4. Solid Wood Walls, Floors and Roofs

D-2.4.1. Minimum Thickness

The minimum thickness of solid wood walls, floors and roofs for fire-resistance ratings from 30 min to 1.5 h is shown in Table D-2.4.1.

Table D-2.4.1.
Minimum Thickness of Solid Wood Walls, Roofs and Floors, mm(1)(2)

Type of Construction	Fire-Resistance Rating			
	30 min	45 min	1 h	1.5 h
Solid wood floor with building paper and finish flooring on top(3)	89	114	165	235
Solid wood, splined or tongued and grooved floor with building paper and finish flooring on top(4)	64	76	–	–
Solid wood walls of loadbearing vertical plank(3)	89	114	140	184
Solid wood walls of non-loadbearing horizontal plank(3)	89	89	89	140

Notes to Table D-2.4.1.:

(1) See CSA O141, "Softwood Lumber," for sizes.

(2)(2)The fire-resistance ratings and minimum dimensions for floors also apply to solid wood roof decks of comparable thickness with finish roofing material.

(2)(3) The assembly shall consist of 38 mm thick members on edge fastened together with 101 mm common wire nails spaced not more than 400 mm o.c. and staggered in the direction of the grain.

(2)(4) The floor shall consist of 64 mm by 184 mm wide planks either tongued and grooved or with 19 mm by 38 mm splines set in grooves and fastened together with 88 mm common nails spaced not more than 400 mm o.c.

D-2.4.2. Increased Fire-Resistance Rating

1) The fire-resistance rating of the assemblies described in Table D-2.4.1. may be increased by 15 min if one of the following finishes is applied on the fire-exposed side:

a) 12.7 mm thick gypsum board,
b) 20 mm thick gypsum-sand plaster on metal lath, or
c) 13 mm thick gypsum-sand plaster on 9.5 mm gypsum lath.

2) Fastening of the plaster to the wood structure shall conform to Subsection D-2.3.

D-2.4.3. Supplementary Ratings

Supplementary ratings based on tests are included in Table D-2.4.3. The ratings given shall apply to constructions that conform in all details with the descriptions given.

Table D-2.4.3.
Fire-Resistance Rating of Non-Loadbearing Built-up Solid Wood Partitions(1)

Construction Details	Actual Overall Thickness, mm	Fire-Resistance Rating
Solid panels of wood boards 64 mm to 140 mm wide grooved and joined with wood splines, nailed together, boards placed vertically with staggered joints, 3 boards thick	58	30 min
Solid panels with 4 mm plywood facings(2) glued to 46 mm solid wood core of glued, tongued and grooved construction for both sides and ends of core pieces with tongued and grooved rails in the core about 760 mm apart	54	1 h

Notes to Table D-2.4.3.:
(1) The ratings and notes are taken from "Fire Resistance Classifications of Building Constructions," Building Materials and Structures Report BMS 92, National Bureau of Standards, Washington, 1942.
(2)(2) Ratings for plywood faced panel are based on phenolic resin glue being used for gluing facings to wood frames. If other types of glue are used for this purpose, the ratings apply if the facings are nailed to the frames in addition to being glued.

D-2.5. Solid Plaster Partitions

D-2.5.1. Minimum Thickness

The minimum thickness of solid plaster partitions for fire-resistance ratings from 30 min to 4 h is shown in Table D-2.5.1.

Table D-2.5.1.
Minimum Thickness of Non-Loadbearing Solid Plaster Partitions, mm

Type of Plaster on Metal Lath(1)	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Portland cement-sand(2) or Portland cement-lime-sand	50(3)	–	–	–	–	–	–
Gypsum-sand	50(3)	50(3)	64	–	–	–	–
Gypsum-vermiculite, gypsum-perlite, Portland cement-vermiculite or Portland cement-perlite	50(3)	50(3)	50(3)	58	64	83	102

Notes to Table D-2.5.1.:

(1) Metal lath shall be expanded metal lath or welded woven wire fabric supported on 19 mm vertical light steel studs spaced not more than 600 mm o.c. Plaster shall be applied to both sides of the lath.

(2)(2) For mixture of Portland cement-sand plaster, see Sentence D-1.7.2.(2).

(2)(3) CSA A82.30-M, "Interior Furring, Lathing and Gypsum Plastering," does not permit solid plaster partitions less than 50 mm thick.

D-2.6. Protected Steel Columns

D-2.6.1. Minimum Thickness of Protective Covering

The minimum thickness of protective covering to steel columns is shown in Tables D-2.6.1.-A to D-2.6.1.-F for fire-resistance ratings from 30 min to 4 h.

Table D-2.6.1.-A
Minimum Thickness of Concrete or Masonry Protection to Steel Columns, mm

Description of Cover	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Monolithic concrete							
Type S concrete(1) (column spaces filled)(2)	25	25	25	25	39	64	89
Type N or L concrete(1) (column spaces filled)(2)	25	25	25	25	32	50	77
Concrete masonry units(3) or precast reinforced concrete units							
Type S concrete (column spaces not filled)	50	50	50	50	64	89	115
Type N or L concrete (column spaces not filled)	50	50	50	50	50	77	102
Clay or shale brick(4) (column spaces filled)(2)	50	50	50	50	50	64	77
Clay or shale brick(4) (column spaces not filled)	50	50	50	50	50	77	102
Hollow clay tile(5) (column spaces filled)(2)	50(6)	50(6)	50(6)	50(6)	(7)	(7)	(7)
Hollow clay tile(5) (column spaces not filled)	50(6)	50(6)	50(6)	–	–	–	–

Notes to Table D-2.6.1.-A:

(1) Applies to cast-in-place concrete reinforced with 5.21 mm diam wire wrapped around column spirally 200 mm o.c., or 1.57 mm diam wire mesh with 100 mm by 100 mm openings.

(2)(2) The space between the protective covering and the web or flange of the column shall be filled with concrete, cement mortar or a mixture of cement mortar and broken bricks.

(2)(3) Concrete masonry shall be reinforced with 5.21 mm diam wire or wire mesh with 1.19 mm diam wire and 10 mm by 10 mm openings, laid in every second course.

(2)(4) Brick cover 77 mm thick or less shall be reinforced with 2.34 mm diam wire or 1.19 mm diam wire mesh with 10 mm by 10 mm openings, laid in every second course.

(2)(5) Hollow clay tiles and masonry mortar shall be reinforced with 1.19 mm diam wire mesh with 10 mm by 10 mm openings, laid in every horizontal joint and lapped at corners.

(2)(6) Hollow clay tiles shall conform to CAN/CSA-A82, "Fired Masonry Brick Made from Clay or Shale."

(2)(7) 50 mm nominal hollow clay tile, reinforced with 1.19 mm diam wire mesh with 10 mm by 10 mm openings laid in every horizontal joint and covered with 19 mm gypsum-sand plaster and with limestone concrete fill in column spaces, has a 4 h fire-resistance rating.

Table D-2.6.1.-B
Minimum Thickness of Plaster Protection to Steel Columns, mm

Description	Fire-Resistance Rating(1)(2)						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Gypsum-sand plaster on 9.5 mm gypsum lath(3)	13	13	13	20	–	–	–
Gypsum-perlite or vermiculite plaster on 9.5 mm gypsum lath(3)	13	13	13	20	25	–	–
Gypsum perlite or vermiculite plaster on 12.7 mm gypsum lath(3)	13	13	13	20	25	32	50
Gypsum perlite or vermiculite plaster on double 12.7 mm gypsum lath(3)	13	13	13	20	25	25	32
Portland cement-sand plaster on metal lath(4)(5)	25	25	25	–	–	–	–

Notes to Table D-2.6.1.-B:
(1) Fire-resistance ratings of 30 min and 45 min apply to columns whose M/D ratio is 30 or greater. Fire-resistance ratings greater than 45 min apply to columns whose M/D ratio is greater than 60. Where the M/D ratio is between 30 and 60 and the required fire-resistance rating is greater than 45 min, the total thickness of protection specified in the Table shall be increased by 50%. (To determine M/D, refer to Article D-2.6.4.)
(2)(2) Where the thickness of plaster over gypsum lath is 25 mm or more, wire mesh with 1.57 mm diam wire and openings not exceeding 50 mm by 50 mm shall be placed midway in the plaster.

(2)(3) Lath held in place by 1.19 mm diam wire wrapped around lath 450 mm o.c.

(2)(4) Expanded metal lath 1.36 kg/m^2 fastened to 9.5 mm by 19 mm steel channels held in vertical position around column by 1.19 mm diam wire ties.

(2)(5) For mixture of Portland cement-sand plaster, see Sentence D-1.7.2.(2).

Table D-2.6.1.-C
Minimum Thickness of Gypsum-Sand Plaster on Metal Lath Protection to Steel Columns, mm

M/D(1)	Fire-Resistance Rating					
	30 min	45 min	1 h	1.5 h	2 h	3 h
30 to 60	16	16	32	–	–	–
over 60 to 90	16	16	16	32	–	–
over 90 to 120	16	16	16	25	39	–
over 120 to 180	16	16	16	16	25	–
over 180	16	16	16	16	25	39

Notes to Table D-2.6.1.-C:
(1) To determine the M/D ratio, refer to Article D-2.6.4.

Table D-2.6.1.-D
Minimum Thickness of Gypsum-Perlite or Gypsum-Vermiculite Plaster on Metal Lath Protection to Steel Columns, mm

M/D(1)	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
30 to 60	16	16	20	32	35	–	–
over 60 to 90	16	16	16	20	26	35	45
over 90 to 120	16	16	16	16	26	35	45
over 120 to 180	16	16	16	16	20	32	35
over 180	16	16	16	16	16	26	35

Notes to Table D-2.6.1.-D:
(1) To determine the M/D ratio, refer to Article D-2.6.4.

Table D-2.6.1.-E
Steel Columns with Sheet-Steel Membrane and Insulation as Shown in Figures D-2.6.1-A. and D-2.6.1-B.

Type of Protection	Steel Thickness,(1) mm	Fastening(2)	Insulation	Fire-Resistance Rating
See Figure D-2.6.1.-A	0.51	No. 8 sheet-metal screws 9.5 mm long, 200 mm o.c.	50 mm mineral wool batts(3)	45 min
See Figure D-2.6.1.-B	0.64	Self-threading screws or No. 8 sheet-metal screws, 600 mm o.c.	2 layers 12.7 mm gypsum board	1.5 h
See Figure D-2.6.1.-A	0.64	No. 8 sheet-metal screws, 9.5 mm long 200 mm o.c.	75 mm mineral wool batts,(3) 12.7 mm gypsum board	2 h
See Figure D-2.6.1.-B	0.76	Crimped joint or No. 8 sheet-metal screws, 300 mm o.c.	2 layers 15.9 mm gypsum board	2 h

Notes to Table D-2.6.1.-E:
(1) Minimum thickness, galvanized or wiped-zinc-coated sheet-steel.
(2)(2) Sheet-steel shall be securely fastened to the floor and superstructure, or where sheet-steel cover does not extend floor to floor, fire stopping shall be provided at the level where sheet-steel protection ends. In the latter case, an alternate type of fire protection shall be applied between the fire stopping and the superstructure.

(2)(3) Conforming to CAN/ULC-S702, “Mineral Fibre Thermal Insulation for Buildings,” Type 1A, minimum density 30 kg/m^3: column section and batts wrapped with 25 mm mesh chicken wire.

Table D-2.6.1.-F
Minimum M/D Ratio for Steel Columns Covered with Type X Gypsum Board Protection[1]

Minimum Thickness of Type X Gypsum Board Protection,[2] mm	Fire-Resistance Rating			
	1 h	1.5 h	2 h	3 h
12.7	75	–	–	–
15.9	55	–	–	–
25.4	35	60	–	–
28.6	35	50	–	–
31.8	35	40	75	–
38.1	35	35	55	–
41.3	35	35	45	–
44.5	35	35	35	–
47.6	35	35	35	–
50.8	35	35	35	75
63.5	35	35	35	45

Notes to Table D-2.6.1.-F:
[1] To determine the M/D ratio, refer to Article D-2.6.4.
(2)[2] See Article D-2.6.5.

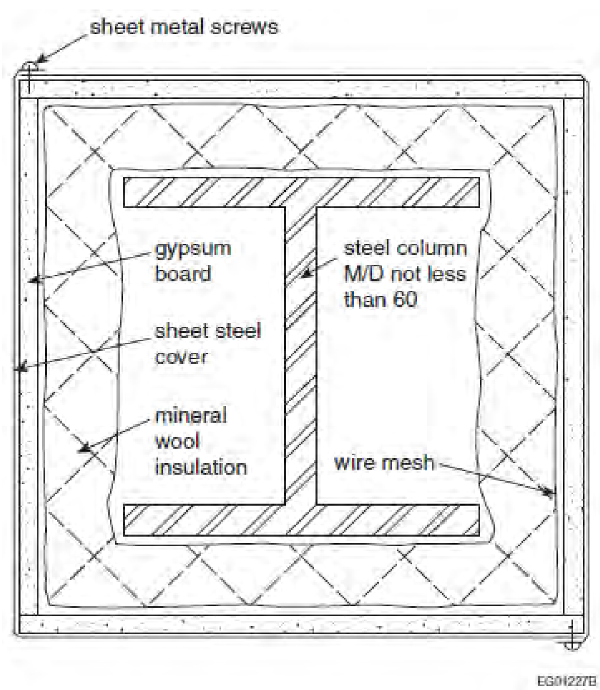


Figure D-2.6.1.-A
Column protected by sheet-steel membrane and mineral-wool insulation

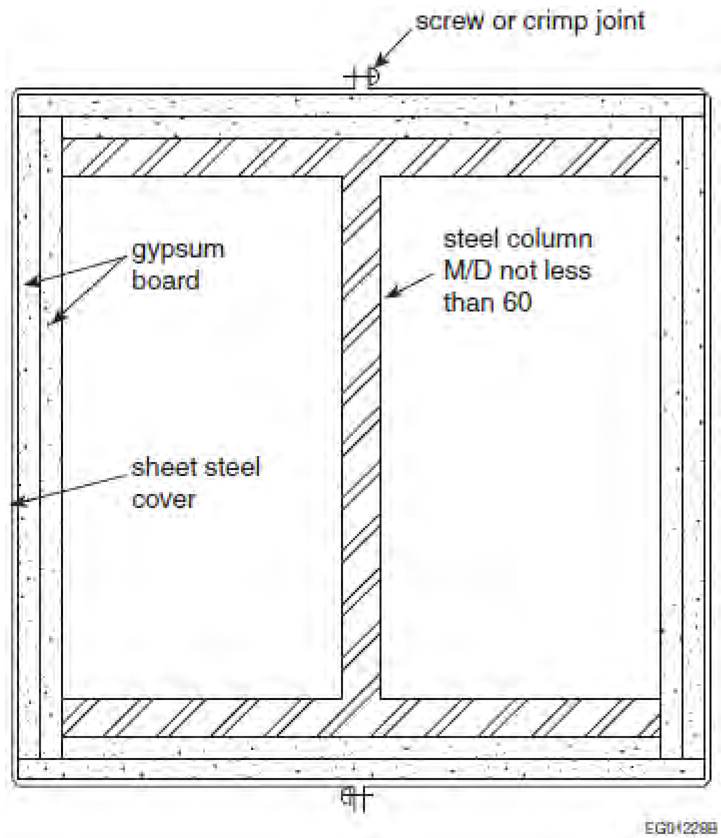


Figure D-2.6.1.-B
Column protected by sheet-steel membrane and gypsum board

D-2.6.2. Hollow Unit Masonry Columns

For hollow-unit masonry column protection, the thickness shown in Tables D-2.6.1.-A to D-2.6.1.-D is the equivalent thickness as described in Subsection D-1.6.

D-2.6.3. Effect of Plaster

The effect on fire-resistance ratings of the addition of plaster to masonry and monolithic concrete column protection is described in Subsection D-1.7.

D-2.6.4. Determination of M/D Ratio

1) The ratio M/D to which reference is made in Tables D-2.6.1.-B, D-2.6.1.-C, D-2.6.1.-D and D-2.6.1.-F shall be found by dividing “M,” the mass of the column in kilograms per metre by “D,” the heated perimeter of the steel column section in metres.
2) The heated perimeter “D” of steel columns, shown as the dashed line in Figure D-2.6.4.-A, shall be equal to 2 (B+H) in Examples (1) and (2), and 3.14B in Example (3). In Figure D-2.6.4.-B, the heated perimeter “D” shall be equal to 2 (B+H).

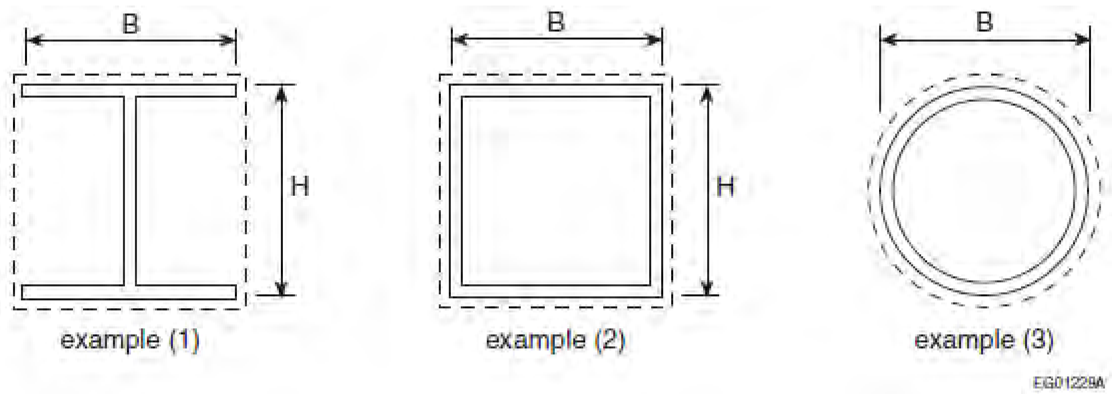


Figure D-2.6.4.-A
Example (1), standard or wide-flange beam; Example (2), hollow structural section (rectangular or square); Example (3), hollow structural section (round)

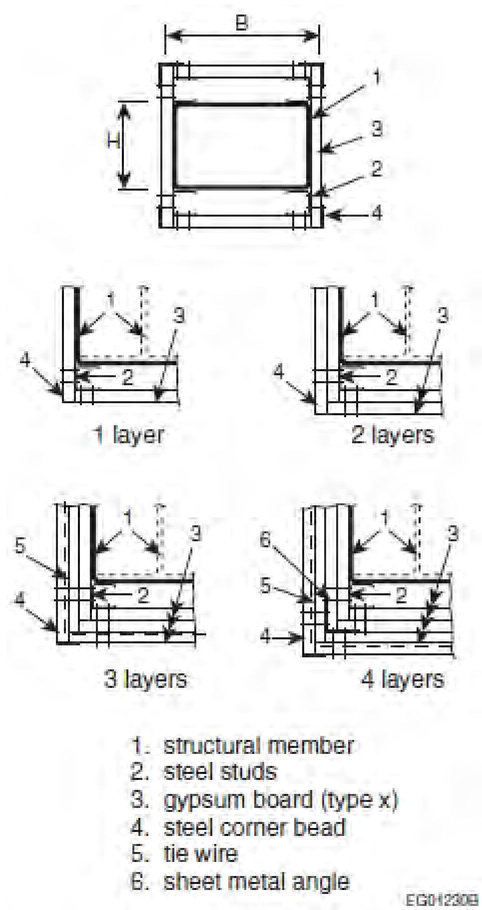


Figure D-2.6.4.-B
Columns protected by Type X gypsum board without sheet-steel membrane

D-2.6.5. Attachment of Gypsum Board

1) Where Type X gypsum board is used to protect a steel column without an outside sheet-steel membrane, the method of gypsum board attachment to the column shall be as shown in Figure D-2.6.4.-B and shall meet the construction details described in Sentences (2) to (7).

2) The Type X gypsum board shall be applied vertically without horizontal joints.
3) The first layer of gypsum board shall be attached to steel studs with screws spaced not more than 600 mm o.c. and other layers of gypsum board shall be attached to steel studs and steel corner beads with screws spaced at a maximum of 300 mm o.c. Where a single layer of gypsum board is used, attachment screws shall be spaced not more than 300 mm o.c.
4) Steel tie wires spaced at a maximum of 600 mm o.c. shall be used to secure the second last layer of gypsum board in 3- and 4-layer systems.
5) Studs shall be fabricated of galvanized steel not less than 0.53 mm thick and not less than 41.3 mm wide, with legs not less than 33.3 mm long and shall be 12.7 mm less than the assembly height.
6) Corner beads shall
a) be fabricated of galvanized steel that is not less than 0.41 mm thick,
b) have legs not less than 31 mm long,
c) be attached to the gypsum board or stud with 25.4 mm screws spaced not more than 300 mm o.c., and
d) have the attaching fasteners penetrate either another corner bead in multiple layer assemblies or the steel stud member.
7) In a 4-layer system, metal angles shall be fabricated of galvanized steel and shall be not less than 0.46 mm thick with legs not less than 51 mm long.

D-2.6.6. Concrete Filled Hollow Steel Columns

1) A fire-resistance rating, R, is permitted to be assigned to concentrically loaded hollow steel columns that are filled with plain concrete, steel-fibre reinforced concrete or bar-reinforced concrete, that are fabricated and erected within the tolerances stipulated in CSA S16, “Design of Steel Structures,” and that comply with Sentences (2) and (3), provided:

$$C \leq C_{max}$$

where
C = axial compressive force due to dead and live loads without load factors, kN,

$$C_{max} = \left(\frac{a(f'_c + 20)D^{2.5}}{R(KL - 1000)}\right)^2$$

but shall not exceed
a) 1.0 C'_r for plain concrete filling (PC),
b) 1.1 C'_r for steel-fibre reinforced concrete filling (FC), and
c) 1.7 C'_r for bar-reinforced concrete filling (RC),

where

$$C'_r = 0.85\varphi_c f'_c A_c \lambda_c^{-2}\left(\sqrt{1 + 0.25\lambda_c^{-4}} - 0.5\lambda_c^{-2}\right)$$

where
a = constant obtained from Table D-2.6.6.-A,
f'_c = specified compressive strength of concrete in accordance with CSA A23.3, “Design of Concrete Structures,” MPa,
r_c = radius of gyration of the concrete area,
A_c = area of concrete, mm^2,
D = outside diameter of a round column or outside width of a square column, mm,
E_c = initial elastic modulus for concrete, considering the effects of long-term loading for normal-weight concrete = $\left(1 + \frac{S}{T}\right)2500\sqrt{f'_c}$, where f'_c is expressed in MPa, S is the short-term load, and T is the total load on the column,
R = specified fire-resistance rating, min,
KL = effective length of column as defined in CSA S16, “Design of Steel Structures,” mm,

$$\lambda_c = \frac{KL}{r_c}\sqrt{\frac{f'_c}{w^2E_c}}\text{, and}$$

$$\varphi_c = 0.60$$

subject to the validity limits stated in Table D-2.6.6.-B.

Table D-2.6.6.-A
Values of Constant "a"

Filling Type	Concrete Type(1)	Steel Reinforcement	Circular Columns	Square Columns
PC	S	n/a	0.070	0.060
FC	S	≈ 2%	0.075	0.065
RC	S	1.5%-3%	0.080	0.070
RC	S	3%-5%	0.085	0.075
PC	N	n/a	0.080	0.070
FC	N	≈ 2%	0.085	0.075
RC	N	1.5%-3%	0.090	0.080
RC	N	3%-5%	0.095	0.085

Notes to Table D-2.6.6.-A:
(1) See Subsection D-1.4.

2) A pair of steam vent holes shall be provided at each end of the hollow steel column and at each intermediate floor level, and the holes shall be
a) not less than 13 mm in diameter,
b) located on opposite faces, 150 mm above or below a base plate, cap plate or concrete slab,
c) orientated so that adjacent pairs are perpendicular, and
d) not obstructed by other building elements.

3) Load application and reaction shall be through end bearing in accordance with CSA S16, "Design of Steel Structures."

Table D-2.6.6.-B
Validity Limits

Parameter	Type of Concrete Filling		
	PC	FC	RC
f'c (MPa)	20 to 40	20 to 55	20 to 55
D (round) (mm)	140 to 410	140 to 410	165 to 410
D (square) (mm)	140 to 305	102 to 305	175 to 305
Reinforcement (%)	n/a	≈ 2% of the concrete mix by mass	1.5% to 5% of cross-sectional area(1)
Concrete Cover (mm)	n/a	n/a	≥ 25
R (min)	≤ 120	≤ 180	≤ 180

KL (mm)	2 000 to 4 000	2 000 to 4 500	2 000 to 4 500
Class[2]	1, 2 or 3	1, 2 or 3	1, 2 or 3

Notes to Table D-2.6.6.-B:

[1] Limits on size, number and spacing of bars and ties in accordance with CSA A23.3, "Design of Concrete Structures."

(2)[2] Classification of sections in accordance with CSA S16, "Design of Steel Structures."

D-2.7. Individually Protected Steel Beams

D-2.7.1. Minimum Thickness of Protective Covering

The minimum thickness of protective covering on steel beams exposed to fire on 3 sides for fire-resistance ratings from 30 min to 4 h is shown in Table D-2.7.1.

Table D-2.7.1.
Minimum Thickness of Cover to Individual Protected Steel Beams, mm[1]

Description of Cover	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Type S concrete[2] (beam spaces filled solid)	25	25	25	25	32	50	64
Type N or L concrete[2] (beam spaces filled solid)	25	25	25	25	25	39	50
Gypsum-sand plaster on 9.5 mm gypsum lath[3]	13	13	13	20	–	–	–
Gypsum-perlite or vermiculite plaster on 9.5 mm gypsum lath[3]	13	13	13	13	25	–	–
Gypsum-perlite or gypsum-vermiculite on 12.7 mm gypsum lath[3]	13	13	13	20	25	39	50
Gypsum-perlite or vermiculite plaster on double 12.7 mm gypsum lath[3]	13	13	13	20	25	25	39
Portland cement-sand on metal lath[4]	23	23	23	–	–	–	–
Gypsum-sand on metal lath[4] (plaster in contact with lower flange)	16	20	25	39	–	–	–
Gypsum-sand on metal lath with air gap between plaster and lower flange[4]	16	16	16	25	25	–	–
Gypsum-perlite or gypsum-vermiculite on metal lath[4]	16	16	16	23	23	35	48[5]

Notes to Table D-2.7.1.:

[1] Where the thickness of plaster finish applied over gypsum lath is 26 mm or more, the plaster shall be reinforced with wire mesh with 1.57 mm diam wire and 50 mm by 50 mm openings placed midway in the plaster.

(2)[2] Applies to cast-in-place concrete reinforced by 5.21 mm diam wire spaced 200 mm o.c. or 1.57 mm diam wire mesh with 100 mm by 100 mm openings.

(2)[3] Lath held in place by 1.18 mm diam wire wrapped around the gypsum lath 450 mm o.c.

(2)[4] Expanded metal lath 1.63 kg/m^2 fastened to 9.5 mm by 19 mm steel channels held in position by 1.19 mm diam wire.

(2)[5] Plaster finish shall be reinforced with wire mesh with 1.57 mm diam wire and 50 mm by 50 mm openings placed midway in the plaster.

D-2.7.2. Types of Concrete

Concrete is referred to as Type S, N or L, depending on the nature of the aggregate used. This is described in Article D-1.4.1.

D-2.7.3. Effect of Plaster

The effect on fire-resistance ratings of the addition of plaster finish to concrete or masonry beam protection is described in Article D-1.7.1.

D-2.7.4. Exceptions

The fire resistance of protected steel beams depends on the means used to hold the protection in place. Because of the importance of this factor, no rating has been assigned in Table D-2.7.1. to masonry units used as protective cover to steel beams. These ratings, however, may be determined on the basis of comparison with column protection at the discretion of the *Chief Building Official*, if satisfactory means of fastening are provided.

D-2.7.5. Beam Protected by a Membrane

A steel beam or steel joist assembly that is entirely above a horizontal ceiling membrane will be protected from fire below the membrane and will resist structural collapse for a period equal to the fire-resistance rating determined in conformance with Subsection D-2.3. The support for this membrane shall be equivalent to that described in Subsection D-2.3. The rating on this basis shall not exceed 1.5 h.

D-2.8. Reinforced Concrete Columns

D-2.8.1. Minimum Dimensions

Minimum dimensions for reinforced concrete columns and minimum concrete cover for vertical steel reinforcement are obtained from Articles D-2.8.2. to D-2.8.5., taking into account the type of concrete, the effective length of the column and the area of the vertical reinforcement.

D-2.8.2. Method

1) The minimum dimension, t, in millimetres, of a rectangular reinforced concrete column shall be equal to

a) 75 f (R + 1) for all Types L and L40S concrete,
b) 80 f (R + 1) for Type S concrete when the design condition of the concrete column is defined in the second and fourth columns of Table D-2.8.2.,
c) 80 f (R + 0.75) for Type N concrete when the design condition of the concrete column is defined in the second and fourth columns of Table D-2.8.2., and
d) 100 f (R + 1) for Types S and N concrete when the design condition of the concrete column is defined in the third column of Table D-2.8.2.

where
f = the value shown in Table D-2.8.2.,
R = the required fire-resistance rating in hours,
K = the effective length factor obtained from CSA A23.3, “Design of Concrete Structures,”
H = the unsupported length of the column in metres, and
P = the area of vertical reinforcement in the column as a percentage of the column area.

2) The diameter of a round column shall be not less than 1.2 times the value t determined in Sentence (1) for a rectangular column.

Table D-2.8.2.
Values of Factor f[1]

Overdesign Factor[2]	Values of Factor f to be Used in Applying Article D-2.8.2.	
	Where kh is not more than	Where kh is more than 3.7 m but not more than 7.3 m

	3.7 m	t is not more than 300 mm, p is not more than 3%(3)	All other cases(4)
1.00	1.0	1.2	1.0
1.25	0.9	1.1	0.9
1.50	0.83	1.0	0.83

Notes to Table D-2.8.2.:

(1) For conditions that do not fall within the limits described in Table D-2.8.2., further information may be obtained from Reference (7) in Subsection D-6.1.

(2)(2) Overdesign factor is the ratio of the calculated load carrying capacity of the column to the column strength required to carry the specified loads determined in conformance with CSA A23.3, "Design of Concrete Structures."

(2)(3) Where the factor f results in a t greater than 300 mm, the appropriate factor f for "All other cases" shall be applicable.

(2)(4) Where p is equal to or less than 3% and the factor f results in a t less than 300 mm, the minimum thickness shall be 300 mm.

D-2.8.3. Minimum Thickness of Concrete Cover

1) Where the required fire-resistance rating of a concrete column is 3 h or less, the minimum thickness in millimetres of concrete cover over vertical steel reinforcement shall be equal to 25 times the number of hours of fire resistance required or 50 mm, whichever is less.

2) Where the required fire-resistance rating of a concrete column is greater than 3 h, the minimum thickness in millimetres of concrete cover over vertical steel reinforcement shall be equal to 50 plus 12.5 times the required number of hours of fire resistance in excess of 3 h.

3) Where the concrete cover over vertical steel required in Sentence (2) exceeds 62.5 mm, wire mesh reinforcement with 1.57 mm diameter wire and 100 mm openings shall be incorporated midway in the concrete cover to retain the concrete in position.

D-2.8.4. Minimum Requirements

The structural design standards may require minimum column dimensions or concrete cover over vertical steel reinforcement differing from those obtained in Sentences D-2.8.2.(1) and D-2.8.2.(2). Where a difference occurs, the greater dimension shall govern.

D-2.8.5. Addition of Plaster

The addition of plaster finish to the concrete column may be taken into account in determining the cover over vertical steel reinforcement by applying the multiplying factors described in Subsection D-1.7. The addition of plaster shall not, however, justify any decrease in the minimum column sizes shown.

D-2.8.6. Built-in Columns

The fire-resistance rating of a reinforced concrete column that is built into a masonry or concrete wall so that not more than one face may be exposed to the possibility of fire at one time may be determined on the basis of cover to vertical reinforcing steel alone. In order to meet this condition, the wall shall conform to Subsection D-2.1. for the fire-resistance rating required.

D-2.9. Reinforced Concrete Beams

D-2.9.1. Minimum Cover Thickness

The minimum thickness of cover over principal steel reinforcement in reinforced concrete beams is shown in Table D-2.9.1. for fire-resistance ratings from 30 min to 4 h where the width of the beam or joist is at least 100 mm.

Table D-2.9.1.
Minimum Cover to Principal Steel Reinforcement in Reinforced Concrete Beams, mm

Type of Concrete	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Type S, N or L	20	20	20	25	25	39	50

D-2.9.2. Maximum Rating
No rating over 2 h may be assigned on the basis of Table D-2.9.1. to a beam or joist where the average width of the part that projects below the slab is less than 140 mm, and no rating over 3 h may be assigned where the average width of the part that projects below the slab is less than 165 mm.

D-2.9.3. Beam Integrated in Floor or Roof Slab
For the purposes of these ratings, a beam may be either independent of or integral with a floor or roof slab assembly.

D-2.9.4. Minimum Thickness
Where the upper extension or top flange of a joist or T-beam in a floor assembly contributes wholly or partly to the thickness of the slab above, the total thickness at any point shall be not less than the minimum thickness described in Table D-2.2.1.-A for the fire-resistance rating required.

D-2.9.5. Effect of Plaster
The addition of plaster finish to a reinforced concrete beam may be taken into account in determining the cover over principal reinforcing steel by applying the multiplying factors described in Subsection D-1.7.

D-2.10. Prestressed Concrete Beams
D-2.10.1. Minimum Cross-Sectional Area and Thickness of Cover
The minimum cross-sectional area and thickness of concrete cover over steel tendons in prestressed concrete beams for fire-resistance ratings from 30 min to 4 h are shown in Table D-2.10.1.

Table D-2.10.1.
Minimum Thickness of Concrete Cover over Steel Tendons in Prestressed Concrete Beams, mm(1)

Type of Concrete	Area of Beam, cm^2	Fire-Resistance Rating						
		30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Type S or N	260 to 970	25	39	50	64	–	–	–
	Over 970 to 1 940	25	26	39	45	64	–	–
	Over 1 940	25	26	39	39	50	77	102
Type L	Over 970	25	25	25	39	50	77	102

Notes to Table D-2.10.1.:
(1) Where the thickness of concrete cover over the tendons exceeds 64 mm, a wire mesh reinforcement with 1.57 mm diam wire and 100 mm by 100 mm openings shall be incorporated in the beams to retain the concrete in position around the tendons. The mesh reinforcement shall be located midway in the cover.

D-2.10.2. Minimum Cover Thickness

The cover for an individual tendon shall be the minimum thickness of concrete between the surface of the tendon and the fire-exposed surface of the beam, except that for ungrouted ducts the assumed cover thickness shall be the minimum thickness of concrete between the surface of the duct and the surface of the beam. For beams in which several tendons are used, the cover is assumed to be the average of the minimum cover of the individual tendons. The cover for any individual tendon shall be not less than half the value given in Table D-2.10.1. nor less than 25 mm.

D-2.10.3. Applicability of Ratings

The ratings in Table D-2.10.1. apply to a beam that is either independent of or integral with a floor or roof slab assembly. Minimum thickness of slab and minimum cover to steel tendons in prestressed concrete slabs are contained in Subsection D-2.2.

D-2.10.4. Effect of Plaster

The addition of plaster finish to a prestressed concrete beam may be taken into account in determining the cover over steel tendons by applying the multiplying factors described in Subsection D-1.7.

D-2.10.5. Minimum Cover

1) Except as provided in Sentence (2), in unbonded post-tensioned prestressed concrete beams, the concrete cover to the tendon at the anchor shall be not less than 15 mm greater than the minimum required away from the anchor. The concrete cover to the anchorage bearing plate and to the end of the tendon, if it projects beyond the bearing plate, shall be not less than 25 mm.

2) The requirements in Sentence (1) do not apply to those portions of beams not likely to be exposed to fire (such as the ends and the tops of flanges of beams immediately below slabs).

D-2.11. Glued-Laminated Timber Beams and Columns

D-2.11.1. Applicability of Information

The information in Subsection D-2.11. applies to glued-laminated timber beams and columns required to have fire-resistance ratings greater than those afforded under the provisions of Article 3.1.4.6.

D-2.11.2. Method of Calculation

1) The fire-resistance rating of glued-laminated timber beams and columns in minutes shall be equal to

a) $0.1\ fB\ [4 - 2(B/D)]$ for beams that may be exposed to fire on 4 sides,
b) $0.1\ fB\ [4 - (B/D)]$ for beams that may be exposed to fire on 3 sides,
c) $0.1\ fB\ [3 - (B/D)]$ for columns that may be exposed to fire on 4 sides, and
d) $0.1\ fB\ [3 - (B/2D)]$ for columns that may be exposed to fire on 3 sides,

where
f = the load factor shown in Figure D-2.11.2.-A,
B = the full dimension of the smaller side of a beam or column in millimetres before exposure to fire [see Figure D-2.11.2.-B],
D = the full dimension of the larger side of a beam or column in millimetres before exposure to fire [see Figure D-2.11.2.-B],
K = the effective length factor obtained from CSA O86, “Engineering Design in Wood,”
L = the unsupported length of a column in millimetres.

2) The factored resistance of a beam or column shall be determined by using the specified strengths in CSA O86, “Engineering Design in Wood.”

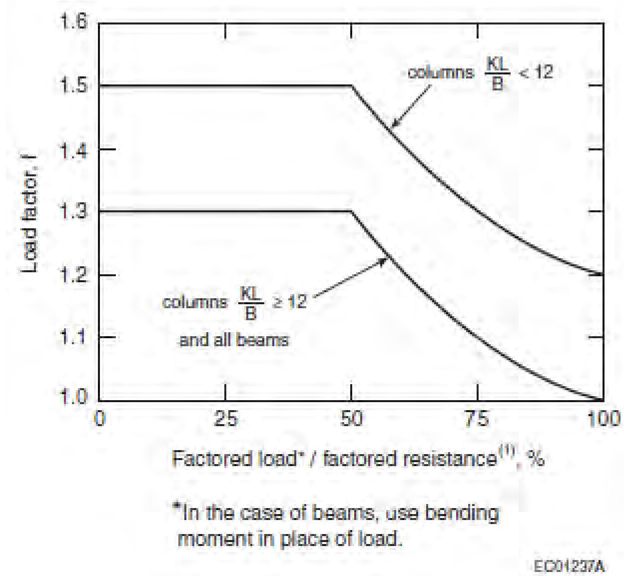


Figure D-2.11.2.-A
Factors to compensate for partially loaded columns and beams

Note to Figure D-2.11.2.-A:

(1) See Sentence (2).

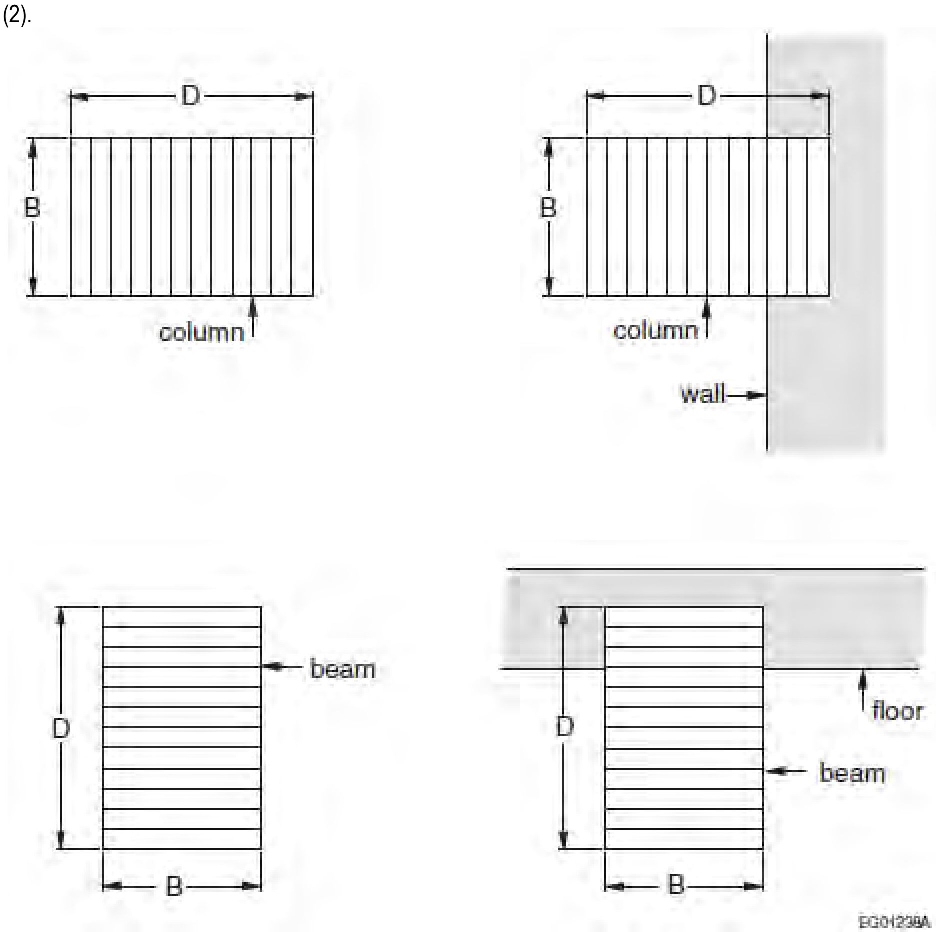


Figure D-2.11.2.-B
Full dimensions of glued-laminated beams and columns

D-2.12. Cross Laminated Timber

D-2.12.1. Applicability of Information

At this time, this By-law does not presently contain explicit provisions for the use of CLT although this may be considered as part of a design compliant with Article 3.2.1.7. As a developing technology, it is expected that designers follow best practice in the use of this material. To this end, in addition to compliance with the CSA-086-14 standard (as amended), designers should consider the information and criteria contained in published good engineering practice references such as the Canadian Wood Council Wood Design Manual (2017) and CLT handbook which are recognized to represent much of the current information related to the design of cross laminated timber (CLT) assemblies. In addition, research by the NRC, Canadian Wood Council, and other groups have shown that the type and arrangement of connections and penetrations, and the adhesive used as part of the CLT play a major role in the fire-resistive performance of these assemblies. Designers are therefore urged to carefully consider the impacts of such details as a part of their design.

(2)

Section D-3 Flame-Spread Ratings and Smoke Developed Classifications

D-3.1. Interior Finish Materials

D-3.1.1. Scope of Information

Tables D-3.1.1.-A and D-3.1.1.-B show flame-spread ratings and smoke developed classifications for combinations of some common interior finish materials. The values are based on all the evidence available at present. Many materials have not been included because of lack of test evidence or because of inability to classify or describe the material in generic terms for the purpose of assigning ratings.

Table D-3.1.1.-A
Assigned Flame-Spread Ratings and Smoke Developed Classifications for Combinations of Wall and Ceiling Finish Materials and Surface Coatings(1)

<table>
<tr><th rowspan="2">Materials</th><th rowspan="2">Applicable Material Standard</th><th rowspan="2">Minimum Thickness, mm</th><th colspan="2">Surface Coating</th></tr>
<tr><th>Unfinished</th><th>Paint or Varnish not more than 1.3 mm Thick, Cellulosic Wallpaper not more than One Layer(2)(3)</th></tr>
<tr><td>Brick, concrete, tile</td><td>None</td><td>None</td><td rowspan="3">0/0</td><td rowspan="3">25/50</td></tr>
<tr><td>Steel, copper, aluminum</td><td>None</td><td>0.33</td></tr>
<tr><td>Gypsum plaster</td><td>CSA A82.22-M</td><td>None</td></tr>
<tr><td rowspan="2">Gypsum board</td><td>CAN/CSA-A82.27-M</td><td rowspan="2">9.5</td><td rowspan="2">25/50</td><td rowspan="2">25/50</td></tr>
<tr><td>ASTM C 1396/C 1396M</td></tr>
<tr><td>Lumber</td><td>None</td><td>16</td><td>150/300</td><td>150/300</td></tr>
</table>

Douglas Fir plywood[4]	CSA O121	11	150/100	150/300
Poplar plywood[4]	CSA O153			
Plywood with Spruce face veneer[4]	CSA O151			
Douglas Fir plywood[4]	CSA O121	6	150/100	150/100
Fibreboard low density	CAN/ULC-S706	11	X/100	150/100
Hardboard				
Type 1	CAN/CGSB-11.3-M	9	150/X	[5]
Standard		6	150/300	150/300
Particleboard	ANSI A208.1	12.7	150/300	[5]
Waferboard, OSB	CSA O437.0	–	[5]	[5]
	CSA O325	–	[5]	[5]

Notes to Table D-3.1.1.-A:

[1] See Sentence D-1.1.1.(5) for standards used to assign flame-spread ratings and smoke developed classifications.

(2)[2] Flame-spread ratings and smoke developed classifications for paints and varnish are not applicable to shellac and lacquer.

(2)[3] Flame-spread ratings and smoke developed classifications for paints apply only to alkyd and latex paints.

(2)[4] The flame-spread ratings and smoke developed classifications shown are for those plywoods without a cellulose resin overlay.

(2)[5] Insufficient test information available.

Table D-3.1.1.-B
Flame-Spread Ratings and Smoke-Developed Classifications for Combinations of Common Floor Finish Materials and Surface Coatings[1]

Materials	Applicable Standard	FSR/SDC[2]
Hardwood or softwood flooring either unfinished or finished with a spar or urethane varnish coating	None	300/300
Wool carpet (woven), pile weight not less than 1120 g/m², applied with or without felt underlay[3]	CAN/CGSB-4.129	300/300
Nylon carpet, pile weight not less than 610 g/m² and not more than 800 g/m², applied with or without felt underlay[3]	CAN/CGSB-4.129	300/500
Nylon carpet, pile weight not less than 610 g/m² and not more than 1355 g/m², glued down to concrete	CAN/CGSB-4.129	300/500
Wool/nylon blend carpet (woven) with not more than 20% nylon and pile weight not less than 1120 g/m²	CAN/CGSB-4.129	300/500
Nylon/wool blend carpet (woven) with not more than 50% wool, pile weight not less than 610 g/m² and not more than 800 g/m²	CAN/CGSB-4.129	300/500

Polypropylene carpet, pile weight not less than 500 g/m² and not more than 1200 g/m², glued down to concrete	CAN/CGSB-4.129	300/500

Notes to Table D-3.1.1.-B:

(1) Tested on the floor of the tunnel in conformance with provisions of CAN/ULC-S102.2, "Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies."

(2)(2) Flame-Spread Rating/Smoke Developed Classification.

(2)(3) Type 1 or 2 underlay as described in CGSB 4-GP-36M, "Carpet Underlay, Fiber Type."

D-3.1.2. Ratings

The ratings shown in Tables D-3.1.1.-A and D-3.1.1.-B are arranged in groups corresponding to the provisions of this By-law. The ratings apply to materials falling within the general categories indicated.

D-3.1.3. Table Entries

In Tables D-3.1.1.-A and D-3.1.1.-B, the first number of each entry relates to flame spread and the second number to smoke developed limit. For example:

25/50 represents a flame-spread rating of 0 to 25 and a smoke developed classification of 0 to 50,
150/300 represents a flame-spread rating of 75 to 150 and a smoke developed classification of 100 to 300, and
X/X applied to walls and ceilings means a flame-spread rating over 150 and a smoke developed classification over 300.

D-3.1.4. Effect of Surface Coatings

Thin surface coatings can modify flame-spread characteristics either upward or downward. Table D-3.1.1.-A includes a number of thin coatings that increase the flame-spread rating of the base material, so that these may be considered where more precise control over flame-spread hazard is desired.

D-3.1.5. Proprietary Materials

1) Information on flame-spread rating of proprietary materials and fire-retardant treatments that cannot be described in sufficient detail to ensure reproducibility is available through the listing and labeling services of Underwriters' Laboratories of Canada, Intertek Testing Services NA Ltd., or other recognized testing laboratory.

2) A summary of flame-spread test results published prior to 1965 has been prepared by NRC (see Item (1) in Subsection D-6.1.).

D-3.1.6. Limitations and Conditions

1) The propagation of flame along a surface in the standard test involves some finite depth of the material or materials behind the surface, and this involvement extends to the depth to which temperature variations are to be found during the course of the test; for many commonly used lining materials, such as wood, the depth involved is about 25 mm.

2) For all the combustible materials described in Table D-3.1.1.-A, a minimum dimension is shown, and this represents the thickness of the test samples on which the rating has been based; when used in greater thicknesses than that shown, these materials may have a slightly lower flame-spread rating, and thinner specimens may have higher flame-spread ratings.

3) No rating has been included for foamed plastic materials because it is not possible at this time to identify these products with sufficient accuracy on a generic basis. Materials of this type that melt when exposed to the test flame generally show an increase in flame-spread rating as the thickness of the test specimen increases.

D-3.1.7. Referenced Standards
In Tables D-3.1.1.-A and D-3.1.1.-B, the standards applicable to the materials described are noted because the ratings depend on conformance with these specifications.

(2)

(2) Section D-4 Noncombustibility

D-4.1. Test Method
D-4.1.1. Determination of Noncombustibility

1) Noncombustibility is required of certain components of buildings by the provisions of this By-law, which specifies noncombustibility by reference to CAN/ULC-S114, "Test for Determination of Non-Combustibility in Building Materials."

2) The test to which reference is made in Sentence (1) is severe, and it may be assumed that any building material containing even a small proportion of combustibles will itself be classified as combustible. The specimen, 38 mm by 51 mm, is exposed to a temperature of 750°C in a small furnace. The essential criteria for noncombustibility are that the specimen does not flame or contribute to temperature rise.

D-4.2. Materials Classified as Combustible
D-4.2.1. Combustible Materials
Most materials from animal or vegetable sources will be classed as combustible by CAN/ULC-S114, "Test for Determination of Non-Combustibility in Building Materials," and wood, wood fibreboard, paper, felt made from animal or vegetable fibres, cork, plastics, asphalt and pitch would therefore be classed as combustible.

D-4.2.2. Composite Materials
Materials that consist of combustible and noncombustible elements in combination will in many cases also be classed as combustible, unless the proportion of combustibles is very small. Some mineral wool insulations with combustible binder, cinder concrete, cement and wood chips and wood-fibred gypsum plaster would also be classed as combustible.

D-4.2.3. Effect of Chemical Additives
The addition of a fire-retardant chemical is not sufficient to change a combustible product to a noncombustible product.

D-4.3. Materials Classified as Noncombustible
D-4.3.1. Typical Examples
Noncombustible materials include brick, ceramic tile, concrete made from Portland cement with noncombustible aggregate, plaster made from gypsum with noncombustible aggregate, metals commonly used in buildings, glass, granite, sandstone, slate, limestone and marble.

(2) Section D-5 Protection of Openings in Fire-Rated Assemblies

D-5.1. Scope
D-5.1.1. Installation Information

1) The information in this Section specifies requirements for the installation of fire doors and fire dampers in gypsum-board-protected stud wall assemblies.

D-5.2. Installation of Fire Doors and Fire Dampers

D-5.2.1. References

1) Fire doors and fire dampers in gypsum-board-protected steel stud non-loadbearing walls required to have a fire-resistance rating shall be installed in conformance with Section 9.24. of this By-law and the applicable requirements of NFPA 80, “Fire Doors and Other Opening Protectives.”

2) Fire doors and fire dampers in gypsum-board-protected wood stud walls required to have a fire-resistance rating shall be installed in conformance with Section 9.23. of this By-law and the applicable requirements of NFPA 80, “Fire Doors and Other Opening Protectives.”

(2)

Section D-6 Background Information

D-6.1. Fire Test Reports

Summaries of available fire test information have been published by NRC as follows:

(1) M. Galbreath, Flame Spread Performance of Common Building Materials. Technical Paper No. 170, Division of Building Research, National Research Council Canada, Ottawa, April 1964. NRCC 7820.

(2) M. Galbreath and W.W. Stanzak, Fire Endurance of Protected Steel Columns and Beams. Technical Paper No. 194, Division of Building Research, National Research Council Canada, Ottawa, April 1965. NRCC 8379.

(3) T.Z. Harmathy and W.W. Stanzak, Elevated-Temperature Tensile and Creep Properties of Some Structural and Prestressing Steels. American Society for Testing and Materials, Special Technical Publication 464, 1970, p. 186 (DBR Research Paper No. 424) NRCC 11163.

(4) T.Z. Harmathy, Thermal Performance of Concrete Masonry Walls in Fire. American Society for Testing and Materials, Special Technical Publication 464, 1970, p. 209 (DBR Research Paper No. 423) NRCC 11161.

(5) L.W. Allen, Fire Endurance of Selected Non-Loadbearing Concrete Masonry Walls. DBR Fire Study No. 25, Division of Building Research, National Research Council Canada, Ottawa, March 1970. NRCC 11275.

(6) A. Rose, Comparison of Flame Spread Ratings by Radiant Panel, Tunnel Furnace, and Pittsburgh-Corning Apparatus. DBR Fire Study No. 22, Division of Building Research, National Research Council Canada, Ottawa, June 1969. NRCC 10788.

(7) T.T. Lie and D.E. Allen, Calculation of the Fire Resistance of Reinforced Concrete Columns. DBR Technical Paper No. 378, Division of Building Research, National Research Council Canada, Ottawa, August 1972. NRCC 12797.

(8) W.W. Stanzak, Column Covers: A Practical Application of Sheet Steel as a Protective Membrane. DBR Fire Study No. 27, Division of Building Research, National Research Council Canada, Ottawa, February 1972. NRCC 12483.

(9) W.W. Stanzak, Sheet Steel as a Protective Membrane for Steel Beams and Columns. DBR Fire Study No. 23, Division of Building Research, National Research Council Canada, Ottawa, November 1969. NRCC 10865.

(10) W.W. Stanzak and T.T. Lie, Fire Tests on Protected Steel Columns with Different Cross-Sections. DBR Fire Study No. 30, Division of Building Research, National Research Council Canada, Ottawa, February 1973. NRCC 13072.

(11) G. Williams-Leir and L.W. Allen, Prediction of Fire Endurance of Concrete Masonry Walls. DBR Technical Paper No. 399, Division of Building Research, National Research Council Canada, Ottawa, November 1973. NRCC 13560.

(12) G. Williams-Leir, Prediction of Fire Endurance of Concrete Slabs. DBR Technical Paper No. 398, Division of Building Research, National Research Council Canada, Ottawa, November 1973. NRCC 13559.

(13) A. Rose, Flammability of Fibreboard Interior Finish Materials. Building Research Note No. 68, Division of Building Research, National Research Council Canada, Ottawa, October 1969.

(14) L.W. Allen, Effect of Sand Replacement on the Fire Endurance of Lightweight Aggregate Masonry Units. DBR Fire Study No. 26, Division of Building Research, National Research Council Canada, Ottawa, September 1971. NRCC 12112.

(15) L.W. Allen, W.W. Stanzak and M. Galbreath, Fire Endurance Tests on Unit Masonry Walls with Gypsum Wallboard. DBR Fire Study No. 32, Division of Building Research, National Research Council Canada, Ottawa, February 1974, NRCC 13901.

(16) W.W. Stanzak and T.T. Lie, Fire Resistance of Unprotected Steel Columns. Journal of Structural Division, Proc., Am. Soc. Civ. Eng., Vol. 99, No. ST5 Proc. Paper 9719, May 1973 (DBR Research Paper No. 577) NRCC 13589.
(17) T.T. Lie and T.Z. Harmathy, Fire Endurance of Concrete-Protected Steel Columns. A.C.I. Journal, January 1974, Title No. 71-4 (DBR Technical Paper No. 597) NRCC 13876.
(18) T.T. Lie, A Method for Assessing the Fire Resistance of Laminated Timber Beams and Columns. Can. J. Civ. Eng., Vol. 4, No. 2, June 1977 (DBR Technical Paper No. 718) NRCC 15946.
(19) T.T. Lie, Calculation of the Fire Resistance of Composite Concrete Floor and Roof Slabs. Fire Technology, Vol. 14, No. 1, February 1978 (DBR Technical Paper No. 772) NRCC 16658.
(20) M.A. Sultan, Y.P. Séguin and P. Leroux. Results of Fire Resistance Tests on Full-Scale Floor Assemblies, Institute for Research in Construction, National Research Council Canada, Ottawa, May 1998, IRC-IR-764.
(21) M.A. Sultan, J.C. Latour, P. Leroux, R.C. Monette, Y.P. Séguin and J.P. Henrie, Results of Fire Resistance Tests on Full-Scale Floor Assemblies - Phase II, Institute for Research in Construction, National Research Council Canada, Ottawa, March 2005, RR-184.
(22) M.A. Sultan and G.D. Lougheed, Results of Fire Resistance Tests on Full-Scale Gypsum Board Wall Assemblies, Institute for Research in Construction, National Research Council Canada, Ottawa, August 2002, IRC-IR-833.
(23) V.K.R. Kodur, M.A. Sultan, J.C. Latour, P. Leroux, R.C. Monette, Experimental Studies on the Fire Resistance of Load-Bearing Steel Stud Walls, Research Report, National Research Council Canada, Ottawa, August 2013, RR-343.

D-6.2. Obsolete Materials and Assemblies

Building materials, components and structural members and assemblies in buildings constructed before 1995 may have been assigned ratings based on earlier editions of the Supplement to the National Building Code of Canada or older reports of fire tests. To assist users in determining the ratings of these obsolete assemblies and structural members, the following list of reference documents has been prepared. Although some of these publications are out of print, reference copies are available through NRC.

(1) M. Galbreath, Fire Endurance of Unit Masonry Walls. Technical Paper No. 207, Division of Building Research, National Research Council Canada, Ottawa, October 1965. NRCC 8740.
(2) M. Galbreath, Fire Endurance of Light Framed and Miscellaneous Assemblies. Technical Paper No. 222, Division of Building Research, National Research Council Canada, Ottawa, June 1966. NRCC 9085.
(3) M. Galbreath, Fire Endurance of Concrete Assemblies. Technical Paper No. 235, Division of Building Research, National Research Council Canada, Ottawa, November 1966. NRCC 9279.
(4) Guideline on Fire Ratings of Archaic Materials and Assemblies. Rehabilitation Guideline #8, U.S. Department of Housing and Urban Development, Germantown, Maryland 20767, October 1980.
(5) T.Z. Harmathy, Fire Test of a Plank Wall Construction. Fire Study No. 2, Division of Building Research, National Research Council Canada, Ottawa, July 1960. NRCC 5760.
(6) T.Z. Harmathy, Fire Test of a Wood Partition. Fire Study No. 3, Division of Building Research, National Research Council Canada, Ottawa, October 1960. NRCC 5769.

D-6.3. Assessment of Archaic Assemblies

Information in this document applies to new construction. Please refer to early editions of the Supplement to the National Building Code of Canada for the assessment or evaluation of assemblies that do not conform to the information in this By-law. As with other documents, this By-law is revised according to the information presented to the standing committee responsible for its content, and with each update new material may be added and material that is not relevant may be deleted.

D-6.4. Development of the Component Additive Method

The component additive method was developed based upon the following observations and conclusions drawn from published as well as unpublished test information.

Study of the test data showed that structural failure preceded failure by other criteria (transmission of heat or hot gases) in most of the tests of loadbearing wood-framed assemblies. The major contributor to fire resistance was the membrane on the fire-exposed side.

Fire tests of wood joist floors without protective ceilings resulted in structural failure between 8 and 10 min. Calculation of the time for wood joists to approach breaking stress, based upon the charring rate of natural woods, suggested a time of 10 min for structural failure. This time was subtracted from the fire-resistance test results of wood joist floors and the remainder considered to be the contribution of the membrane.

The figures obtained for the contribution of membranes were then applied to the test results for open web steel joist floors and wood and steel stud walls and values of 20 min for the contribution of wood stud framing and 10 min for steel framing were derived.
The fire-resistance rating has been limited to 1.5 h as this method of developing ratings for framed assemblies was new and untried. Although this is the subject of current review, no decision has been made to extend the ratings beyond 1.5 h.

(1) M. Galbreath, G. C. Gosselin, and R. B. Chauhan, Historical Guide to Chapter 2 of the Supplement to the National Building Code of Canada, Committee Paper FPR 1-3, Prepared for the Standing Committee on Fire Performance Ratings, May 1987.
Example showing fire-resistance rating of a typical membrane assembly, calculated using the component additive method.

1 hour Gypsum Board/Wood Stud Interior Partition
A 1 h fire-resistance rating is required for an interior wood framed partition, using 12.7 mm Type X gypsum board.

a) Since gypsum board is used (Sentence D-2.3.4.(2) and Table D-2.3.4.-A) time assigned to 12.7 mm Type X gypsum board membrane on the fire-exposed side of the partition = 25 min

b) Time assigned to wood framing members at 400 mm o.c. (Sentence D-2.3.4.(3) and Table D-2.3.4.-E) = 20 min

c) Time assigned to insulation, if the spaces between the studs are filled with preformed insulation of rock or slag fibres conforming to CAN/ULC-S702, “Mineral Fibre Thermal Insulation for Buildings,” (Sentence D-2.3.4.(4) and Table D-2.3.4.-G) = 15 min

d) Time assigned to the membrane on the non-fire-exposed side (Sentence D-2.3.5.(1)) = 0 min
Fire-resistance rating = 25 + 20 + 15 = 60 min

Division C
Administrative Provisions

Part 1
General

Section 1.1. Application

1.1.1. Application

1.1.1.1. Application

1) This Part applies to all *buildings* covered in this By-law. (See Article 1.1.1.1. of Division A.)

Section 1.2. Terms and Abbreviations

1.2.1. Definitions of Words and Phrases

1.2.1.1. Non-defined Terms

1) Words and phrases used in Division C that are not included in the list of definitions in Article 1.4.1.2. of Division A shall have the meanings that are commonly assigned to them in the context in which they are used, taking into account the specialized use of terms by the various trades and professions to which the terminology applies.

2) Where objectives and functional statements are referred to in Division C, they shall be the objectives and functional statements described in Parts 2 and 3 of Division A.

3) Where acceptable solutions are referred to in Division C, they shall be the provisions stated in Parts 3 to 10 of Division B.

4) Where alternative solutions are referred to in Division C, they shall be the alternative solutions mentioned in Clause 1.2.1.1.(1)(b) of Division A.

1.2.1.2. Defined Terms

1) The words and terms in italics in Division C shall have the meanings assigned to them in Article 1.4.1.2. of Division A.

1.2.2. Symbols and Other Abbreviations

1.2.2.1. Symbols and Other Abbreviations

1) The symbols and other abbreviations in Division C shall have the meanings assigned to them in Article 1.4.2.1. of Division A.

Section 1.3. Interpretation, Intent and Prohibitions

1.3.1. General Interpretation

1.3.1.1. Interpretation

1) This By-law shall, despite any other provision herein, be interpreted in accordance with this Section.

2) The Schedules attached to this Part 1 form part of this By-law.

1.3.2. General Intent

1.3.2.1. Intent

1) This By-Law sets standards in the general public interest. It is enacted and retained on the understanding and specifically expressed condition that it creates no duty whatsoever on the *City*, the *Chief Building Official* or any employee of the *City* to enforce its provisions, and on the further condition that a failure to administer or enforce its provisions, or the incomplete or inadequate administration or enforcement of its provisions, shall not give rise to a cause of action in favour of any person whatsoever. The issuance of any *permit*, including an *occupancy permit*, is not a representation, warranty or statement that this By-Law or any other enactment has been complied with, and the issuance thereof in error shall not give rise to a cause of action. Accordingly, words in this By-law defining the responsibilities and authority of the *Chief Building Official* shall be construed as internal administrative directions which do not create a duty.

1.3.2.2. Reliance on Registered and Certified Professionals

1) The *City* and the *Chief Building Official* do not have the resources to deal with matters which fall within the expertise of *registered professionals* and the *City* and the *Chief Building Official* rely on letters of assurance, documents sealed with professional seals, and related documents received from *registered professionals*, and on *field reviews* carried out by or under the supervision of *registered professionals*, as evidence that the design and *construction* of *buildings* complies with the provisions of this By-law, including alternate solutions, and substantially complies with any other applicable enactments.

2) The *City* and the *Chief Building Official* do not have the resources to deal with matters which fall within the expertise of *certified professionals* and the *City* and the *Chief Building Official* rely on letters of assurance, documents stamped with professional stamps, and related documents received from *certified professionals*, on site reviews carried out by *certified professionals*, and on field reviews monitored by *certified professionals* as evidence that the design and *construction* of *buildings* complies with the provisions of this By-law, including alternate solutions and substantially complies with any other applicable enactments.

1.3.2.3. No Representation or Warranty

1) No person shall rely on a *permit* issued by the *Chief Building Official* or an inspection carried out by the *Chief Building Official* as establishing compliance with this By-Law or any other enactment or assume or conclude that this By-Law has been administered or enforced according to its terms.

2) All persons shall make such independent investigations as they deem necessary to determine whether a *building* complies with this By-law or any other enactment.

1.3.3. General Prohibitions

1.3.3.1. Contravention

1) No person shall fail to comply with an order or notice issued by the *Chief Building Official*.

1.3.3.2. No Work Without Permit

1) No person shall work or authorize or allow work to proceed on a *project* for which a *permit* is required unless a valid *permit* exists for the work to be done.

1.3.3.3. Deviation Needs Prior Approval

1) No person shall deviate from the plans and supporting documents forming part of the *permit*, without having first paid all necessary fees and obtained all necessary *permits* and approvals from the *Chief Building Official*.

1.3.3.4. No Occupancy Without Permission

1) No person shall occupy a *building* or authorize or allow the *occupancy* of a *building* without having first obtained the permission of the *Chief Building Official*.

1.3.3.5. Unsafe Conditions

(See Note A-1.3.3.5.)

1) No person who is an *owner* or who is involved in the *construction*, relocation or *occupancy* of a *building* shall cause, allow or maintain any *unsafe condition*.

1.3.3.6. Work on Public Property
(See Note A-1.3.3.6.)
1) No person shall excavate or undertake work on public property, or erect or place any *construction* or work or store any materials thereon without approval having first been obtained in writing from the *Chief Building Official* over such public property.

1.3.3.7. Changes in Ground Elevation and Limiting Distance
(See Note A-1.3.3.7.)
1) No person shall change or alter the ground elevations or grading of a *building* site without first obtaining the necessary *permits*.
2) No person shall change or alter the *limiting distance* of an *exposing building face* without first obtaining the necessary *permits.*

1.3.3.8. Compliance with By-law and Other Enactments
1) No person shall work, or authorize or allow work to proceed, or undertake any *building*, *construction*, work or *occupancy* which is in contravention of this By-law or any other enactment.

1.3.3.9. False Information
1) No person shall submit false or incorrect information to the *Chief Building Official*.

1.3.3.10. Tampering with a Posted Notice or Order
1) No person, except for the *Chief Building Official*, shall reverse, alter, deface, cover, remove or in any way tamper with any notice or order which has been posted on or affixed to a *building* pursuant to this By-law.

Section 1.4. Obligations of the Owner and Contractor

1.4.1. Obligations of the Owner

1.4.1.1. Right of Entry of Chief Building Official
1) The *owner* shall allow the *Chief Building Official* to enter any *building* or premises at any reasonable time for the purpose of administering and enforcing this By-law.

1.4.1.2. Permit Required
1) The *owner* shall obtain all *permits* or approvals prior to commencing the work to which they relate.

1.4.1.3. Compliance with Permit
1) The *owner* shall comply with all conditions of a *permit* or a staged *permit*.

1.4.1.4. Posting a Permit
1) The *owner* shall ensure that the *permit* authorizing the work, or a true copy of the *permit*, is posted conspicuously on the site or is affixed to the exterior of the *building* during the entire *project*.

1.4.1.5. Compliance with By-law and other enactments
1) The *owner* shall comply with this By-law and all other applicable enactments.
2) The *owner* shall ensure that all work, *construction*, or *occupancy* is carried out in accordance with this By-law and all other applicable enactments.

3) The *owner* shall ensure that the *occupancy* of a *building* or part of a *building* complies with the *occupancy permit*.
4) The issuance of a *permit*, the acceptance of plans and supporting documents submitted for a *permit*, or the making of inspections by the *Chief Building Official* shall not relieve the *owner* of a *building* from the full responsibility for carrying out the work or having the work carried out in accordance with this By-law and all other applicable enactments.
5) The *owner* shall ensure that all underground storage tanks on the subject property that are intended for the storage of heating oil but have not been used for over 2 years are removed and any associated contamination is remediated to the applicable standards as prescribed in the Contaminated Sites Regulation. All work must be completed in accordance with the requirements of the Vancouver Fire By-law.

1.4.1.6. Compliance with Stop Work Order
1) The *owner* shall not carry out work or *construction* or suffer, permit or allow work or *construction* to be carried out in contravention of a stop work order issued by the *Chief Building Official*.

1.4.1.7. Compliance with Development Permit Plans
1) The *owner* shall ensure that the plans and supporting documents submitted for a *permit* conform substantially with the approved Development Permit plans and supporting documents, except that where differences exist, the *owner* shall make application for a "Development Permit Amendment" as required by the Zoning and Development By-law.

1.4.1.8. Owner's Undertaking
1) The *owner* shall submit a completed *Owner's* Undertaking letter to the *Chief Building Official* in support of and prior to the issuance of a *permit*, in the applicable form set out in Schedules E-1 and E-2 at the end of this Part.

1.4.1.9. Letters of Assurance
1) When required by this By-law, the *owner* shall provide to the *Chief Building Official* any applicable letters of assurance in the forms set out in Schedules A, B, C-A and C-B at the end of Part 2 of Division C of Books I and II of this By-law or in the forms set out in Schedules D and C-D at the end of Part 5 of Division B of Book I (General) of this By-law.

1.4.1.10. Project Directory
(See Note A-1.4.1.10.)
1) The *owner* shall, prior to commencing work, give notice in writing to the *Chief Building Official*, of the name, address, electronic mail address and telephone number of the *owner*, the *constructor* or other person in charge of the work, the *designer* reviewing the work, and any inspection or testing agency engaged to monitor the work.
2) During the course of the *construction*, the *owner* shall give immediate notice in writing to the *Chief Building Official*, of any change in employment of persons listed in the notice given pursuant to Sentence (1).

1.4.1.11. Other Notices
1) The *owner* shall give such other notices to the *Chief Building Official* as may be required by the *Chief Building Official*, by this By-law, or by another enactment.

1.4.1.12. Construction Safety
1) Where a *Construction Safety Plan* is required by Section 8.2 of Division B of Book I (General) of this By-law, the *owner* shall:
a) prior to commencing work, ensure that the *Construction Safety Plan* has been submitted to the *Chief Building Official*, and

b) during *construction*, ensure that the *Construction Safety Plan* is posted at all times and is amended from time to time in accordance with the requirements of this By-law.

2) Where a *building* is required by Subsection 2.2.7. of Division C of Book I (General) of this By-law to be professionally designed and reviewed, the *owner* shall, prior to commencing work, ensure that the *contractor* provides a full-time *construction safety officer* at the worksite.

1.4.1.13. Plans Required on Site

1) The *owner* shall ensure that the plans and specifications on which the issuance of the *permit* was based are available at the worksite for inspection during working hours by the *Chief Building Official*.

1.4.1.14. Site Cleared of Debris

1) The *owner* shall ensure that upon completion of *demolition* procedures, all debris and fill is cleared and the site levelled or graded, to the satisfaction of the *Chief Building Official*.

1.4.1.15. Tests to Establish Compliance

(See Note A-1.4.1.15.)

1) Where required by the *Chief Building Official* the *owner* shall make or have made, at the *owner's* expense, tests or inspections, as necessary to establish compliance with this By-law and shall promptly provide a copy of all such tests or inspection reports to the *Chief Building Official*.

1.4.1.16. Up-to-Date Survey

1) The *owner* shall provide to the *Chief Building Official* a survey, which has been certified by a registered land surveyor no more than 30 days before the date of delivery of the survey to the *Chief Building Official*

a) in the case of an *existing building* and site, if required by the *Chief Building Official* to substantiate the *building* location and size, above, at and below ground level, relative to the site,

b) in the case of an *existing building* and site, if required by the *Chief Building Official* to establish the relationship of the *building* to neighbouring grades, and

c) in the case of all new *buildings*, upon completion of foundations and footings and before any further *construction*, and the survey must include the elevation of a bench mark on the front of the foundation wall, to substantiate its size, location, and elevation relative to the site and to neighbouring grades.

1.4.1.17. Covering Work Prior to Inspection, Site Review or Field Review

1) The *owner* shall not cover work prior to inspection, site review or *field review*.

1.4.1.18. Request for Inspection

1) The *owner* shall give at least 24 hours notice to the *Chief Building Official* when requesting an inspection of work that is required or ordered to be inspected.

1.4.1.19. Uncovering Work

1) The *owner* shall uncover any work that has been covered without inspection, when required to do so by the *Chief Building Official*. (See Note A-1.4.1.19.(1).)

2) An *owner* who is required to uncover work by the *Chief Building Official* shall uncover and replace such work at the *owner's* expense.

1.4.1.20. Reinspection

1) If the *Chief Building Official* discovers faulty or incomplete work or faulty materials during an inspection, the *owner* shall apply for a reinspection.

2) Every applicant for a reinspection of a *project* shall pay the applicable reinspection fees set out in the Fee Schedule, prior to the reinspection.

1.4.1.21. Report of Building, Demolition or Excavation Failure

1) When a *building*, *demolition* or excavation failure occurs which causes or has the potential to cause injury or loss
of life, the *owner* shall

a) immediately report the failure to the *Chief Building Official*,

b) submit a report, if required to do so by the *Chief Building Official*, in accordance with Article 1.5.3.1., and

c) carry out any repairs or remedial work required by the *Chief Building Official*.

1.4.1.22. Removing Unsafe Conditions

1) When a *building* or part thereof is in an *unsafe condition*, the *owner* shall forthwith take all necessary action to put the *building* in a safe condition.

1.4.1.23. Damage to City Property

1) The *owner* is responsible for the cost of repair of any damage to *City* property or works located thereon that occurs as a result of undertaking work for which a *permit* or a *street* use *permit* was required.

1.4.1.24. Requirements Regarding Street Addresses

1) An *owner* shall not post any number or letter on a *building* or *suite* entry except for a *street* address or *suite* number that has been designated by the *Chief Building Official*.

2) Every *owner* shall place and maintain the designated *street* address on the *building* in a place that is easily visible from the *street*, and the address shall be mounted on a contrasting background and shall conform with the minimum character size requirements in Table 1.4.1.24.

Table 1.4.1.24.
Requirements Regarding Street Addresses
Forming part of Sentence 1.4.1.24.(2)

Building Setback from *Street*	Minimum Non-illuminated Character Size	Minimum Illuminated Character Size
0 - 15 m	100 mm	80 mm
15 - 20 m	150 mm	100 mm
Greater than 20 m	200 mm	150 mm

3) Where landscaping or other structures obscure the visibility of a *building* from the *street*, the *owner* shall erect a sign no larger than 0.4 m2 displaying the *street* address, on the *building* property within sight of the *street*.

4) Every *owner* shall place and maintain a designated *suite* number on a contrasting background and of a character size of no less than 25 mm at the *suite* entry. (See also Article 3.8.3.13. of Division B of Book I (General) of this By-law for design requirements for persons with a visual impairment.)

5) If a *suite* number is assigned to an exterior principal *suite* entry, every *owner* shall place and maintain the designated *suite* number in conformance with this Section.

6) Every *owner* shall ensure that designated *street* addresses and *suite* numbers are made of durable materials and are affixed securely to the *building*.

1.4.1.25. Requirements regarding Professional Design and Review

1) In addition to the obligations listed in this section, the *owner* of a *building* to which the provisions of Part 2 of Division C of Book I (General) of this By-law apply, shall also comply with the *owner's* obligations in that Part.

1.4.2. Obligations of the Contractor

1.4.2.1. Construction Safety

1) The *contractor* shall ensure that all requirements of this By-law relating to *construction* safety are complied with, and shall ensure that every sub-*contractor* of the *project* has retained a *trades safety coordinator* as required by Sentence (2).

2) Every sub-*contractor* shall retain a qualified *trades safety coordinator* whose responsibilities shall include appropriate training of all persons working for the sub-*contractor* at the worksite in safe *construction* and installation practice.

3) The *trades safety coordinator* shall provide certification respecting training to the *Chief Building Official* upon request.

1.4.2.2. Work on Public Property

1) The *contractor* shall ensure that no excavation or other work is undertaken on public property, and that no *building* is erected or materials stored thereon, without first having obtained approval in writing from the appropriate government authority.

1.4.2.3. Compliance with By-law and Other Enactments

1) The *contractor* shall ensure that all work, *building*, *construction*, or *occupancy* is carried out in accordance with this By-law and with all other applicable enactments.

1.4.2.4. Right of Entry of Chief Building Official

1) The *contractor* shall allow the *Chief Building Official* to enter any *building* or premises at any reasonable time for the purpose of administering and enforcing this By-law.

1.4.2.5. Compliance with Stop Work Order

1) The *contractor* shall not carry out work or *construction*, or suffer, permit or allow work or *construction* to be carried out, in contravention of a stop work order issued by the *Chief Building Official*.

Section 1.5. Authority of the Chief Building Official

1.5.1. Administration

1.5.1.1. Administrator

1) The *Chief Building Official* is authorized to administer this By-law.

1.5.1.2. Filing Documents

1) The *Chief Building Official* is authorized to keep copies of applications received, *permits* and orders issued, inspections and tests made and papers and documents connected with the administration of this By-law, for such time as is required by law.

2) Despite the provisions of Sentence (1), the *Chief Building Official* is authorized to keep copies of applications received, *permits* and orders issued, inspections and tests made and papers and documents connected with the administration of this By-law, for such time as is necessary, in the opinion of the *Chief Building Official*, to support the administration of this By-law.

1.5.1.3. Inspection of Records

1) The *Chief Building Official* is authorized to provide plans and documents filed pursuant to the provisions of this By-law for inspection, subject to the provisions of the Freedom of Information and Protection of Privacy Act.

1.5.1.4. Fees for Inspection of Records

1) The *Chief Building Official* shall charge a fee as set out in the Fee Schedule, payable in advance, for the inspection of records referred to in Article 1.5.1.3.

2) No refund shall be issued for any fees or portion of fees, resulting from any outstanding costs incurred by the *City* for the inspection of records pursuant to Article 1.5.1.4.

1.5.2. Authorities

1.5.2.1. Power of Entry

(See Note A-1.5.2.1.)

1) The *Chief Building Official*, and any person authorized to act on behalf of the *Chief Building Official*, may enter any *building* or premises at any reasonable time for the purpose of administering or enforcing this By-law, or immediately if there is reason to believe an *unsafe condition* exists.

1.5.2.2. Review of Value of Work

1) The *Chief Building Official* may review the value of the proposed work in an application for a *permit* and may substitute a different value, in accordance with Articles 1.6.2.3. and 1.6.2.4. , for the purpose of determining applicable *permit* fees.

1.5.2.3. Construction Safety

1) The *Chief Building Official* may review a *Construction Safety Plan* and may require that the *Construction Safety Plan* be changed or amended.

1.5.2.4. Permit Issuance

1) The *Chief Building Official* shall issue a *permit* when the applicable requirements of this By-law have been met.

1.5.2.5. Permit Refusal

1) The *Chief Building Official* may refuse to issue a *permit*

a) if plans or supporting documents are incomplete or do not comply with the provisions of this By-law,

b) if plans or supporting documents contain false or incorrect information, or

c) for any *building*, *construction*, work or *occupancy* that would not be permitted by this By-law or by another enactment.

2) The *Chief Building Official* shall provide reasons for the refusal to issue a *permit*, on the request of an applicant or *owner*.

1.5.2.6. Permit with Incomplete Application

(See Note A-1.5.2.6.)

1) The *Chief Building Official* may issue a *permit* for a *building* based on an incomplete application if the incomplete information is of a secondary nature and is unavailable at the time of *permit* issuance.

2) If the *Chief Building Official* issues a *permit* pursuant to Sentence (1) the *Chief Building Official* may impose conditions requiring submission of further information by a specified date.

3) The *Chief Building Official* may suspend or revoke a *permit* issued pursuant to Sentence (1), if the holder of the *permit* fails to comply with the conditions imposed by the *Chief Building Official*.

1.5.2.7. Conditions on Permits

1) The *Chief Building Official* may impose conditions on *permits* including, but not limited to, conditions regarding

a) notifications and notices,

b) safety,
c) health,
d) design requirements,
e) *construction* requirements,
f) timing of *construction*,
g) deadlines for completion of *construction*,
h) reviews and inspections,
i) responsibilities of the *owner*, *constructor*, *registered professional* and *certified professional*,
j) compliance with this By-law and other enactments,
k) use and *occupancy*, and
l) temporary *buildings* and *occupancies*.

1.5.2.8. Permits for Existing Buildings

1) The *Chief Building Official* may issue a *permit* for an *existing building* in accordance with the provisions of Part 11, Division B, Book I and may impose conditions on the *permit*.

2) The *Chief Building Official* may permit an alternative solution to the alternative *acceptable* solutions provided in this By-law for the conversion of an *existing building* if

a) the *owner* demonstrates, to the satisfaction of the *Chief Building Official*, that the level of upgrade required presents an extraordinary hardship for the *owner*, and
b) the *owner* proposes an alternative solution which achieves the objectives of the alternative *acceptable* solutions prescribed by this By-law, to the satisfaction of the *Chief Building Official*.

1.5.2.9. Combustible Construction for Minor Repairs in Existing Buildings

1) If *additions* and new work are required to be *noncombustible construction* pursuant to Subsection 3.2.2. of Division B, the *Chief Building Official* may permit minor repairs to existing floor or wall assemblies to be *combustible construction* provided

a) the minor repair of the floor assembly does not exceed 5 per cent of the *floor area* of the room in which it is located, and
b) the minor repair of the wall assembly does not exceed 5 per cent of the wall area of the wall plane on which it is located.

1.5.2.10. Permits for Plumbing and Sprinkler Systems

1) The *Chief Building Official* may issue a *permit* for a plumbing system or *sprinkler system* in accordance with the provisions of Subsection 1.6.3.

1.5.2.11. Permits in Designated Flood Plain

1) If a *building* is located on a *designated flood plain* the *Chief Building Official* may

a) require plans and supporting documents to demonstrate that the elevation or design of the *buildings* incorporates *flood construction level requirements* intended to reduce the risk of flood damage,
b) require that a covenant acknowledging the risk of flood damage be registered against the land, and
c) withhold issuance of a *permit* until the requirements of the *Chief Building Official* have been satisfied.

2) The *Chief Building Official* may increase the *flood construction level requirements* or the setback requirements as provided in Article 2.2.9.5.

3) The *Chief Building Official* may relax the *flood construction level requirements* or the setback requirements in this By-law as provided in Article 2.2.9.6.

1.5.2.12. Permit for Staged Construction

(See Note A-1.5.2.12.)

1) Where a *permit* for staged *construction* is applied for pursuant to Subsection 1.6.5., the *Chief Building Official* may authorize the excavation or *construction* of a portion of a *building*, and may impose conditions to ensure compliance with this By-law, before all the plans and supporting documents for the *building* have been accepted, at the risk of the *owner*.
2) The *Chief Building Official* may suspend or revoke a *permit* issued pursuant to Subsection 1.6.5. if the holder of the *permit* fails to comply with the conditions imposed by the *Chief Building Official*.

1.5.2.13. Minor Revisions to Permit

1) The *Chief Building Official* may accept an application for minor revisions to an existing *permit* if the proposed revisions do not add or delete additional *storeys* or *major occupancy* classifications to or from the *project*.

1.5.2.14. Requirement for New Permit

1) The *Chief Building Official* may require that an applicant for revisions to an existing *permit* apply for a new *permit*,
if the proposed revisions would add or delete *floor area*, *storeys*, *dwelling units* or *major occupancy* classifications to or from the *project*.

1.5.2.15. Permit Suspension

1) The *Chief Building Official* may suspend a *permit* by issuing an order to stop work.

1.5.2.16. Permit Revocation

1) The *Chief Building Official* may revoke a *permit* if
a) there is a contravention of any condition under which the *permit* was issued,
b) the *permit* was issued in error, or
c) the *permit* was issued on the basis of false or incorrect information.

1.5.2.17. Permit Extension

1) The *Chief Building Official* may extend a *permit* in accordance with Subsection 1.6.7. of this Part.

1.5.2.18. Designation of Street Addresses

1) The *Chief Building Official* may, at any time, number, renumber or assign a series of numbers or *suite* numbers to
any *building*, or part thereof.
2) Upon the issuance of a *building permit*, the *Chief Building Official* shall designate the *street* address or series of
suite numbers required for the *building*, or any portion of the *building*.
3) Upon registration of a parcel of land in the Land Title Office, the *Chief Building Official* shall designate the *street*
address or series of numbers required for the parcel.

1.5.2.19. Renumbering of Street Addresses

1) Where an *owner* has requested a renumbering and has paid the applicable fees set out in the Fee Schedule, the *Chief Building Official* may renumber any *building* or *suite* within a *building*, or parcel of land.

1.5.2.20. Proof of Compliance

1) The *Chief Building Official* may direct that tests of materials, equipment, devices, *construction* methods, structural assemblies or foundations be made, or sufficient evidence or proof be submitted, at the expense of the *owner*, where such evidence or proof is necessary, in the opinion of the *Chief Building Official*, to determine whether the material, equipment, device, *construction*, structural assembly or foundation condition complies with this By-law.

1.5.2.21. Occupancy Permit for Building at Variance with By-law

1) The *Chief Building Official* may issue an *occupancy permit* for a *building* which varies in a minor respect from the requirements of this By-law if, in the opinion of the *Chief Building Official*, such variation will not substantially interfere with the objectives of this By-law.

1.5.2.22. Occupancy Permit Prior to Completion

1) The *Chief Building Official* may issue an *occupancy permit* to allow the *occupancy* of a *building* or a part thereof for the approved use, prior to commencement or completion of the *construction* or *demolition* work.

2) The *Chief Building Official* may impose conditions on an *occupancy permit* issued in accordance with Sentence (1).

1.5.3. Authorities Regarding Unsafe and Unsanitary Conditions

1.5.3.1. Report of Failure

1) Where any *building*, *construction* or excavation failure occurs which causes or has the potential to cause injury or loss of life, the *Chief Building Official* may require the *owner* to submit a report which includes

a) the name and address of the *owner*,
b) the address or location of the *building*, *demolition* or excavation,
c) the name and address of the constructor,
d) the nature of the failure,
e) the cause of the failure,
f) a remedial plan to correct the failure, and
g) a plan to prevent future failure.

1.5.3.2. Hazardous Material

1) The *Chief Building Official* may require that any person supervising or doing work to install or remove *building* materials provide evidence of their training, certification or qualifications, if the installation or removal of *building* materials may create an *unsafe condition* or affect the structural safety or fire protection of a *building*.

1.5.3.3. Order to Remove Unsafe Condition

1) When any *building*, *construction* or excavation or part thereof is in an *unsafe condition*, the *Chief Building Official* may issue a written order to the *owner*, certifying the existence of an *unsafe condition* and requiring correction of any *unsafe condition* found on a *building* site, within a specified time.

1.5.3.4. Order to Repair Plumbing Systems

1) The *Chief Building Official*, if of the opinion that the *plumbing system*, or any part of it, in any *building* is defective, unsanitary or inadequate, may notify the *owner* or occupant thereof of such condition and may order that such *plumbing system*, or part thereof, be placed in a proper, safe and sanitary condition.

2) The *Chief Building Official*, if of the opinion that the *plumbing system*, or any part of it, in any *building* may has become dangerous or defective on account of the settlement of the *building* or through abuse, accident or for any other cause whatsoever, may order the *owner* or occupant thereof to have a *plumbing contractor* conduct a smoke test on the waste and *vent pipes* of the *building* to ascertain whether any dangerous or defective condition exists.

1.5.3.5. Corrective Measures

1) If the *Chief Building Official* has issued an order in accordance with Article 1.5.3.3. or 1.5.3.4. and an *owner* has failed to comply with that order, the *Chief Building Official* may

a) authorize *demolition*, removal, posting of security guards or fire wardens, or enclosure of a *building*, *construction*, excavation or part thereof, at the expense of the *owner*,

b) recover such expense in the manner set out in Article 1.5.3.6., and
c) take such other measures as may be necessary to protect the public.

1.5.3.6. Immediate Measures

1) When immediate measures must be taken to avoid an imminent danger or risk of accident, the *Chief Building Official* may take such action as is appropriate, without prior notice and at the expense of the *owner*.

2) Where immediate security measures must be taken to limit the risk of damage, vandalism, theft, loss, or the creation of *unsafe conditions*, the *Chief Building Official* may board-up or otherwise secure a *building* against unauthorized entry without prior notice and at the expense of the *owner*.

1.5.3.7. Recovery of City Costs

1) The cost of the measures described in Articles 1.5.3.5. and 1.5.3.6. shall be recoverable from the *owner*
a) in any Court of competent jurisdiction, or
b) by entry of such cost in the real property roll with respect to the property and by collection in the same manner as the taxes shown in the real property roll.

1.5.4. Notices and Orders

1.5.4.1. Notices or Orders

1) The *Chief Building Official* may issue in writing such notices or orders as may be necessary to inform the *owner* of a contravention of this By-law, in the manner set out in this By-law.

1.5.4.2. Scope of Orders

1) The *Chief Building Official* may order
a) a person to comply with the provisions of this By-law within a specified time,
b) a person to allow the *Chief Building Official* to enter any *building* or premises at any reasonable time for the purpose of administering and enforcing this By-law,
c) work to stop on a *building* or any part thereof, if such work is proceeding in contravention of a provision of this By-law or another enactment, or if there is deemed to be an *unsafe condition*,
d) the removal of an unauthorized encroachment on public property,
e) the removal of any *building* or part thereof constructed in contravention of a provision of this By-law,
f) the cessation of any *occupancy* in contravention of a provision of this By-law,
g) the cessation of any *occupancy* if an *unsafe condition* exists,
h) the correction of an *unsafe condition*,
i) the correction of an unsanitary condition,
j) a person to provide a written assessment of a specified condition by a *registered professional* if there is deemed to be an *unsafe condition, and*
k) a person to secure a building against unauthorized entry.

1.5.4.3. Contents of Notice

1) A notice shall state the nature of any contravention and specify the date or the phase of *construction* by which remedial measures must be completed.

1.5.4.4. Delivery of Notice

1) A notice may be posted on a *building*, and may be delivered by regular mail or by hand to the person listed as the *owner* in the records of the Assessment Authority of British Columbia or to a representative of the *owner*.

1.5.4.5. Contents of Order

1) An order shall specify any contraventions of this By-law or any *unsafe condition* or unsanitary condition and may require *demolition*, removal, or compliance with this By-law, by a specified phase of *construction*, or within a specified time after the date of mailing or posting the order.
2) Despite Sentence (1), an order to stop work, board up or cease *occupancy* shall state the nature of the contravention or *unsafe condition*, and may order the immediate suspension of *construction* or of *occupancy* and the rectification of the contravention or *unsafe condition*.

1.5.4.6. Delivery of Order

1) The *Chief Building Official* may deliver an order

a) by mailing the order by registered mail or by regular mail to the *owner* at the *owner's* address as it appears on a Tax Certificate or a State of Title Certificate, and posting the order on the premises which is the subject of the order,
b) by sending the order by electronic mail to the electronic mail address of the *owner* or a representative of the *owner*, or
c) by delivery of the order by hand to the *owner* or a representative of the *owner*.

2) When a building is at imminent or unreasonable risk of collapse which could pose a danger to building occupants or the public, the Chief Building Official may post an order to cease occupancy on the premises which is the subject of the order, which shall be deemed to comply with the requirements of Sentence (1).
3) Delivery of an order in accordance with the provisions of Sentences (1) or (2) shall be deemed to be good and sufficient service of the order.

Section 1.6. Permits, Applications and Fees

1.6.1. Permits

1.6.1.1. When a Permit is Required

1) A *permit* is required before any work regulated by this By-Law is undertaken.

1.6.1.2. Construction without a Permit

1) If *construction* for which a *permit* is required has been commenced before a *permit* has been issued, the *owner* shall

a) make application for any necessary *permits* in accordance with Subsection 1.6.2. of this By-law, and
b) pay to the *City*, a minimum of $500 or double the fee set out in the Fee Schedule to a maximum of $20,000, whichever is the lesser amount.

2) If *construction* for which a *permit* is required has been commenced before a *permit* has been issued, the *owner* shall, if ordered to do so by the *Chief Building Official*,

a) provide proof that the *construction* complies with this By-law and any other applicable enactments,
b) carry out tests and investigations by independent agencies, at the cost of the *owner*, to determine whether or not the *construction* complies with this By-law,
c) carry out tests and investigations by independent agencies, at the cost of the *owner*, to determine appropriate remedial measures to ensure that the *construction* complies with this By-law,
d) provide to the *Chief Building Official*, at the cost of the *owner*, the results of any tests and investigations ordered by the *Chief Building Official*, and
e) provide documentation to the satisfaction of the *Chief Building Official* to establish that all remedial measures to ensure the *construction* complies with this By-law have been completed.

1.6.1.3. Additional Permits

1) In addition to a *permit* required by Article 1.6.1.1., other *permits* and supporting documents necessary for specific *building* components, services and uses, may be required by the *Chief Building Official*.

1.6.2. Application for Permit

1.6.2.1. Owner Requirement

1) To obtain a *permit*, the *owner* shall file an application in writing in the form prescribed by the *Chief Building Official*.

1.6.2.2. Application Requirements

(See Note A-1.6.2.2.)

1) Except as otherwise provided in this By-law, every application shall

a) describe the work, *building*, *construction* or and *occupancies* for which the *permit* is required,
b) provide a legal description and address for the land on which the work is to be done,
c) include plans and other supporting documents which conform with Section 2.2. of Division C,
d) state the value of the proposed work calculated in accordance with Article 1.6.2.3.,
e) include the requisite *permit* fee, in accordance with the Fee Schedule at the end of this Part,
f) include the appropriate *owner's* undertaking letter in the applicable form set out in Schedule E-1 or E-2 at the end of this Part,
g) include any other plans or supporting documents required by the *Chief Building Official* to establish that the work, *building*, *construction* and *occupancy* complies with this By-law or any other enactment, and
h) list the names, addresses, electronic mail addresses and telephone numbers of all *owners*, designers and constructors.

1.6.2.3. Valuation for Permit

1) The value of the proposed work stated on the application for the *permit* shall reflect the total current monetary worth of all proposed materials, *construction* and work related to the *building*.

2) In addition to Sentence (1), the value of the proposed work shall include the total current monetary worth of all labour and all fees and costs incurred for design, investigative testing, consulting services, *construction*, *construction* management, *contractor's* profit and overhead, sales taxes, and *construction* insurance related to the *building*.

3) The total current monetary worth referred to in Sentences (1) and (2) shall include the market value of all labour, including unpaid labour provided by an *owner* or volunteer, and the market value of all materials, including donated, recycled or used materials.

4) The total current monetary worth referred to in Sentences (1) and (2) shall include all components of the *building*, notwithstanding the fact that some components of the *building* may be subject to other *permits* and fees.

1.6.2.4. Review of Valuation by *Chief Building Official*

1) The *Chief Building Official* may review the value of the proposed work stated in an application, using the Marshall Valuation Method, and may substitute a different value for the proposed work.

1.6.2.5. Fee Schedule

1) *Permit* fees shall be calculated in accordance with the Fee Schedule at the end of this Part and the fees for *construction* without a *permit* are as outlined in Article 1.6.1.2.

1.6.2.6. No Refund

1) Except as permitted in Article 1.6.2.7. or Article 1.6.4.5., no *permit* fees or part thereof shall be refunded if

a) *construction* authorized by a *permit* has commenced,
b) the *permit* has expired pursuant to Article 1.6.7.1., or

c) the application has lapsed as outlined in Article 1.6.2.8.

1.6.2.7. Partial Refund and Set-off

1) If *construction* authorized by *permit* has not commenced and the *Chief Building Official* approves, the Director of Finance may refund a portion of the fees related to the *permit*, after deduction of any outstanding costs incurred by the *City* in processing the application for the *permit* and in carrying out any work pursuant to Article 1.5.3.4. or Article 1.5.3.5.

1.6.2.8. Lapse of Application

1) Subject to the provisions of Article 1.6.2.9., an *owner* shall comply with all the necessary requirements to complete an application for a *permit* within 6 months after the date of receipt of the application by the *Chief Building Official*.
2) If an *owner* fails to comply with the requirements of Sentence (1), the application for a *permit* shall lapse.
3) An application for a *permit* which has lapsed is expired and shall not be renewed except in accordance with Article 1.6.2.9.

1.6.2.9. Renewal of Lapsed Application

1) The *Chief Building Official* may renew a lapsed application for a *permit* if the *Chief Building Official* determines that
a) no more than 3 months have passed since the date the application lapsed, and
b) the failure to complete the requirements of the original application for a *permit* was reasonable in the circumstances.
2) Despite the provisions of Sentence (1), the *Chief Building Official* shall not renew a lapsed application for a *permit* more than once.
3) An application for a *permit* which has been renewed pursuant to Sentence (1) must comply with any amendments to this By-law made since the date of receipt of the original application by the *Chief Building Official*.

1.6.3. Additional Requirements for Plumbing and Sprinkler Permits

1.6.3.1. Application Requirements

1) The *Chief Building Official* may issue a *permit* for a *plumbing system* or *sprinkler system* if the applicant is authorized to obtain such a *permit* in accordance with the provisions of this Section.

1.6.3.2. Permit for Plumbing System

1) The *Chief Building Official* shall only issue a *permit* to construct, extend, alter, renew or repair a *plumbing system* to a licensed plumbing *contractor*.

1.6.3.3. Permit for Sprinkler System

1) The *Chief Building Official* shall only issue a *permit* to construct, extend, alter, renew or repair a *sprinkler system* to a licensed *sprinkler contractor*.

1.6.3.4. Permit for Plumbing System to Licensed Contractor

1) Despite the provisions of Article 1.6.3.2., the *Chief Building Official* may issue a *permit* to a licensed *contractor*
a) to install *sewers*, *sumps*, *catch basins*, and water lines outside of a *building*, or
b) to install *backflow* devices or other similar protection devices inside a *building*.

1.6.3.5. Permit for Plumbing System to Owner

1) Despite the provisions of Article 1.6.3.2., the *Chief Building Official* may issue a *permit* to the *owner* of a residential *building* with not more than one principal *dwelling unit* to do plumbing work in that *building* if the *owner* is the occupier of the *building*.

1.6.3.6. No Permit for Minor Repairs to Plumbing System

1) Despite the provisions of Article 1.6.3.1., no *permit* is required to repair or replace a valve, faucet, fixture, *fixture outlet pipe* or *service water heater*, to clear a stoppage, or to repair a leak, if there is no change to any other piping.

1.6.3.7. Requirement for Inspection

1) No person shall use a *plumbing system* or *sprinkler system* until it has been inspected by the *Chief Building Official*.

1.6.4. Applications by Certified Professionals

1.6.4.1. Applications for Permits by Certified Professionals

1) A *Certified Professional* may apply for a *permit* on behalf of an *owner*.

1.6.4.2. Requirements for Permit

1) A *Certified Professional* who applies for a *permit* on behalf of an *owner* must comply with the requirements of Section 1.6 of this By-law.

1.6.4.3. Application Review For Permit

1) The *Chief Building Official* may issue a *permit* based upon a modified review of the drawings and other supporting documents submitted with the application for a *permit* by a *Certified Professional*.

1.6.4.4. Site Review For Permit

1) A *Certified Professional* shall carry out detailed site reviews and shall be responsible for monitoring and follow-up necessary to support the *construction* authorized by the *permit* and to support the *construction* of the entire *building*.

1.6.4.5. Refund of Permit Fees

1) Except as otherwise determined in this Article, the *Chief Building Official* may refund a portion of the fees for a *permit* issued to a *Certified Professional* for the administrative costs assumed by the applicant that would have otherwise been incurred by the *Chief Building Official.*

2) An application for a refund of *permit* fees pursuant to Sentence (1) must be submitted to the Chief Building Official in writing, within 90 days following the issuance of a final *occupancy permit*.

3) Calculation of the administrative costs pursuant to Sentence (1) shall be determined from

- a) the prevailing fee rate(s) at the time of application for the refund, and
- b) as applicable and determined in
  - i) the Schedule of Fees at the end of this Part, or
  - ii) the Schedule of Fees in the “Zoning and Development Fee By-law” currently in force and effect.

4) No refund for *permit* fees or part thereof identified pursuant to Sentence (1) shall be issued for

- a) *alterations* to *existing buildings*, or
- b) the failure to make an application pursuant to the requirements of Sentence (2).

1.6.5. Applications for Staged Construction by Certified Professionals

1.6.5.1. Requirements for Staged Construction

1) The *Chief Building Official* may issue a *permit* to construct a *building* in stages if

a) the applicant for the staged *construction* is a *Certified Professional*,
b) the *Certified Professional* also applies for permission to construct the entire *building*,
c) the *Certified Professional* submits complete plans and all supporting documents for each portion of the work for which a *permit* for staged *construction* is sought, and
d) the *Certified Professional* submits all documents required pursuant to the Certification of Professionals By-law.

1.6.5.2. Owner's Risk

1) The issuance of a staged *permit* creates no obligation on the *Chief Building Official* to issue any other staged *permits* or to issue a *permit* to construct the entire *building*.
2) An *owner* who commences *construction* of a *building* in accordance with a staged *permit* does so at the *owner's* risk.

1.6.5.3. Owner's Responsibility

1) An *owner* who fails to complete the work authorized by a *permit* for staged *construction* or who fails to comply with the conditions of a *permit* for staged *construction* shall restore the site to a safe condition, to the satisfaction of the *Chief Building Official*.

1.6.5.4. Application Review for Permit for Staged Construction

1) Where a *Certified Professional* complies with all application requirements for a *permit* for staged *construction*, the *Chief Building Official* may issue a *permit* for staged *construction* based upon a modified review of the drawings and other supporting documents submitted for the *permit* for staged *construction*.

1.6.5.5. Site Review of Staged Construction

1) Where a *permit* for staged *construction* is issued, the *Certified Professional* shall carry out detailed site reviews and shall be responsible for monitoring and follow-up necessary to support the *construction* authorized by the *permit* for staged *construction* and to support the *construction* of the entire *building*.

1.6.6. Revisions

1.6.6.1. Revisions to Applications

1) All applications for revisions to the original application shall comply with Article 1.6.2.2.
2) When revisions to the original application result in an increase in the value of the proposed work, the *Chief Building Official* shall review the valuation and recalculate the *permit* fee in accordance with this By-law.
3) When application documents are either incomplete or changed to the extent that an additional plan review is necessary, an additional revision fee shall be charged in accordance with the Fee Schedule at the end of this Part.

1.6.6.2. Minor Revisions to Permits

1) All applications for minor revisions to the original *permit* shall comply with Article 1.6.2.2. to the extent required by the *Chief Building Official*.
2) When applications for minor revisions to the original *permit* result in an increase in the value of the proposed work, the *Chief Building Official* shall review the valuation and recalculate the *permit* fee in accordance with this By-law.
3) An additional revision fee shall be charged for applications for minor revisions to the original *permit* in accordance with the Fee Schedule at the end of this Part.

1.6.7. Permit Expiry and Extension

1.6.7.1. Permit Expiry

1) Except as provided in this Subsection, a *permit* shall expire and the rights of the *owner* under the *permit* shall terminate if in the opinion of the *Chief Building Official*

a) the work authorized by the *permit* is not commenced within 6 months from the date of issue of the *permit*,

b) the work although commenced is not continuously and actively carried out thereafter, or

c) the work has been substantially discontinued for a period of 6 months. (See Note A-1.6.7.1.(1).)

2) Except as provided in this Subsection 1.6.7., a *permit* for a temporary *building* or *occupancy* shall expire and the rights of the *owner* under the *permit* shall terminate on the expiry date noted on the *permit*.

1.6.7.2. Application to *Chief Building Official* for Extension

1) An *owner* who wishes to seek an extension of a *permit* shall make application to the *Chief Building Official* prior to the expiry of the *permit*.

2) An *owner* who wishes to seek an extension of a *permit* shall submit the application in writing accompanied by the requisite extension fee.

1.6.7.3. Extension of Permit by *Chief Building Official*

1) If the *Chief Building Official* is of the opinion that substantial completion of the work has been prevented because of exceptional circumstances, the *Chief Building Official* may extend the *permit* twice only, provided that, in the meantime, no applicable amendments have been made to this By-law.

2) If the *Chief Building Official* is of the opinion that a *building* or *occupancy* is temporary, the *Chief Building Official* may extend the *permit* for a temporary *building* or *occupancy* twice only, provided that, in the meantime, no applicable amendments have been made to this By-law.

1.6.7.4. Application to Council for Extension

1) An *owner* who has been granted an extension of a *permit* by the *Chief Building Official* may make application to Council for a further extension prior to the expiry of the *permit*.

2) An *owner* who wishes to seek an extension of a *permit* from Council shall submit an application in writing to the *Chief Building Official* accompanied by the requisite extension fee.

3) The *Chief Building Official* shall forward to Council any application submitted in accordance with this section, together with information and advice to assist Council in considering the application.

1.6.7.5. Extension of Permit by Council

1) Council may extend a *permit* for such further period or periods it deems appropriate.

2) If Council grants an extension of a *permit*, the *Chief Building Official* shall endorse the further extension or extensions on the *permit*.

1.6.8. Permits for Temporary Buildings, Including Tents and Air-Supported Structures

1.6.8.1. Definition of "Temporary"

1) In this Subsection, "temporary" means for a time period not exceeding twelve consecutive months.

1.6.8.2. Compliance with By-law

1) Except as otherwise provided in this Subsection or in Section 11.6, Division B, Book 1, no person shall erect a temporary *building*, including a tent or *air-supported structure*, which does not comply with this By-law.

1.6.8.3. Permit Required

1) No person shall erect, or use or occupy a temporary *building*, including a tent or *air-supported structure* without a *permit*.

1.6.8.4. Compliance with Permit Conditions

1) No person shall erect, or use or occupy a temporary *building*, including a tent or *air-supported structure*, in contravention of the conditions of a *permit*.

1.6.8.5. Application Requirements

1) The application for a *permit* for a temporary *building*, including a tent or *air-supported structure*, shall be accompanied by

a) plans showing the location of the temporary *building*, tent or *air-supported structure* on the site, all other *existing buildings* on the same property and all other *buildings* on adjacent property located within at least 10 feet of the property line of the site,

b) *construction* details of the *building*, tent or *air-supported structure*, and

c) a statement by the *owner* indicating the intended use and intended duration of such use.

2) The application for a temporary *occupancy permit* for a tent or *air-supported structure* shall be accompanied by documentation sufficient to establish that the tent or *air-supported structure* complies with Subsection 3.1.6. of Division B of Book I (General) of this By-law.

1.6.8.6. Time Limited Permits for Temporary Buildings

1) The *Chief Building Official* may issue a *permit* authorizing the *construction*, use or *occupancy* of a temporary *building*, including a tent or *air-supported structure*, and may attach conditions to such *permit*, including conditions allowing for selective compliance with the provisions of this By-law, if the *Chief Building Official* determines that the *construction*, use or *occupancy* will exist for a short time, and the circumstances do not warrant complete compliance with this By-law.

1.6.8.7. Permit End Date

1) A *permit* for a temporary *building*, including a tent or *air-supported structure*, shall state the date after which the *permit* is no longer valid.

1.6.8.8. Permit Extension

1) A *permit* for a temporary *building*, including a tent or *air-supported structure*, may only be extended if an extension is granted by the *Chief Building Official* prior to the expiry of the *permit*.
2) An *owner* who wishes to seek an extension of a *permit* for a temporary *building* from the *Chief Building Official* shall submit an application in writing to the *Chief Building Official* accompanied by the requisite extension fee.
3) If the *Chief Building Official* is of the opinion that the temporary *building* complies with the life safety requirements of this By-law, the *Chief Building Official* may extend the *permit* once only, and the *Chief Building Official* may require documentation from *registered professionals* to verify that the requirements of this By-law are being met.

1.6.9. Operating Permits

1.6.9.1. Operating Permit Required

1) No person shall install or retain existing equipment or systems for which an *operating permit* is required under this By-law, without an *operating permit*.

1.6.9.2. Compliance with Permit Conditions

1) No person shall install or retain existing equipment or systems for which an *operating permit* is required under this By-law, in contravention of the conditions of an *operating permit*.

1.6.9.3. Application Requirements

1) To obtain an *operating permit*, the *owner* shall file an application in writing in the form prescribed by the *Chief Building Official*.

2) The application for an *operating permit* shall be accompanied by the *operating permit* fees and any documentation required by the *Chief Building Official* to verify that the requirements of this By-law are being met.

1.6.9.4. Permit Expiry

1) An *operating permit* shall expire and the rights of the *owner* under the *operating permit* shall terminate on the expiry date noted on the *operating permit*.

1.6.9.5. Operating Permit Fees

1) *Operating permit* fees are as set out in the Schedule of Fees at the end of this Part.

Section 1.7. Permission to Occupy Buildings

1.7.1. General

1.7.1.1. Occupancy Permit Required

1) Except as otherwise provided in this By-law, no person shall occupy or allow the *occupancy* of any *building* or part thereof unless the *owner* has obtained an *occupancy permit* from the *Chief Building Official*.
2) No person shall occupy any *building* for a purpose other than the *occupancy* stipulated in an *occupancy permit* issued by the *Chief Building Official*.

1.7.1.2. Occupancy Permit

(See Note A-1.7.1.2.)
1) Every *owner* shall obtain an *occupancy permit* from the *Chief Building Official* prior to any
- a) *occupancy* of a *building* or part thereof after *construction* or *alteration* of that *building*,
- b) change in the *major occupancy* of any *building* or part thereof, or
- c) change in the permitted *occupancy* within the same Division of the *major occupancy* Group, where the occupant load or the fire load has increased.

1.7.1.3. Exemptions from Occupancy Permit

1) Despite the requirements of Articles 1.7.1.1. and 1.7.1.2., an *occupancy permit* is not required for
- a) residential *building* with not more than two principal *dwelling units*, or
- b) a change in the permitted *occupancy* within the same *major occupancy* classification provided the *occupant load* is not increased and no *construction* has taken place.

1.7.1.4. Posting of Lawful Use

1) In any *building* not requiring an *occupancy permit*, the *Chief Building Official* may post a notice which describes the uses to which the *building* may be lawfully put.

1.7.2. Occupancy Permit Process

1.7.2.1. Owner's Obligation

1) An *owner* who wishes to obtain an *occupancy permit* shall file an application in the form required by the *Chief Building Official*.

1.7.2.2. Requirements for Occupancy Permit Application

1) The *permit* application requirements described in Article 1.6.2.2. do not apply to an application for an *occupancy permit* if the application includes

a) a letter from the *owner* declaring that the work complies with the By-law, the necessary *permits*, including *operating permits*, have been obtained and the *building* conforms with the accepted plans, in any case where a professional is not required by Subsection 2.2.7., Division C, Book I,
b) the appropriate letters of assurance in any case where a professional *field review* is required by Subsection 2.2.7. of Division C of Book I (General) of this By-law,
c) the anticipated date of completion,
d) the classification of the *building*,
e) the number of *storeys* in the *building*,
f) the gross *floor area* of each *storey*,
g) the allowable *live loads* for each *floor area*, and
h) an annual permit as required by the Electrical By-law.

1.7.2.3. Scheduling of Construction, Fire and Life Safety Systems Inspection

1) Prior to the issuance of an *occupancy permit*, the *owner* of a *building* shall call for and coordinate a final inspection of *construction*, fire and life safety systems in the *building*.

1.7.2.4. Requirements prior to Construction, Fire and Life Safety Systems Inspection

1) At least 24 hours prior to the final inspection for an *occupancy permit*, every *owner* shall submit to the *Chief Building Official*

a) proof of compliance with the By-law for all materials, equipment and methods of *construction*,
b) letters of assurance in the applicable forms attached as Schedules C-A and C-B, at the end of Part 2 of Division C,
c) a *contractor's* material and test certificate, certifying that the *sprinkler systems* have been flushed, inspected and tested,
d) a certificate of verification and a manufacturer's inspection report for the fire alarm system,
e) a fire safety plan and record of installed fire safety systems, conforming to the Fire By-law, and
f) a letter from a fire protection consultant verifying that the special devices or methods forming part of the alternative solution achieves the alternative solution.

1.7.2.5. Requirements during Construction, Fire and Life Safety Systems Inspection

1) During the final inspection of *construction*, fire and life safety systems in the *building*, the *owner* of the *building* shall make available

a) a copy of the fire safety plan,
b) a copy of the record of installed fire safety systems, and
c) a preventive maintenance and testing schedule and a maintenance log book for the life and fire safety systems.

1.7.2.6. Notice of Change Prior to Occupancy

1) Every *owner* shall give notice in writing to the *Chief Building Official* of any change to the *owner's* address or any change in the *ownership* of the *building* which occurs

a) prior to the issuance of an *occupancy permit*, or
b) prior to the *occupancy* of the *building*.

1.7.3. Partial Occupancy Permit for Building Under Construction

1.7.3.1. Partial Occupancy Permit

1) The *Chief Building Official* may issue a partial *occupancy permit* for part of a *building* which is under *construction* if, in the opinion of *Chief Building Official*, such partial *occupancy* would not jeopardize life or property.
2) The *Chief Building Official* may impose conditions on a partial *occupancy permit*.
3) The *Chief Building Official* may revoke a partial *occupancy permit* if the *permit* holder fails to comply with the conditions imposed by the *Chief Building Official*.

4) The *Chief Building Official* may revoke a partial *occupancy permit* if the *owner* fails to comply with any *permit* relating to the *building*.

1.7.3.2. Owner's Obligation regarding Unsafe Conditions

1) The *owner* of a *building* for which a partial *occupancy permit* has been issued shall ensure that there are no *unsafe conditions* in the *building*.

1.7.4. Temporary Occupancy Permit

1.7.4.1. Temporary Occupancy Permit

1) The *Chief Building Official* may issue a temporary *occupancy permit* for a temporary use within an *existing building*, or for the limited use of a *building* approved according to Subsection 1.6.8. or as otherwise provided in this By-law.

1.7.5. Re-Occupancy Permit

1.7.5.1. Re-occupancy Permit

1) Every *owner* shall obtain a re-*occupancy permit* from the *Chief Building Official* prior to any *occupancy* of a *building* or part thereof in respect of which the *Chief Building Official* has issued an order to cease *occupancy* due to an *unsafe condition*.

Section 1.8. Street Regulations

1.8.1. Encroachments

1.8.1.1. Encroachment Defined

1) In this Section an encroachment means a *building*, or a *building* appurtenance or fixture, including an existing areaway, a new or existing ornamental projection, awning, canopy, mechanical apparatus, or emergency *exit* apparatus, projecting in a *street*, whether above, at or below ground level.

1.8.1.2. Measurement of Encroachment

1) An encroachment shall be measured at right angles from a theoretical vertical plane located at the property line, to the outermost point of the encroachment in the *street*.

1.8.1.3. No Encroachment without Permission

1) No encroachment shall project into a *street*, unless permission has first been granted by the *City*.

1.8.1.4. Maintenance and Repair of Encroachment

1) Encroachments shall be repaired and maintained to the satisfaction of the *City Engineer* and the *Chief Building Official*.

1.8.1.5. Prohibited Encroachments

1) An encroachment shall not obstruct or interfere with

a) public utility poles or equipment,
b) firefighting equipment or fire rescue operations,
c) *street* trees or lamp standards, or
d) *street* furniture.

1.8.1.6. Compliance with Encroachment By-law

1) The *Chief Building Official* shall not issue a *permit* to construct an encroachment unless the encroachment complies with this By-law and with the Encroachment By-law.

1.8.2. Existing Encroachments

1.8.2.1. Existing Encroachments

1) An existing encroachment which complies with the Encroachment By-law and does not conform with this By-law may be continued if the encroachment is not altered.

1.8.2.2. Damage to Existing Encroachment

1) Subject to the provisions in Sentence (2), an existing encroachment which is damaged may be repaired.
2) Despite the provisions of Sentence (1) if the cost of the repair to an existing encroachment is more than 50 per cent of the current replacement cost of the damaged encroachment, the repair shall constitute a new encroachment and shall comply with the provisions of this By-law and the Encroachment By-law.

1.8.2.3. Alteration to Existing Encroachment

1) Except for signs permitted by the Sign By-law, any enlargement or *alteration* of an existing encroachment shall constitute a new encroachment and shall comply with the provisions of this By-law and the Encroachment By-law.

1.8.2.4. Signs

1) Signs permitted by the Sign By-law which encroach in a *street* shall comply with this By-law.

1.8.2.5. Door Swings

1) Except as provided in Subsection 1.8.10., doors, security gates and other moveable barriers, whether open or closed, shall not encroach in a *street*.

1.8.3. New Encroachments

1.8.3.1. Application

1) This Section applies to
- a) new encroachments, and
- b) *alterations* to existing encroachments which do not comply with the provisions of Subsection 1.8.2.

1.8.3.2. Dimensions and Clearances

1) Unless otherwise provided in this By-law, all new encroachments shall comply with the applicable *construction*, clearance and dimension requirements in Subsections 1.8.5. to 1.8.10.

1.8.3.3. Design and Construction of New Encroachments

1) A new encroachment shall be designed and constructed so that, in the event of its removal from the *building*,
the *building* will comply with the provisions of this By-law.

1.8.3.4. Compliance with By-laws

1) A new encroachment shall comply with the provisions of this By-law and the Encroachment By-law.

1.8.3.5. Encroachments in Narrow Streets

1) Unless otherwise permitted by this Section, new encroachments or encroachments which do not comply with the provisions of Subsection 1.8.2. are not permitted in a *street* which is 10 m or less in width.

1.8.4. Repair or Removal of Encroachment

1.8.4.1. Removal or Repair by Owner

1) The *owner* of a *building* which encroaches in a *street* shall repair, alter or remove the encroachment if so ordered

a) by the *Chief Building Official*, in accordance with this By-law, or
b) by the *City Engineer*, in accordance with the Encroachment By-law.

1.8.4.2. Repair of Building after Removal of Encroachment

1) Upon removal of an encroachment from a *building*, the *owner* shall promptly repair the *building* and shall ensure that the *building* complies with this By-law.

1.8.4.3. Repair of Building at Owner's Expense

1) If the *Chief Building Official* has issued an order in accordance with Article 1.8.4.1. and an *owner* has failed to
comply with that order, the *Chief Building Official* may

a) authorize *demolition* or removal of an encroachment, posting of security guards or fire wardens, or enclosure of such encroachment, *building*, *construction*, excavation or part thereof, at the expense of the *owner*,
b) recover such expense in the manner set out in this By-law, and
c) take such other measures as may be necessary to protect the public.

1.8.5. Areaways

1.8.5.1. Areaway Defined

1) In this Subsection an areaway means an existing underground *building* or *building* appurtenance, which encroaches in a *street* and forms part of or serves an adjacent *building*.

1.8.5.2. Design and Structural Requirements

1) The *Chief Building Official* shall refuse to issue a *permit* for *alteration* of an areaway unless the design has been first approved by the *City Engineer*.
2) Areaways shall be constructed with reinforced concrete walls and roofs which are capable of supporting the *street* surface, any superimposed *live loads*, surcharge loads and seismic loads, to the satisfaction of the *City Engineer*.
3) Notwithstanding Sentences (1) and (2), the provisions of Part 4, Division B, Book I of this By-law apply to the *construction* of an areaway.

1.8.5.3. Surface Construction Requirements

1) If any part of an areaway interfaces with the *street* surface, the areaway shall be

a) *noncombustible construction*,
b) constructed with solid non slip surfaces at the *street* surface interface, and
c) level with the *street* surface at the *street* surface interface.

1.8.5.4. Removal of Areaway

1) A person who wishes to remove an areaway shall

a) apply for and obtain all necessary *permits*,
b) install a cut-off wall integral to the *building*, to the satisfaction of the *Chief Building Official*,
c) waterproof the cut-off wall, to the satisfaction of the *Chief Building Official*, and
d) backfill and restore the *street* surface in accordance with the Encroachment By-law, to the satisfaction of the *City Engineer*.

1.8.6. Ornamental Projections and Existing Windows

1.8.6.1. Ornamental Projections Defined

1) In this Subsection, ornamental projections mean new and *existing building* appurtenances and fixtures which encroach in a *street*, and include

a) cornices,
b) copings, and
c) belt courses and other minor architectural trim such as water tables, column capitals and bases.

1.8.6.2. Construction

1) Except as permitted in Sentence (2), all ornamental projections, including their connections and supports, which encroach in a *street*, shall be *noncombustible construction*, and if constructed of metal, shall be no less than 0.56 mm in thickness.

2) Where roof *construction* is permitted to be of wood, the *Chief Building Official* may also permit a cornice to be of *combustible* materials, if

a) the cornice only consists of roof members cantilevered over the *street* and covered by a roof deck, and
b) the underside of the cornice is exposed, without a boxed-in soffit.

1.8.6.3. Ornamental Projections in Streets

1) For the purposes of this Article 1.8.6.3., the height of an ornamental projection shall be determined by vertical measurement from the lowest point of the encroachment to the *street* level immediately below.

2) Subject to the provisions of Sentence 1.8.6.3.(3), an ornamental projection may encroach into a *street* which is at least 10 m wide, no more than:

a) 75mm for a projection located below 2.75m above the *street*,
b) 500mm for a projection located between 2.75m and 5.2m above the *street*,
c) 915mm for a projection located between 5.2m and 7.62m above the *street*, and
d) 1370mm for a projection located more than 7.62m above the *street*.

3) The provisions of Sentence 1.8.6.3.(2) do not apply to an existing encroaching ornamental projection which is designated by by-law as protected heritage property or is the subject of a heritage revitalization agreement.

4) An ornamental projection may encroach in a *street* which is less than 10 m wide, if

a) it is located no less than 7.62 m above the *street*,
b) it does not encroach more than 915 mm beyond the property line, and
c) it does not interfere with overhead public utilities.

1.8.6.4. Existing Encroaching Windows

1) An oriel or bay window shall not encroach in a *street* except that *alterations* may be made to an existing oriel or bay window if

a) it encroaches no more than 600 mm beyond the property line,
b) it is located no less than 5.2 m above the *street*, and
c) the *street* is no less than 10 m in width.

2) The provisions of Sentence (1) do not apply to an existing encroaching oriel or bay window which is designated in accordance with a heritage designation by-law or is the subject of a heritage revitalization agreement with the *City*.

1.8.7. Awnings

1.8.7.1. Awning Defined

1) In this Subsection, an awning means a light detachable structure which encroaches in a *street* and which consists of a covering of fabric, sheet metal or other relatively flexible material on a fixed or retractable structural frame attached to and entirely supported by a *building*.

1.8.7.2. Attachments

1) No electrical wiring, illuminated device, electrical equipment or apparatus shall be attached to or incorporated in an awning, except that drive mechanisms and attachments to the structural frame required for the operation of collapsible awnings may be permitted by the *Chief Building Official*.

1.8.7.3. Structural Design

1) Except as permitted in Sentence (3), the structural frame of an awning and its connections to the supporting *building* shall be designed in conformance with Part 4 of Division B of Book I (General) of this By-law.
2) The structural frame of an awning and its connections to the supporting *building* shall be *noncombustible*.
3) A fabric covered retractable awning shall be designed to withstand wind, rain, snow, and seismic design loads applied to the closed awning.

1.8.7.4. Clearances

1) The horizontal distance from the outer edge of an awning measured to the outer face of the *street* curb shall be no less than 600 mm.
2) No portion of an awning shall be less than 2.75 m above the level of the street surface or established *building* grade, except that if the *street* surface or established building grade below the awning slopes more than 0.1 m over the length of the awning, the vertical clearance may be no less than 2.6 m, except that a soft fringe attached to the awning and made of canvas or cloth may have a clearance of no less than 2.3 m.

1.8.7.5. Combustible Material Requirements

1) *Combustible* materials used in awnings shall conform to the appropriate requirements for resistance to fire as set out in CAN/ULC-S109, "Flame Tests of Flame-Resistant Fabrics and Films", or NFPA 701, "Standard Method of Fire Tests for Flame Propagation of Textiles and Films."
2) *Combustible* materials shall not be used in an awning which is above the second *storey* of a *building*.
3) *Combustible* materials shall not be used in an awning which is attached to an exterior wall required to be of *noncombustible construction*.

1.8.7.6. Vertical Height

1) The vertical dimensions of the front and sides of an awning shall not exceed 3.65 m at any point, unless otherwise permitted by the *Chief Building Official*.

1.8.7.7. Awning Not To Span Unprotected Openings

1) An awning shall not span unprotected openings in separate fire compartments.

1.8.8. Canopies

1.8.8.1. Canopy Defined

1) In this Subsection, a canopy means a structure encroaching in a *street* that provides pedestrian weather protection and has a covering of glass, metal or other rigid material on a fixed detachable rigid frame that is attached to and entirely supported by a *building*.

1.8.8.2. Requirements for Materials

1) A canopy shall be
a) constructed of *noncombustible* materials, except as provided in Sentence (2) and Clause (3)(c),
b) supported entirely by the *building* to which the canopy is attached, and

c) constructed so that its removal conforms to Sentence 1.8.3.3.(1).

2) Despite Clause (1)(a), if the *building* or the exterior wall to which the canopy is attached is of *combustible construction*, a canopy may be constructed of *combustible* materials.

3) The deck and roof of a canopy shall be constructed of

a) wired or laminated safety glass,
b) metal no less than 0.56 mm in thickness, or
c) wood plank no less than 60 mm in thickness, sheathed on the top and the soffit with metal or other *noncombustible* material, and constructed and fire stopped to the satisfaction of the *Chief Building Official*.

1.8.8.3. Clearances

1) The vertical distance from the lowest point of a canopy to the *street* surface shall be no less than 2.75 m.

2) The horizontal distance from the outer edge of a canopy to the outer face of the *street* curb shall be no less than 750 mm.

3) A canopy shall be no less than 600 mm from an adjoining property line or from the production of the property line into the *street*, unless the canopy is constructed entirely of *noncombustible* materials.

4) Despite the provisions of Sentence (3), if a property line is adjacent to a *lane*, a canopy shall be located no less than 600 mm from the production of the property line into the *street*.

5) A canopy shall be no less than 600 mm from a utility pole or lamp standard.

1.8.8.4. Vertical Dimensions of Canopy

1) Unless otherwise accepted by the *Chief Building Official*, the vertical dimensions of the front and sides of a canopy shall not exceed 3.65 m at any point.

1.8.8.5. Canopy Not to Span Unprotected Openings

1) A canopy shall not span unprotected openings in separate fire compartments.

1.8.8.6. Canopy Drainage System

1) Unless otherwise permitted by the *Chief Building Official*, a canopy roof shall be provided with a drainage system conforming to Part 2 of Division B of Book II (Plumbing Systems) of this By-law and connected to the *building storm water* system.

2) Downpipes for canopies shall not encroach more than 75 mm in the *street*.

1.8.8.7. Structural Design of Canopies

1) A canopy shall be designed to

a) support the expected loads due to weather, and
b) withstand seismic design loads

1.8.9. Solar Shading Device

1.8.9.1. Solar Shading Device Defined

1) In this Subsection, a solar shading device means a structure encroaching in a *street*, that prevents solar heat gain through windows and has a fixed detachable rigid frame that is attached to and entirely supported by a *building.*

1.8.9.2. Requirements for Materials

1) A solar shading device shall be

a) constructed of *noncombustible* materials, except as provided in Sentence (2) and Clause (3)(c),
b) supported entirely by the *building* to which the solar shading device is attached, and
c) constructed so that its removal conforms to Sentence 1.8.3.3.(1).

2) Despite Clause (1)(a), if the *building* or the exterior wall to which the solar shading device is attached is of *combustible construction*, a solar shading device may be constructed of *combustible* materials.
3) The solar shading device shall
a) if constructed of glass, use wired or laminated safety glass,
b) if constructed of metal, shall be no less than 0.56 mm in thickness, or
c) if constructed of wood plank, shall be no less than 60 mm in thickness, sheathed on the top and the soffit with metal or other *noncombustible* material, and constructed and fire stopped to the satisfaction of the *Chief Building Official*.
4) Solar shading devices shall be of *noncombustible* construction where installed on an exposing wall face required to be *noncombustible* in accordance with Division B, Subsection 3.2.3.7.

1.8.9.3. Clearances
1) The horizontal distance from the outer edge of a solar shading device to the outer face of the *street* curb shall be no less than 600 mm.
2) For the purposes of this Article 1.8.9.3., the height of a solar shading device shall be determined by vertical measurement from the lowest point of the encroachment to the *street* level immediately below.
3) The maximum projection of a solar shading device into a *street* which is at least 10 m wide, shall be
a) 500mm for a solar shading device located between 2.75 and 5.2m above the *street*,
b) 915mm for a solar shading device located between 5.2m and 7.62m above the street, and
c) 1370mm for a solar shading device located more than 7.62m above the street except that a solar shading device must also conform to the requirements of Sentence 1.8.9.3.(1).
4) A solar shading device may encroach in a *street* which is less than 10 m wide, if
a) it is located no less than 7.62 m above the *street*,
b) it does not encroach more than 915 mm beyond the property line, and
c) it does not interfere with overhead public utilities.
5) A solar shading device shall be no less than 600 mm from an adjoining property line or from the production of the property line into the *street*, unless the solar shading device is constructed entirely of *noncombustible* materials.
6) Despite the provisions of Sentence (5), if a property line is adjacent to a *lane*, a solar shading device shall be located no less than 600 mm from the production of the property line into the *street*.

1.8.9.4. Solar Shading Device Not to Span Unprotected Openings
1) A solar shading device shall not span unprotected openings in separate fire compartments.

1.8.9.5. Structural Design of Solar Shading Device
1) A solar shading device shall be designed to
a) support the expected loads due to weather,
b) withstand seismic design loads, and
c) shed snow and ice in a manner that minimizes risk to persons and property below.

1.8.10. Mechanical Apparatus

1.8.10.1. Clearances
1) Exterior hose connections for fire-fighting equipment, ventilation intakes and outlets, *chimneys* and air conditioning units shall not encroach in a street unless permitted by the *City Engineer*.
2) Fire alarm bells and fire gongs may encroach up to 300 mm in a *street*, except that such encroachments shall be located no less than 2.6 m above the *street* surface or established *building* grade.

1.8.11. Emergency Exits

1.8.11.1. Stairways and Fire Escapes

1) The *Chief Building Official* may permit stairways and balconies for fire escapes to encroach in a *street*, except that the lowest part of such stairways and balconies shall be no less than 5.2 m above the *street* surface.

1.8.11.2. Emergency Exit Doors

1) Emergency *exit* doors may encroach no more than 300 mm in a *street* which is no less than 10 m in width.

2) Despite Sentence (1), the *City Engineer* may permit an emergency *exit* door to encroach in a *street* which is less than 10 m in width, provided that such door does not encroach more than 300 mm in the *street*.

Section 1.9. Temporary Occupancy of a Street for Construction Purposes

1.9.1. General Requirements

1.9.1.1. Permit Required Prior to Occupancy of Street

1) No person shall occupy a *street* or the air space above a *street* in connection with, or incidental to the *construction* or maintenance of any *building*, without first obtaining a *street* use *permit* from the *City Engineer*.

1.9.1.2. Permit Required Prior to Excavation in Street

1) No person shall excavate or backfill any part of a *street* without first obtaining a *street* use *permit* from the *City Engineer*.

1.9.1.3. Liability Disclaimer

1) An application for a *street* use *permit* shall contain an undertaking by the *owner* to save harmless the *City* against all claims, liabilities, judgments, costs and expenses in consequence of, or in any way incidental to the granting of such *permit*, in a form satisfactory to the Director of Legal Services.

1.9.2. Overhead Construction

1.9.2.1. Permit Required for Overhead Construction

1) No person shall cause a swing scaffold or *construction* hoisting device to occupy the air space above a *street* without first obtaining a *street* use *permit* from the *City Engineer*.

1.9.2.2. Prevention of Public Entry

1) The *street* under a swing scaffold or *construction* hoisting device shall be fenced, roped off or otherwise protected against public entry to the satisfaction of the *City Engineer*.

1.9.3. Public Safety

1.9.3.1. Construction Site Protection of the Public Required

1) No person shall construct, alter or repair any *building* unless fencing, boarding, barricades or covered walkways as required by Part 8 of Division B of Book I (General) of this By-law have first been erected on or adjacent to the *street*, to the satisfaction of the *Chief Building Official*.

2) The *Chief Building Official* may modify the requirements of Sentence (1) if satisfied that the location of the *construction* is sufficiently protected or remote from areas frequented by the public.

1.9.3.2. Permit Required for Fencing, Boarding, Barricades or Covered Walkways

1) No person shall erect fencing, boarding, barricades or covered walkways on a *street*, without first obtaining a *street* use *permit* from the *City Engineer*.

Section 1.10. Addressing Buildings and Parcels of Land

1.10.1. Address Numbering System

1.10.1.1. Numeric Addresses

1) Addressing of *buildings*, *suites* within a *building* or parcels of land shall be numeric.

1.10.1.2. East/West Addresses

1) East/West addresses shall run in series, commencing with the unit block and increasing in numeric value in a westerly direction from the west side of Ontario Street or the west side of Carrall Street and commencing with the unit block and increasing in numeric value in an easterly direction from the east side of Ontario Street or the east side of Carrall Street.

2) *Buildings* on the north side of *streets* running in an east or west direction shall have odd numbers, and *buildings* on the south side of such *streets* shall have even numbers.

1.10.1.3. North/South Addresses

1) North/South addresses shall run in series, commencing with the unit block and increasing in numeric value in a northerly direction from the north side of Dundas Street and commencing with the unit block and increasing in numeric value in a southerly direction from the south side of Dundas Street.

2) *Buildings* on the west side of *streets* running in a north or south direction shall have odd numbers, and *buildings* on the east side of such *streets* shall have even numbers.

1.10.1.4. Multiple Suite Addresses

1) Where a *building* with a non-continuous *public corridor* or direct exterior access contains multiple addressable *suites*, addresses of *suites* on *floor areas* shall be assigned in an increasing numeric order commencing from the point of entry as determined by the *Chief Building Official* and moving in a direction as determined by the *Chief Building Official*.

2) Where a *building* with a continuous *public corridor* contains multiple addressable *suites*, addresses of *suites* on *floor areas* shall be assigned in an increasing numeric order commencing from the point of entry as determined by the *Chief Building Official* and moving in a direction as determined by the *Chief Building Official*.

1.10.1.5. Principal Buildings

1) Except is permitted by Sentence (2), every *building,* or substantive portion of a *building* that is provided with a separate exterior principle access designed such that it will function as a separate and distinct entity, on a site shall be assigned a separate numeric *street* address where sufficient numeric street addresses are available.

2) In the case where there is an insufficient number of numeric street addresses available, the Chief Building Official may assign the same street number to one or more adjacent buildings on a site provided

- a) that suite numbers are assigned between the affected buildings in a simple and logical manner that makes the location of each suite self-evident,
- b) sufficient and clear signage is provided and visible on approach so as to make clear what sequence of suite number assignment is,
- c) a principle fire department access *acceptable* to the Chief Building Official and the fire department will be provided to the site, and
- d) a graphic map is provided at the principle fire department access that shows the location of each of the buildings and suites.

1.10.1.6. Exterior Principal Suite Entry

1) Every *suite* with an exterior principal entry shall be assigned a separate numeric *street* address.

2) Where sufficient numeric *street* addresses are not available for every *suite* with an exterior principal entry, an additional *suite* number shall be assigned to every *suite*.

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE E-1

Building Permit No. ______________

Forming Part of Subsection 1.4.1 Div. C of the
Building By-law

OWNER'S UNDERTAKING

Notes:

i) This letter must be submitted after completion of the project but before the *occupancy permit* is issued *or* a final inspection is made, by the *Chief Building Official.*

ii) This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C.

iii) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

Re: ____
Name of Project (Print)

____
Address of Property (Print)

In consideration of the *City* accepting and processing an application for a *building permit* for the *project* identified above, and as required by the Building By-law, the following representations, warranties and indemnities are given to the *City* by the *owner*.

1. ***[If an individual is the owner]***

   ( ) I am the *owner* of the above property.

   or

   [If a corporation is the owner]

   ( ) ______________________________ is the *owner* of the above property

   (Name of Corporation)

2. The *owner* will comply with and cause those employed for this project to comply with all applicable by-laws of the *City* and other statutes and regulations in force in the *City* relating to the development, work, undertaking or permission in respect of which this letter is submitted.

3. The *owner* fully understands the requirements herein, and acknowledges responsibility for carrying out the work, or gives assurance that the work will be carried out, in accordance with all by-laws governing the *construction* of the *building*. The *owner* understands and acknowledges that the issuance of any permit, including an *occupancy permit*, or the inspection or approval or passage of work by the *City*, is not a representation or warranty that any by□law has been complied with and the *owner* remains responsible at all times for compliance. The *owner* has read and understands Article 1.3.2.1. and Article 1.4.1.5. of Division C Book I and Book II of the Building By-law, which are set out below.

4. The owner hereby agrees to indemnify and save harmless the City and its employees from all claims, liability, judgments, costs and expenses of every kind including negligence which may result from the failure to comply fully with all by-laws, statutes and regulations relating to any work or undertaking in respect of which this letter is submitted.

5. Where the words "work" or "undertaking" are used herein, the owner understands this to include all trade work, including but not limited to: electrical, plumbing, mechanical, gas and other works necessary to complete the contemplated construction.

6. I am authorized to give these representations, warranties, assurances and indemnities to the City.

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

Schedule E– 1 *Continued*

Building Permit No.______________

[Where the owner is an individual]

____
Owner's Signature

____
Owner's Name (Print)

____
Date

____
Phone No. and Email address

Signed, sealed and delivered in the presence of:

____
Witness Signature

____
Witness's Name (Print)

____
Date

____
Witness's address

[Where the owner is a corporation]

____
Name of Corporation

____
Per: Authorized Signatory

____
Name (Print)

____
Date

____
Phone No. and Email address

Signed, sealed and delivered in the presence of:

____
Witness Signature

____
Witness's Name (Print)

____
Witness's address

____
Date

Referenced Articles *below*

Building By-law, Division C, Article 1.3.2.1 Intent

1) This By-Law sets standards in the general public interest. It is enacted and retained on the understanding and specifically expressed condition that it creates no duty whatsoever on the City, the Chief Building Official or any employee of the City to enforce its provisions, and on the further condition that a failure to administer or enforce its provisions, or the incomplete or inadequate administration or enforcement of its provisions, shall not give rise to a cause of action in favour of any person whatsoever. The issuance of any permit, including an occupancy permit, is not a representation, warranty or statement that this By-Law or any other enactment has been complied with, and the issuance thereof in error shall not give rise to a cause of action. Accordingly, words in this By-law defining the responsibilities and authority of the Chief Building Official shall be construed as internal administrative directions which do not create a duty.

Building By-law, Division C, Article 1.4.1.5. Compliance with By-law and other enactments

1) The *owner* shall comply with this By-law and all other applicable enactments.

2) The *owner* shall ensure that all work, *construction*, or *occupancy* is carried out in accordance with this By-law and all other applicable enactments.

3) The *owner* shall ensure that the *occupancy* of a *building* or part of a *building* complies with the *occupancy permit*.

4) The issuance of a *permit*, the acceptance of plans and supporting documents submitted for a *permit*, or the making of inspections by the *Chief Building Official* shall not relieve the *owner* of a *building* from the full responsibility for carrying out the work or having the work carried out in accordance with this By-law and all other applicable enactments.

5) The *owner* shall ensure that all underground storage tanks on the subject property that are intended for the storage of heating oil but have not been used for over 2 years are removed and any associated contamination is remediated to the applicable standards as prescribed in the Contaminated Sites Regulation. All work must be completed in accordance with the requirements of the Vancouver Fire By-law.

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE E-2

Forming Part of Subsection 1.4.1, Div. C of the Building Bylaw

Building Permit No. ______________

Project Address ______________

OWNER'S AND TENANTS UNDERTAKING

[to be used when a tenant is carrying out the project]

To: The *Chief Building Official*

Re: ______________________________
Name of Project (Print)

____
Address of Property (Print)

In consideration of the *City* accepting and processing an application for a *building permit* for the *project* identified above, and as required by the Building By-law, the following representations, warranties and indemnities are given to the *City* by the *owner* and by the tenant.

1. ***[If an individual is the owner]***

   ( ) I am the *owner* of the above property.

   or

   [If a corporation is the owner]

   ( ) ______________________ is the *owner* of the above property.
   (Name of Corporation)

   [If an individual is the tenant]

   ( ) I am the *owner* of the above property.

   or

   [If a corporation is the tenant]

   ( ) ______________________ is the *owner* of the above property.
   (Name of Corporation)

2. The *owner* and the tenant will comply with and cause those employed for this project to comply with all applicable by-laws of the *City* and other statutes and regulations in force in the *City* relating to the development, work, undertaking or permission in respect of which this letter is submitted.

3. The *owner* and the tenant fully understands the requirements herein, and acknowledges responsibility for carrying out the work, or gives assurance that the work will be carried out, in accordance with all by-laws governing the *construction* of the *building*. The *owner* understands and acknowledges that the issuance of any permit, including an *occupancy permit*, or the inspection or approval or passage of work by the *City*, is not a representation or warranty that any by‑law has been complied with and the *owner* remains responsible at all times for compliance. The *owner* has read and understands Article 1.3.2.1. and Article 1.4.1.5. of Division C Book I and Book II of the Building By-law, which are set out below.

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

Schedule E– 2 *Continued*

Building Permit No.

Project Address

4. The owner and the tenant hereby agree to indemnify and save harmless the City and its employees from all claims, liability, judgments, costs and expenses of every kind including negligence which may result from the failure to comply fully with all by-laws, statutes and regulations relating to any work or undertaking in respect of which this letter is submitted.

5. Where the words "work" or "undertaking" are used herein, the owner and the tenant understand this to include all trade work, including but not limited to: electrical, plumbing, mechanical, gas and other works necessary to complete the contemplated construction.

6. The owner and the tenant are authorized to give these representations, warranties, assurances and indemnities to the City.

Owner's signature

[Where the owner is an individual]

Owner's Signature

Owner's Name (Print)

Date

Phone No. and Email address

Signed, sealed and delivered in the presence of:

Witness Signature

Witness's Name (Print)

Date

Witness's address

[Where the owner is a corporation]

Name of Corporation

Per: Authorized Signatory

Name (Print)

Date

Phone No. and Email address

Signed, sealed and delivered in the presence of:

Witness Signature

Witness's Name (Print)

Witness's address

Date

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

Schedule E– 2 *Continued*

Building Permit No

Project Address

Tenant's Signature

[Where the owner is an individual]

Signed, sealed and delivered in the presence of:

Owner's Signature	Witness Signature
Owner's Name (Print)	Witness's Name (Print)
Date	Date
Phone No. and Email address	Witness's address

[Where the owner is a corporation]

Signed, sealed and delivered in the presence of:

Name of Corporation	Witness Signature
Per: Authorized Signatory	Witness's Name (Print)
Name (Print)	Witness's address
Date	Date

Referenced Articles *below*

Building By-law, Division C, Article 1.3.2.1 Intent

1) This By-Law sets standards in the general public interest. It is enacted and retained on the understanding and specifically expressed condition that it creates no duty whatsoever on the City, the Chief Building Official or any employee of the City to enforce its provisions, and on the further condition that a failure to administer or enforce its provisions, or the incomplete or inadequate administration or enforcement of its provisions, shall not give rise to a cause of action in favour of any person whatsoever. The issuance of any permit, including an occupancy permit, is not a representation, warranty or statement that this By-Law or any other enactment has been complied with, and the issuance thereof in error shall not give rise to a cause of action. Accordingly, words in this By-law defining the responsibilities and authority of the Chief Building Official shall be construed as internal administrative directions which do not create a duty.

Building By-law, Division C, Article 1.4.1.5. Compliance with By-law and other enactments

1) The *owner* shall comply with this By-law and all other applicable enactments.

2) The *owner* shall ensure that all work, *construction*, or *occupancy* is carried out in accordance with this By-law and all other applicable enactments.

3) The *owner* shall ensure that the *occupancy* of a *building* or part of a *building* complies with the *occupancy permit*.

4) The issuance of a *permit*, the acceptance of plans and supporting documents submitted for a *permit*, or the making of inspections by the *Chief Building Official* shall not relieve the *owner* of a *building* from the full responsibility for carrying out the work or having the work carried out in accordance with this By-law and all other applicable enactments.

5) The *owner* shall ensure that all underground storage tanks on the subject property that are intended for the storage of heating oil but have not been used for over 2 years are removed and any associated contamination is remediated to the applicable standards as prescribed in the Contaminated Sites Regulation. All work must be completed in accordance with the requirements of the Vancouver Fire By-law.

Schedule of Fees

PART A – BUILDING

1. The fees hereinafter specified shall be paid to the City with respect to and upon the application for the issue of a PERMIT as follows:

(a) Except as provided for in Clause (b) for the CONSTRUCTION of any BUILDING, or part thereof:
When the estimated cost of the work, being the valuation referred to in Article 1.6.2.3. of Book I, Division C
and Book II, Division C of this By-law, does not exceed $5,000 or for the first $5,000 of the estimated cost of the work **$158.00**
For each $1,000, or part thereof, by which the estimated cost of the work exceeds $5,000 but does not exceed $50,000 .... **$10.10**
For each $1,000, or part thereof, by which the estimated cost of the work exceeds $50,000 .... **$5.10**

(b) For the installation, CONSTRUCTION, re- construction, ALTERATION or repair of, or ADDITION to:
(i) any CHIMNEY, FIREPLACE, INCINERATOR, VENTILATING SYSTEM, AIR- CONDITIONING .. SYSTEM, or HEATING SYSTEM, the fee shall be in accordance with Clause (a), except that a fee shall not be charged when the cost of such work is less than $500
(ii) any PHOTOVOLTAIC PANELS, and related roof ALTERATION or repair........ **$100.00**

(c) For a permit for temporary OCCUPANCY of a part of a STREET, or of the AIR SPACE immediately ABOVE a part of a STREET, in accordance with Section 1.9. of Book I, Division C and Book II, Division C
of this By-law, the daily fee shall be for each 10 m^2 or part thereof, of STREET or of AIR SPACE part thereof, of STREET or of AIR SPACE immediately above such STREET to be occupied **$3.20**
Subject to a minimum fee of........ **$110.00**
Flat fee for each portable toilet........ **$110.00**

(d) For an OCCUPANCY PERMIT not required by this By-law but requested........ **$228.00**

(e) For the demolition of a BUILDING, not including a ONE-FAMILY DWELLING, which has at any time since November 1, 1986 provided RESIDENTIAL OCCUPANCY, subject to Section 3:
For each DWELLING UNIT **$1,150.00**
For each sleeping room in a multiple conversion dwelling, hotel or other BUILDING, which is or has been a principal dwelling or residence of a person, family or household........ **$1,150.00**

(f) For the demolition of a ONE-FAMILY DWELLING, which has at any time since November 1, 1986 provided RESIDENTIAL OCCUPANCY, subject to Section 3 .... **$1,150.00**

(g) For the repair of building walls pursuant to requirements of Book I, Division B, Part 5 for any residential building........ **Nil**

2. The fees hereinafter specified shall be paid to the City as follows:

(a) For a required permit inspection for compliance with this By-Law which cannot be carried out during normal working hours and where there is a request to carry out the inspection after hours, the fee to be based on the time actually spent in making such inspection, at a minimum inspection time of four (4) hours, including traveling time:
For each hour or part thereof........ **$311.00**

(b) For a plan review where an applicant requests in writing that the review be carried out during overtime:
For each hour or part thereof **$311.00**

(c) For each special inspection of a BUILDING or structure to determine compliance with this By-law, and in respect of which no specific fee is otherwise prescribed, the fee to be based on the time actually spent in making the inspection:
For each hour or part thereof **$206.00**

(d) For each REINSPECTION made necessary due to faulty work or materials or incomplete work requested to be inspected **$206.00**

(e) For each inspection of a drainage tile system:
For a one- or two-family residence **$212.00**
For all other drain tile inspections:
When the estimated cost of the CONSTRUCTION of the BUILDING, being the valuation referred to in Article 1.6.2.3. of Book I, Division C and Book II, Division C does not exceed $500,000 .... **$414.00**
When the estimated cost of the work exceeds $500,000 but does not exceed $1,000,000 ..... **$827.00**
When the estimated cost of the work exceeds $1,000,000 .... **$1,034.00**

(f) For the special search of records pertaining to a BUILDING to advise on the status of .... outstanding orders and other matters concerning the BUILDING:
For a residential *building* containing not more than 2 principal *dwelling units* **$265.00**
For all other BUILDINGS **$532.00**

(g) To access plans (electronic or on microfilm) or documents for viewing or copying **$45.10**

(h) For each microfilm image or electronic file copied **$12.40**

(i) For a request to renumber a BUILDING **$984.00**

(j) For the extension of a BUILDING PERMIT where requested in writing by an applicant pursuant to Article 1.6.7.1. of Book I, Division C and Book II, Division C ....
.... 50% of the original BUILDING PERMIT fee to a maximum of **$380.00**

(k) For the extension of a building permit by Council where requested in writing by an applicant pursuant to Article 1.6.7.4. of Book I, Division C and Book II, Division C **$2,490.00**

(l) For an evaluation of plans, specifications, building materials, procedures or design methods for the purpose of revisions to an application or a permit in accordance with Article 1.5.2.13. and Section 1.6.6. of Book I, Division C and Book II, Division C
where the PERMIT relates to a ONE-FAMILY DWELLING or a SECONDARY SUITE **$206.00**
plus for each hour, or part thereof, exceeding one hour **$206.00**
where the PERMIT relates to any other BUILDING **$623.00**
plus for each hour, or part thereof, exceeding one hour **$311.00**

(m) For each RE-OCCUPANCY PERMIT after rectification of an UNSAFE CONDITION and related By-law violations **$379.00**

(n) For review of plans, specifications, building materials, procedures or design methods for the purpose of acceptance of an alternative solution for new construction under Article 2.3.2.1. of Book 1, Division C for each application **$871.00**

(o) For an evaluation of plans, specifications, building materials, procedures or design methods for the purpose of acceptance of existing conditions with mitigating features, for each application ... **$498.00**

(p) For review by the alternative solution review panel **$2,790.00**

(q) For the evaluation of a resubmission or revised submission made under Clauses (n) or (o) of this Section 2........ **$311.00**

3. Upon written application of the payor and on the advice of the Acting General Manager of Community Services, the Director of Finance shall refund to the payor, or a designate of the payor, the fees paid pursuant to Clauses (e) and (f) of Section 1:

(a) for all demolished dwelling units in a building that will be replaced by a social housing or co-operative development that has received a Project Commitment Letter from the British Columbia Housing Management Commission or the Canada Mortgage and Housing Corporation; and

(b) for each demolished dwelling unit that has been replaced by a dwelling unit occupied by rental tenants and not created pursuant to the Strata Property Act.

PART B - PLUMBING

Every applicant for a Plumbing PERMIT shall, at the time of application, pay to the City the fees set out hereunder:

1. INSTALLATIONS

For the Installation of:

One, two or three FIXTURES	**$206.00**
Each additional FIXTURE	**$64.70**

Note: For the purpose of this schedule the following shall also be considered as FIXTURES:

- Every "Y" intended for future connection;
- Every ROOF DRAIN, swimming pool, dishwasher, and interceptor;
- Every vacuum breaker in a lawn sprinkler system; and
- Every back-flow preventer

Alteration of Plumbing (no FIXTURES involved):

For each 30 m of piping or part thereof	**$302.00**
For each 30 m of piping or part thereof, exceeding the first 30 m	**$84.00**
Connection of the City water supply to any hydraulic equipment	**$114.00**

2. INSPECTIONS OF FIRELINE SYSTEMS:

Hydrant & Sprinkler System:

First two inspections for each 30 m of water supply pipe or part thereof	**$302.00**
Each additional inspection for each 30 m of water supply pipe or part thereof	**$124.00**

Sprinklers:

First head, one- or two-family dwelling	**$344.00**
First head, all other buildings	**$731.00**
First head, renovations to existing sprinkler systems	**$213.00**
Each additional head, all buildings (no limit on number)	**$3.80**

Firelines:

Hose Cabinets	**$39.80**
Hose Outlets	**$39.80**
Wet & Dry Standpipes	**$39.80**
Standpipes	**$39.80**
Dual Check Valve In-flow Through Devices	**$39.80**
Backflow Preventer	**$206.00**

Wet & Dry Line Outlets:

Each connection	**$39.80**

NOTE: A Siamese connection shall be considered as two dry line outlets.

Each Fire Pump	**$321.00**
Each Fire Hydrant	**$99.00**

3. REINSPECTIONS

For each REINSPECTION made necessary due to faulty work or materials or incomplete work requested to be inspected	**$206.00**

4. SPECIAL INSPECTIONS

Each inspection to establish fitness of any existing fixture for each hour or part thereof	**$206.00**
An inspection outside normal working hours and at a minimum inspection time of four (4) hours, including traveling time, for each hour or part thereof	**$311.00**

5. BUILDING SEWER INSPECTIONS

First two inspections for each 30 m of BUILDING SEWER or part thereof	**$302.00**
Each additional inspection for each 30 m of BUILDING SEWER or part thereof	**$124.00**

PART C – OPERATING PERMITS

Every applicant for an OPERATING PERMIT shall, at the time of application, pay to the City the fee set out hereunder:

For each OPERATING PERMIT $00.00

Notes to Part 1
Administrative Provisions

This Appendix is included for explanatory purposes only and does not form Part of the requirements except as defined in Division A Sentence 1.1.3.1.(1). The numbers that introduce each Appendix Note correspond to the applicable requirements in this Division.

A-1.3.3.5. Unsafe Conditions Although words such as alteration, occupancy, building and unsafe conditions are defined in Article 1.4.1.2. of Division A, such words as removal and relocation contained here and in the definitions are adequately defined in dictionaries and need not be defined herein.

A-1.3.3.6. Work on Public Property The appropriate government authority may be federal, provincial or city, depending on the nature of the public property.

A-1.3.3.7. Changes in Ground Elevation and Limiting Distance If a new or existing building is built as close to a boundary line as the regulations permit, moving the property boundary could result in contravention of the By-law in regards to spatial separations. In those circumstances, this Subsection would not apply.

A-1.4.1.10. Project Directory This Subsection requires the owner to inform the Chief Building Official of changes in responsibilities of certain employees. It is not intended to limit the owner's right to change the constructor, engineer, architect or inspection or testing agency, but rather to let the building official know of any such change so that construction will not be held up because of any misunderstanding as to who is responsible. See Letters of Assurance at the end of Part 2 of Division C.

A-1.4.1.15. Tests to Establish Compliance Where a manufacturer, fabricator or erector is required to conform to specified requirements, such as those referenced by Articles 4.3.1.2. and 4.3.3.1. of Division B, Book I, it is intended that proof of such compliance be filed with the Chief Building Official. See Letters of Assurance at the end of Part 2 of Division C.

A-1.4.1.19.(1) Uncovering Work The requirement to uncover and replace work will normally apply only if Article 1.4.1.17. has not been complied with, that is, if work requiring inspection has been covered prematurely. Complete uncovering may not be necessary. Here, again, the judgment of the designated official is required to determine if partial uncovering, test holes or similar actions will be sufficient to indicate compliance, the purpose being to promote compliance not to penalize the constructor.

A-1.6.2.2. Application Requirements In addition to the information required by this provision, further information is required by Subsection 2.3.4. of Division C, Structural and Foundation Drawings and Calculations, and Subsection 2.3.5. of Division C, Heating, Ventilating, Air-Conditioning and Energy Utilization Drawings and Specifications.

A-1.6.7.1.(1) Permit Expiry The owner must provide documentation to establish that the work has not been substantially discontinued for 6 months.

A-1.7.1.2. Occupancy Permit An occupancy permit is required for a temporary occupancy.

Part 2
Administrative Provisions

Section 2.1. Application

2.1.1. Application

2.1.1.1. Application

1) This Part applies to all *buildings* covered in this By-law. (See Article 1.1.1.1. of Division A.)

Section 2.2. Administration

2.2.1. Administration

2.2.1.1. Conformance with Administrative Requirements

1) This By-law is made pursuant to Section 306 of the Vancouver Charter.

2.2.1.2. Structural Design

1) Except as required in Sentence (2), for a design carried out in accordance with Part 4 of Division B, the *designer* shall be a *registered professional* skilled in the work concerned. (See Note A-2.2.1.2.(1).)

2) For the design of a Part 3 Division B *building*, carried out in accordance with Part 4 of Division B, the designer
shall be a *registered professional* designated by the Association of Professional Engineers and Geoscientists of British
Columbia as a *Designated Structural Engineer (Struct. Eng.)* and shall

a) assume overall responsibility for the design work and field reviews of the primary structural components of a
building that falls within the scope of Article 1.3.3.2. of Division A of Division A,

b) apply his or her professional (P.Eng.) seal and Struct. Eng. stamp, sign and date the plans and supporting
documents prepared by, or under the supervision of the *Designated Structural Engineer*, and

c) apply his or her professional (P.Eng.) seal and Struct. Eng. stamp and sign and date the Letters of Assurance
described in Subsection 2.2.7.

2.2.2. Information Required for Proposed Work

2.2.2.1. General Information Required

1) Sufficient information shall be provided to show that the proposed work will conform to this By-law and whether or not it may affect adjacent property.

2) Plans shall be drawn to scale and shall indicate

a) the nature and extent of the work or proposed *occupancy* in sufficient detail to establish that, when completed, the work and the proposed *occupancy* will conform to this By-law,

b) the applicable edition of the By-law,

c) whether the *building* is designed under Part 3 or Part 9,

d) the *major occupancy* classifications of the *building*,

e) the *building area* and *building height*,

f)the number of *streets* the *building* faces,

g) the *accessible* entrances, work areas and washrooms, and
h) the *accessible* facilities particular to the *occupancies*.

3) When proposed work is changed during construction, information on the changes shall comply with the requirements of this Section for proposed work.

2.2.2.2. Site Plans

1) Site plans shall be referenced to an up-to-date survey and, when required to prove compliance with this Code, a copy of the survey shall be provided.

2) Site plans shall show

a) by dimensions from property lines, the location of the proposed *building*,
b)the similarly dimensioned location of every adjacent existing *building* on the property,
c)existing and finished ground levels to an established datum at or adjacent to the site,
d)the access routes for firefighting, and
e)the *accessible* paths of travel to the *building* from
i) the sidewalk, roadway or *street*, and
ii) if provided, exterior parking stalls for *persons with disabilities* and exterior passenger-loading zones, and
f) the exterior entrances and key plan for each *storey* indicating the location and number of *suites*.

2.2.2.3. Information Required on Building Plans for Addressing Purposes

1) Architectural floor plans provided for addressing purposes shall

a) measure 280 mm by 430 mm,
b) identify the location and designated *street* number of the principal entrance of a *building* and the location and designated *suite* number of all interior and exterior *suite* entrances.

2.2.3. Fire Protection and Plumbing Components

2.2.3.1. Information Required for Fire Protection Components

1) Information shall be submitted to show the major components of fire protection including

a) the division of the *building* by *firewalls*,
b) the *building area*,
c) the degree of *fire separation* of *storeys*, shafts and special rooms or areas, including the location and rating of *closures* in *fire separations*,
d) the source of information for *fire-resistance ratings* of elements of construction (to be indicated on large-scale sections),
e) the location of *exits*, and
f) fire detection, suppression and alarm systems.

2.2.3.2. Plans of Sprinkler Systems

1) Before a sprinkler system is installed or altered, plans showing full details of the proposed sprinkler system and essential details of the *building* in which it is to be installed shall be drawn to an indicated scale.

2.2.3.3. Information Required on Plumbing Drawings and Related Documents

1) If the *Chief Building Official* requires an application for a permit in respect of *plumbing systems*, plumbing drawings and related documents submitted with the application shall show

a) the location and *size* of every *building drain* and of every *trap* and *cleanout* fitting that is on a *building drain*,
b) the *size* and location of every *soil-or-waste pipe*, *trap* and *vent pipe*, and
c) a layout of the *potable water distribution system*, including pipe *sizes* and valves.

2.2.4. Structural and Foundation Drawings and Calculations

2.2.4.1. Application

1) This Subsection applies only to *buildings* covered in Part 4 of Division B. (See Article 1.3.3.2. of Division A.)

2.2.4.2. Professional Seal and Signature of Designer

1) Structural drawings and related documents submitted with the application to build shall be dated and shall bear the authorized professional seal and signature of the *designer* as defined in Sentence 2.2.1.2.(1).

2.2.4.3. Information Required on Structural Drawings

1) Structural drawings and related documents submitted with the application to build shall indicate, in addition to those items specified in Article 2.2.4.6. and in Part 4 of Division B applicable to the specific material,

a)the name and address of the person responsible for the structural design,
b) the date of issue of the By-law and standards to which the design conforms,
c) the dimensions, location and size of all structural members in sufficient detail to enable the design to be checked,
d) sufficient detail to enable the *dead loads* to be determined, and
e) all effects and loads, other than *dead loads*, used for the design of the structural members and exterior cladding.

2.2.4.4. Drawings of Parts or Components

1) Structural drawings of parts or components including *guards* designed by a person other than the *designer* of the *building* shall be dated and shall bear the authorized professional seal and signature of the *designer* of such parts or components.

2.2.4.5. Design Calculations and Analysis

1) The calculations and analysis made in the design of the structural members, including parts and components, of a *building* shall be available for inspection upon request.

2.2.4.6. Information Required on Foundation Drawings

1) Foundation drawings submitted with the application to build or excavate shall be provided to indicate

a) the type and condition of the *soil* or *rock*, as well as the *groundwater* conditions, as determined by the *subsurface investigation*,
b) the factored bearing pressures on the *soil* or *rock*, the factored loads when applicable and the design loads applied to *foundation units*, and
c) the earth pressures and other loads applied to the supporting structures of supported *excavations*.

2) When required, evidence that justifies the information on the drawings shall be submitted with the application to excavate or build.

2.2.4.7. Altered Conditions

1) Where conditions as described under Sentences 4.2.2.4.(1) and (2) of Division B are encountered, or where *foundation units* or their locations are altered, this information shall be recorded on appropriate drawings or new “as constructed” drawings.

2.2.5. Drawings and Specifications for Environmental Separators and Other Assemblies Exposed to the Exterior

2.2.5.1. Application

1) This Subsection applies to building materials, components and assemblies to which Part 5 of Division B applies. (See Article 1.3.3.2. of Division A.)

2.2.5.2. Information Required on Drawings and Specifications

1) Information shown on drawings and in specifications shall be clear and legible, and shall contain sufficient details to demonstrate conformance with this By-law. (See Note A-2.2.6.2.(1).)

2.2.6. Heating, Ventilating and Air-conditioning Drawings and Specifications

2.2.6.1. Application

1)This Subsection applies only to *buildings* covered in Part 6 of Division B. (See Article 1.3.3.2. of Division A.)

2.2.6.2. Information Required on Drawings

1)The information shown on architectural drawings and on drawings for heating, ventilating and air-conditioning systems shall be clear and legible and shall contain all necessary details to demonstrate conformance with this By-law. (See Note A-2.2.6.2.(1).)

2.2.7. Professional Design and Review

(See Note A-2.2.7.)

2.2.7.1. Application

1) The requirements of this Subsection apply to

a) *buildings* within the scope of Part 3 of Division B,

b) *buildings* within the scope of Part 9 of Division B that are designed with common egress systems for the occupants and require the use of *firewalls* according to Article 1.3.3.4. of Division A, and

c) the following, in respect of *buildings* within the scope of Part 9 of Division B other than *buildings* described in Clause (b),

i) structural components that are not within the scope of Part 9 of Division B (See Note A-2.2.7.1.(1)(c)(i).),

ii) geotechnical conditions at *building* sites that are not within the scope of Part 9 of Division B,

iii) sprinkler systems designed to NFPA 13, “Installation of Sprinkler Systems”, NFPA 13R, “Installation of Sprinkler Systems in Low-Rise Residential Occupancies”, or NFPA 13D, “Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes”, and

iv) standpipe and hose systems designed to NFPA 14, “Installation of Standpipe and Hose Systems”,

d) a *building* that is designed according to Article 1.3.3.5. of Division A,

e) a *building* that is within the scope of Part 5 of Division B,

f) *additions* which are subject to Part 11 of Division B, and

g) a change of *major occupancy* which is subject to Part 11 of Division B.

2.2.7.2. Responsibilities

1) Before the construction of or the *alteration* to a *building*, the owner shall

a) retain a *coordinating registered professional* to coordinate all design work and *field reviews* of the *registered professionals of record* required for the project in order to ascertain that (See Note A-2.2.7.2.(1)(a).)

i) the design will substantially comply with the Building By-law and other applicable *City* By-laws, and

ii) the construction of the project will substantially comply with the Building By-law and other applicable enactments respecting safety, not including the construction safety aspects, and

b) if a *building* permit is required, deliver to the *Chief Building Official* letters in the forms set out in Schedules A and B, and (See the end of Division C and Note A-2.2.7.2.(1)(a) and (b).)

c) provide reasonable and timely written notice of any work or excavation that would directly or indirectly affect private property adjacent to the excavation site, to the *owner* of the affected property, and deliver a copy of the notice to the *Chief Building Official*. (See Note A-2.2.7.2.(1)(c).)

2) If an occupancy permit or final inspection from an *Chief Building Official* is required and before an owner occupies or receives permission to occupy the *building*, the owner or *coordinating registered professional* shall deliver to that authority letters in the forms set out in Schedules C-A and C-B (See the end of Division C and Note A-2.2.7.2.(2).)

2.2.7.3. Registered Professional Responsibilities

(See Note A-2.2.7.3.)

1) A *registered professional of record* who signs a letter, the form of which is set out in a Schedule to this Subsection, and an owner who signs or has an agent sign a letter the form of which is set out in a Schedule to this Subsection, shall comply with this Subsection, Part 1, and the provisions of the letter that apply to the person signing.

2) A *registered professional of record* or *coordinating registered professional* who is responsible for a *field review* shall keep a record of the *field review* and of any corrective action taken as a result of the *field review* and shall submit monthly summary reports to the Chief Building Official.

3) A *registered professional of record* who is retained to undertake design work and *field reviews* and who is required to provide letters pursuant to Clause 2.2.7.2.(1)(b) shall

a) place his or her professional seal or stamp on the plans submitted by him or her in support of the application for a *building* permit, after ascertaining that they substantially comply with the Building By-law and other applicable enactments respecting safety,

b) provide to the *Chief Building Official* a letter in the form of Schedule C-B (See the end of Division C) after ascertaining that the components of the project for which the *registered professional of record* is responsible are constructed so as to substantially comply, in all material respects, with

i) the plans and supporting documents prepared by the *registered professional of record*, and

ii) the requirements of the Building By-law and other applicable enactments respecting safety, not including construction safety aspects.

2.2.7.4.

1) An owner must not terminate the appointment of a *coordinating registered professional* or *registered professional of record* unless

a) the owner immediately replaces the *coordinating registered professional* or *registered professional of record*, or

b) the owner has complied with Clause (1)(b) and Sentence (2) of Article 2.2.7.2. by delivering letters in the forms set out in Schedule A, B, C-A and C-B, as applicable, to the *Chief Building Official*.

2) In respect of a project to which this Subsection applies,

a) if the *coordinating registered professional* ceases to be retained at any time before the completion of the project, both the owner and the *coordinating registered professional* shall notify the *Chief Building Official*, and

b) if a *registered professional of record* ceases to be retained at any time before the completion of the project, both the *coordinating registered professional* and the *registered professional of record* shall notify the *Chief Building Official*.

3) Notification under Sentences (1) and (2) shall be made,

a) if possible, before the *coordinating registered professional* or *registered professional of record*, as the case may be, ceases to be retained, or

b) if advance notice is not possible, as soon as possible.

2.2.7.5. Reserved.

2.2.8. Deleted.

2.2.9. Buildings on Designated Flood Plains

2.2.9.1. Exemptions from Flood Construction Level Requirements

1) *Flood construction level requirements* do not apply to:

a) *alteration* of an *existing building*, not including reconstruction as defined in this By-law. (See A-11.2.1.2. of Div C),

b) *alteration* of an *existing building* to increase the *building area* by less than 25 per cent of the total *building area* existing as of July 29, 1999, if

i) the number of *dwelling units* is not increased,

ii) there is no further encroachment into setbacks required by this By-law, and

iii) there is no further reduction in the *flood construction level*,

c) enclosed parking areas, including bicycle and residential storage areas, in a multiple dwelling, if there is

i) an unobstructed non-mechanized means of pedestrian ingress and egress to the areas, above the *flood construction level*, and

ii) a sign posted at all entry points warning of the risk of flood damage,

d) *buildings* and portions of *buildings* used as a carport or garage,

e) non-residential accessory *buildings*, and

f) loading facilities used for water oriented industry.

2.2.9.2. Design Considerations on Designated Flood Plains

1) For *buildings* constructed on *designated flood plains*, the *building* designer shall comply with by-law requirements
regarding *construction* materials and service equipment installations below *flood construction level requirements*, to the
satisfaction of the *Chief Building Official*. (See Article 1.5.2.11. of Division C.)

2.2.9.3. Construction Considerations on Designated Flood Plains

1) For *buildings* constructed on *designated flood plains*, *construction* of the *buildings* to *flood construction level requirements* shall be achieved, to the satisfaction of the *Chief Building Official*, by

a) the structural elevation of the floor system of the *building*

b) the use of adequately compacted fill, or

c) a combination of structural elevation and compacted fill.

2) No person shall install furnaces, electrical switchgear, electrical panels, fire protection systems or other fixed *building* services susceptible to flood damage, below the *flood construction level*, unless such services are protected from flood damage and accessible for servicing during a flood, to the satisfaction of the *Chief Building Official*.

3) No person shall store hazardous or toxic substances below the *flood construction level*.

4) All piping, wiring and conduit penetrations shall be water stopped and sealed to prevent water seepage into the *building*.

2.2.9.4. Setback Requirements on Designated Flood Plains

1) Subject to the provisions of this By-law, no *building*, structural support or fill shall be constructed or located within

a) 30 m of the *natural boundary* of the Fraser River,

b) 15 m of the *natural boundary* of Burrard Inlet, English Bay or False Creek,

c) 5 m of the *natural boundary* of Still Creek,

d) 7.5 m of any structure erected for flood protection or seepage control, or

e) in the case of a *building*, structural support, or fill located on a bluff in a *designated flood plain*, where the toe of the bluff is subject to erosion or is closer than 15 m from the *natural boundary*, a setback measuring 3.0 times the height of the bluff as measured from the toe to the crest of the bluff.

2.2.9.5. Increase of Flood Construction Level and Setback Requirements on Designated Flood Plains

1) The *Chief Building Official* may increase the *flood construction level requirements* or the setback requirements in this By-law if, in the opinion of the *Chief Building Official*, a higher *flood construction level* or a greater setback is necessary as the result of a site-specific geological or hydrological feature.

2.2.9.6. Relaxation of Flood Construction Level and Setback Requirements on Designated Flood Plains

1) The *Chief Building Official* may relax the *flood construction level requirements* in this By-law in accordance with Article 1.5.2.11., if

a) the *owner* demonstrates to the satisfaction of the *Chief Building Official*, that, due to existing site characteristics and the location of existing infrastructure, it is impractical to meet the *flood construction level requirements*,

b) the *owner* demonstrates to the satisfaction of the *Chief Building Official*, the proposed *construction* methods are designed to mitigate flood damage, and

c) the *owner* provides a report, to the satisfaction of the *Chief Building Official*, stamped by a professional engineer, certifying that the habitable space in the *building* will be safe during a flood if a lower *flood construction level* is applied.

2) The *Chief Building Official* may relax the setback requirements in this By-law in accordance with Article 1.5.2.11., if

a) the *owner* demonstrates to the satisfaction of the *Chief Building Official*, that, due to existing site characteristics and the location of existing infrastructure, it is impractical to meet the setback requirements,

b) if considered necessary by the *Chief Building Official*, the *owner* agrees to construct erosion protection works to mitigate flood damage and erosion, and

c) the *owner* provides a report, to the satisfaction of the *Chief Building Official*, stamped by a professional engineer, certifying that the habitable space in the *building* will be safe during a flood if a reduced setback requirement is applied.

Section 2.3. Alternative Solutions

2.3.1. Alternative Solutions

(See Note A-2.3.1.)

2.3.1.1. Application

1) For the purposes of Clause 1.2.1.1.(1)(b) of Division A, on written request by the owner of a *building* or an authorized agent of that owner, the *Chief Building Official* shall accept a measure as an alternate solution to an acceptable solution for the building if satisfied that

a) the measure will achieve at least the level of performance required by Clause 1.2.1.1.(1)(b) of Division A, and

b) the acceptable solution does not expressly require conformance to a provincial enactment other than the Building By-law.

2.3.1.2. Documentation

1) The *Chief Building Official* may require a person requesting the use of an alternative solution to provide documentation to demonstrate that the proposed alternative solution will achieve at least the level of performance required by Clause 1.2.1.1.(1)(b) of Division A.

2) The documentation referred to in Sentence (1) shall include

a) a Code analysis outlining the analytical methods and rationales used to determine that a proposed alternative solution will achieve at least the level of performance required by Clause 1.2.1.1.(1)(b) of Division A, and

b) information concerning any special maintenance or operational requirements, including any *building* component commissioning requirements, that are necessary for the alternative solution to achieve compliance with the By-law after the *building* is constructed.

3) The Code analysis referred to in Clause (2)(a) shall identify the applicable objectives, functional statements and acceptable solutions, and any assumptions, limiting or restricting factors, testing procedures, engineering studies or performance parameters that will support a Code compliance assessment.

4) The Code analysis referred to in Clause (2)(a) shall include information about the qualifications, experience and background of the person or persons taking responsibility for the design.

5) The information provided under Sentence (3) shall be in sufficient detail to convey the design intent and to support the validity, accuracy, relevance and precision of the Code analysis.

6) Where more than one person is responsible for the design of a *building* or facility that includes a proposed alternative solution, the person requesting the use of the alternative solution shall identify a single person to co-ordinate the preparation of the design, Code analysis and documentation referred to in this Article.

2.3.1.3 Alternative Solution Expiry

1) The Chief Building Official may rescind a request or application made pursuant to the requirements of this Subsection if in the opinion of the *Chief Building Official*

a) there has been no substantial progress or activity by the owner of a *building* or an authorized agent of that owner to demonstrate that the level of performance specified by Clause 1.2.1.1.(1)(b) of Division A will be achieved,

b) the work to install measures describe in the alternative solution although commenced is not continuously and actively carried out thereafter, or

c) the work to install measures describe in the alternative solution has been substantially discontinued for a period of 6 months.

2.3.2. Additional Requirements for Fire and Life Safety Alternative Solutions

2.3.2.1. Design Criteria

1) Alternative solutions, as described in Article 2.3.1.2., shall be based upon an *acceptable* report sealed by an *acceptable registered professional* and provided to the *Chief Building Official*, which shall include

a) a thorough description of the *building*,

b) an analysis of the *building* that identifies all deviations from the requirements of this By-law,

c) the life safety principles considered in developing the proposed alternative solutions and their rationale, based upon NRC fire research reports and other approved agencies where applicable,
d) a proposal for alternative solutions,
e) an evaluation of the proposed alternative solutions based upon generally recognized studies,
f) evidence of reliable performance of the proposed alternative solutions,
g) a method of monitoring the design of the proposed alternative solutions, and
h) a commitment to perform field review of the proposed alternative solutions.

2) The report described in Sentence (1) shall be sufficiently detailed to permit evaluation of the proposed alternative solutions.

3) Upon acceptable of a proposed alternative solution by the *Chief Building Official*, the *registered professional* who has placed their seal on the report shall
a) submit a letter to the *Chief Building Official*, assuring that the alternative solution, as installed, will perform as represented in the report, and
b) at the request of the *Chief Building Official*, submit an acceptable field commissioning and testing report.

2.3.3. Alternative Solution Review Panel

2.3.3.1. Request for Review by Alternative Solution Review Panel

1) An applicant may apply to the *Chief Building Official* to request the appointment of an alternative review panel to review an alternative solution application.

2) An applicant who requests the appointment of an alternative review panel must pay the fees set out in the Fee Schedule.

3) At the request of the applicant, the *Chief Building Official* may appoint an alternative solution review panel of up to three experts to review the alternative solution application, to hear from the applicant and *City* staff and to advise the applicant and the *Chief Building Official* regarding the proposed solution.

4) A decision of an alternative solution review panel is not binding on the *Chief Building Official*.

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE A

Forming Part of Sentence 2.2.7.2.(1), Div. C of the Building By-law

Building Permit No: ______________
(for Building Official's use)

CONFIRMATION OF COMMITMENT BY OWNER AND COORDINATING REGISTERED PROFESSIONAL

Notes:

i) This letter must be submitted before issuance of a building permit.
ii) This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C.
iii) In this letter the words in italics have the same meaning as in the Building By-law.

Re: Design and *Field Review* of *Construction* by a *Coordinating Registered Professional*

To: The *Chief Building Official*

Re: ______________________________
Name of Project (Print)

____
Address of Project (Print)

____

The undersigned has retained ______________________________ as a *coordinating registered professional* to coordinate the design work and *field reviews* of the *registered professionals of record* required[1] for this project. The *coordinating registered professional* shall coordinate the design work and *field reviews* of the *registered professionals of record* required for the project in order to ascertain that the design will substantially comply with the Building By-law and other applicable enactments respecting safety and that the construction of the project will substantially comply with the Building By-law and other applicable enactments respecting safety, not including the construction safety aspects.

"*field reviews*" are defined in the Building By-law to mean those reviews of the work

(a) at a project site of a development to which a *building* permit relates, and

(b) where applicable, at fabrication locations where *building* components are fabricated for use at the project site

that a *registered professional* in his or her professional discretion considers necessary to ascertain whether the work substantially complies in all material respects with the plans and supporting documents prepared by the *registered professional of record* for which the *building* permit is issued.

The *owner* and the *coordinating registered professional* have read Subsection 2.2.7, Division C of the Building By-law. The *owner* and the *coordinating registered professional* each acknowledge their responsibility to notify the *Chief Building Official* of the date the *coordinating registered professional* ceases to be retained by the *owner* before the date the *coordinating registered professional* ceases to be retained or, if that is not possible, then as soon as possible. The *coordinating registered professional* acknowledges the responsibility to notify the *Chief Building Official* of the date a *registered professional of record* ceases to be retained before the date the *registered professional of record* ceases to be retained or, if that is not possible, then as soon as possible.

[1] It is the responsibility of the *coordinating registered professional* to ascertain which *registered professionals* are required, and to initial each Schedule B prior to submission to the *Chief Building Official*.

1 of 2

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE A - continued

Building Permit No. ______________
(for Building Official's use)

____
Project Address

The *owner* and the *coordinating registered professional* understand that where the *coordinating registered professional* or a *registered professional of record* ceases to be retained at any time during *construction*, work on the above project will cease until such time as

(a) a new *coordinating registered professional* or *registered professional of record*, as the case may be, is retained, and

(b) a new letter in the form set out in Schedule A or in the forms set out in Schedules B, as the case may be, is filed with the *Chief Building Official*.

The undersigned *coordinating registered professional* certifies that he or she is a *registered professional* as defined in the Building By-law, and agrees to coordinate the design work and *field reviews* of the *registered professionals of record* required for the project as outlined in the attached Schedules B including coordination and integration of functional testing of fire protection and life safety systems. (See A-2.2.7.3 in Appendix A.)

Coordinating Registered Professional

____
Coordinating Registered Professional's Name (Print)

____
Address (Print)

____

____
Phone No. and Email address

Professional's Seal and Signature

Owner

____
Owner's Name (Print)

____
Address (Print)

____

____
Name of Agent or Signing Officer if applicable (Print)

____
Date

____
Owner's or Owner's appointed agent's Signature.
(If *owner* is a corporation the signature of a signing officer must be given here. If the signature is that of the agent, a copy of the document that appoints the agent must be attached.)

Certified Professional's Seal and Signature (if applicable)

(If the *Coordinating Registered Professional* is a member of a firm, complete the following.)

I am a member of the firm ______________________________
(Print name of firm)

and I sign this letter on behalf of the firm.

This letter must be signed by the *owner* or the *owner's* appointed agent and by the *coordinating registered professional*. An agent's letter of appointment must be attached. If the *owner* is a corporation, the letter must be signed by a signing officer of the corporation and the signing officer must set forth his or her position in the corporation.

The Building By-law defines a *registered professional* to mean

(a) a person who is registered or licensed to practise as an architect under the Architects Act, or

(b) a person who is registered or licensed to practise as a professional engineer under the Engineers and Geoscientists Act.

2 of 2

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE B

Forming Part of Sentence 2.2.7, Div. C of the Building By-law

Building Permit No:______________
(for Building Official's use)

ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW

Notes:

- I) This letter must be submitted prior to the commencement of *construction* activities of the components identified below. A separate letter must be submitted by each *registered professional of record.*
- II) This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C.
- III) In this letter the words in italics have the same meaning as in the Building By-law.

Professional's Seal and Signature

To: The *Chief Building Official*

Re: ____
Name of Project (Print)

____
Address of Project (Print)

____

Certified Professional's Seal and Signature
(if applicable)

The undersigned hereby gives assurance that the design of the
(Initial those of the items listed below that apply to this registered professional of record. All the disciplines will not necessarily be employed on every project.)

___________ **ARCHITECTURAL**
___________ **STRUCTURAL**
___________ **MECHANICAL**
___________ **PLUMBING**
___________ **FIRE SUPPRESSION SYSTEMS**
___________ **ELECTRICAL**
___________ **GEOTECHNICAL — temporary**
___________ **GEOTECHNICAL — permanent**

components of the plans and supporting documents prepared by this *registered professional* in support of the application for the *building permit* as outlined below substantially comply with the Building By-law and other applicable enactments respecting safety except for *construction* safety aspects.

The undersigned hereby undertakes to be responsible for *field reviews* of the above referenced components during *construction* as indicated on the "SUMMARY OF DESIGN AND FIELD REVIEW REQUIREMENTS" below.

____
CRP's Initials

1 of 4

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE B - continued

Building Permit No.____________
(for Building Official's use)

____
Project Address

____
Discipline

The undersigned also undertakes to notify the *Chief Building Official* in writing as soon as possible if the undersigned's contract for *field review* is terminated at any time during *construction*.

I certify that I am a *registered professional* as defined in the Building By-law.

Coordinating Registered Professional

____
Coordinating Registered Professional's Name (Print)

____
Address (Print)

____

____
Phone No. and Email address

(If the *Coordinating Registered Professional* is a member of a firm, complete the following.)

I am a member of the firm ________________________________

and I sign this letter on behalf of the firm. (Print name of firm)

Note: This letter must be signed by the *owner* or the *owner's* appointed agent and by the *coordinating registered professional*. An agent's letter of appointment must be attached. If the *owner* is a corporation, the letter must be signed by a signing officer of the corporation and the signing officer must set forth his or her position in the corporation.

The Building By-law defines a *registered professional* to mean

(a) a person who is registered or licensed to practise as an architect under the Architects Act, or
(b) a person who is registered or licensed to practise as a professional engineer under the Engineers and Geoscientists Act.

____
CRP's Initials

2 of 4

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE B - continued

Building Permit No.____________
(for Building Official's use)

____
Project Address

____
Discipline

SUMMARY OF DESIGN AND FIELD REVIEW REQUIREMENTS

(Initial applicable discipline below and cross out and initial only those items not applicable to the project.)

______ **ARCHITECTURAL**

1.1 Fire resisting assemblies
1.2 *Fire separations* and their continuity
1.3 *Closures*, including tightness and operation
1.4 Egress systems, including *access to exit* within *suites* and *floor areas*
1.5 Performance and physical safety features (guardrails, handrails, etc.)
1.6 Structural capacity of architectural components, including anchorage and seismic restraint
1.7 Sound control
1.8 Landscaping, screening and site grading
1.9 Provisions for firefighting access
1.10 *Access* requirements for *persons with disabilities*
1.11 Elevating devices
1.12 Functional testing of architecturally related fire emergency systems and devices
1.13 Development Permit and conditions therein
1.14 Interior signage, including acceptable materials, dimensions and locations
1.15 Review of all applicable shop drawings
1.16 Interior and exterior finishes
1.17 Dampproofing and/or waterproofing of walls and slabs below *grade*
1.18 Roofing and flashings
1.19 Wall cladding systems
1.20 Condensation control and cavity ventilation
1.21 Exterior glazing
1.22 Integration of building envelope components
1.23 Environmental separation requirements (Part 5)
1.24 Building envelope, Part 10 requirements (ASHRAE, NECB, ZEBP, etc)

______ **STRUCTURAL**

2.1 Structural capacity of structural components of the *building*, including anchorage and seismic restraint
2.2 Structural aspects of *deep foundations*
2.3 Review of all applicable shop drawings
2.4 Structural aspects of unbonded post-tensioned concrete design and construction

______ **MECHANICAL**

3.1 HVAC systems and devices, including high *building* requirements where applicable
3.2 *Fire dampers* at required *fire separations*
3.3 Continuity of *fire separations* at HVAC penetrations
3.4 Functional testing of mechanically related fire emergency systems and devices
3.5 Maintenance manuals for mechanical systems
3.6 Structural capacity of mechanical components, including anchorage and seismic restraint
3.7 Review of all applicable shop drawings
3.8 Mechanical systems, Part 10 requirements (ASHRAE, NECB, ZEBP, etc)

____
CRP's Initial

2 of 2

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE C-A

Building Permit No: ______________

(for Building Official's use)

Forming Part of Sentence 2.2.7.2.(1), Div. C of the Building By-law

ASSURANCE OF COORDINATION OF PROFESSIONAL FIELD REVIEW

Notes:

I) This letter must be submitted after completion of the project but before the *occupancy permit* is issued *or* a final inspection is made, by the *Chief Building Official.*

II) This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C.

III) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

____

Name of Jurisdiction (Print)

Re: ______________________________

Name of Project (Print)

____

Address of Project (Print)

(The *coordinating registered professional* shall complete the following:)

____

Name (Print)

____

Address (Print)

____

Phone No. and Email address (Print)

I hereby give assurance that

a) I have fulfilled my obligations for coordination of *field reviews* of the *registered professionals of record* required for the project as outlined in Subsection 2.2.7, Division C of the Building By-law and in the previously submitted Schedule A, "CONFIRMATION OF COMMITMENT BY OWNER AND BY COORDINATING REGISTERED PROFESSIONAL,"

b) I have coordinated the functional testing of the fire protection and life safety systems to ascertain that they substantially comply in all material respects with

  i) the applicable requirements of the Building By-law and other applicable enactments respecting safety, not including construction safety aspects, and

  ii) the plans and supporting documents submitted in support of the application for the *building* permit,

c) I am a *registered professional* as defined in the Building By-law.

(If the *registered professional* is a member of a firm, complete the following:)

I am a member of the firm ______________________________ (Print name of firm)
and I sign this letter on behalf of the firm.

Note: The above letter must be signed by a *coordinating registered professional*, who is also a *registered professional*. The Building By-law defines a *registered professional* to mean

a) a person who is registered or licensed to practise as an architect under the Architects Act, or

b) a person who is registered or licensed to practise as a professional engineer under the Engineers and Geoscientists Act.

1 of 1

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE C-B

Building Permit No: ____________
(for Building Official's use)

Forming Part of Sentence 2.2.7.2, Division C of the Building By-law

ASSURANCE OF PROFESSIONAL FIELD REVIEW AND COMPLIANCE

Notes:

i) This letter must be submitted after completion of the project but prior to final inspection by the *Chief Building Official*. A separate letter must be submitted by each *registered professional of record*.

ii) This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C.

iii) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

____
Name of Jurisdiction (Print)

Re: ______________________________
Name of Project (Print)

____
Address of Project (Print)

(The *coordinating registered professional* shall complete the following:)

____
Name (Print)

____
Address (Print)

____
Phone No. and Email address (Print)

I hereby give assurance that

a) I have fulfilled my obligations for coordination of *field reviews* as outlined in Subsection 2.2.7, Division C of the Building By-law and in the previously submitted Schedule B, "ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW, and

b) I have coordinated the functional testing of the fire protection and life safety systems to ascertain that they substantially comply in all material respects with

   i) the applicable requirements of the Building By-law and other applicable enactments respecting safety, not including construction safety aspects, and

   ii) the plans and supporting documents submitted in support of the application for the *building* permit,

c) I am a *registered professional* as defined in the Building By-law.

(If the *registered professional* is a member of a firm, complete the following:)

I am a member of the firm ______________________________
and I sign this letter on behalf of the firm. (Print name of firm)

Note: The above letter must be signed by a *registered professional of record*, who is a *registered professional*. The Building By-law defines a *registered professional* to mean

a) a person who is registered or licensed to practise as an architect under the Architects Act, or

b) a person who is registered or licensed to practise as a professional engineer under the Engineers and Geoscientists Act.

1 of 1

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE C-D

Forming Part of Section 5.1, Division B of the Building By-law

Building Permit No: ____________

COMPLETION OF BUILDING ENVELOPE PROFESSIONAL REVIEW

Notes:

- i) This letter must be submitted after the completion of the project at final inspection.
- ii) This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C.
- iii) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

RE: ______________________________

Address of Project (Print)

The undersigned *Building Envelope Professional* has been retained with respect to the above referenced *project*, and gives a commitment of responsibility for *Building Envelope Professional* design review and enhanced *field review* for components and assemblies as required **in Article 5.1.2.2. in Part 5 of Division B**, of the Building By-law, and as the *Building Envelope Professional* in their professional discretion considers to be necessary, for the *project* designed by,

____

Name of *registered professional* signing for 'Architectural' items of Schedule B letters (Print)

who is providing the *Chief Building Official* with Schedule B 'ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW' letter covering 'Architectural' items. The undersigned will sign and provide copies of all reports to the *registered professional* responsible for 'Architectural' items, and copies of these reports shall also be available on site, for review by the City of Vancouver District Building Inspector. The undersigned undertakes to notify the *Chief Building Official* in writing as soon as practical if their contract is terminated at any time.

____

Name (Print)

____

Address of (Print)

____

City Postal Code

____

Telephone (Print) Email

(If the *Building Envelope Professional* is a member of a firm, complete the following.)

I am a member of the firm; ______________________________ and I sign this letter on behalf of the firm.

(Print Name of Firm)

NOTE: The above letter must be signed by a *Building Envelope Professional*. The Building By-Law defines a *Building Envelope Professional* to mean a person who is a member of the Architectural Institute of British Columbia or the Association of Professional Engineers and Geoscientists of British Columbia.

____

CRP's Initials

1 of 1

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE D

Forming Part of Sentence 2.2.7.2.(1), Div. C of the Building By-law

Building Permit No:______________

(for Building Official's use)

COMMITMENT FOR BUILDING ENVELOPE PROFESSIONAL REVIEW

Notes:

i) This letter must be submitted before issuance of a building permit.
ii) This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C.
iii) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

RE: ____

Address of Project (Print)

The undersigned *Building Envelope Professional* has been retained with respect to the above referenced *project*, and gives a commitment of responsibility for *Building Envelope Professional* design review and enhanced *field review* for components and assemblies as required **in Article 5.1.2.2. in Part 5 of Division B**, of the Building By-law, and as the *Building Envelope Professional* in their professional discretion considers to be necessary, for the *project* designed by,

____

Name of *registered professional* signing for 'Architectural' items of Schedule B letters (Print)

who is providing the *Chief Building Official* with Schedule B 'ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW' letter covering 'Architectural' items. The undersigned will sign and provide copies of all reports to the *registered professional* responsible for 'Architectural' items, and copies of these reports shall also be available on site, for review by the City of Vancouver District Building Inspector. The undersigned undertakes to notify the *Chief Building Official* in writing as soon as practical if their contract is terminated at any time.

____

Name (Print)

____

Address of (Print)

____

City Postal Code

____

Telephone (Print) Email

(If the *Building Envelope Professional* is a member of a firm, complete the following.)

I am a member of the firm; ____________________________ and I sign this letter on behalf of the firm.

(Print Name of Firm)

NOTE: The above letter must be signed by a *Building Envelope Professional*. The Building By-Law defines a *Building Envelope Professional* to mean a person who is a member of the Architectural Institute of British Columbia or the Association of Professional Engineers and Geoscientists of British Columbia.

____

CRP's Initials

1 of 1

Notes to Part 2 Administrative Provisions

A-2.2.1.2.(1) Structural Design. Part 4 of Division B is written on the assumption that structural design will be carried out by a registered professional who is qualified to perform such design. Sentence 2.2.1.2.(1) is not intended to imply that a registered professional may not also be required in the application of requirements in other Parts of the Building By-law.

A-2.2.6.2.(1) Information Required on Drawings and Specifications. Examples of information that should be shown on architectural drawings and drawings for heating, ventilating and air-conditioning systems are:

(a) the name, type and location of the building,
(b) the name of the owner,
(c) the name of the architect,
(d) the name of the engineer or designer,
(e) the north point,
(f) the dimensions and height of all rooms,
(g) the intended use of all rooms,
(h) the details or description of the wall, roof, ceiling and floor construction, including insulation,
(i) the details or description of the windows and outside doors, including the size, weatherstripping, storm sashes, sills and storm doors,
(j) the size and continuity of all pipes, ducts, shafts, flues and fire dampers,
(k) the location, size, capacity and type of all principal units of equipment,
(l) the size, shape and height of all chimneys and gas vents,
(m) the size and location of all combustion air and ventilation openings, and
(n) the location and fire-resistance rating of required fire separations.

A-2.2.7. Professional Design and Review. This Subsection provides for the use of what are generally called Letters of Assurance. The letters themselves, known as Schedules A, B, C-A and C-B and located at the end of Division C, are intended to put on paper the responsibilities of the owner and the various registered professionals in a construction project. The Letters of Assurance do not impose any additional responsibilities on the registered professionals nor are they intended to alter the roles and responsibilities of the authorities having jurisdiction.

The Schedules have been very carefully scrutinized by the City of Vancouver, Province of British Columbia, Union of BC Municipalities, Building Officials' Association of British Columbia, Architectural Institute of British Columbia, Engineers & Geoscientists British Columbia and their respective legal counsel. The precise wording in the letters is extremely critical and must not be modified. Any notations on these Schedules which are absolutely necessary to suit a particular project must be clearly and legibly marked in ink on the copies.

It is typical that the registered professional responsible for the design is also responsible for the field review. There are instances where this is not the case and having a different registered professional doing the field reviews is unavoidable. Schedule C-B requires that the registered professional who provides the field review provide assurance that the building as finally constructed is in substantial conformance with the By-law. In the event that another registered professional is to provide field review, the field reviewer takes on the responsibility to confirm that the construction substantially complies with the plans and supporting documents that were submitted for the building permit. The responsibility for code compliance of the design remains with the original registered professional who undertook the design. In this event, the Schedule C-B must be modified by the field reviewer by crossing out and initialing Clause (b)(i) and providing the effective transition date.

Note that Schedules A, B, C-A & C-B, as required by Subsection 2.2.7., must be signed, sealed and submitted to the *Chief Building Official*, as applicable for each specific project. Conditional or qualified Schedules are not typically acceptable. Any fire and life safety issue relative to the Schedule B disciplines is to be remedied before the

Schedules C-A / C-B are released, not accommodated by conditions or qualifications placed on the Schedule or by any attached document. See the Guide to Letters of Assurance, available from the Building and Safety Standards Branch Web site, for more details.

A-2.2.7.1.(1)(c)(i) Structural Components. The reference to "structural components of buildings that fall within the scope of Part 4" includes the situation where a building is classified under Part 9 due to its size and occupancy but also contains some structural components (such as beams supporting concentrated loads) which must be designed under Part 4. In this situation only Schedules B and C-B for the structural components are required. Schedule A and Schedules B, C-A and C-B relating to non-structural components are not required.

A-2.2.7.2.(1)(a) Coordinating Registered Professional. The coordinating registered professional is responsible to ascertain that all Code related aspects which are relevant to the project are clearly identified by each of the registered professionals in the collection of Schedules B. If a registered professional of record has crossed out any item on their Schedule B, the coordinating registered professional must confirm this item is not applicable to the project or resolve the issue with the registered professional of record.

A-2.2.7.2.(1)(b) Schedule B. The purpose of Schedule B is to clearly identify the appropriate registered professional of record who has the overall responsibility in each discipline for compliance with the various By-law related aspects of the project. Detailed design of certain building components may be undertaken by other registered professionals. The registered professional of record is responsible for monitoring the design work and field review of the other registered professionals within their discipline for components listed in Schedule B. In the event that the other registered professionals provide design and field review, the registered professional of record must be satisfied that such design and field reviews have been performed and is responsible for Schedule C-B.

A-2.2.7.2.(1)(c) Shoring Works in Street or Lane Where shoring works are proposed to be left in the street and/or lane permanently, an application for the proposal should be made by the owner to the City Engineer. Where the City Engineer is satisfied as to the safety and advisability of the proposal, the City Engineer may approve the basis on which the shoring works may be allowed to remain.

A-2.2.7.2.(2) Schedule C-A. Schedule C-A provides confirmation that the coordinating registered professional has completed the obligation to coordinate the various registered professionals engaged in the project. It also confirms that the testing of the interrelated fire and life safety systems, such as fire alarms and sprinklers, has been completed and the systems function as intended.

A-2.2.7.3. Demonstration of the Coordinated Fire and Life Safety Systems. The design drawings and supporting documents must clearly indicate all essential details of the Coordinated Fire and Life Safety Systems prior to the construction of or the alteration to a building. Demonstration of the proper, integrated operation of the Fire and Life Safety Systems must be conducted prior to occupancy.

Note that Schedules A, B, C-A & C-B, as required by Subsection 2.2.7., must be signed and sealed and submitted to the *Chief Building Official*, as appropriate for each specific project.

The following is an example of the steps required to coordinate the installation and testing of fire and life safety systems in buildings.

1.0. General

Referencing Schedule B:

- Item No. 1.14 "Functional Testing of Architecturally Related Fire Emergency Systems and Devices,"
- Item No. 3.4 "Functional Testing of Mechanically Related Fire Emergency Systems and Devices,"
- Item No. 4.5 "Functional Testing of Plumbing Related Fire Emergency Systems and Devices,"

• Item No. 5.14 "Functional Testing of Fire Suppression Systems and Devices," and
• Item No. 6.3 "Functional Testing of Electrical Related Fire Emergency Systems and Devices."
The Coordinating Registered Professional (CRP) and Registered Professionals of Record (RPRs) must demonstrate that the Fire and Life Safety Systems' design has been coordinated prior to the issuance of the Building Permit. That is, the CRP/RPRs must accumulate and submit the necessary documentation, such as:
• complete drawings,
• schedules,
• schematic diagrams,
• a fire alarm system sequencing description showing coordination between mechanical and electrical fire protection and life safety systems,
• mechanical fire protection and life safety schematic riser diagrams,
• an electrical fire alarm riser diagram,
• a motor data list coordinated with fire alarm system sequencing, and
• other documentation, as appropriate,
to demonstrate that the interface of the Fire and Life Safety Systems has been designed and coordinated so that when built correctly they will function as an integrated system. Further, it is intended that when the construction of the Fire & Life Safety Systems is indicated by the Contractor to be complete, the RPRs/CRP witness the demonstration of the testing of the Fire and Life Safety Systems to confirm compliance that the as-built systems function as intended by the design.

The required list of items will depend on the simplicity or complexity of the Project. The following is a comprehensive list of items for Fire and Life Safety Systems for a complex project, which must be coordinated in order to demonstrate compliance:

Notes: *It is the responsibility of the Coordinating Registered Professional (CRP) and Registered Professionals of Record (RPRs) to determine the best method of "How To" demonstrate to the Chief Building Official (CBO) that the Fire and Life Safety Systems have been coordinated for each project. That is, the method(s) used (i.e., charts, drawings, matrices, tables, etc.) for demonstration purposes should be project-specific and relate only to that project.*

It is not the intent of this Appendix material to dictate or produce "checklists" or other prescriptive methods for demonstrating compliance since this is best left to the professional discretion of the appropriate CRP/RPRs.

2.0. Design Phase — Building Permit Application Stage & Final Construction Phase — Occupancy Permit Application Stage

2.1. Fire Protection and Life Safety Systems

2.1.1. Automatic Sprinkler Systems
• design requirements to appropriate Standard

2.1.2. Standpipe Systems
• design requirements to appropriate Standard
• Class I/Class II
• locations
• coverage
• F.D. connections

2.1.3. Fire Pump Systems

• design requirements to appropriate Standard

2.1.4. Fire Alarm Systems
• one/two stage system(s)
• no. of systems
• design requirements to appropriate Standard
• sequence of operation
• F.A. system zoning
• location of F.A. system devices
• annunciator panel (location and design criteria)
• annunciator panel shop drawings (detail design)
• sprinkler zone/waterflow device
• smoke detectors
• smoke alarms
• manual pull stations
• signals to Fire Department via an acceptable central monitoring station
• activation of ancillary devices

2.1.6. Emergency Telephone System
• each exit stair

2.1.7. Emergency Power
• design requirements to appropriate Standard
• supervisory provisions for fire alarm
• emergency electrical load
• emergency generator

2.1.8. Emergency Lighting
• exits
• access to exits
• public corridors
• other floor areas

2.1.9. Exit Signs

2.2. Additional Requirements for High Buildings

2.2.1. Interface Condition between Highrise and Lowrise Components (Measure 'N' Vestibules)

2.2.2. Smoke Control — Measure A
• design requirements to appropriate Standard
• venting above-grade stairs
• separation of above-grade and below-grade stairs
• venting below-grade stairs
• pressurization of below-grade stairs at bottom
• above-grade elevator shaft serving below-grade protected with a "protected" vestibule
• additional controls at CACF (annunciator panel shop drawings)

2.2.3. Smoke Venting

2.2.4. Fire Fighters' Elevators

- fire fighting controls
- emergency recall

2.2.5. Protection of Emergency Electrical Conductors

- highrise elevator
- emergency generator(s)
- fire pump(s)
- smoke control systems
- smoke venting systems
- fire alarm and emergency voice communication systems

2.2.6. Emergency Voice Communications

- integrated with F.A. system
- audible to appropriate Standard
- zoning of speakers

3.0. Roles and Responsibilities for the Demonstration of the Coordinated Fire and Life Safety Systems

3.1. Roles and Responsibilities for the Design, Commissioning and Functional Testing of Fire and Life Safety Systems

3.1.1. Design Phase

RPRs will clearly indicate on their drawings and supporting documents the details of the fire and life safety systems for each applicable item of Section 2 for their particular discipline. RPRs will also coordinate the design of the components in their system with the designs of other RPRs on the project. RPRs are to indicate what functional testing, system verification, etc., must be performed by the Contractor or subtrades and establish the documentation to be provided.

The CRP will develop the project-specific test protocol and procedures in consultation with the RPRs. The CRP will act as the facilitator for the coordination of the design of the fire and life safety systems among the various RPRs.

3.1.2. Construction Phase

The Contractor will coordinate the activities of the subtrade contractors for the installation of the fire and life safety systems in accordance with the contract documents.

RPRs will provide field reviews to ascertain that the construction of the fire and life safety systems substantially complies with their design.

RPRs will review shop drawings of the fire and life safety systems to determine that they accurately reflect their design intent. They will also coordinate their reviews with those of the other RPRs on the project.

The CRP will coordinate the shop drawing reviews and field reviews by the RPs with the objective that the entire fire and life safety system will correctly operate as an integrated system.

3.1.3. Occupancy Phase

The Contractor will coordinate the subtrade contractors for the commissioning and functional testing of the fire and life safety systems. The Contractor will also collect all of the required Occupancy Permit submission documents from the various subtrade contractors and forward them to the CRP.

The CRP will take the lead role in coordinating the activities of the RPRs required for the commissioning and functional testing of the fire and life safety systems. The CRP will distribute the test protocol and test procedures, as developed in the Design Stage, to the various parties involved in the process.

RPRs will ascertain that the appropriate commissioning and functional testing of the fire and life safety systems of the components in their disciplines have been satisfactorily completed by the subtrade

contractors. They will also determine that the appropriate Occupancy Permit submission documents have been submitted and filled in correctly.
The CRP will be responsible for collecting all of the required Occupancy Permit submission documents, reviewing them for completeness and accuracy, and forwarding them to the CBO in a complete package at least 24 hours prior to the Coordinated Final CBO Review.

3.2. Sample Summary of Roles and Responsibilities for Demonstration of the Coordinated Fire and Life Safety Systems

The following is a sample summary (only) of the roles and responsibilities for a typical highrise building with underground parking. The precise roles and responsibilities for each project will vary depending on the complexity. The CRP will ascertain that the appropriate roles and responsibilities for each project are fulfilled by the RPRs.

3.2.1. Coordinating Registered Professional

Design Phase

- Determine the appropriate RPRs required for the project and make arrangements with the owner for their services.
- Clarify the roles and responsibilities of the various RPRs.
- Coordinate the design of the fire and life safety systems by the RPRs.
- Coordinate and develop the test protocol and procedures for functional testing of the fire and life safety systems.
- Coordinate the submission of the design drawings and supporting documents for the Building Permit application.

Construction Phase

- Coordinate and monitor the field reviews of the RPRs.
- Coordinate and monitor the review of shop drawings by the RPRs.
- Facilitate the information flow among the RPRs and Contractor.

Occupancy Phase

- In conjunction with the RPRs, finalize the project-specific test protocol and procedures for the fire and life safety systems, and review the requirements with the Contractor, subtrades and RPRs.
- Finalize the list of project-specific occupancy permit submission documents and the schedule for submissions and confirm completeness with CBO.
- Organize the "Coordinated Final Consultant Review" at least one week prior to "Coordinated CBO Final Review."
- Take a lead role in coordinating the functional testing of the fire and life safety systems during the "Coordinated Final Consultant Review."
- Coordinate the RPRs' review of Occupancy Permit submission documents for completeness and accuracy.
- Coordinate Certification of Equivalencies, if applicable.
- Collect all of the required Occupancy Permit submission documents and submit them in a complete package to the CBO.
- Organize the "Coordinated CBO Final Review."
- Record any deficiencies identified at the "Coordinated CBO Final Review" and monitor RPRs' field review of the corrective actions by the subtrades.
- Assist in finalizing the list of outstanding requirements which need to be met for the issuance of the Occupancy Permit.
- Follow-up on minor deficiencies post-Occupancy.

3.2.2. Architectural Design Phase

- Establish the conceptual design for the fire and life safety systems in consultation with RPRs.
- Determine equivalency reports required and coordinate the implementation on the drawings and supporting documents.
- Clearly indicate on drawings and supporting documents:
  - Major occupancies and code classifications.
  - Fire separations and fire-resistance ratings.
- Closures:
  - Fire-protection rating
  - Temperature rise requirements
  - Amount of glazing
- Hardware for closures
  - Panic hardware
  - Hold-open devices
  - Electromagnetic locks
- Egress systems.
- Provisions for fire fighting access.
- Interior and exterior finishes.
- Elevating devices c/w integrated controls to the fire alarm panel.
- Signage coordinated with fire alarm system and annunciation.

Construction Phase

- Provide field reviews of architectural components.
- Review shop drawings for architectural components and coordinate requirements with other RPRs.
- Review shop drawings for other disciplines which may influence architectural components.

Occupancy Phase

- Ascertain that the architectural components substantially conform to the architectural drawings and supporting documents.
- Perform an active role in witnessing the functional testing of the architectural components of the fire and life safety systems.
- Coordinate the signage with the fire alarm annunciator and the fire safety plans.
- Review the architecturally-related Occupancy Permit submission documents provided by the Contractor and subtrades for completeness and accuracy.
- Prepare and forward to the CRP the architectural Schedule C-B and other assurance letters required for the Occupancy Permit.

3.2.3. Mechanical/Plumbing Design Phase

- Coordinate mechanical/plumbing clearances and functional requirements with other RPRs.
- Clearly indicate on drawings and supporting documents:
  - Details of the mechanical/plumbing components of the fire and life safety systems.
  - Schematic diagram of the smoke venting system showing all fans, ducts, motorized dampers, fusible link dampers and backdraft dampers.
  - Location and fire-protection ratings of fusible link fire dampers and fire stop flaps.
  - Location and fire-protection ratings of motorized fire dampers.
  - Location and fire-resistance ratings of fire-rated duct enclosures.
  - Fire stop systems for mechanical/plumbing penetrations of fire separations.
  - Kitchen exhaust system/suppression system.
- Mechanical fans/motorized dampers sequence of operations:
  - Describe operation under normal mode

- Describe operation under fire alarm mode
- Indicate fire alarm initiation devices that activate change of operation

Construction Phase
- Provide field reviews of mechanical/plumbing components.
- Review shop drawings for mechanical/plumbing components and coordinate requirements with other RPRs.
- Review shop drawings for other disciplines which may influence mechanical/plumbing components.

Occupancy Phase
- Ascertain that the mechanical/plumbing components substantially conform to the mechanical/plumbing drawings and supporting documents.
- Perform an active role in witnessing the functional testing of the mechanical/ plumbing components of the fire and life safety systems.
- Review the mechanical/plumbing related occupancy permit submission documents provided by the Contractor and subtrades for completeness and accuracy.
- Prepare and forward to the CRP the mechanical/plumbing Schedule C-B and other assurance letters and documentation required for the Occupancy Permit.

3.2.4. Fire Suppression
The design of sprinkler systems can be accomplished by at least two possible scenarios:

Scenario 1
- The engineer of record undertakes the complete detailed design prior to the building permit application.
- The engineer of record submits Schedule B with the BP application.
- The engineer of record provides field reviews during construction and submits a Schedule C-B prior to Occupancy Permit.

Scenario 2 (where *acceptable* to the *Chief Building Official*)
- The engineer of record provides a detailed performance specification for the sprinkler design, as well as sufficient drawings to demonstrate/assure layout feasibility and interface with other components.
- The engineer of record submits Schedule B with the BP application for overall coordination of the sprinkler design. Schedule B can be annotated "For Performance Specification Only."
- The performance specifications may include a requirement that a separate sprinkler design engineer be responsible for detailed sprinkler design, preparation of sprinkler shop drawings and hydraulic calculations, letter of assurance Schedule B, (for field review during construction), and Schedule C-B (for Detailed Design) prior to Occupancy Permit.
- The engineer of record reviews the detailed sprinkler design and shop drawings to ascertain that they substantially comply with the performance specifications.
- The engineer of record provides a Schedule C-B prior to Occupancy Permit to confirm overall coordination of the sprinkler design and installation. Schedule C-B can be annotated "For Performance Specification Only." The engineer of record is entitled to rely upon the professional seal of the sprinkler design engineer for the detailed design and field review of the sprinkler system.

For purposes of this example, Scenario 2 Roles and Responsibilities are outlined below:

Design Phase by Engineer of Record
- Coordinate fire suppression spatial and functional requirements with other RPRs/CRP.
- Clearly indicate on the drawings and performance specification:
    - Fundamental design parameters for the fire suppression system to appropriate Standard.
    - Location of fire department siamese hose connections.
    - Location and size of standpipes and hose connections.

  - Details of special sprinkler protection as per equivalent reports.
  - Fire stop systems for pipe penetrations of fire separations.
  - Zoning of the sprinkler system to be coordinated with the electrical engineer for the fire alarm annunciation and clearly identified in the performance specifications.

Construction Phase by Sprinkler Design Engineer

- Prepare, sign and seal shop drawings and hydraulic calculations, clearly indicating:
  - Details of the fire suppression components of the fire and life safety systems.
  - Schematic riser diagram of sprinkler and standpipe systems c/w all devices that will be connected to the fire alarm system (flow switches, tamper switches, pressure switches, freeze monitoring, heat trace monitoring).
  - Location of fire department siamese hose connections.
  - Location and size of standpipes and hose connections.
  - Details of special sprinkler protection as per equivalent reports.
  - Zoning of the sprinkler system to be coordinated with the electrical engineer for the fire alarm annunciation and clearly identified on the sprinkler shop drawings.
  - Coordinate fire suppression location and functional requirements with engineer of record/CRP.
- Provide field reviews of fire suppression components.

Construction Phase by Engineer of Record

- Review shop drawings and hydraulic calculations for fire suppression components to determine substantial conformance to the performance specifications.
- Provide field reviews of fire suppression components to determine substantial conformance to the performance specifications.
- Monitor the field reviews by the Sprinkler Design Engineer to determine substantial conformance with the performance specifications.
- Review shop drawings for other disciplines which may influence fire suppression components.

Occupancy Phase by the Engineer of Record

- Ascertain that the fire suppression components substantially conform to the performance specifications.
- Perform an active role in witnessing the functional testing of the fire suppression components of the fire and life safety systems.
- Review the fire suppression-related Occupancy Permit submission documents by the Contractor and subtrades for completeness and accuracy.
- Collect the Schedule C-B from the Sprinkler Design Engineer, review for accuracy and completeness and forward to the CRP.
- Collect other Occupancy Permit documents from the subtrade contractor (e.g., Contractor's Material and Test Certificates), review for completeness and forward to the CRP.
- Prepare and forward to the CRP the fire suppression Schedule C-B for overall coordination of the fire suppression system.

Occupancy Phase by the Sprinkler Design Engineer

- Ascertain that the fire suppression components substantially conform to the sprinkler shop drawings and supporting documents.
- Perform an active role in witnessing the functional testing of the fire suppression components of the fire and life safety systems.
- Review the fire suppression-related Occupancy Permit submission documents by the Contractor and subtrades for completeness and accuracy.
- Prepare and forward to the Engineer of Record the fire suppression Schedule C-B and other assurance letters and documentation required for the Occupancy Permit.

3.2.5. Electrical

Design Phase

- Coordinate with the CRP and RPRs the test protocol and procedures for functional testing of the fire and life safety systems.
- Details of the electrical components of the fire and life safety systems.
- Clearly indicate on drawings and supporting documents:
    - Fire Alarm System
        - Location of fire alarm annunciator panel and central alarm control facility
        - Location of fire alarm initiating devices (smoke detectors, heat detectors, manual pull stations)
        - Fire alarm riser diagram c/w ancillary device connections
        - Audibility of fire alarm signal throughout floor area
        - Zoning of fire alarm initiation devices and audible signal appliances
        - Monitoring of fire alarm
        - Routing and method of protection of emergency conductors
        - Wiring methods for equipment
        - Testing/verification requirements and the documentation to be submitted to the RPR
    - Sprinkler System
        - Coordinate design with sprinkler design engineer
        - Sprinkler system alarm initiation and monitoring to be indicated on the fire alarm riser diagram (flow, tamper, pressure, etc.)
        - Detailed diagrams for freeze protection systems (heat trace monitoring, low temperature monitoring, etc.)
    - Fire Pump Systems
        - Riser diagram to indicate monitoring of the fire pump (pump running, power failure, phase reversal, wiring details for device connections)
        - Routing and method for protection of fire pump feeders from fire and power source, so that a fire from one source will not interrupt power from the other source
        - Electrical requirements to appropriate Standard and documents to be submitted to RPR (overcurrent protection details, location of controller and transfer switches, voltage drop, etc.)
    - Kitchen Exhaust/Fire Suppression System
    - Emergency Generator
        - Generator load calculations
        - Details and wiring diagram for monitoring through the fire alarm system
        - Details for testing to appropriate Standard and documents to be submitted to RPR
    - Smoke Venting Systems
        - Coordinate design with the mechanical engineer
        - Fire alarm riser diagram to indicate smoke venting fans and motorized dampers and HVAC/exhaust fan shutdown
        - Detailed wiring diagrams for fan shut-offs, exhaust fan operation, pressurization fan operation, damper operation (opening, closing, throttling)
        - Sequence of operation of smoke venting system in a narrative form
        - Describe operation under normal mode
        - Describe operation under fire alarm mode
        - Indicate fire alarm initiating devices that activate changes of operation/sequence
        - Routing methods for protection of emergency conductors
    - Electromagnetic Locks and Hold-Open Devices
        - Coordinate design with the architect
        - Sequence of operation in both normal and fire alarm mode

- Wiring diagrams for connection of devices
- Locations of devices on the floor plans

- Elevators
  - Sequence of operation in a narrative form
  - Wiring diagram details
  - Routing and method of protection of emergency conductors
    - Fire stop systems for electrical penetrations of fire separations
    - Coordinate electrical equipment location and functional requirements with other RPRs/CRP.

Construction Phase
- Provide field reviews of electrical components.
- Review shop drawings for electrical components and coordinate requirements with other RPRs.
- Review shop drawings for other disciplines which may influence electrical components.

Occupancy Phase
- Ascertain that the electrical components substantially conform to the electrical drawings and supporting documents.
- Perform an active role in witnessing the functional testing of the electrical components of the fire and life safety systems.
- Review the electrical-related Occupancy Permit submission documents provided by the Contractor and subtrades for completeness and accuracy.
- Prepare and forward to the CRP the electrical Schedule C-B and other assurance letters and documents required for the Occupancy Permit.

4.0. Sample Occupancy Demonstration/Witnessing Flowchart

DEVELOP TESTING PROTOCOL/PROCEDURE (Design Stage)
CRP/RPRs develop Testing Demonstration/Witness Protocol
— Issue to Authorities Having Jurisdiction & Contractor
||
V
DOCUMENTATION SUBMISSION
Contractor/Subtrades submit/deliver all appropriate documentation to CRP/RPRs, including:
— The original Contractor's Materials and Test Certificate for the sprinkler system
— Fire Pump Flow Test Certificate(s)
— Back Flow Prevention Certificate(s)
— Emergency generator commissioning and verification reports
— The original Certificate of Verification for the fire alarm system
— Appendix "A" to the fire alarm verification report
— ULC Certificate for Protective Signaling Service
— Other documentation, as appropriate
||
V
CONTRACTOR DEMONSTRATION — CONSTRUCTION COMPLETE
Contractor & Subtrades
(Mechanical, Electrical, Elevator, Sprinkler, Fire Alarm, etc.) as appropriate
||
V
COORDINATED FINAL CONSULTANT REVIEW DEMONSTRATION/WITNESSING CRP/RPRs

(Architect, Mechanical Engineer, Electrical Engineer, Sprinkler Engineer, Equivalency Consultant, etc.) as appropriate
||
\/
OCCUPANCY SUBMISSION DOCUMENTS
CRP to collect all submission documents, including Schedule Cs from RPRs, and submit to CBO in a complete package
||
\/
COORDINATED FINAL CBO REVIEW DEMONSTRATION/WITNESSING
Contractor, Subtrades, CRP/RPRs demonstrate to CBO
(Building, Fire, Mechanical, Electrical and Sprinkler)
||
\/
OP ISSUED

A-2.2.8.1.(1) Deleted.

A-2.2.8.3.(2)(c)(i) Deleted.

A-2.3.1. Alternative Solutions. Beyond the purposes of demonstrating compliance and acquiring a building permit, there are other important reasons for requiring that the proponent of an alternative solution submit project documentation (i.e. a compliance report) to the *Chief Building Official* and for the *Chief Building Official* to retain that documentation for a substantial period following the construction of a building:

- Alternative solutions made possible by objective-based codes may have special maintenance requirements, which would be described in the documentation.
- Documentation helps consultants perform code compliance assessments of existing buildings before they are sold and informs current owners or prospective buyers of existing buildings of any limitations pertaining to their future use or development.
- Documentation provides design professionals with the basic information necessary to design changes to an existing building.
- An alternative solution could be invalidated by a proposed alteration to a building. Designers and regulators must therefore know the details of the particular alternative solutions that were integral to the original design. Complete documentation should provide insight as to why one alternative solution was chosen over another.
- Documentation is the “paper trail” of the alternative solution negotiated between the designer and the regulator and should demonstrate that a rational process led to the acceptance of the alternative solution as an equivalency.
- It is possible that over time a particular alternative solution may be shown to be inadequate. It would be advantageous for a jurisdiction to know which buildings included that alternative solution as part of their design: documentation will facilitate this type of analysis.
- Project documentation provides important information to a forensic team that is called to investigate an accident or why a design failed to provide the level of performance expected.

This subject is discussed in further detail in “Recommended Documentation Requirements for Projects Using Alternative Solutions in the Context of Objective-Based Codes,” which was prepared for the CCBFC Task Group on Implementation of Objective-Based Codes and is available on NRC’s Web site.

Part 3
Appeals, Offences and Penalties and Transition Provisions

Section 3.1. Appeals

3.1.1. BUILDING BOARD OF APPEAL

3.1.1.1. Appeal Within 30 Days

1) Any person dissatisfied with a decision of the *Chief Building Official* relating to matters described in Article 3.1.1.2. may appeal the decision to the *Building* Board of Appeal who shall have such powers relating to this By-law as are set out in this By-law and in the *Building* Board of Appeal By-law.

3.1.1.2. Limits of Appeal

1) An appeal lies to the *Building* Board of Appeal from any decision of the *Chief Building Official* regarding

a) the interpretation of this By-law,
b) the use of new *construction* methods or materials,
c) upgrading *existing buildings* or
d) permitting alternative proposals.

3.1.1.3. Filing of Appeal

1) An application for an appeal shall be filed with the Secretary of the Board, in writing, within 30 days of the decision which gives rise to the appeal.

2) An application for an appeal shall include

a) the address of the *building* to which the decision relates,
b) the applicable provisions of the By-law, and
c) sufficient detail to describe the factual and technical basis for the appeal.

Section 3.2. Offences and Penalties

3.2.1. VIOLATION OF BY-LAW

3.2.1.1. Offences

1) Every person who

a) violates any of the provisions of this By-law,
b) suffers or permits any act or thing to be done in contravention or in violation of any of the provisions of this By-law,
c) neglects to do or refrains from doing anything required to be done by any of the provisions of this By-law,
d) does any act which violates any of the provisions of this By-law, or
e) fails to comply with an order or notice given under this By-law,

is guilty of an offence against this By-law and liable to the penalties hereby imposed.

3.2.2. FINES AND PENALTIES

3.2.2.1. Minimum Fine

1) Every person who commits an offence against this By-law is liable to a fine of no less than $250 and not more than $10,000 for each offence.

3.2.2.2. Continuing Offence

1) Every person who commits an offence of a continuing nature against this By-law is liable to a fine of not less than $250 and no more than $10,000 for each day such offence is continued.

3.2.2.3. Unsafe Condition

1) Despite the minimum fine referred to in Article 3.2.2.1., every person who permits *occupancy* to occur while an *unsafe condition* exists in or about a *building* or the premises is liable to a fine of no less than $500 and not more than $10,000 for each offence.

3.2.2.4. Failure to Comply with an Order

1) Despite the minimum fine referred to in Article 3.2.2.1., every person who fails to comply with an order or notice issued by the *Chief Building Official* is liable to a fine of no less than $500 and not more than $10,000 for each offence.

3.2.2.5. Work Without a Permit

1) Despite the minimum fine referred to in Article 3.2.2.1., every person who works without *permit* is liable to a fine of no less than $500 and not more than $10,000 for each offence.

3.2.2.6. Failure to Permit Entry

1) Despite the minimum fine referred to in Article 3.2.2.1., every person who fails to allow the *Chief Building Official* entry to a *building* or premises is liable to a fine of not less than $500 and not more than $10,000 for each offence.

Section 3.3. Transition Provisions

3.3.1. GENERAL

3.3.1.1. Validity of Permits Issued under Previous By-law

1) Subject to the provisions of Articles 1.5.2.4. and 3.3.1.2., *buildings* for which *permits* were obtained under By-law No. 10908 may be constructed in accordance with the provisions of that By-law.

3.3.1.2. Grace Period

1) Where an *owner* has applied for a *permit* prior to June 03, 2019, a *building* may be constructed in accordance with By-law No. 10908 if, in the opinion of the *Chief Building Official*, the *owner* has commenced the work authorized by the *permit* within 6 months of the date of issuance of the *permit* and the *owner* has continued work to completion without interruption other than work stoppages which are standard in the *building* industry.

Schedule 2
Book II (Plumbing Systems)

Preface

The 2019 Building By-law (hereinafter the "Building By-law") is an objective-based code which identifies the minimum standard in the City of Vancouver for buildings to which this By-law applies. These address the same objectives of the Building By-law's parent codes.

The Building By-law establishes standards for building materials, products and assemblies. Some standards are explicitly provided in the Building By-law while others are incorporated by reference to existing standards for materials products and assemblies which are developed and published by specialist organizations.

The Building By-law is substantially based on Book I (General) and Book II (Plumbing Systems) of the British Columbia Building Code, which in turn is substantially based on the model National Building Code of Canada 2015 and the model National Plumbing Code of Canada 2015. This model of adoption of national model codes helps promote consistency among building codes.

This Building By-law replaces the 2014 Building By-law and also contains certain transition provisions which apply to permits issued under the 2014 Building By-law. The Building By-law is regularly updated and users should ensure that the By-law is current.

Code Development

Development of Codes Canada

The Canadian Commission on Building and Fire Codes (CCBFC) is responsible for the content of the National Model Codes. The CCBFC is an independent body made up of volunteers from across the country and from all facets of the code-user community. Members of the CCBFC and its standing committees include builders, engineers, skilled trade workers, architects, building owners, building operators, fire and building officials, manufacturers and representatives of general interests.

Codes Canada (formerly named the Canadian Codes Centre) of the National Research Council (NRC) provides technical and administrative support to the CCBFC and its standing committees. NRC publishes Codes Canada and periodic revisions to the Codes to address pressing issues. However, such periodic revisions do not have legal effect until adopted into law.

British Columbia Building Code

In British Columbia, the 2018 Building Code is the legal adoption of National Model Building and Plumbing Codes under the authority of the government of the Province of British Columbia. This includes much of the National Model Codes as amended from time to time, but also includes provincially applicable requirements to address provincial priorities and concerns.

Vancouver Building By-law

This By-law consists of two Books, that set out the minimum standard for the design and construction of new buildings as applicable. It also applies to the alteration, change of use and demolition of existing buildings.

The By-law, is substantially based upon the British Columbia Building Code and establishes requirements to address five objectives, which are fully described in Division A of the By-law.

General Requirements
Building By-law - Book I (General) requirement must address at least one of the Code's five stated objectives:

- safety
- health
- accessibility for persons with disabilities
- fire and structural protection of buildings
- environment

Code provisions do not necessarily address all the characteristics of buildings that might be considered to have a bearing on the Code's objectives. The design of a technically sound building depends upon many factors beyond simple compliance with building regulations. Such factors include the availability of knowledgeable practitioners who have received appropriate education, training and experience and who have some degree of familiarity with the principles of good building practice and experience using textbooks, reference manuals and technical guides.

The Building By-law does not list acceptable proprietary building products. It establishes the criteria that building materials, products and assemblies must meet. Some of these criteria are explicitly stated in the By-law while others are incorporated by reference to material or product standards published by standards development organizations. Only those portions of the standards related to the objectives of this By-law are mandatory.

Plumbing Requirements
Book II (Plumbing Systems) of the Building By-law sets out technical provisions for the design and installation of new plumbing systems. It also applies to the extension, alteration, renewal and repair of existing plumbing systems. Book II (Plumbing Systems) establishes requirements to address the following four objectives, which are fully described in Division A of the Code:

- safety
- health
- protection of buildings and facilities from water and sewage damage
- environment

Code provisions do not necessarily address all the characteristics of buildings and facilities that might be considered to have a bearing on the Code's objectives. It is not a textbook on plumbing system design or installation. The design of a technically sound plumbing system depends upon many factors beyond simple compliance with plumbing regulations. Such factors include the availability of knowledgeable practitioners who have received appropriate education, training and experience and who have some degree of familiarity with the principles of good plumbing practice and experience using textbooks, reference manuals and technical guides.

The Building By-law does not list acceptable proprietary plumbing products. It establishes the criteria that plumbing materials, products and assemblies must meet. Some of these criteria are explicitly stated in the By-law while others are incorporated by reference to material or product standards published by standards development organizations. Only those portions of the standards related to the objectives of this By-law are mandatory.

Additional Information

Numbering System

A consistent numbering system has been used throughout this By-law. The first number indicates the Part of the By-law; the second, the Section in the Part; the third, the Subsection; and the fourth, the Article in the Subsection. The detailed provisions are found at the Sentence level (indicated by numbers in brackets), and Sentences may be broken down into Clauses and Subclauses. This structure is illustrated as follows:

B	Division
3	Part
3.5.	Section
3.5.2.	Subsection
3.5.2.1.	Article
3.5.2.1.(2)	Sentence
3.5.2.1.(2)(a)	Clause
3.5.2.1.(2)(a)(i)	Subclause

Change Indication

Where a technical change or addition has been made relative to the Building By-law National Building Code (NBC) and National Plumbing Code (NPC) 2010 edition, a vertical line has been added in the margin next to the affected provision to indicate the approximate location of new or modified content. No change indication is provided for renumbered or deleted content.

In addition to the above noted vertical lines, which indicate a change to the NBC or NPC that has been included in the British Columbia Building Code (BCBC), further technical changes or additions relative to the 2012 edition of the BCBC are identified. These changes are underlined, wherever practical. The vertical lines and underlining are for convenience only and have no legal effect. No change indication is provided for renumbered or deleted provisions.

The term “reserved” is included in place of certain deleted National Codes content which has not been adopted. The term “reserved” is generally used so that the numbering structure of the BCBC is aligned with the model National Codes, easing comparability and possible future harmonization.

Unique to Vancouver Indication

All text in the By-law that is unique to Vancouver is provided with a grey background wherever practical. This identifier was utilized to provide the user of the By-law with a means by which to differentiate the Vancouver provisions of this By-law from those of the 2018 British Columbia Building and Plumbing Codes. Where the provisions of Vancouver have required the deletion of the 2018 British Columbia Building and Plumbing Code text, and no Vancouver text has replaced the deleted text, the word “deleted” has been used to alert the user that a deletion has been made and that there is a difference from the 2018 British Columbia Building and Plumbing Codes text.

Meaning of the words “and” and “or” between the Clauses and Subclauses of a Sentence

Multiple Clauses and Subclauses are connected by the word “and” or “or” at the end of the second last Clause or Subclause in the series. Although this connecting word appears only once, it is meant to apply to all the preceding Clauses or Subclauses within that series.

For example, in a series of five Clauses – a) to e) – in a By-law Sentence, the appearance of the word “and” at the end of Clause d) means that all Clauses in the Sentence are connected to each other with the word “and.” Similarly, in a series of five Clauses – a) to e) – in a By-law Sentence, the appearance of the word “or” at the end of Clause d) means that all Clauses in the Sentence are connected to each other with the word “or.”

In all cases, it is important to note that a Clause (and its Subclauses, if any) must always be read in conjunction with its introductory text appearing at the beginning of the Sentence.

Metric Conversion
All values in this By-law, other than nominal sizes, are given in metric units. A conversion table of imperial equivalents for the most common units used in plumbing system design and installation is located at the end of the By-law.

Parts in Division B and Professional Disciplines
Division B is organized into Parts that are largely related to disciplines. However, this does not mean that persons of a certain discipline who are executing the design or construction of a particular building component can necessarily deal with only one Part of the Code in isolation since provisions related to that building component may be found in more than one Part.

For example:

- provisions that deal with fire safety issues related to heating, ventilating and air-conditioning systems are located in Part 3 of Division B, Fire Protection, Occupant Safety and Accessibility, and not in Part 6, Heating, Ventilating and Air-conditioning;
- structural requirements related to loads on handrails and grab bars are located in Part 3 of Division B, Fire Protection, Occupant Safety and Accessibility, while structural requirements related to loads on guards and handrails are located in Part 4, Structural Design.

For this reason, the part-based structure of Division B is not well suited for use as the basis for allocating responsibilities to different professions or as the basis for contractual arrangements.

Acknowledgements and Copyright

Production and Marketing Manager
Codes Canada
National Research Council of Canada
Ottawa, Ontario K1A 0R6
E-mail: Codes@nrc-cnrc.gc.ca

Intellectual Property Services
PO Box 9452 STN PROV GOVT
Victoria, BC V8W 9V7

Website: https://www2.gov.bc.ca/gov/content/home/copyright
Email: QPIPPCopyright@gov.bc.ca

Requests for permission to reproduce the unique to Vancouver provisions of the By-law must be sent to:

Code Development Engineer
Office of the Chief Building Official
Community Service
453 West 12th Avenue
Vancouver, BC
V5Y 1V4

Contact Information
The Provincial government and CCBFC welcomes comments and suggestions for improvements to the Building Code and Plumbing Code. To submit comments or suggestions or to request printed copies of Internet material referred to in this Preface, contact:

Building and Safety Standards Branch
Office of Housing and Construction Standards
614 Humboldt Street
PO Box 9844 Stn Prov Govt
Victoria BC V8W 9T2
Email: building.safety@gov.bc.ca

Persons interested in the development of the National Codes, the model document for the British Columbia Codes can contact:

The Secretary
Canadian Commission on Building and Fire Codes
Codes Canada
National Research Council of Canada
Ottawa, Ontario K1A 0R6
Telephone: 613-993-9960
Fax: 613-952-4040
E-mail: Codes@nrc-cnrc.gc.ca

Relationship of the Building By-law to Standards Development and Conformity Assessment

The development of many provisions in this By-law and the assessment of conformity to those provisions are supported by several of the member organizations of Canada's National Standards System (NSS).

The NSS is a federation of accredited organizations concerned with standards development, certification, testing, inspection, personnel and management systems registration that is established under the auspices of the Standards Council of Canada Act. Activities of the NSS are coordinated by the Standards Council of Canada (SCC), which has accredited 8 standards development organizations, 36 certification organizations, 21 registration organizations, and 344 calibration and testing laboratories.

The SCC is a federal non-profit Crown corporation responsible for the coordination of voluntary standardization in Canada. It also has responsibilities for Canada's activities in voluntary international standardization.

Canadian Standards
The By-law contains many references to standards published by accredited standards development organizations in Canada. As part of the accreditation requirements, these organizations adhere to the principles of consensus. This generally means substantial majority agreement of a committee comprising a balance of producer, user and general interest members, and the consideration of all negative comments. The organizations also have formal procedures for the second-level review of the technical preparation and balloting of standards prepared under their auspices. (The Canadian Commission on Building and Fire Codes (CCBFC) follows these same principles of consensus in the operation of its Code development process.)

The following organizations are accredited as standards development organizations in Canada:

- American Society for Testing and Materials International (ASTM)
- Bureau de normalisation du Québec (BNQ)
- Canadian General Standards Board (CGSB)
- Canadian Standards Association (CSA)
- ULC Standards (ULC)
- Underwriters' Laboratories (UL)

Table 1.3.1.2. of Division B lists the standards referenced in this By-law. Standards proposed to be referenced in this By-law are reviewed to ensure their content is compatible with the Code. Thereafter, referenced standards are reviewed as needed during each Code cycle. Standards development organizations are asked to provide information on any changes in the status of their standards referenced in this By-law – withdrawals, amendments, new editions, etc. This information is passed on to the CCBFC, its standing committees, the provinces and territories, and interested stakeholders on particular issues, all of whom are given the opportunity to identify any problems associated with the changes. These bodies do not necessarily review in detail the revised standards; rather, the approach relies on the consensus process involved in the maintenance of the standards and on the extensive knowledge and backgrounds of committee members, provincial or territorial staff, NRC staff, and consulted stakeholders to identify changes in the standards that might create problems in the By-law.

Non-Canadian Standards
A number of subject areas for which the Canadian standards development organizations have not developed standards are covered in this By-law. In these cases, the Code often references standards developed by organizations in other countries, such as the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) and the National Fire Protection Association (NFPA). These standards are developed using processes that may differ from those used by the Canadian standards development organizations; nevertheless, these standards have been reviewed by the relevant standing committees and found to be acceptable in the context in which they are referenced by this By-law.

Conformity Assessment
This By-law establishes minimum measures, either within its own text or that of referenced standards. However, this By-law does not deal with the question of who is responsible for assessing conformity to the measures or how those with this responsibility might carry it out.

In Vancouver, the Chief Building Official is authorized to, by bylaw, regulate construction and to enforce the requirements of this By-law.

Those persons responsible for ensuring that a material, appliance, system or equipment meets the performance requirements of this By-law have several means available to assist them. These means vary from on-site inspection to the use of certification services provided by accredited third-party organizations. Test reports or mill certificates provided by manufacturers or suppliers can also assist in the acceptance of products. Engineering reports may be required for more complex products.

Requirements for Registered Professionals are located in Division C of this By-law.

Testing
The accreditation programs of the SCC include many organizations accredited for testing and calibration that are capable of reliably testing building products to specified standards. The test results produced by these organizations can be used in the evaluation, qualification and certification of building products to Code provisions. The SCC's Web site (www.scc.ca) lists accredited certification bodies and allows users to search the scope of accreditation for each of these organizations.

Certification
Certification is the confirmation by an independent organization that a product or service meets a requirement. Certification of a product, process, or system entails physical examination, testing as specified in the appropriate standards, plant examination, and follow-up unannounced plant inspections. This procedure leads to the issuing of a formal assurance or declaration, by means of a certification mark or certificate, that the product, process or system is in full conformity with specified provisions.

In some cases, a product for which no standard exists can be certified using procedures and criteria developed by the accredited certifying organization and specifically designed to measure the performance of that product. Certification bodies publish lists of certified products and companies.

Registration
Quality Registration Organizations assess a company's conformance to quality assurance standards like the International Organization for Standardization ISO 9000.

Evaluation
An evaluation is a written opinion by an independent professional organization that a product will perform its intended function in a building. An evaluation is very often done to determine the ability of an innovative product, for which no standards exist, to satisfy the intent of a By-law requirement. Follow-up plant inspections are not normally part of the evaluation process. Several organizations, including the Canadian Construction Materials Centre (CCMC), offer such evaluation services. While the development of such an evaluation is useful to establish a basis for acceptance, this it does not mean that there will be an automatic assumption of By-law compliance by the Chief Building Official for any given material, product or assembly covered by this evaluation or that will necessarily be deemed applicable in every situation.

Qualification
The qualification of building products also evaluates the ability of a product to perform its intended function by verifying that it meets the requirements of a standard. Qualification normally includes some follow-up plant inspection. Some organizations publish lists of qualified products that meet the specified requirements. Some organizations qualify manufacturing and/or testing facilities for building products for compliance with the By-law and relevant standards.

Division A
Compliance, Objective and Functional Statements

Part 1
Compliance

Section 1.1. General

1.1.1. Application of this By-law

1.1.1.1. Application of this By-law

1) This By-law applies to the design, installation, extension, alteration, renewal, repair or operation of *plumbing systems* in and for *buildings* in the circumstances described in Section 1.1. of Division A of Book I (General) of this By-law. (See Note A-1.1.1.1.(1).)

2) This By-law specifies the minimum requirements for

a) *drainage systems* for water-borne wastes and *storm water* for *buildings* to the point of connection with public services,

b) *venting systems*,

c) water service pipes, and

d) *water distribution systems*.

3) Plumbing facilities in *buildings* shall be provided in accordance with Part 7 of Division B of Book I (General) of this By-law.

1.1.2. Internal References to this By-law

1.1.2.1. Book I (General) of the By-law

1) This is the second of the two Books, Book I (General) and Book II (Plumbing Systems), that together form the Building By-law.

1.1.2.2. Internal References to the By-law

1) Unless a Book is specified, references to "the Vancouver Building By-law," "the Building By-law," "the By-law," "this By-law" and the like shall be read as references to the Book in which they appear.

1.1.3. Appendices, Notes and Annotations

1.1.3.1. Appendices, Notes and References to Appendices and Notes have No Legal Effect

1) The Appendices and Notes of this By-law have no legal effect, except for the Appendix Notes that are directly referenced in a Part of this By-law, being the following Notes:

a) A-1.4.1.2.(1) Designated flood plain of Division A of Book I (General), including Figures A-1.4.1.2.(1)-C, D and E, and

b) A-1.4.1.2.(1) Flood construction level requirements of Division A of Book I (General).

2) References in parentheses to the Appendices and Notes of this By-law have no legal effect.

Section 1.2. Compliance

1.2.1. Compliance with this By-law

1.2.1.1. Compliance with this Code

1) Compliance with this By-law shall be achieved by

a) complying with the applicable acceptable solutions in Division B (See Note A-1.2.1.1.(1)(a).), or

b) except as required by Sentence (3), using alternative solutions, accepted by the *Chief Building Official* under Section 2.3 of Division C, that will achieve at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the applicable acceptable solutions. (See Note A-1.2.1.1.(1)(b).)

2) For the purposes of compliance with this By-law as required in Clause 1.2.1.1.(1)(b), the objectives and functional statements attributed to the acceptable solutions in Division B shall be the objectives and functional statements referred to in Subsection 1.1.2. of Division B.

3) An alternative solution shall not be used in place of an acceptable solution if the acceptable solution expressly requires conformance to a provincial enactment other than Book I (General) or Book II (Plumbing Systems) of the Building By-law.

1.2.1.2. Responsibility of Owner

1) Unless otherwise specified in this By-law, the owner of a *building* shall be the person responsible for carrying out the provisions of this By-law in relation to that *building*.

2) The owner of a *building* is in no way relieved of full responsibility for complying with this By-law by the *Chief Building Official*

a) granting a building permit,
b) approving drawings or specifications, or
c) carrying out inspections.

1.2.2. Materials, Appliances, Systems and Equipment

1.2.2.1. Characteristics of Materials, Appliances, Systems and Equipment

1) All materials, *appliances*, systems and equipment installed to meet the requirements of this By-law shall possess the necessary characteristics to perform their intended functions when installed in or serving a *building*.

1.2.2.2. Used Materials and Equipment

1) Used materials and equipment, including *fixtures*, shall not be reused unless they meet the requirements of this By-law for new materials and equipment and are otherwise satisfactory for their intended use.

1.2.3. Installation

1.2.3.1. Personnel Performing Plumbing Work

1) Personnel performing the installation, extension, *alteration*, renewal or repair of a *plumbing system* shall

a) possess a Canadian tradesman's qualification certification as a plumber,
b) be an indentured apprentice supervised by a journeyman who meets the criteria set out in Clause (a), or
c) be the registered owner and occupant or intended occupant of the single family dwelling in which plumbing work will occur.

1.2.3.2. Personnel Performing Sprinkler System Work

1) Persons performing installation, *alteration* or repair on a *sprinkler system* shall

a) possess a British Columbia industry training credential as a *sprinkler system installer*, or
b) be a trainee supervised by a *Sprinkler System Installer* qualified under the Industry Training Authority Act.

Section 1.3. Divisions A, B and C of this Code

1.3.1. General

1.3.1.1. Scope of Division A

1) Division A contains the compliance and application provisions, objectives and functional statements of this By-law.

1.3.1.2. Scope of Division B

1) Division B contains the acceptable solutions of this By-law.

1.3.1.3. Scope of Division C

1) Division C contains the administrative provisions of this By-law.

1.3.1.4. Internal Cross-references

1) Where the Division of a referenced provision is not specified in this By-law, it shall mean that the referenced provision is in the same Division as the referencing provision.

1.3.2. Application of Division A

1.3.2.1. Application of Parts 1, 2 and 3

1) Parts 1, 2 and 3 of Division A apply to all *plumbing systems* covered in this By-law. (See Article 1.1.1.1.)

1.3.3. Application of Division B

1.3.3.1. Application of Parts 1 and 2

1) Parts 1 and 2 of Division B apply to all *plumbing systems* covered in this By-law. (See Article 1.1.1.1.)

1.3.4. Application of Division C

1.3.4.1. Application of Parts 1 and 2

1) Parts 1, 2 and 3 of Division C apply to all *plumbing systems* covered in this By-law. (See Article 1.1.1.1.)

Section 1.4. Terms and Abbreviations

1.4.1. Definitions of Words and Phrases

1.4.1.1. Non-defined Terms

1) Words and phrases used in this By-law that are not included in the list of definitions in Article 1.4.1.2. shall have the meanings that are commonly assigned to them in the context in which they are used, taking into account the specialized use of terms by the various trades and professions to which the terminology applies.

2) Where objectives and functional statements are referred to in this By-law, they shall be the objectives and functional statements described in Parts 2 and 3.

3) Where acceptable solutions are referred to in this By-law, they shall be the provisions stated in Part 2 of Division B.

4) Where alternative solutions are referred to in this By-law, they shall be the alternative solutions mentioned in Clause 1.2.1.1.(1)(b).

1.4.1.2. Defined Terms

1) The words and terms in italics in this By-law shall have the following meanings (an asterisk (*) following a defined word or term indicates that the definition for that word or term is taken from the Book I (General) of this By-law):

*Acceptable** means acceptable to the *Chief Building Official*.

*Accepted** means accepted by the *Chief Building Official*.

Accredited laboratory means a laboratory approved by the BC Provincial Health Officer for drinking water microbiology testing.

*Addition** means an alteration to any building which will increase the total aggregate floor area or the building height (in storeys).

Additional circuit vent means a *vent pipe* that is installed between a *circuit vent* and a *relief vent* to provide additional air circulation.

Air admittance valve means a one-way valve designed to allow air to enter the *drainage system* when the pressure in the *plumbing system* is less than the atmospheric pressure. (See Note A-2.2.10.16.(1) of Division B.)

Air break means the unobstructed vertical distance between the lowest point of an *indirectly connected soil-or-waste pipe* and the *flood level rim* of the *fixture* into which it discharges. (See Note A-2.3.3.11.(2) of Division B.)

Air gap means the unobstructed vertical distance through air between the lowest point of a water supply outlet and the *flood level rim* of the *fixture* or device into which the outlet discharges. (See Note A-2.6.2.9.(2) of Division B.)

*Air space parcel** has the meaning assigned to it by the Land Title Act of British Columbia.

Alert means a bell, horn, speaker, light or text display that provides audible, tactile or visible outputs, or any combination thereof.

Alloyed zinc means an alloy of zinc having the corrosion resistance and physical properties of an alloy containing 0.15% titanium, 0.74% copper and 99.11% zinc, and so tempered as to be capable of being formed into the shape required for a watertight joint.

*Alteration** means a change or extension to any matter or thing or to any *occupancy* regulated by this By-law.

Alternate water source system means a system designed to collect, treat, and use non-*potable* water from alternate water sources in lieu of *potable* water, but excludes a system in a *building* used exclusively for *residential occupancy* containing no more than 4 principal *dwelling units*, and excludes the use of rain barrels of up to a cumulative capacity of 500 litres.

*Apprentice** means a regularly indentured apprentice under the provisions of the Industry Training Authority Act of British Columbia.

*Approved** means *accepted*.

Auxiliary water supply means any water supply on or available to the premises other than the primary *potable* water supply. (See Note A-1.4.1.2.(1).)

Backflow means a flowing back or reversal of the normal direction of the flow.

Backflow preventer means a device or a method that prevents *backflow*. (See Figure A-1.4.1.2.(1)-A in Note A-1.4.1.2.(1).)

Back pressure means pressure higher than the supply pressure.

Back-siphonage means *backflow* caused by a negative pressure in the supply system. (See Figure A-1.4.1.2.(1)-B in Note A-1.4.1.2.(1).)

Back-siphonage preventer (or *vacuum breaker*) means a device or a method that prevents *back-siphonage*. (See Figure A-1.4.1.2.(1)-C in Note A-1.4.1.2.(1).)

Backwater valve means a *check valve* designed for use in a gravity *drainage system*.

Bathroom group means one lavatory basin, one water closet and one bathtub or maximum 2 head shower drain.

Blackwater means waste water from water closets, urinals and other sanitary fixtures designed for carrying human waste, kitchen sinks, utility sinks, medical sinks, laboratory sinks, and industrial processes, but does not include *clear-water waste*.

Bottle trap means a *trap* that retains water in a closed chamber and that seals the water by submerging the inlet pipe in the liquids or by a partition submerged in the liquids.

Branch means a *soil-or-waste pipe* connected at its upstream end to the junction of 2 or more *soil-or-waste pipes* or to a *soil-or-waste stack*, and connected at its downstream end to another *branch*, a sump, a *soil-or-waste stack* or a *building drain*. (See Figure A-1.4.1.2.(1)-F in Note A-1.4.1.2.(1).)

Branch vent means a *vent pipe* that is connected at its lower end to the junction of 2 or more *vent pipes*, and at its upper end, either to another *branch vent* or to a *stack vent*, *vent stack* or *vent header*, or terminates in open air. (See Figure A-1.4.1.2.(1)-D in Note A-1.4.1.2.(1).

*Building** means any structure used or intended for supporting or sheltering any use or *occupancy*, including any *float home* or *marina* and any retaining structures greater than 1.2 m in height.

Building drain means the lowest horizontal piping, including any vertical *offset*, that conducts *sewage*, *clear-water waste* or *storm water* by gravity to a *building sewer*. (See Figure A-1.4.1.2.(1)-F in Note A-1.4.1.2.(1).)

Building sewer means a pipe that is connected to a *building drain* 1 m outside a wall of a *building* and that leads to a public sewer or *private sewage disposal system*.

Building trap means a *trap* that is installed in a *building drain* or *building sewer* to prevent the circulation of air between a *drainage system* and a public sewer. (See Note A-2.4.5.4.(1) of Division B.)

*Business and personal services occupancy** means the *occupancy* or use of a *building* or part thereof for the transaction of business or the rendering or receiving of professional or personal services.

*Care** means the provision of services other than *treatment* by or through care facility management to residents who require these services because of cognitive, physical or behavioural limitations.

Care or detention occupancy means the *occupancy* or use of a *building* or part thereof by persons who require special care or treatment because of cognitive or physical limitations or by persons who are restrained from, or are incapable of, self-preservation because of security measures not under their control.

*Certified Professional** means a Certified Professional as defined in the Certification of Professionals By-law.

Check valve means a valve that permits flow in one direction but prevents a return flow.

*Chief Building Official** means the *City Building Inspector*, and any person authorized to act on behalf of the *City Building Inspector*.

Circuit vent means a *vent pipe* that serves a number of *fixtures* and connects to the *fixture drain* of the most upstream *fixture*.

Cistern means a tank for storing non-*potable* water as part of an *alternate water source system*.

*City** means the City of Vancouver.

*City Building Inspector** means the person appointed as such by City Council pursuant to the provisions of the Vancouver Charter.

*City Engineer** means the person appointed as such by City Council pursuant to the provisions of the Vancouver Charter.

Class 1 fire sprinkler/standpipe system means an assembly of pipes and fittings that conveys water from the water *service pipe* to the sprinkler/standpipe system's outlets, is *directly connected* to the public water supply main only, has no pumps or reservoirs, and in which the sprinkler drains discharge to the atmosphere, to dry wells or to other safe outlets.

Class 2 fire sprinkler/standpipe system means a *Class 1 fire sprinkler/standpipe system* that includes a booster pump in its connection to the public water supply main.

Class 3 fire sprinkler/standpipe system means an assembly of pipes and fittings that conveys water from the *water service pipe* to the sprinkler/standpipe system's outlets and is *directly connected* to the public water supply main as well as to one or more of the following storage facilities, which are filled from the public water supply main only: elevated water storage, fire pumps supplying water from aboveground covered reservoirs, or pressure tanks. The water in this sprinkler/standpipe system must be maintained in *potable* condition. (See Note A-1.4.1.2.(1).)

Class 4 fire sprinkler/standpipe system means an assembly of pipes and fittings that conveys water from the *water service pipe* to the sprinkler/standpipe system's outlets and is *directly connected* to the public water supply main (similar to *Class 1* and *Class 2 fire sprinkler/standpipe systems*) and to an *auxiliary water supply* dedicated to fire department use that is located within 520 m of a pumper connection.

Class 5 fire sprinkler/standpipe system means an assembly of pipes and fittings that conveys water from the *water service pipe* to the sprinkler/standpipe system's outlets and is *directly connected* to the public water supply main and also interconnected with an *auxiliary water supply*.

Class 6 fire sprinkler/standpipe system means an assembly of pipes and fittings that conveys water from the *water service pipe* to the sprinkler/standpipe system's outlets and acts as a combined industrial water supply and fire protection system supplied from the public water supply main only, with or without gravity storage or pump suction tanks.

Cleanout means an access provided in *drainage* and *venting systems* to provide for cleaning and inspection services.

*Clear-water waste** means waste water with impurity levels that will not be harmful to health and may include cooling water and condensate drainage from refrigeration and air-conditioning equipment and cooled condensate from steam heating systems, but does not include *storm water*. (See Note A-1.4.1.2.(1).)

Combined building drain means a *building drain* that is intended to conduct *sewage* and *storm water*.

Combined building sewer means a building sewer that is intended to conduct *sewage* and *storm water*.

Combined sewer means a sewer that is intended to conduct sewage and storm water.

*Combustible** means that a material fails to meet the acceptance criteria of CAN/ULC-S114, "Test for Determination of Non-Combustibility in Building Materials."

*Construction** means, with respect to a *building*: erection, repair, *alteration*, enlargement, *addition*, *demolition*, *deconstruction*, removal and excavation.

*Construction Safety Officer** means a person who has been trained specifically to understand and apply safe *construction* practice as it relates to the worksite and as it affects the public, neighbouring properties and utilities, and who has been retained by the *owner*, or the *owner's* principal *contractor* or *project* manager, to coordinate all sub trade supervisors relating to *construction* safety at the *project* site.

*Construction Safety Plan** means a plan containing *construction* procedures and fire safety measures designed to protect workers on a project, neighbouring private property, public property, and members of the general public.

*Constructor** means a person who contracts with an owner or their authorized agent to undertake a project, and includes an *owner* who contracts with more than one person for the work on a project or undertakes the work on a project or any part thereof.

Continuous vent means a *vent pipe* that is an extension of a vertical section of a *branch* or *fixture drain*. (See Figure A-1.4.1.2.(1)-E in Note A-1.4.1.2.(1).)

Cooling tower means a cooling tower, evaporative condenser, or fluid cooler that is part of a recirculated *water system* incorporated into a *building*'s cooling, industrial process, refrigeration, or energy production system.

*Coordinating registered professional** means a *registered professional* retained under Clause 2.2.7.2.(1)(a) of Division C to coordinate all design work and *field reviews* of the *registered professionals* who are required for a project.

Critical level means the level of submergence at which the *back-siphonage preventer* ceases to prevent *back-siphonage*.

Dead end means a pipe that terminates with a closed fitting.

*Deconstruction** means demolition by systematic disassembly of a building resulting in the reuse, recycling or recovery of not less than 75% of all building materials, excluding materials which are hazardous or banned from landfill.

*Demolition** means the action or process of demolishing a *building*, and includes *deconstruction*.

*Designated flood** means a flood which may occur in any given year, of such magnitude as to equal a flood having a 200 year return period.

*Designated flood plain** means those lands in the *City* which are hereby designated, for the purposes of section 306(1)(cc) of the Vancouver Charter, as flood plains susceptible to flooding and subject to *flood construction level requirements*, and those lands so designated include:

(a) lands located in the proximity to the *natural boundary* of the Burrard Inlet, English Bay, False Creek and the Fraser River, which are located within the areas shown shaded or crosshatched on the maps attached to this By‑law as Diagrams A1 and A2. (See Book I, Division A, Figure A-1.4.1.2.(1)-C for Diagram A1: Burrard Inlet, English Bay, False Creek and Fraser River flood plains and Book I, Division A, Figure A-1.4.1.2.(1)-D for Diagram A2: Burrard Inlet, English Bay, False Creek and Fraser River flood plain, wave effect zone.); and

(b) lands located in the areas shown crosshatched on the map attached to this By‑law as Diagram B. (See Book I, Division A, Figure A-1.4.1.2.(1)-E for Diagram B: Still Creek flood plain and *flood construction levels*.)

*Designated Structural Engineer (Struct. Eng.)** means a person who is registered or licensed to practice as a professional engineer under the Engineers and Geoscientists Act of British Columbia, and a person who is designated by the Association of Professional Engineers and Geoscientists of British Columbia as a Designated Structural Engineer.

Developed length means the length along the centre line of the pipe and fittings. (See Note A-2.5.6.3.(1) of Division B.)

Directly connected means physically connected in such a way that water or gas cannot escape from the connection.

*Drainage system** means an assembly of pipes, fittings, *fixtures*, *traps* and appurtenances that is used to convey *sewage*, *clear-water waste* or *storm water* to a public sewer or a *private sewage disposal system*, but does not include *subsoil drainage pipes*. (See Figure A-1.4.1.2.(1)-F in Note A-1.4.1.2.(1).)

Dual vent means a *vent pipe* that serves 2 *fixtures* and connects at the junction of the *trap arms*.
(See Figure A-1.4.1.2.(1)-G in Note A-1.4.1.2.(1).)

*Dwelling unit** means a *suite* operated as a housekeeping unit, used or intended to be used by one or more persons and usually containing cooking, eating, living, sleeping and sanitary facilities.

E. coli means *Escherichia coli.*

Emergency floor drain means a *fixture* for the purposes of overflow protection that does not receive regular discharge from other *fixtures*, other than from a *trap* primer. (See Note A-1.4.1.2.(1).)

Emergency once through cooling equipment means *once through cooling equipment* that is not normally operated and is only activated in the event of a sudden, unforeseen failure of an otherwise properly designed, operated and maintained primary cooling system.

*Excavation** means the space created by the removal of *soil*, *rock* or *fill* for the purposes of construction.

*Existing building** means a *building* lawfully constructed and completed under a permit before submission of the current *permit* application.

*Field review** means a review of the work

- at a *building* site, and
- where applicable, at locations where *building* components are fabricated for use at the *building* site that a *registered professional* in his or her professional discretion considers necessary to ascertain whether the work substantially complies in all material respects with the plans and supporting documents prepared by a *registered professional*.

*Fire separation** means a construction assembly that acts as a barrier against the spread of fire. (See Book I, Division A, Note A-1.4.1.2.(1).)

Fire service pipe means a pipe that conveys water from a public water main or private water source to the inside of a *building* for the purpose of supplying the fire sprinkler or standpipe systems.

Fixture means a receptacle, appliance, apparatus or other device that discharges *sewage* or *clear-water waste*, and includes a *floor drain*.

Fixture drain means the pipe that connects a *trap* serving a *fixture* to another part of a *drainage system*.

Fixture outlet pipe* means a pipe that connects the waste opening of a *fixture* to the *trap* serving the *fixture*. (See Figure A-1.4.1.2.(1)-H in Note A-1.4.1.2.(1).)

Fixture unit (as applying to *drainage systems*) means the unit of measure based on the rate of discharge, time of operation and frequency of use of a *fixture* that expresses the hydraulic load that is imposed by that *fixture* on the *drainage system*.

Fixture unit (as applying to *water distribution systems*) means the unit of measure based on the rate of supply, time of operation and frequency of use of a *fixture* or outlet that expresses the hydraulic load that is imposed by that *fixture* or outlet on the supply system.

Float home* means any structure incorporating a floatation system, intended for use or occupancy or being used or occupied for residential purposes, containing one dwelling unit only, and not primarily intended for, or useable in, navigation, but does not include any *water craft* designed or intended for navigation.

Flood construction level* means the minimum elevation of the underside of a floor system, or of the top of a concrete slab, of a building which is used or may be used for habitation, business, or for the storage of goods which may be damaged by flood water.

Flood construction level requirements* means

(a) on the Burrard Inlet, English Bay, False Creek and Fraser River flood plains:

(i) for *buildings* located within the areas shown shaded or crosshatched on the map attached to this By-law, the underside of a floor system or the top of a concrete slab of a *buildings* used for habitation, business or storage of goods, shall not be lower than 4.6m Greater Vancouver Regional District datum.

(See Book I, Division A, Figure A-1.4.1.2.(1)-C for Diagram A1: Burrard Inlet, English Bay, False Creek and Fraser River flood plains); and

(ii) for *buildings* located in the areas shown shaded or crosshatched on the map attached to this By-law, an additional elevation allowance above 4.6 m may be required for wave run-up, at a level as determined by a Professional Engineer and to the satisfaction of the *Chief Building Official*. (See Book I, Division A, Figure A-1.4.1.2.(1)-D for Diagram A2: Burrard Inlet, English Bay, False Creek and Fraser River flood plain wave effect zone); and

(b) on the Still Creek flood plain:

(i) the underside of a floor system or the top of a concrete slab of any *buildings* used for habitation, business or storage of goods shall not be lower than the applicable elevation shown on the map attached to this By-law. (See Book I, Division A, Figure A-1.4.1.2.(1)-E for Diagram B: Still Creek flood plain and *flood construction levels*.)

Flood level rim means the top edge at which water can overflow from a *fixture* or device. (See Figure A-1.4.1.2.(1)-B in Note A-1.4.1.2.(1).)

Floor drain* means a fixture used to receive water from the floor of a *building*.

Flow control roof drain means a *roof drain* that restricts the flow of *storm water* into the *storm drainage system*.

Fresh air inlet means a *vent pipe* that is installed in conjunction with a *building trap* and terminates outdoors. (See Note A-2.4.5.4.(1) of Division B.)

General Manager, Park Board* means the person appointed as such by the Park Board.

General Manager, Real Estate and Facilities Management* means the person appointed as such by City Council.

Greywater means waste water from all sources except *blackwater* and *clear-water waste*.

Groundwater* means a freestanding body of water in the ground.

Indirect service water heater* means a *service water heater* that derives its heat from a heating medium such as warm air, steam or hot water.

Indirectly connected means not *directly connected*. (See Note A-2.3.3.11.(2) of Division B.)

Individual vent means a *vent pipe* that serves one *fixture*.

Interceptor means a receptacle that is installed to prevent oil, grease, sand or other materials from passing into a *drainage system*.

*Journeyman plumber** means a person, other than an *apprentice*, who holds a certificate issued pursuant to the provisions of the Industry Training Authority Act of British Columbia authorizing the person to engage in the plumbing trade.

Leader means a pipe that is installed to carry *storm water* from a roof to a *storm building drain* or *sewer* or other place of disposal.

Maintenance once through cooling equipment means *once through cooling equipment* that is not normally operated and is only activated to temporarily supplement or replace the primary cooling system during scheduled maintenance on the primary cooling system.

*Marina** means any structure or installation, including *marina walkways*, which provides moorage space for *water craft*.

*Marina walkway** means any surface extending over navigable water used to accommodate pedestrian traffic, and used so that *water craft* and *float homes* may lie alongside to receive and discharge cargo and passengers.

Metering fixture means a *self-closing plumbing fixture* that dispenses a specific volume of water for each actuation cycle.

Nominally horizontal means at an angle of less than 45° with the horizontal. (See Figure A-1.4.1.2.(1)-J in Note A-1.4.1.2.(1).)

Nominally vertical means at an angle of not more than 45° with the vertical. (See Figure A-1.4.1.2.(1)-J in Note A-1.4.1.2.(1).)

*Noncombustible** means that a material meets the acceptance criteria of CAN/ULC-S114, “Test for Determination of Non-Combustibility in Building Materials.”

Non-recirculating liquid ring pump means a vacuum pump that uses water to cool the pump or to create a seal and recirculates less than 60% of the water that passes through the pump.

*Occupancy** means the use or intended use of a *building* or part thereof for the shelter or support of persons, animals or property.

Offset means the piping that connects the ends of 2 pipes that are parallel. (See Figure A-1.4.1.2.(1)-K in Note A-1.4.1.2.(1).)

Offset relief vent means a *relief vent* that provides additional air circulation upstream and downstream of an *offset* in a *soil-or-waste stack*. (See Note A-2.5.4.4.(1) of Division B.)

Once through cooling equipment means equipment that produces a cooling effect by transfer of heat to water that is only circulated once through the equipment and is then discharged, and includes but is not limited to commercial and industrial air conditioners, refrigerators, freezers, coolers and ice machines.

*Operating permit** means permission or authorization in writing by the *Chief Building Official* to install or retain existing equipment or systems for which an operating permit is required under this By-law.

*Owner** means a registered owner, a holder of an agreement for sale and purchase and, in the case of Crown-owned lands, owner shall mean the occupier.

Perimeter drainage water means water collected from the foundation of a structure.

*Permit** means permission or authorization in writing by the *Chief Building Official* to perform work regulated by this By-law and, in the case of an *occupancy permit*, to occupy any *building* or part thereof, but does not include an *operating permit*.

*Plumbing contractor** means a person licensed as a *contractor* pursuant to the License By-law and who is either a plumber or a person who employs a plumber on a full time basis.

Plumbing fixture means any installed receptacle, device or appliance, including *floor drains* and *roof drains* and swimming pools, which are supplied with water or which receive liquid or liquid-borne wastes and discharge such wastes into the *drainage system* to which they may be directly or indirectly connected, except that industrial or commercial tanks, vats and similar processing equipment are not *plumbing fixtures*, but may be connected to or discharge into *traps* or *plumbing fixtures* which are in compliance with or otherwise provided for in this By-law.

*Plumbing system** means a *drainage system*, a *venting system* and a *water system* or parts thereof. (See Figure A-1.4.1.2.(1)-L in Note A-1.4.1.2.(1).)

Potable means safe for human consumption.

Pre-rinse spray valve means a handheld device for use with commercial dishwashing and ware washing equipment that sprays water on dishes, flatware, and other food service items for the purpose of removing food residue before cleaning and sanitizing the items.

*Private sewage disposal system** means a privately owned plant for the treatment and disposal of *sewage* (such as a septic tank with an absorption field).

Private use (as applying to the classification of plumbing *fixtures*) means *fixtures* in residences and apartments, in private bathrooms of hotels, and in similar installations in other *buildings* for one family or an individual.

*Private water supply system** means an assembly of pipes, fittings, valves, equipment and appurtenances that supplies water from a private source to a *water distribution system*.

*Project** means any *construction*, *alteration* or *demolition* operation.

Public sewer connection means that part of the public *sewer* which connects or is intended to connect a *building sewer* with any public *sewer*.

Public use (as applying to the classification of plumbing *fixtures*) means *fixtures* in general washrooms of schools, gymnasiums, hotels, bars, public comfort stations and other installations where *fixtures* are installed so that their use is unrestricted.

*Registered professional** means

- a person who is registered or licensed to practise as an architect under the Architects Act, or
- a person who is registered or licensed to practise as a professional engineer under the Engineers and Geoscientists Act.

*Registered professional of record** means a *registered professional* retained to undertake design work and *field reviews* in accordance with Subsection 2.2.7. of Division C.

*Re-occupancy permit** means permission or authorization in writing by the *Chief Building Official* to re-occupy any *building* or part thereof in respect of which the *Chief Building Official* has issued an order to cease *occupancy* because of an *unsafe condition*.

*Residential occupancy** means the *occupancy* or use of a *building* or part thereof by persons for whom sleeping accommodation is provided but who are not harboured for the purpose of receiving *care* or *treatment* and are not involuntarily detained.

Roof drain means a fitting or device that is installed in the roof to permit *storm water* to discharge into a *leader*.

Sanitary building drain means a *building drain* that conducts *sewage* to a *building sewer* from the most upstream *soil-or-waste stack*, *branch* or *fixture drain* serving a water closet.

Sanitary building sewer means a *building sewer* that conducts *sewage*.

*Sanitary drainage system** means a drainage system that conducts sewage.

Sanitary sewer means a sewer that conducts *sewage*.

Self-closing plumbing fixture means a *plumbing fixture* that closes automatically upon the deactivation of a mechanical or electronic control mechanism.

Separate system area means an area in which the *City Engineer* has required the separate disposal of *storm water* and *sewage*.

*Service water heater** means a device for heating water for plumbing services.

*Sewage** means any liquid waste other than *clear-water waste* or *storm water*.

*Sewer** means an underground drain or conduit to remove waste water and organic refuse.

Shower head means any fitting that transmits water for the purposes of showering and includes rain heads, rain tiles, rain systems, waterfalls, body sprays and jets. A hand-held shower shall be considered a *shower head*.

Size means the nominal diameter by which a pipe, fitting, *trap* or other similar item is commercially designated.

Soil-or-waste pipe or *waste pipe* means a pipe in a *sanitary drainage system*.

Soil-or-waste stack means a vertical *soil-or-waste pipe* that passes through one or more *storeys*, and includes any *offset* that is part of the stack.

*Sprinkler contractor** means a person licensed as a *contractor* pursuant to the License By-law and who is either a *sprinkler system installer* or a person who employs a *sprinkler system installer* on a full-time basis.

*Sprinkler system** means an automatic fire extinguishing system designed to the National Fire Protection Association 13, 13D or 13R standard and all applicable associated sprinkler standards, and which consists of a system of devices and equipment designed to automatically detect a fire and discharge water or another approved fire extinguishing agent in the area of or onto a fire.

*Sprinkler system installer** means a person who has successfully completed an accredited program as a *Sprinkler System Installer* under the Industry Training Authority Act and Industry Training Regulation of British Columbia.

Stack vent means a *vent pipe* that connects the top of a *soil-or-waste stack* to a *vent header* or to outside air. (See Figure A-1.4.1.2.(1)-G in Note A-1.4.1.2.(1).)

*Storage-type service water heater** means a *service water heater* with an integral hot water storage tank.

Storey for the purposes of Book II of this By-law, means the interval between 2 successive floor levels, including mezzanine floors that contain plumbing fixtures, or between a floor level and roof.

*Storm building drain** means a *building drain* that conducts *storm water* and is connected at its upstream end to a *leader*, sump or catch basin, and at its downstream end to a *building sewer* or a designated *storm water* disposal location.

Storm building sewer means a *building sewer* that conveys *storm water*.

Storm drainage system means a *drainage system* that conveys *storm water*.

Storm sewer means a sewer that conveys *storm water*.

*Storm water** means water that is discharged from a surface as a result of rainfall or snowfall.

*Street** means a public road, highway, bridge, viaduct, *lane*, and sidewalk, and any other way normally open to the use of the public, but does not include a private right-of-way on private property and, for the purposes only of Part 3 and Part 9 of this By-law, a street which is less than 9 m in width or a *lane* or sidewalk.

*Subsoil drainage pipe** means a pipe that is installed underground to intercept and convey subsurface water.

*Suite** means a single room or series of rooms of complementary use, operated under a single tenancy, and includes *dwelling units*, individual guest rooms in motels, hotels, boarding houses, rooming houses and dormitories as well as individual stores and individual or complementary rooms for *business and personal services occupancies*. (See Book I, Division A, Note A-1.4.1.2.(1).)

*Sump** means a receptacle installed between the storm or *combined sewer* and the *building* storm system to intercept the flow of debris into the *building* or public *sewer* and to prevent the outflow of *sewer* gas.

Trade waste system means a system of drainage pipes from *floor drains* and hub drains located in food display areas that are intercepted by a trade waste *sump* and *backwater valve* before entering the *sanitary building drain*.

*Trap** means a fitting or device that is designed to hold a liquid seal that will prevent the passage of gas but will not materially affect the flow of a liquid.

Trap arm means that portion of a *fixture drain* between the *trap weir* and the *vent pipe* fitting. (See Note A-2.5.6.3.(1) of Division B.)

Trap dip means the lowest part of the upper interior surface of a *trap*.

Trap seal depth means the vertical distance between the *trap dip* and the *trap weir*. (See Note A-2.2.3.1.(1) and (3) of Division B.)

Trap standard means the *trap* for a *fixture* that is integral with the support for the *fixture*.

Trap weir means the highest part of the lower interior surface of a *trap*. (See Note A-2.2.3.1.(1) and (3) of Division B.)

*Treatment** means the provision of medical or other health-related intervention to persons, where the administration or lack of administration of these interventions may render them incapable of evacuating to a safe location without the assistance of another person. (See Book I, Division A, Note A-1.4.1.2.(1).)

*Unsafe condition** means any condition that could cause undue hazard or risk to the life, limb or health of any person authorized, expected or anticipated to be on or about the premises, *building* or *construction*.

Vacuum breaker (See *back-siphonage preventer*).
Vent header means a *vent pipe* that connects any combination of *stack vents* or *vent stacks* to outside air. (See Figure A-1.4.1.2.(1)-I in Note A-1.4.1.2.(1).)
Vent pipe means a pipe that is part of a *venting system*.
Vent stack means a *vent pipe* that is connected at its upper end to a *vent header* or that terminates in outside air and is connected at its lower end to the *soil-or-waste stack* at or below the lowest *soil-or-waste pipe* connection. (See Figure A-1.4.1.2.(1)-G in Note A-1.4.1.2.(1).)
*Venting system** means an assembly of pipes and fittings that connects a *drainage system* with outside air for circulation of air and the protection of trap seals in the *drainage system*. (See Figures A-1.4.1.2.(1)-F and A-1.4.1.2.(1)-G in Note A-1.4.1.2.(1).)
Waste pipe (See *soil-or-waste pipe*).
*Water craft** means any boat, hull, barge, or houseboat which is afloat, whether self-propelled or not, and includes pleasure and commercial craft.
*Water distribution system** means an assembly of pipes, fittings, valves and appurtenances that conveys water from the *water service pipe* or *private water supply system* to water supply outlets, *fixtures*, appliances and devices.
*Water service pipe** means a pipe that conveys water from a public water main or private water source to the inside of the *building*.
*Water system** means a *private water supply system,* a *water service pipe*, a *water distribution system* or parts thereof.
Wet vent means a *soil-or-waste pipe* that also serves as a *vent pipe* and extends from the most downstream wet-vented *fixture* connection to the most upstream *fixture* connection. (See Note A-2.5.8.1.(2) of Division B.)
Yoke vent means a *vent pipe* that is connected at its lower end to a *soil-or-waste stack* and at its upper end to a *vent stack* or to a *branch vent* connected to a *vent stack*. (See Note A-2.5.4.3. of Division B.)

1.4.2. Symbols and Other Abbreviations

1.4.2.1. Symbols and Other Abbreviations

1) The symbols and other abbreviations in this By-law shall have the meanings assigned to them in this Article and Article 1.3.2.1. of Division B.

1 in 50 .... slope of 1 vertical to 50 horizontal
ABS................ acrylonitrile-butadiene-styrene
AL.................. aluminum
cm^2 .... square centimetre(s)
CPVC .... chlorinated polyvinyl chloride
CRP .... coordinating registered professional
° .... degree(s)
°C................... degree(s) Celsius
diam............... diameter
DWV............. drain, waste and vent
h..................... hour(s)
in.................... inch(es)
Inc. .... Incorporated
kg/m^3 .... kilogram(s) per cubic metre
kPa................. kilopascal(s)
L .... litre(s)
Lpf .... litre(s) per flush
L/s.................. litre(s) per second
m.................... metre(s)

m² .... square metre(s)
max. .... maximum
min. .... minimum
min .... minute(s)
mm .... millimetre(s)
n/a.................. not applicable
No. …………… number(s)
Pa ....pascal(s)
PE.................. polyethylene
PEX................ crosslinked polyethylene
PP-R............... polypropylene
PVC .... polyvinyl chloride
RP .... registered professional
VBBL … .... Vancouver Building By-law

Section 1.5. Referenced Documents and Organizations

1.5.1. Referenced Documents

1.5.1.1. Application of Referenced Documents

1) Except as provided in Sentence (2), the provisions of documents referenced in this By-law, and of any documents referenced within those documents, apply only to the extent that they relate to

a) *plumbing systems*, and

b) the objectives and functional statements attributed to the applicable acceptable solutions in Division B where the documents are referenced.

(See Note A-1.5.1.1.(1).)

2) Where a provision of this By-law references the Fire By-law, the NECB, or Book I (General) of this By-law, the applicable objectives and functional statements shall include those found in that referenced document. (See Note A-2.1.1.2.(6).)

1.5.1.2. Conflicting Requirements

1) In case of conflict between the provisions of this By-law and those of a referenced document, the provisions of this By-law shall govern.

1.5.1.3. Applicable Editions

1) Where documents are referenced in this By-law, they shall be the editions designated in Subsection 1.3.1. of Division B.

1.5.2. Organizations

1.5.2.1. Abbreviations of Proper Names

1) The abbreviations of proper names in this By-law shall have the meanings assigned to them in Article 1.3.2.1. of Division B.

Notes to Part 1 Compliance

A-1.1.1.1.(1) Application to Existing Buildings.
(See Part 11 of Division B of Book I (General) of the Building By-law)

A-1.2.1.1.(1)(a) By-law Compliance via Acceptable Solutions. If a plumbing system design (e.g., material, component, assembly or system) can be shown to meet all provisions of the applicable acceptable solutions in Division B (e.g., it complies with the applicable provisions of a referenced standard), it is deemed to have satisfied the objectives and functional statements linked to those provisions and thus to have complied with that part of the By-law. In fact, if it can be determined that a design meets all the applicable acceptable solutions in Division B, there is no need to consult the objectives and functional statements in Division A to determine its compliance.

A-1.2.1.1.(1)(b) By-law Compliance via Alternative Solutions. Where a design differs from the acceptable solutions in Division B, then it should be treated as an "alternative solution." A proponent of an alternative solution must demonstrate that the alternative solution addresses the same issues as the applicable acceptable solutions in Division B and their attributed objectives and functional statements. However, because the objectives and functional statements are entirely qualitative, demonstrating compliance with them in isolation is not possible. Therefore, Clause 1.2.1.1.(1)(b) identifies the principle that Division B establishes the quantitative performance targets that alternative solutions must meet. In many cases, these targets are not defined very precisely by the acceptable solutions – certainly far less precisely than would be the case with a true performance code, which would have quantitative performance targets and prescribed methods of performance measurement for all aspects of building performance. Nevertheless, Clause 1.2.1.1.(1)(b) makes it clear that an effort must be made to demonstrate that an alternative solution will perform as well as a design that would satisfy the applicable acceptable solutions in Division B – not "well enough" but "as well as."

In this sense, it is Division B that defines the boundaries between acceptable risks and the "unacceptable" risks referred to in the statements of the By-law's objectives, i.e., the risk remaining once the applicable acceptable solutions in Division B have been implemented represents the residual level of risk deemed to be acceptable by the broad base of Canadians who have taken part in the consensus process used to develop the Model Building Code.

Level of Performance
Where Division B offers a choice between several possible designs, it is likely that these designs may not all provide exactly the same level of performance. Among a number of possible designs satisfying acceptable solutions in Division B, the design providing the lowest level of performance should generally be considered to establish the minimum acceptable level of performance to be used in evaluating alternative solutions for compliance with the By-law.

Sometimes a single design will be used as an alternative solution to several sets of acceptable solutions in Division B. In this case, the level of performance required of the alternative solution should be at least equivalent to the overall level of performance established by all the applicable sets of acceptable solutions taken as a whole.

Each provision in Division B has been analyzed to determine what it is intended to achieve. The resultant intent statements clarify what undesirable results each provision seeks to preclude. These statements are not a legal component of the By-law, but are advisory in nature, and can help By-law users establish performance targets for alternative solutions. They are published as part of the online Code subscriptions and as a separate electronic document entitled “Supplement to the NPC 2015: Intent Statements,” which is available on NRC’s Web site.

Areas of Performance
A subset of the acceptable solutions in Division B may establish criteria for particular types of designs (e.g. certain types of materials, components, assemblies, or systems). Often such subsets of acceptable solutions are all attributed to the same objective: Sanitation for example. In some cases, the designs that are normally used to satisfy this subset of acceptable solutions might also provide some benefits that could be related to some other objective: Protection of the Building or Facility from Water and Sewage Damage for example. However, if none of the applicable acceptable solutions are linked to Objective OP5, Protection of the Building or Facility from Water and Sewage Damage, it is not necessary that alternative solutions proposed to replace these acceptable solutions provide a similar benefit related to Protection of the Building or Facility from Water and Sewage Damage. In other words, the acceptable solutions in Division B establish acceptable levels of performance for compliance with the By-law only in those areas defined by the objectives and functional statements attributed to the acceptable solutions.

Applicable Acceptable Solutions
In demonstrating that an alternative solution will perform as well as a design that would satisfy the applicable acceptable solutions in Division B, its evaluation should not be limited to comparison with the acceptable solutions to which an alternative is proposed. It is possible that acceptable solutions elsewhere in the By-law also apply. The proposed alternative solution may be shown to perform as well as the most apparent acceptable solution, which it is replacing, but may not perform as well as other relevant acceptable solutions. For example, an innovative piping material may perform adequately in a drainage system but may not meet combustibility requirements elsewhere in the By-law. All applicable acceptable solutions should be taken into consideration in demonstrating the compliance of an alternative solution.

A-1.4.1.2.(1) Defined Terms.
Auxiliary Water Supply
The auxiliary water supply may include water from a secondary potable water supply or from any natural source, such as a well, lake, spring, stream or harbour. It may also include waste water (but not sanitary drainage) from industrial processes, such as cooling towers, or from storm retention ponds. These sources may be polluted or contaminated and constitute an unacceptable water source over which the primary water purveyor does not have sanitary control. It is generally accepted that there are two categories of auxiliary water supply:

- any public potable water supply over which the primary water purveyor does not have sanitary control, or
- any private water supply, other than the primary potable water supply, that is on or available to the premises.

Class 3 Fire Sprinkler/Standpipe Systems
In Class 3 fire sprinkler/standpipe systems, water is supplied to the storage facilities from the public water supply and is maintained in potable condition. Class 3 fire sprinkler/standpipe systems resemble Class 1 fire sprinkler/standpipe systems in all other respects.

Clear-Water Waste
Examples of clear-water waste are the waste waters discharged from a drinking fountain, cooling jacket, air conditioner or relief valve outlet.

Emergency Floor Drains
There are two types of floor drains. One is an emergency floor drain installed to avoid flooding in a building from any pipe or fixture failure. The other encompasses floor drains installed to receive discharge from specific pieces of equipment; this type is defined as a fixture.

Illustrations for Defined Terms

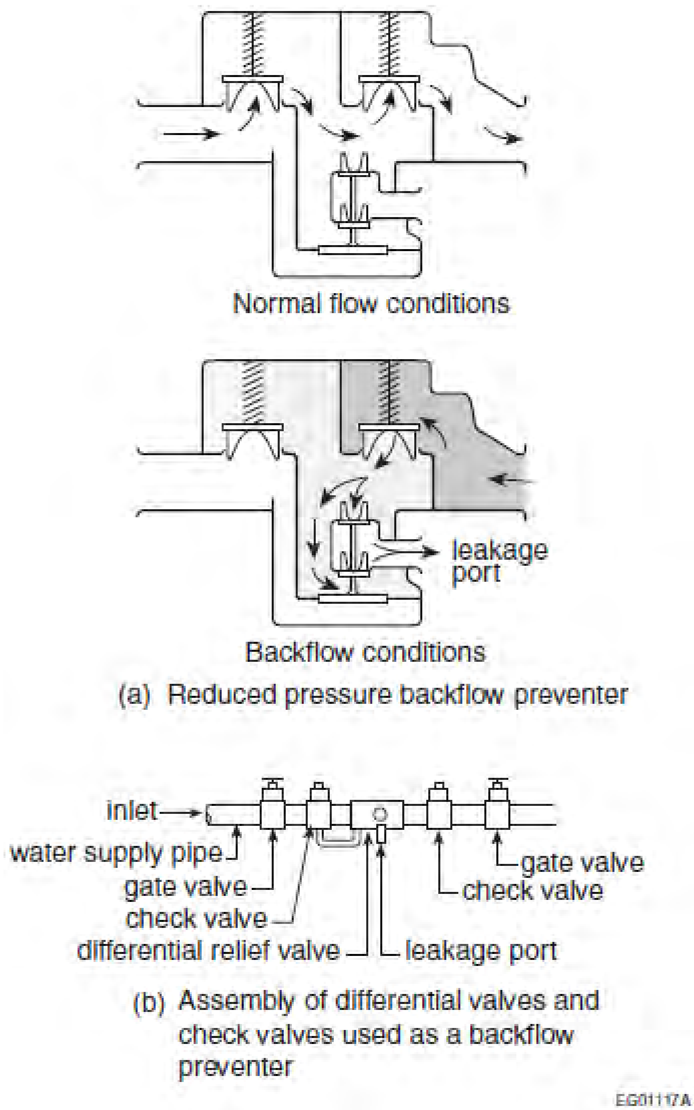


Figure A-1.4.1.2.(1)-A
Backflow Preventer

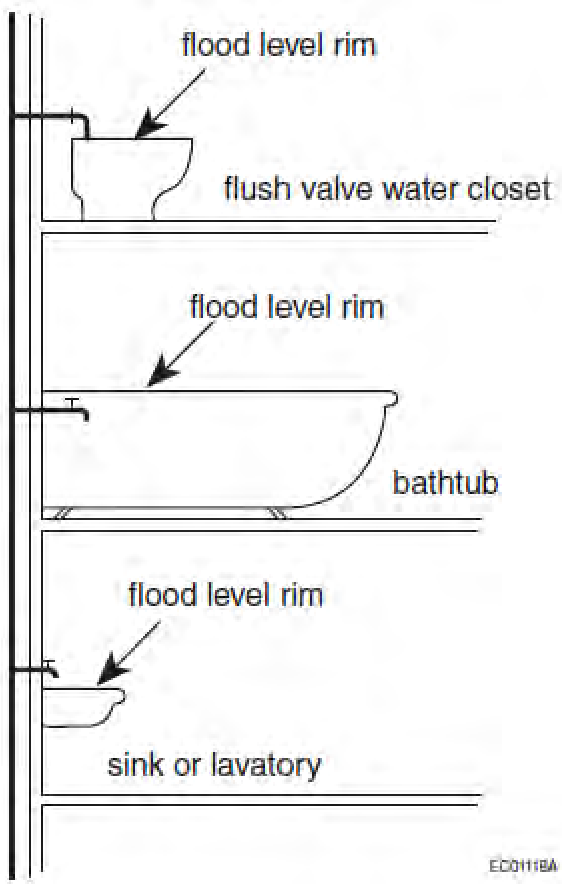


Figure A-1.4.1.2.(1)-B
Back-siphonage

Notes to Figure A-1.4.1.2.(1)-B:
(1) Figure A-1.4.1.2.(1)-B shows a situation that is fairly common in old buildings. If the bathtub is filled to a level above the faucet outlet, or if the flush valve of the water closet is faulty, and if the faucet at the sink or lavatory on the lower floor is opened, water can be drawn (siphoned) from the bathtub or the water closet into the water system when the pressure in the water system is low or the water supply has been shut off.
(2) Back-siphonage can be prevented in the above situations by providing an air gap or a back-siphonage preventer (See Subsection 2.6.2. of Division B).

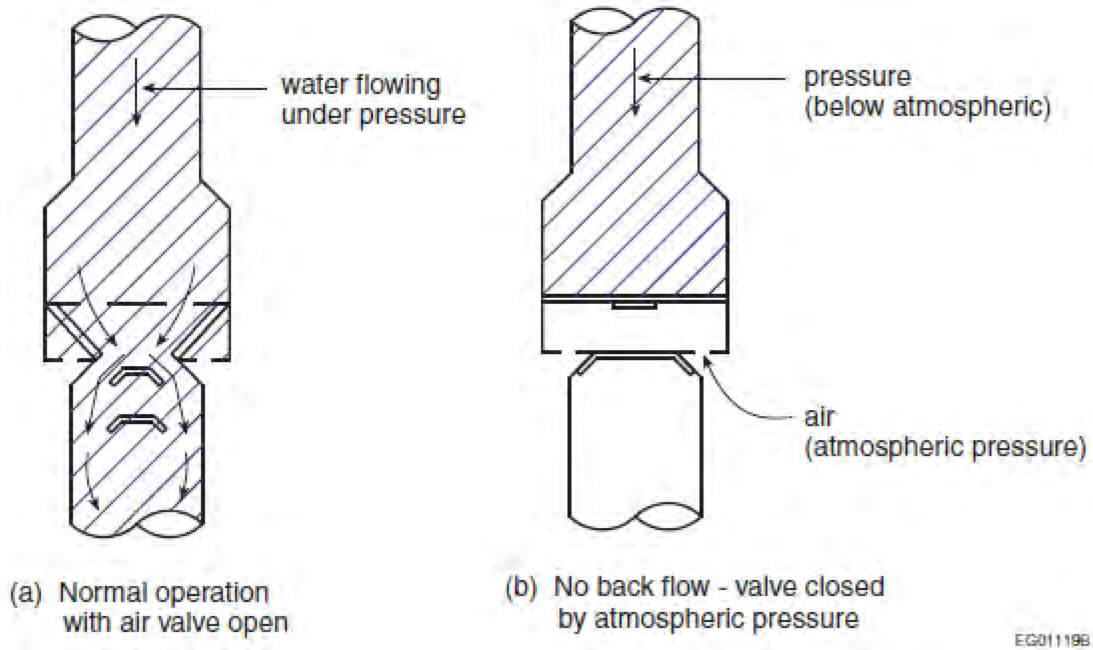


Figure A-1.4.1.2.(1)-C
Back-siphonage Preventer

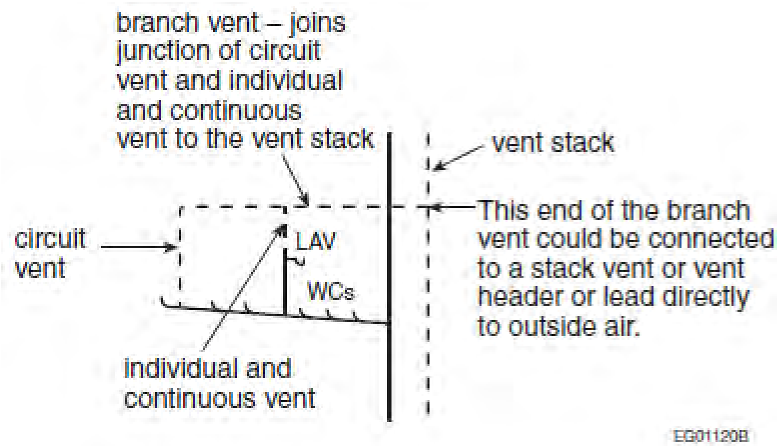


Figure A-1.4.1.2.(1)-D
Branch Vent

Note to Figure A-1.4.1.2.(1)-D:
(1) See also the definitions of header and drainage system in Article 1.4.1.2.

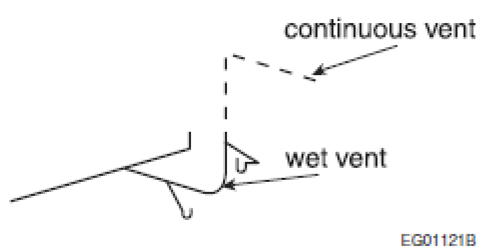


Figure A-1.4.1.2.(1)-E
Continuous Vent

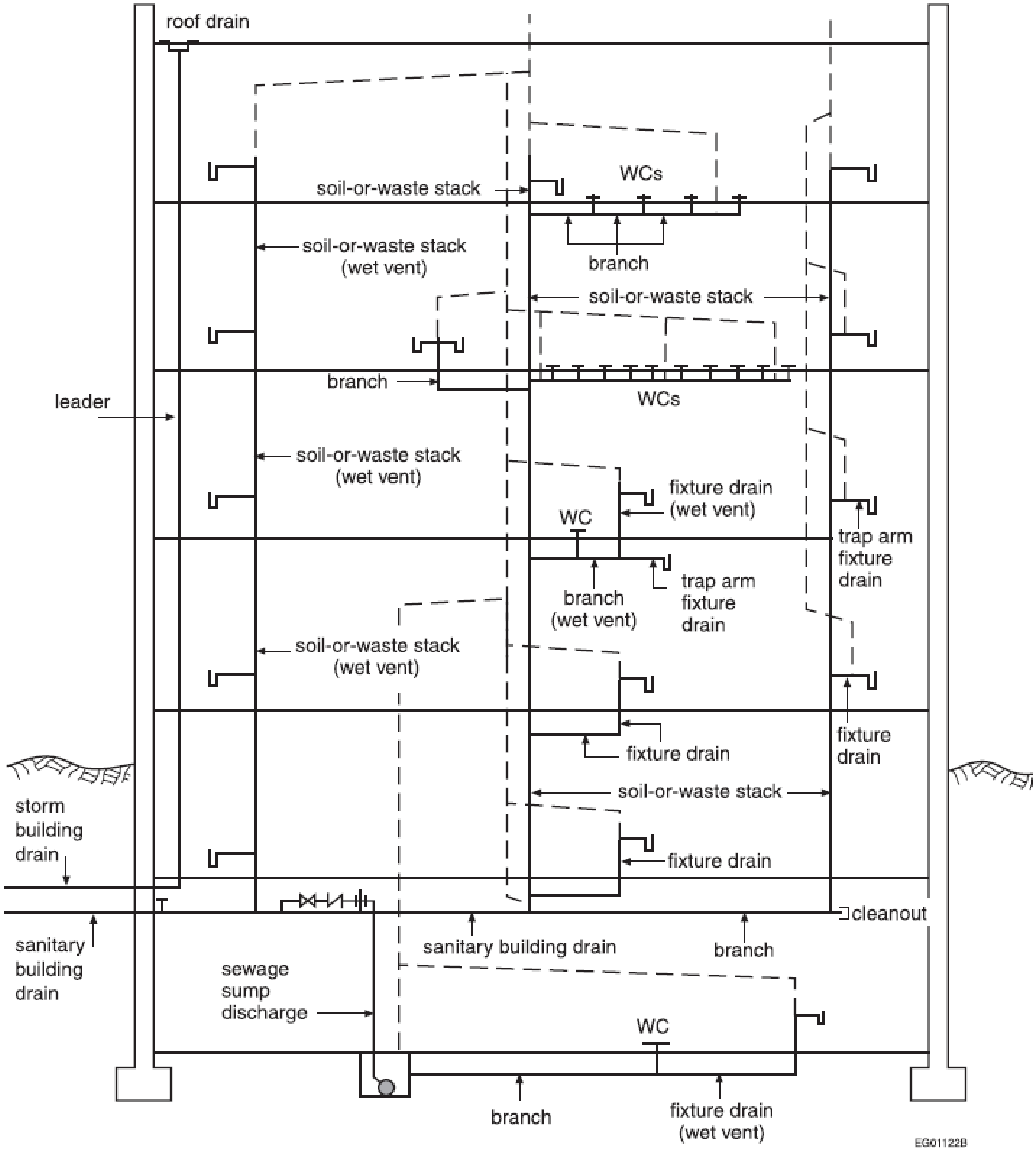


Figure A-1.4.1.2.(1)-F
Drainage System

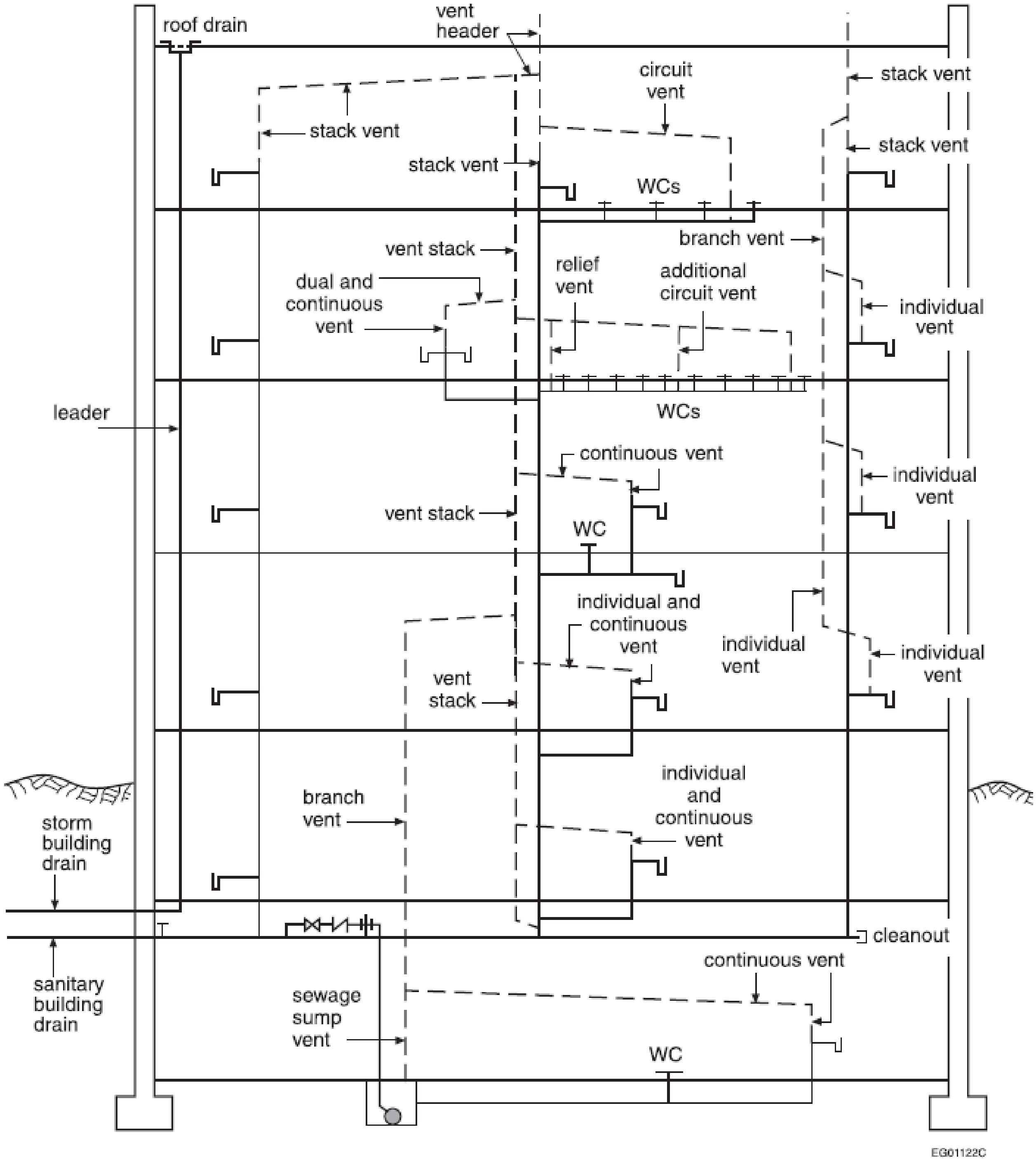


Figure A-1.4.1.2.(1)-G
Venting System

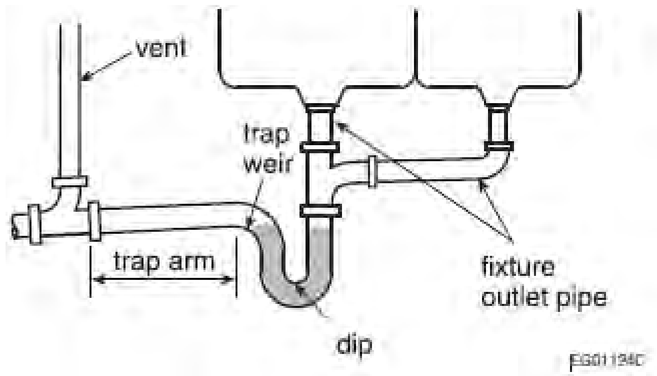


Figure A-1.4.1.2.(1)-H
Fixture Outlet Pipe and Trap Arm

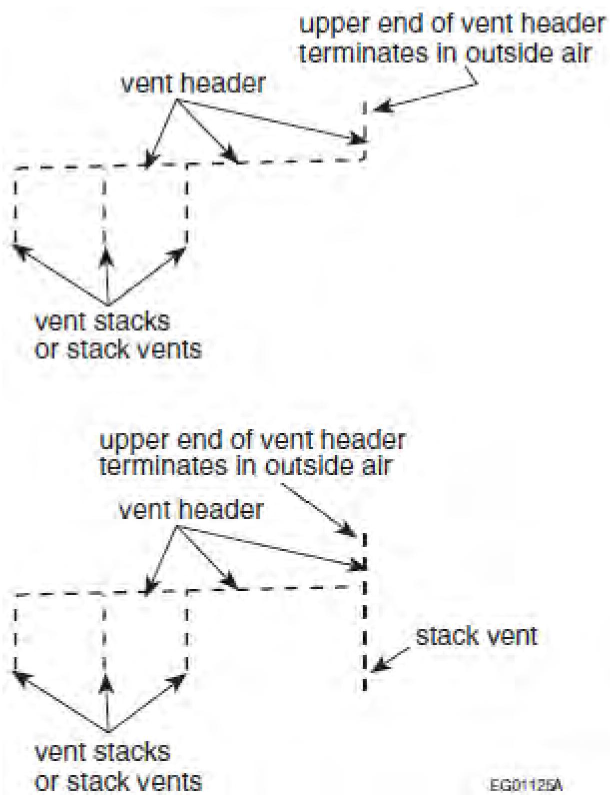


Figure A-1.4.1.2.(1)-I
Vent Header

Note to Figure A-1.4.1.2.(1)-I:
(1) Although a vent header is similar to a branch vent, it serves the special purpose of connecting the tops of stack vents or vent stacks. To make certain that it is adequate for that purpose, it is made larger than a branch vent. The developed length used to determine its size is the total length from the most distant soil-or-waste pipe to outside air, rather than the shorter length used to size a branch vent.

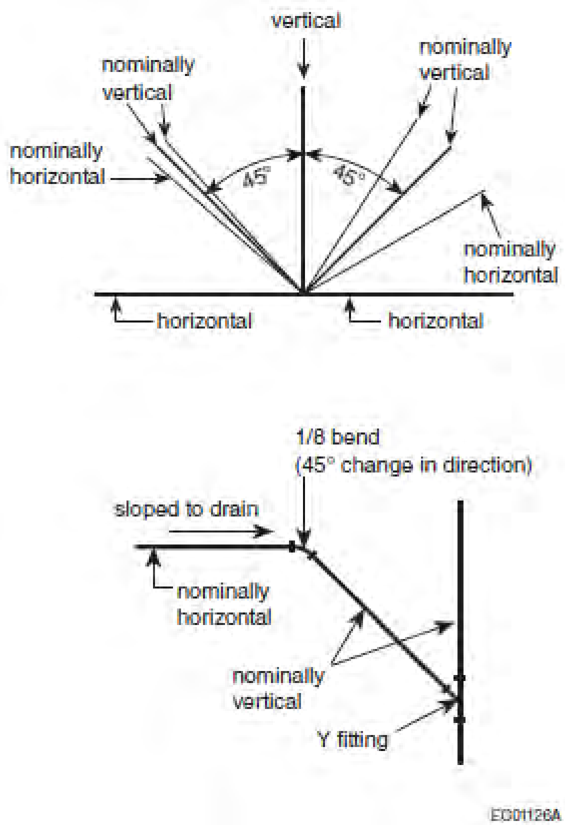


Figure A-1.4.1.2.(1)-J
Nominally Horizontal and Nominally Vertical

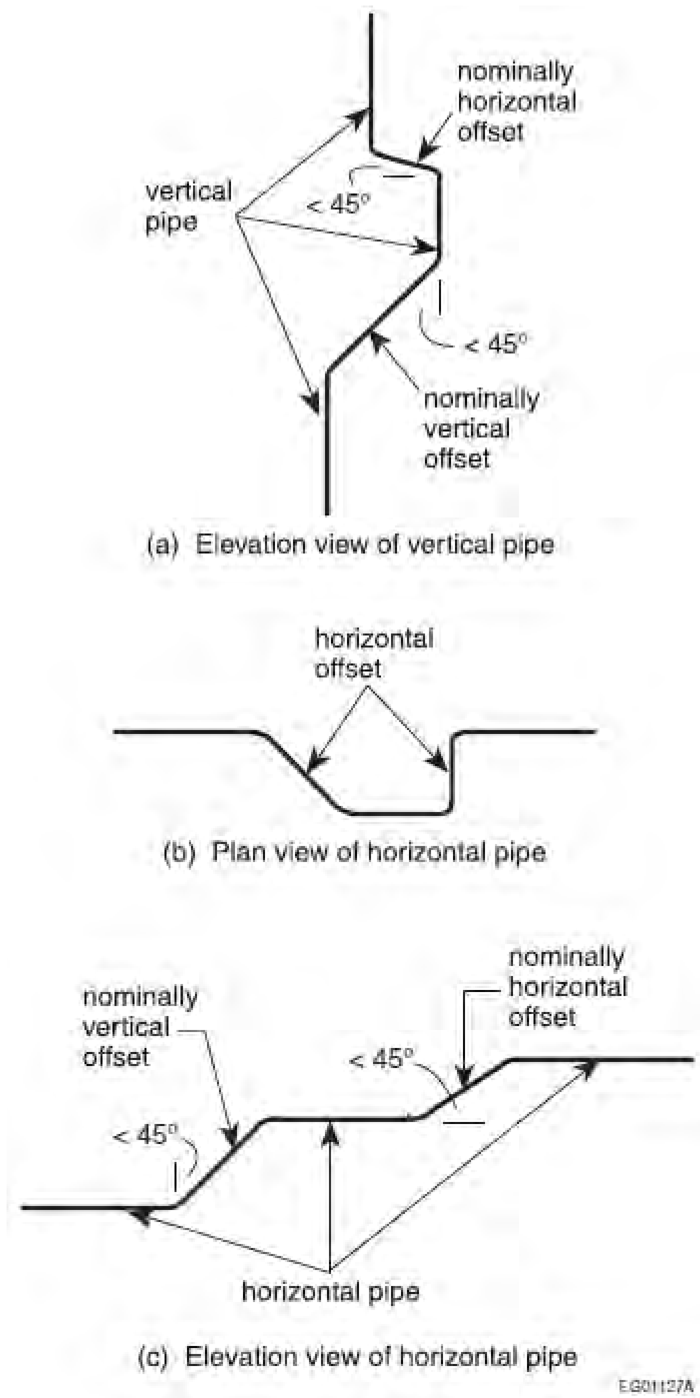


Figure A-1.4.1.2.(1)-K
Offset

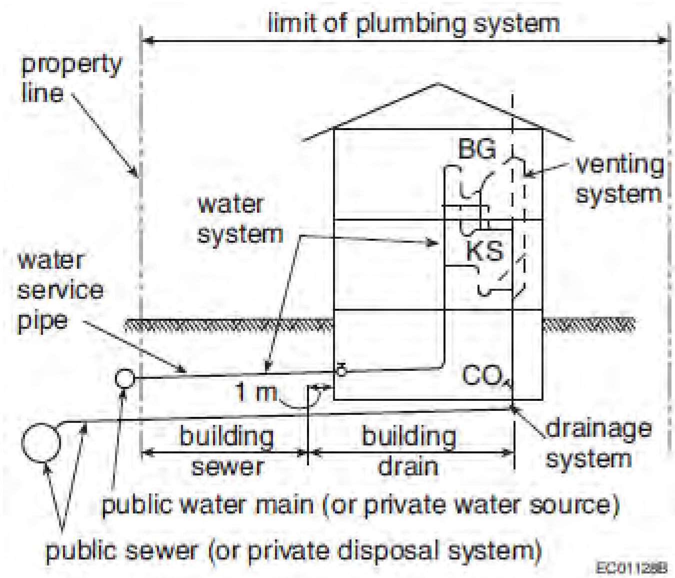


Figure A-1.4.1.2.(1)-L
Plumbing System

A-1.5.1.1.(1) Application of Referenced Documents. Documents referenced in the By-law may contain provisions covering a wide range of issues, including issues that are unrelated to the objectives and functional statements stated in Parts 2 and 3 of Division A respectively; e.g. conservation of water resources. Sentence 1.5.1.1.(1) is intended to make it clear that, whereas referencing these documents in the By-law generally has the effect of making the provisions of those documents part of the By-law, provisions that are unrelated to plumbing systems or to the objectives and functional statements attributed to the provisions in Division B where the document is referenced are excluded.

Furthermore, many documents referenced in the By-law contain references to other documents, which may also, in turn, refer to other documents. These secondary and tertiary referenced documents may contain provisions that are unrelated to plumbing systems or to the objectives and functional statements of the By-law: such provisions – no matter how far down the chain of references they occur – are not included in the intent of Sentence 1.5.1.1.(1).

Part 2
Objectives

Section 2.1. Application

2.1.1. Application

2.1.1.1. Application

1) This Part applies to all *plumbing systems* covered in this By-law. (See Article 1.1.1.1.)

2.1.1.2. Application of Objectives

1) The objectives described in this Part apply

a) to all *plumbing systems* covered in this By-law (See Article 1.1.1.1.), and

b) only to the extent that they relate to compliance with this By-law as required in Article 1.2.1.1.

Section 2.2. Objectives

2.2.1. Objectives

2.2.1.1. Objectives

1) The objectives of this By-law are as follows (See Note A-2.2.1.1.(1).):

OS Safety

An objective of this By-law is to limit the probability that, as a result of the design or installation of the *plumbing system*, a person in or adjacent to the *building* or facility will be exposed to an unacceptable risk of injury.

OS1 Fire Safety

An objective of this By-law is to limit the probability that, as a result of the design or installation of the *plumbing system*, a person in or adjacent to the *building* or facility will be exposed to an unacceptable risk of injury due to fire. The risks of injury due to fire addressed in this By-law are those caused by –

OS1.1 – fire or explosion occurring

OS1.4 – fire safety systems failing to function as expected

OS2 Structural Safety

An objective of this By-law is to limit the probability that, as a result of the design or installation of the *plumbing system*, a person in or adjacent to the *building* will be exposed to an unacceptable risk of injury due to structural failure. The risks of injury due to structural failure addressed in this By-law are those caused by –

OS2.1 – loads bearing on the *building* elements that exceed their load-bearing capacity

OS3 Safety in Use

An objective of this By-law is to limit the probability that, as a result of the design or installation of the *plumbing system*, a person in or adjacent to the *building* or facility will be exposed to an unacceptable risk of injury due to hazards. The risks of injury due to hazards addressed in this By-law are those caused by –

OS3.1 – tripping, slipping, falling, contact, drowning or collision

OS3.2 – contact with hot surfaces or substances

OS3.4– exposure to hazardous substances

OH Health

An objective of this By-law is to limit the probability that, as a result of the design or installation of the *plumbing system*, a person will be exposed to an unacceptable risk of illness.

OH1 Indoor Conditions

An objective of this By-law is to limit the probability that, as a result of the design or installation of the *plumbing system*, a person in the *building* or facility will be exposed to an unacceptable risk of illness due to indoor conditions. The risks of illness due to indoor conditions addressed in this By-law are those caused by –

OH1.1 – inadequate indoor air quality

OH2 Sanitation

An objective of this By-law is to limit the probability that, as a result of the design or installation of the *plumbing system*, a person in the *building* or facility will be exposed to an unacceptable risk of illness due to unsanitary conditions. The risks of illness due to unsanitary conditions addressed in this By-law are those caused by –

OH2.1 – exposure to human or domestic waste
OH2.2 – consumption of contaminated water
OH2.3 – inadequate facilities for personal hygiene
OH2.4 – contact with contaminated surfaces

OH5 Hazardous Substances Containment

An objective of this By-law is to limit the probability that, as a result of the design or installation of the *plumbing system*, the public will be exposed to an unacceptable risk of illness due to the release of hazardous substances from the *building* or facility.

OP Protection of the Building or Facility from Water and Sewage Damage

OP5 Protection of the Building or Facility from Water and Sewage Damage

An objective of this By-law is to limit the probability that, as a result of the design or installation of the *plumbing system*, the *building* or facility will be exposed to an unacceptable risk of damage due to the leakage of service water or *sewage*.

OE Environment

An objective of this By-law is to limit the probability that, as a result of the design, construction or renovation of the *building* or of the *plumbing system*, the environment will be affected in an unacceptable manner.

OE1 Energy Efficiency and Water Use

An objective of this By-law is to limit the probability that, as a result of the design construction or renovation of the *building,* the use of energy will be inefficient or the use of water will be excessive. The risks of inefficient energy use or excessive water use addressed in this By-law are those caused by –

OE1.2 – excessive use of water by plumbing *fixtures* and *water distribution systems*

Notes to Part 2 Objectives

A-2.2.1.1.(1) Objectives.

Listing of objectives

Any gaps in the numbering sequence of the objectives are due to the fact that there is a master list of objectives covering the three principal By-law Documents – the Building By-law Book I (General), Building By-law Book II (Plumbing Systems) and the Fire By-law – but not all objectives are pertinent to all By-laws.

The building or facility

Where the term "the building or facility" is used in the wording of the objectives, it refers to the building or facility for which compliance with the Building By-law Book II (Plumbing Systems) is being assessed.

Part 3
Functional Statements

Section 3.1. Application

3.1.1. Application

3.1.1.1. Application

1) This Part applies to all *plumbing systems* covered in this By-law. (See Article 1.1.1.1.)

3.1.1.2. Application of Functional Statements

1) The functional statements described in this Part apply

a) to all *plumbing systems* covered in this By-law (See Article 1.1.1.1.), and

b) only to the extent that they relate to compliance with this By-law as required in Article 1.2.1.1.

Section 3.2. Functional Statements

3.2.1. Functional Statements

3.2.1.1. Functional Statements

1) The objectives of this By-law are achieved by measures, such as those described in the acceptable solutions in Division B, that are intended to allow the *plumbing system* to perform the following functions (See Note A-3.2.1.1.(1).):

F01 To minimize the risk of accidental ignition.
F02 To limit the severity and effects of fire or explosions.
F20 To support and withstand expected loads and forces.
F21 To limit or accommodate dimensional change.
F30 To minimize the risk of injury to persons as a result of tripping, slipping, falling, contact, drowning or collision.
F31 To minimize the risk of injury to persons as a result of contact with hot surfaces or substances.
F40 To limit the level of contaminants.
F41 To minimize the risk of generation of contaminants.
F43 To minimize the risk of release of hazardous substances.
F45 To minimize the risk of the spread of disease through communal shower facilities.
F46 To minimize the risk of contamination of potable water.
F62 To facilitate the dissipation of water and moisture from the *building*.
F70 To provide potable water.
F71 To provide facilities for personal hygiene.
F72 To provide facilities for the sanitary disposal of human and domestic wastes.
F75 To minimize obstacles for future modification to provide *access* (See Sentence 3.1.1.2.(4) for application limitation).
F80 To resist deterioration resulting from expected service conditions.
F81 To minimize the risk of malfunction, interference, damage, tampering, lack of use or misuse.
F82 To minimize the risk of inadequate performance due to improper maintenance or lack of maintenance.
F130 To limit the unnecessary demand and/or consumption of water for *fixtures*.
F131 To limit the unnecessary demand and/or consumption of water for fittings.

Notes to Part 3
Functional Statements

A-3.2.1.1.(1) Listing of Functional Statements. The numbered functional statements are grouped according to functions that deal with closely related subjects. For example, the first group deals with fire risks, the second group deals with the structural properties of piping materials, etc. There may be gaps in the numbering sequence for the following reasons:

- Each group has unused numbers which allows for the possible future creation of additional functional statements within any one group.
- There is a master list of functional statements covering the three principal By-law Documents – the Building By-law Book I (General), Building By-law Book II (Plumbing Systems) and the Fire By-law – but not all functional statements are pertinent to all By-laws.

Division B
Acceptable Solutions

Part 1
General

Section 1.1. General

1.1.1. Application

1.1.1.1. Application

1) This Part applies to all *plumbing systems* covered in this By-law. (See Article 1.1.1.1. of Division A.)

1.1.2. Objectives and Functional Statements

1.1.2.1. Attribution to Acceptable Solutions

1) For the purposes of compliance with this By-law as required in Clause 1.2.1.1.(1)(b) of Division A, the objectives and functional statements attributed to the acceptable solutions in Division B shall be the objectives and functional statements identified in Section 2.8. (See Note A-1.1.2.1.(1).)

Section 1.2. Terms and Abbreviations

1.2.1. Definitions of Words and Phrases

1.2.1.1. Non-defined Terms

1) Words and phrases used in Division B that are not included in the list of definitions in Article 1.4.1.2. of Division A shall have the meanings that are commonly assigned to them in the context in which they are used, taking into account the specialized use of terms by the various trades and professions to which the terminology applies.

2) Where objectives and functional statements are referred to in Division B, they shall be the objectives and functional statements described in Parts 2 and 3 of Division A.

3) Where acceptable solutions are referred to in Division B, they shall be the provisions stated in Part 2.

1.2.1.2. Defined Terms

1) The words and terms in italics in Division B shall have the meanings assigned to them in Article 1.4.1.2. of Division A.

1.2.2. Symbols and Other Abbreviations

1.2.2.1. Symbols and Other Abbreviations

1) The symbols and other abbreviations in Division B shall have the meanings assigned to them in Article 1.4.2.1. of Division A and Article 1.3.2.1.

Section 1.3. Referenced Documents and Organizations

1.3.1. Referenced Documents

1.3.1.1. Effective Date

1) Unless otherwise specified herein, the documents referenced in this By-law shall include all amendments, revisions, reaffirmations, reapprovals, addenda and supplements effective to 30 June 2014.

1.3.1.2. Applicable Editions

1) Where documents are referenced in this By-law, they shall be the editions or versions designated in Table 1.3.1.2.

Table 1.3.1.2.
Documents Referenced in Book II (Plumbing Systems) of the Building By-law
Forming Part of Sentence 1.3.1.2.(1)

Issuing Agency	Document Number[(1)]	Title of Document[(2)]	By-law Reference
ANSI/CSA	ANSI Z21.22-1999/CSA 4.4-M99 (including Addenda 1 and 2)	Relief Valves for Hot Water Supply Systems	2.2.10.11.(1)
ASHRAE	2013	ASHRAE Handbook – Fundamentals	A-2.6.3.1.(2)
ASHRAE	2011	ASHRAE Handbook – HVAC Applications	A-2.6.3.1.(2)
ASME/CSA	ASME A112.18.1-2012/CSA B125.1-12	Plumbing Supply Fittings	2.2.10.6.(1) 2.2.10.7.(1)
ASME/CSA	ASME A112.18.2-2011/CSA B125.2-11	Plumbing Waste Fittings	2.2.3.3.(1) 2.2.10.6.(6)
ASME/CSA	ASME A112.19.1-2013/CSA B45.2-13	Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures	2.2.2.2.(1)
ASME/CSA	ASME A112.19.2-2013/CSA B45.1-13	Ceramic Plumbing Fixtures	2.2.2.2.(1)
ASME/CSA	ASME A112.19.3-08/CSA B45.4-08	Stainless Steel Plumbing Fixtures	2.2.2.2.(1)
ASME/CSA	ASME A112.19.7-2012/CSA B45.10-12	Hydromassage Bathtub Systems	2.2.2.2.(1)
ASME	A112.6.9-2005	Siphonic Roof Drains	2.3.6.1.(6) 2.4.10.14.(1)
ASME	B16.3-2011	Malleable-Iron Threaded Fittings: Classes 150 and 300	2.2.6.7.(1) A-2.2.5., 2.2.6. and 2.2.7.
ASME	B16.4-2011	Gray Iron Threaded Fittings: Classes 125 and 250	2.2.6.6.(1) A-2.2.5., 2.2.6. and 2.2.7.
ASME	B16.5-2013	Pipe Flanges and Flanged Fittings: NPS ½ Through NPS 24 Metric/Inch Standard	2.2.6.13.(1)
ASME	B16.9-2007	Factory-Made Wrought Buttwelding Fittings	2.2.6.12.(1) 2.2.6.15.(1)
ASME	B16.12-2009	Cast Iron Threaded Drainage Fittings	2.2.6.4.(1)
ASME	B16.15-2013	Cast Copper Alloy Threaded Fittings: Classes 125 and 250	2.2.7.3.(1) A-2.2.5., 2.2.6. and

			2.2.7.
ASME	B16.18-2012	Cast Copper Alloy Solder-Joint Pressure Fittings	2.2.7.6.(1) 2.2.7.6.(2) A-2.2.5., 2.2.6. and 2.2.7.
ASME	B16.22-2013	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings	2.2.7.6.(1) A-2.2.5., 2.2.6. and 2.2.7.
ASME	B16.23-2011	Cast Copper Alloy Solder Joint Drainage Fittings: DWV	2.2.7.5.(1) A-2.2.5., 2.2.6. and 2.2.7.
ASME	B16.24-2011	Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500	2.2.7.2.(1)
ASME	B16.26-2013	Cast Copper Alloy Fittings for Flared Copper Tubes	2.2.7.7.(1) 2.2.7.7.(2)
ASME	B16.29-2012	Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings – DWV	2.2.7.5.(1) A-2.2.5., 2.2.6. and 2.2.7.
ASME	B31.9-2008	Building Services Piping	2.3.2.8.(1)
ASME	B36.19M-2004	Stainless Steel Pipe	2.2.6.11.(1)
ASPE	2010	Plumbing Engineering Design Handbook, Volume 2	A-2.6.3.1.(2)
ASPE	2012	Plumbing Engineering Design Handbook, Volume 4, Chapter 8, Grease Interceptors	A-2.4.4.3.(1)
ASPE/ANSI	ASPE/ANSI 45-2018	Siphonic Roof Drainage	2.4.10.14.(1)
ASSE	ANSI/ASSE 1010-2004	Water Hammer Arresters	2.2.10.15.(1)
ASSE	ASSE 1016-2011/ASME 112.1016-2011/CSA B125.16-11	Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations	A-2.2.10.6.(3)
ASSE	1051-2009G	Individual and Branch Type Air Admittance Valves (AAVs) for Sanitary Drainage Systems	2.2.10.16.(1)
ASTM	A 53/A 53M-12	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless	2.2.6.8.(4) A-2.2.5., 2.2.6. and 2.2.7.
ASTM	A 182/A 182M-06	Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service	2.2.6.13.(1) 2.2.6.14.(1)

ASTM	A 269-10	Seamless and Welded Austenitic Stainless Steel Tubing for General Service	2.2.6.15.(1) A-2.2.5., 2.2.6. and 2.2.7.
ASTM	A 312/A 312M-11	Seamless, Welded, and Heavily Cold Worked Stainless Steel Pipes	2.2.6.11.(1) A-2.2.5., 2.2.6. and 2.2.7.
ASTM	A 351/A 351M-10	Castings, Austenitic, for Pressure-Containing Parts	2.2.6.14.(1)
ASTM	A 403/A 403M-11	Wrought Austenitic Stainless Steel Piping Fittings	2.2.6.12.(1)
ASTM	A 518/A 518M-99	Corrosion-Resistant High-Silicon Iron Castings	2.2.8.1.(1)
ASTM	B 32-08	Solder Metal	2.2.9.2.(1)
ASTM	B 42-10	Seamless Copper Pipe, Standard Sizes	2.2.7.1.(1) A-2.2.5., 2.2.6. and 2.2.7.
ASTM	B 43-14	Seamless Red Brass Pipe, Standard Sizes	2.2.7.1.(2) A-2.2.5., 2.2.6. and 2.2.7.
ASTM	B 88-09	Seamless Copper Water Tube	2.2.7.4.(1) A-2.2.5., 2.2.6. and 2.2.7.
ASTM	B 306-13	Copper Drainage Tube (DWV)	2.2.7.4.(1) A-2.2.5., 2.2.6. and 2.2.7.
ASTM	B 813-10	Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube	2.2.9.2.(3)
ASTM	B 828-02	Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings	2.3.2.4.(1)
ASTM	C 1053-00	Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications	2.2.8.1.(1)
ASTM	D 2466-13	Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40	2.2.5.7.(2) A-2.2.5., 2.2.6. and 2.2.7.
ASTM	D 2467-13a	Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80	2.2.5.7.(2) A-2.2.5., 2.2.6. and 2.2.7.
ASTM	D 3138-04	Solvent Cements for Transition Joints	A-2.2.5.9. to

		Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components	2.2.5.11.
ASTM	D 3261-12e1	Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing	2.2.5.4.(3)
ASTM	F 628-12e1	Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core	2.2.5.9.(1) 2.2.5.11.(1) A-2.2.5., 2.2.6. and 2.2.7.
ASTM	F 714-13	Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter	2.2.5.5.(1) A-2.2.5., 2.2.6. and 2.2.7.
AWS	ANSI/AWS A5.8M/A5.8:2011	Filler Metals for Brazing and Braze Welding	2.2.9.2.(4)
AWWA	M14-2004	Recommended Practice for Backflow Prevention and Cross-Connection Control	A-2.6.2.4.(2)
AWWA	ANSI/AWWA C104/A21.4-13	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings	2.2.6.5.(2)
AWWA	ANSI/AWWA C110/A21.10-12	Ductile-Iron and Gray-Iron Fittings	2.2.6.5.(3)
AWWA	ANSI/AWWA C111/A21.11-12	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings	2.2.6.5.(4)
AWWA	ANSI/AWWA C151/A21.51-09	Ductile-Iron Pipe, Centrifugally Cast	2.2.6.5.(1) A-2.2.5., 2.2.6. and 2.2.7.
AWWA	ANSI/AWWA C228-08	Stainless-Steel Pipe Flanges for Water Service – Sizes 2 in. through 72 in. (50 mm through 1,800 mm)	2.2.6.13.(1)
CCBFC	NRCC 56191	National Energy Code of Canada for Buildings 2015	A-2.2.1.1.(1)[(3)] A-3.2.1.1.(1)[(3)]
CoV		Book I (General) of the By-law	1.1.1.1.(3)[(3)] 1.4.1.2.(1)[(3)] 2.1.3.1.(1) 2.2.5.11.(2) 2.2.5.11.(3) 2.2.6.8.(3) 2.4.3.1.(1) 2.4.10.4.(1) A-2.2.1.1.(1)[(3)] A-2.2.5., 2.2.6. and 2.2.7.

			A-2.4.10. A-2.4.10.4.(1) A-3.2.1.1.(1)(3)
CoV		Fire By-law(4)	2.5.5.2. A-2.2.1.1.(1)(3) A-3.2.1.1.(1)(3)
CoV		Sewer and Watercourse By-law(4)	2.4.4.2.(1)
CoV		Water Works By-law(4)	2.6.2.1.(4)
CSA	A60.1-M1976	Vitrified Clay Pipe	2.2.5.3.(1) A-2.2.5., 2.2.6. and 2.2.7.
CSA	A60.3-M1976	Vitrified Clay Pipe Joints	2.2.5.3.(2)
CSA	A257.1-14	Non-Reinforced Circular Concrete Culvert, Storm Drain, Sewer Pipe, and Fittings	2.2.5.2.(1) A-2.2.5., 2.2.6. and 2.2.7.
CSA	A257.2-14	Reinforced Circular Concrete Culvert, Storm Drain, Sewer Pipe, and Fittings	2.2.5.2.(1) A-2.2.5., 2.2.6. and 2.2.7.
CSA	A257.3-14	Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections, and Fittings Using Rubber Gaskets	2.2.5.2.(2)
CSA	A257.4-14	Precast Reinforced Circular Concrete Manhole Sections, Catch Basins, and Fittings	2.2.5.2.(5)
CSA	CAN/CSA-B45 Series-02	Plumbing Fixtures	2.2.2.2.(1)
CSA	B45.5-11/IAPMO Z124-2011	Plastic Plumbing Fixtures	2.2.2.2.(1)
CSA	CAN/CSA-B45.9-02	Macerating Systems and Related Components	2.2.2.2.(1)
CSA	B64.0-11	Definitions, General Requirements, and Test Methods for Vacuum Breakers and Backflow Preventers	2.2.10.10.(1)
CSA	B64.1.1-11	Atmospheric Vacuum Breakers (AVB)	2.2.10.10.(1)
CSA	B64.1.2-11	Pressure Vacuum Breakers (PVB)	2.2.10.10.(1)
CSA	B64.1.3-11	Spill-Resistant Pressure Vacuum Breakers (SRPVB))	2.2.10.10.(1)
CSA	B64.2-11	Hose Connection Vacuum Breakers (HCVB)	2.2.10.10.(1)
CSA	B64.2.1-11	Hose Connection Vacuum Breakers	2.2.10.10.(1)

		(HCVB) with Manual Draining Feature	
CSA	B64.2.2-11	Hose Connection Vacuum Breakers (HCVB) with Automatic Draining Feature	2.2.10.10.(1)
CSA	B64.3-11	Dual Check Valve Backflow Preventers with Atmospheric Port (DCAP)	2.2.10.10.(1)
CSA	B64.4-11	Reduced Pressure Principle (RP) Backflow Preventers	2.2.10.10.(1)
CSA	B64.4.1-11	Reduced Pressure Principle Backflow Preventers for Fire Protection Systems (RPF)	A-2.6.2.4.(2)
CSA	B64.5-11	Double Check Valve (DCVA) Backflow Preventers	2.2.10.10.(1)
CSA	B64.5.1-11	Double Check Valve Backflow Preventers for Fire Protection Systems (DCVAF)	A-2.6.2.4.(2)
CSA	B64.6-11	Dual Check Valve (DuC) Backflow Preventers	2.2.10.10.(1)
CSA	B64.6.1-11	Dual Check Valve Backflow Preventers for Fire Protection Systems (DuCF)	A-2.6.2.4.(2)
CSA	B64.7-11	Laboratory Faucet Vacuum Breakers (LFVB)	2.2.10.10.(1)
CSA	B64.8-11	Dual Check Valve Backflow Preventers with Intermediate Vent (DuCV)	2.2.10.10.(1)
CSA	B64.9-11	Single Check Valve Backflow Preventers for Fire Protection Systems (SCVAF)	A-2.6.2.4.(2)
CSA	B64.10-11	Selection and Installation of Backflow Preventers	2.6.2.1.(3)
CSA	B64.10.1-11	Maintenance and Field Testing of Backflow Preventers	A-2.6.2.1.(3)
CSA	B70-12	Cast Iron Soil Pipe, Fittings, and Means of Joining	2.2.6.1.(1) 2.4.6.4.(2) A-2.2.5., 2.2.6. and 2.2.7.
CSA	B70.1-03	Frames and Covers for Maintenance Holes and Catchbasins	2.2.6.2.(1)
CSA	B125.3-12	Plumbing Fittings	2.2.10.6.(1) 2.2.10.7.(2) 2.2.10.10.(2) A-2.6.1.11.(1)
CSA	CAN/CSA-B127.1-99	Asbestos Cement Drain, Waste and Vent	2.2.5.1.(1)

		Pipe and Pipe Fittings	2.2.6.3.(1) A-2.2.5., 2.2.6. and 2.2.7.
CSA	B127.2-M1977	Components for Use in Asbestos Cement Building Sewer Systems	2.2.6.3.(1)
CSA	CAN/CSA-B128.1-06	Design and Installation of Non-Potable Water Systems	2.7.2.1.(2) 2.7.4.1.(7) 2.7.8.2.(2)
CSA	CAN/CSA-B137.1-13	Polyethylene (PE) Pipe, Tubing, and Fittings for Cold-Water Pressure Services	2.2.5.4.(1) A-2.2.5., 2.2.6. and 2.2.7.
CSA	CAN/CSA-B137.2-13	Polyvinylchloride (PVC) Injection-Moulded Gasketed Fittings for Pressure Applications	2.2.5.7.(3) A-2.2.5., 2.2.6. and 2.2.7.
CSA	CAN/CSA-B137.3-13	Rigid Polyvinylchloride (PVC) Pipe and Fittings for Pressure Applications	2.2.5.7.(1) A-2.2.5., 2.2.6. and 2.2.7.
CSA	CAN/CSA-B137.5-13	Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications	2.2.5.6.(1) A-2.2.5., 2.2.6. and 2.2.7. A-2.2.5.6.(1)
CSA	CAN/CSA-B137.6-13	Chlorinated Polyvinylchloride (CPVC) Pipe, Tubing, and Fittings for Hot- and Cold-Water Distribution Systems	2.2.5.8.(1) A-2.2.5., 2.2.6. and 2.2.7. A-2.2.5.9. to 2.2.5.11.
CSA	CAN/CSA-B137.9-13	Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure-Pipe Systems	2.2.5.12.(1) A-2.2.5., 2.2.6. and 2.2.7. A-2.2.5.12.(1)
CSA	CAN/CSA-B137.10-13	Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Composite Pressure-Pipe Systems	2.2.5.12.(4) 2.2.5.13.(1) A-2.2.5., 2.2.6. and 2.2.7. A-2.2.5.13.(1)
CSA	CAN/CSA-B137.11-13	Polypropylene (PP-R) Pipe and Fittings for Pressure Applications	2.2.5.14.(1) A-2.2.5., 2.2.6. and 2.2.7. A-2.2.5.14.(1)
CSA	B158.1-1976	Cast Brass Solder Joint Drainage, Waste and Vent Fittings	2.2.10.1.(1)
CSA	CAN/CSA-B181.1-11	Acrylonitrile-Butadiene-Styrene (ABS)	2.2.5.9.(1)

		Drain, Waste, and Vent Pipe and Pipe Fittings	2.2.5.10.(1) 2.2.5.11.(1) 2.4.6.4.(2) A-2.2.5., 2.2.6. and 2.2.7. A-2.2.5.9. to 2.2.5.11.
CSA	CAN/CSA-B181.2-11	Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Drain, Waste, and Vent Pipe and Pipe Fittings	2.2.5.9.(1) 2.2.5.10.(1) 2.2.5.11.(1) 2.4.6.4.(2) A-2.2.5., 2.2.6. and 2.2.7. A-2.2.5.9. to 2.2.5.11.
CSA	CAN/CSA-B181.3-11	Polyolefin and Polyvinylidene Fluoride (PVDF) Laboratory Drainage Systems	2.2.8.1.(1) A-2.2.5., 2.2.6. and 2.2.7.
CSA	CAN/CSA-B182.1-11	Plastic Drain and Sewer Pipe and Pipe Fittings	2.2.5.9.(1) 2.4.6.4.(2) A-2.2.5., 2.2.6. and 2.2.7.
CSA	CAN/CSA-B182.2-11	PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings	2.2.5.9.(1) A-2.2.5., 2.2.6. and 2.2.7.
CSA	CAN/CSA-B182.4-11	Profile Polyvinylchloride (PVC) Sewer Pipe and Fittings	2.2.5.9.(1) A-2.2.5., 2.2.6. and 2.2.7.
CSA	CAN/CSA-B182.6-11	Profile Polyethylene (PE) Sewer Pipe and Fittings For Leak-Proof Sewer Applications	2.2.5.9.(1) A-2.2.5., 2.2.6. and 2.2.7.
CSA	CAN/CSA-B182.8-11	Profile Polyethylene (PE) Storm Sewer and Drainage Pipe and Fittings	2.2.5.9.(1)
CSA	B242-05	Groove- and Shoulder-Type Mechanical Pipe Couplings	2.2.10.4.(1)
CSA	B272-93	Prefabricated Self-Sealing Roof Vent Flashings	2.2.10.14.(2)
CSA	CAN/CSA-B356-10	Water Pressure Reducing Valves for Domestic Water Supply Systems	2.2.10.12.(1)
CSA	B481.0-12	Material, Design, and Construction Requirements for Grease Interceptors	2.2.3.2.(3)
CSA	B481.3-12	Sizing, Selection, Location, and Installation	2.2.3.2.(3)

		of Grease Interceptors	
CSA	B481.4-12	Maintenance of Grease Interceptors	A-2.2.3.2.(3)
CSA	CAN/CSA-B602-10	Mechanical Couplings for Drain, Waste, and Vent Pipe and Sewer Pipe	2.2.10.4.(2)
CSA	CAN/CSA-F379 SERIES-09 (excluding Supplement F379S1-11)	Packaged Solar Domestic Hot Water Systems (Liquid-to-Liquid Heat Transfer)	2.2.10.13.(1)
CSA	CAN/CSA-F383-08	Installation of Packaged Solar Domestic Hot Water Systems	2.6.1.8.(1)
CSA	G401-14	Corrugated Steel Pipe Products	2.2.6.9.(1) A-2.2.5., 2.2.6. and 2.2.7.
EPA		ENERGY STAR® Program Requirements: Product Specification for Clothes Washers(4)	2.2.11.1.(1)
EPA		ENERGY STAR® Program Requirements: Product Specification for Residential Dishwashers(4)	2.2.11.1.(1)
EPA		ENERGY STAR® Program Requirements: Product Specification for Commercial Dishwashers(4)	2.2.11.1.(1)
EPA		ENERGY STAR® Program Requirements: Product Specification for Automatic Commercial Ice Makers(4)	2.2.11.1.(1)
EPA		ENERGY STAR® Program Requirements: Product Specification for Commercial Steam Cookers(4)	2.2.11.1.(1)
EPA		ENERGY STAR® Program Requirements: Product Specification for Commercial Ovens(4)	2.2.11.1.(1)
IAPMO		Water Demand Calculator(4)	2.7.6.2.(1)
McGraw-Hill	2009	International Plumbing Codes Handbook	A-2.6.3.
NFPA	13D-2013	Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes	2.6.2.4.(1) 2.6.3.1.(3)
NIST	Building Materials and Structures Report BMS-79, 1941	Water-Distributing Systems for Buildings	A-2.6.3.

NSF/ANSI	14 - 2017	Plastics Piping System Components and Related Materials	2.7.2.1.(1)
NSF/ANSI	61 – 2016	Drinking Water System Components – Health Effects	2.2.6.11.
NSF/ANSI	372 - 2016	Drinking Water System Components – Lead Content	2.2.6.12., 2.2.6.13., 2.2.6.14.
TIAC	2013	Mechanical Insulation Best Practices Guide	A-2.3.5.4.
ULC	CAN/ULC-S114-05	Test for Determination of Non-Combustibility in Building Materials	1.4.1.2.(1)[3]

Notes to Table 1.3.1.2.:
(1) Some documents may have been reaffirmed or reapproved. Check with the applicable issuing agency for up-to-date information.
(2) Some titles have been abridged to omit superfluous wording.
(3) By-law reference is in Division A.
(4) The current version in effect.

1.3.2. Organizations

1.3.2.1. Abbreviations of Proper Names

1) The abbreviations of proper names in this By-law shall have the meanings assigned to them in this Article.

ANSI American National Standards Institute (www.ansi.org)
ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers (www.ashrae.org)
ASME American Society of Mechanical Engineers (www.asme.org)
ASPE American Society of Plumbing Engineers (www.aspe.org)
ASSE American Society of Sanitary Engineering (www.asse-plumbing.org)
ASTM American Society for Testing and Materials International (www.astm.org)
AWS American Welding Society (www.aws.org)
AWWA American Water Works Association (www.awwa.org)
CAN National Standard of Canada designation
CCBFC Canadian Commission on Building and Fire Codes (see NRC)
CGSB Canadian General Standards Board (www.tpsgc-pwgsc.gc.ca/ongc-cgsb/index-eng.html)
CoV City of Vancouver (www.vancouver.ca)
CSA CSA Group (www.csagroup.org)
EPA United States Environmental Protection Agency (www.epa.gov)
IAPMO International Association of Plumbing and Mechanical Officials (www.iapmo.org)
NBC National Building Code of Canada 2015
NFC National Fire Code of Canada 2015
NFPA National Fire Protection Association (www.nfpa.org)
NIST National Institute of Standards and Technology (www.nist.gov)
NPC National Plumbing Code of Canada 2015
NRC National Research Council of Canada (www.nrc-cnrc.gc.ca)
NRC-IRC National Research Council of Canada, Institute for Research in Construction (former name of NRC Construction)
NSF NSF International (www.nsf.org)
ULC ULC Standards (canada.ul.com/ulcstandards)

Notes to Part 1
General

A-1.1.2.1.(1) Objectives and Functional Statements Attributed to Acceptable Solutions. The objectives and functional statements attributed to each By-law provision are shown in Table 2.8.1.1.

Many provisions in Division B serve as modifiers of or pointers to other provisions or serve other clarification or explanatory purposes. In most cases, no objectives and functional statements have been attributed to such provisions, which therefore do not appear in the above-mentioned table.

For provisions that serve as modifiers of or pointers to other referenced provisions and that do not have any objectives and functional statements attributed to them, the objectives and functional statements that should be used are those attributed to the provisions they reference.

Part 2
Plumbing Systems

Section 2.1. General

2.1.1. Application

2.1.1.1. Application

1) This Part applies to all *plumbing systems* covered in this By-law. (See Article 1.1.1.1. of Division A.)

2.1.2. Service Connections

2.1.2.1. Sanitary Drainage Systems

1) Except as provided in Section 2.7., every *sanitary drainage system* shall be connected to a public *sanitary sewer*, a public *combined sewer* or a *private sewage disposal system*.

2) A *combined building drain* shall not be installed. (See Note A-2.1.2.1.(2).)

2.1.2.2. Storm Drainage Systems

1) Except as provided in Section 2.7., every *storm drainage system* shall be connected to a public *storm sewer*, a public *combined sewer* or a designated *storm water* disposal location.

2.1.2.3. Water Distribution Systems

1) Except as provided in Section 2.7., every *water distribution system* shall be connected to a public water main or a *potable private water supply system*.

2.1.2.4. Separate Services

1) Piping in any *building* connected to the public services shall be connected separately from piping of any other *building*, except that an ancillary *building* on the same property may be served by the same service. (See Note A-2.1.2.4.(1).)

2.1.3. Location of Fixtures

2.1.3.1. Lighting and Ventilation Requirements

1) Plumbing *fixtures* shall not be installed in a room that is not lighted and ventilated in accordance with the appropriate requirements in Parts 3, 6 and 9 of Division B of Book I (General) of this By-law.

2.1.3.2. Accessibility

1) Every *fixture*, appliance, *interceptor*, *cleanout*, valve, device or piece of equipment shall be located so that it is readily accessible for use, cleaning and maintenance.

Section 2.2. Materials and Equipment

2.2.1. General

2.2.1.1. Exposure of Materials

1) Where unusual conditions exist, such as excessively corrosive soil or water, only materials suited for use in such locations shall be used.

2) Materials and equipment used in a *drainage system* where excessively corrosive wastes or storm water are present shall be suitable for the purpose.

2.2.1.2. Restrictions on Re-Use

1) Materials and equipment that have been used for a purpose other than the distribution of *potable* water shall not be subsequently used in a *potable water system*.

2.2.1.3. Identification

1) Every length of pipe and every fitting shall

a) have cast, stamped or indelibly marked on it the maker's name or mark and the weight or class or quality of the product, or

b) be marked in accordance with the relevant standard.

2) Markings required in Sentence (1) shall be visible after installation.

2.2.1.4. Pipe or Piping

1) Where the term pipe or piping is used, it shall also apply to tube or tubing unless otherwise stated.

2.2.1.5. Withstanding Pressure

1) Piping, fittings and joints used in pressure sewer, forcemain or sump pump discharge applications shall be capable of withstanding at least one and one-half times the maximum potential pressure.

2.2.1.6. Working Pressure of a Water Service Pipe

1) The working pressure rating of a *water service pipe* shall not be less than the maximum water main pressure at their point of connection as established by the *City*.

2.2.2. Fixtures

2.2.2.1. Surface Requirements

1) Every *fixture* shall have a smooth, hard, corrosion-resistant surface free of flaws and blemishes that may interfere with cleaning.

2.2.2.2. Conformance to Standards

1) Except as provided in Article 2.2.2.3.,

a) *fixtures* shall conform to CAN/CSA-B45 Series, "Plumbing Fixtures,"

b) vitreous china *fixtures* shall conform to ASME A112.19.2/CSA B45.1, "Ceramic Plumbing Fixtures,"

c) enamelled cast-iron *fixtures* shall conform to ASME A112.19.1/CSA B45.2, "Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures,"

d) porcelain-enamelled steel *fixtures* shall conform to ASME A112.19.1/CSA B45.2, "Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures,"

e) stainless steel *fixtures* shall conform to ASME A112.19.3/CSA B45.4, "Stainless Steel Plumbing Fixtures,"

f) plastic *fixtures* shall conform to CSA B45.5/IAPMO Z124, "Plastic Plumbing Fixtures,"

g) hydromassage bathtubs shall conform to ASME A112.19.7/CSA B45.10, "Hydromassage Bathtub Systems,"and

h) macerating toilet systems shall conform to CAN/CSA-B45.9, "Macerating Systems and Related Components."

2.2.2.3. Showers

1) Shower receptors shall be constructed and arranged so that water cannot leak through the walls or floor.

2) Not more than 6 shower heads shall be served by a single shower drain.

3) Where 2 or more shower heads are served by a shower drain, the floor shall be sloped and the drain located so that water from one head cannot flow over the area that serves another head. (See Note A-2.2.2.3.(3).)
4) Except for column showers, when a battery of shower heads is installed, the horizontal distance between 2 adjacent shower heads shall be not less than 750 mm.

2.2.2.4. Concealed Overflows
1) A dishwashing sink and a food preparation sink shall not have concealed overflows. (See Note A-2.2.2.4.(1).)

2.2.2.5. Water Closets in Public Washrooms
1) When a water closet is installed in a washroom for *public use*, it shall be of the elongated type and provided with a seat of the open front type.

2.2.3. Traps and Interceptors

2.2.3.1. Traps
1) Except as provided for in Sentence (2), *traps* shall
a) have a *trap seal depth* of not less than 38 mm,
b) be so designed that failure of the seal walls will cause exterior leakage, and
c) have a water seal that does not depend on the action of moving parts.
(See Note A-2.2.3.1.(1) and (3).)
2) The *trap seal depth* on *fixtures* draining to an acid waste system shall be a minimum of 50 mm.
3) Except for a floor-mounted service sink, every *trap* that serves a lavatory, a sink or a laundry tray shall
a) be provided with a *cleanout* plug located at the lowest point of the *trap* and of the same material as the *trap*, except that a cast-iron *trap* shall be provided with a brass *cleanout* plug, or
b) be designed so that part of the *trap* can be removed for cleaning purposes.
(See Notes A-2.2.3.1.(1) and (3).)
4) A bell *trap* shall not be installed in a *drainage system*. (See Note A-2.2.3.1.(4).)
5) A drum *trap* shall not be used as a *fixture trap* unless required to serve as an *interceptor* and access for servicing is provided.
6) A *bottle trap* may be used on a laboratory sink or other *fixture* equipped with corrosion resistant fittings.

2.2.3.2. Interceptors
1) *Interceptors* shall be designed so that it can be readily cleaned.
2) Grease *interceptors* shall
a) be designed so that it does not become air bound, and
b) not have a water jacket.
3) Grease *interceptors* shall be selected and installed in conformance with
a) CSA B481.0, “Material, Design, and Construction Requirements for Grease Interceptors,” and
b) CSA B481.3, “Sizing, Selection, Location, and Installation of Grease Interceptors.”
(See Note A-2.2.3.2.(3).)

2.2.3.3. Tubular Traps
1) Tubular metal or plastic *traps* conforming to ASME A112.18.2/CSA B125.2, “Plumbing Waste Fittings,” shall be used only in accessible locations.

2.2.4. Pipe Fittings

2.2.4.1. T and Cross Fittings
(See Note A-2.2.4.1.)

1) A T fitting shall not be used in a *drainage system*, except to connect a *vent pipe*.
2) A cross fitting shall not be used in a *drainage system*.

2.2.4.2. Sanitary T Fittings

(See Note A-2.2.4.2.)
1) A single or double sanitary T fitting shall not be used in a *nominally horizontal soil-or-waste pipe*, except that a single sanitary T fitting may be used to connect a *vent pipe*.
2) A double sanitary T fitting shall not be used to connect the *trap arms* of
- a) back outlet water closets installed back-to-back, or
- b) 2 urinals where no *cleanout* fitting is provided above the connection.

2.2.4.3. 90° Elbows

1) Except as permitted in Sentence (2), 90° elbows of 4 inch *size* or less whose centre-line radius is less than the *size* of the pipe shall not be used to join 2 *soil-or-waste pipes*.
2) For *sanitary drainage systems* of 4 inch *size* or less, 90° elbows described in Sentence (1) shall only be permitted
- a) to change the direction of piping from horizontal to vertical, in the direction of flow,
- b) where a *trap arm* enters a wall, or
- c) to connect *trap arms* as permitted by Sentence 2.5.6.3.(2).

2.2.5. Non-Metallic Pipe and Fittings

(For a summary of pipe applications, see Notes A-2.2.5., 2.2.6. and 2.2.7.)

2.2.5.1. Asbestos-Cement Pipe and Fittings

1) Reserved.
2) Reserved.
3) Asbestos-cement pipe shall not be used in new construction.

2.2.5.2. Concrete Pipe and Fittings

1) Concrete pipe shall conform to
- a) CSA A257.1, “Non-Reinforced Circular Concrete Culvert, Storm Drain, Sewer Pipe, and Fittings,” or
- b) CSA A257.2, “Reinforced Circular Concrete Culvert, Storm Drain, Sewer Pipe, and Fittings.”

2) Joints with internal elastomeric gaskets shall conform to CSA A257.3, “Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections, and Fittings Using Rubber Gaskets.”
3) Concrete fittings fabricated on the site from lengths of pipe shall not be used. (See Note A-2.2.5.2.(3).)
4) Concrete pipe shall not be used above ground inside a *building*.
5) Precast reinforced circular concrete manhole sections, catch basins and fittings shall conform to CSA A257.4, “Precast Reinforced Circular Concrete Manhole Sections, Catch Basins, and Fittings.”

2.2.5.3. Vitrified Clay Pipe and Fittings

1) Vitrified clay pipe and fittings shall conform to CSA A60.1-M, “Vitrified Clay Pipe.”
2) Couplings and joints for vitrified clay pipe shall conform to CSA A60.3-M, “Vitrified Clay Pipe Joints.”
3) Vitrified clay pipe and fittings shall not be used except for an underground part of a *drainage system*.

2.2.5.4. Polyethylene Pipe and Fittings

1) Polyethylene water pipe, tubing and fittings shall conform to Series 160 of CAN/CSA-B137.1, “Polyethylene (PE) Pipe, Tubing, and Fittings for Cold-Water Pressure Services.”
2) Polyethylene water pipe shall not be used except for a *water service pipe*.
3) Butt fusion fittings for polyethylene pipe shall conform to ASTM D 3261, “Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.”

2.2.5.5. Polyethylene Pipe Used Underground

1) Polyethylene pipe used underground outside a *building* for the rehabilitation of existing *drainage systems* using trenchless technology shall conform to ASTM F 714, "Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter," and shall be HDPE 3408 and SDR 11 or heavier. (See Note A-2.2.5.5.(1).)

2.2.5.6. Crosslinked Polyethylene Pipe and Fittings

1) Crosslinked polyethylene pipe and its associated fittings used in hot and cold *potable water systems* shall conform to CAN/CSA-B137.5, "Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications." (See Note A-2.2.5.6.(1).)

2.2.5.7. PVC Pipe and Fittings

1) PVC water pipe, fittings and solvent cement shall

a) conform to CAN/CSA-B137.3, "Rigid Polyvinylchloride (PVC) Pipe and Fittings for Pressure Applications," and

b) have a pressure rating of not less than 1 100 kPa.

2) PVC water pipe fittings shall conform to

a) ASTM D 2466, "Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40," or

b) ASTM D 2467, "Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80."

3) PVC injection-moulded gasketed fittings shall conform to CAN/CSA-B137.2, "Polyvinylchloride (PVC) Injection-Moulded Gasketed Fittings for Pressure Applications."

4) PVC water pipe and fittings referred to in Sentences (1), (2) and (3) shall not be used in a hot *water system*.

2.2.5.8. CPVC Pipe, Fittings and Solvent Cements

1) CPVC hot and cold water pipe, fittings and solvent cements shall conform to CAN/CSA-B137.6, "Chlorinated Polyvinylchloride (CPVC) Pipe, Tubing, and Fittings for Hot- and Cold-Water Distribution Systems."

2) The design temperature and design pressure of a CPVC piping system shall conform to Table 2.2.5.8.

Table 2.2.5.8.
Maximum Permitted Pressure for CPVC Piping at Various Temperatures
Forming Part of Sentence 2.2.5.8.(2)

Maximum Temperature of Water, °C	Maximum Permitted Pressures, kPa
10	3 150
20	2 900
30	2 500
40	2 100
50	1 700
60	1 300
70	1 000
82	690

2.2.5.9. Plastic Pipe, Fittings and Solvent Cement Used Underground

(See Notes A-2.2.5.9. to 2.2.5.11.)

1) Plastic pipe, fittings and solvent cement used underground outside a *building* or under a *building* in a *drainage system* shall conform to

a) ASTM F 628, "Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core,"
b) CAN/CSA-B181.1, "Acrylonitrile-Butadiene-Styrene (ABS) Drain, Waste, and Vent Pipe and Pipe Fittings,"
c) CAN/CSA-B181.2, "Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Drain, Waste, and Vent Pipe and Pipe Fittings,"
d) CAN/CSA-B182.1, "Plastic Drain and Sewer Pipe and Pipe Fittings," with a pipe stiffness not less than 320 kPa,
e) CAN/CSA-B182.2, "PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings," with a pipe stiffness not less than 320 kPa,
f) CAN/CSA-B182.4, "Profile Polyvinylchloride (PVC) Sewer Pipe and Fittings," with a pipe stiffness not less than 320 kPa,
g) CAN/CSA-B182.6, "Profile Polyethylene (PE) Sewer Pipe and Fittings For Leak-Proof Sewer Applications," with a pipe stiffness of not less than 320 kPa, or
h) CAN/CSA-B182.8, "Profile Polyethylene (PE) Storm Sewer and Drainage Pipe and Fittings," for Type 1 joints and non-perforated pipes.

2.2.5.10. Transition Solvent Cement

(See Notes A-2.2.5.9. to 2.2.5.11.)

1) Solvent cement for transition joints shall conform to

a) CAN/CSA-B181.1, "Acrylonitrile-Butadiene-Styrene (ABS) Drain, Waste, and Vent Pipe and Pipe Fittings," or
b) CAN/CSA-B181.2, "Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Drain, Waste, and Vent Pipe and Pipe Fittings."

2) Transition solvent cement shall only be used for joining an ABS *drainage system* to a PVC *drainage system*.

2.2.5.11. Plastic Pipe, Fittings and Solvent Cement Used in Buildings

(See Notes A-2.2.5.9. to 2.2.5.11.)

1) Plastic pipe, fittings and solvent cement used inside or under a *building* in a *drainage* or *venting system* shall conform to

a) ASTM F 628, "Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core,"
b) CAN/CSA-B181.1, "Acrylonitrile-Butadiene-Styrene (ABS) Drain, Waste, and Vent Pipe and Pipe Fittings," or
c) CAN/CSA-B181.2, "Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Drain, Waste, and Vent Pipe and Pipe Fittings."

2) Requirements for *combustible* piping in relation to fire safety shall conform to Sentences 3.1.5.19.(1) and 9.10.9.6.(3) to (11), and Articles 3.1.9.5. and 9.10.9.7. of Division B of Book I (General) of this By-law.

3) Where *noncombustible* piping pierces a *fire separation* or a fire stop, the requirements of fire stopping of Subsection 3.1.9., Sentence 9.10.9.6.(1) and Article 9.10.16.4. of Division B of Book I (General) of this By-law shall apply.

2.2.5.12. Polyethylene/Aluminum/Polyethylene Composite Pipe and Fittings

1) PE/AL/PE composite pipe and fittings shall conform to CAN/CSA-B137.9, "Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure-Pipe Systems." (See Note A-2.2.5.12.(1).)

2) Except as provided in Sentences (3) and (4), PE/AL/PE pipe and fittings shall not be used in hot *water systems*.
3) PE/AL/PE pipe with a pressure rating of 690 kPa or greater at 82°C shall be permitted for hot *water systems*.
4) PE/AL/PE pipe with a pressure rating of 690 kPa or greater at 82°C shall be used with fittings that conform to CAN/CSA-B137.10, "Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Composite Pressure-Pipe Systems," in hot *water systems*.

2.2.5.13. Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene Composite Pressure Pipe and Fittings

1) PEX/AL/PEX composite pipe and fittings used in hot and cold *potable water systems* shall conform to CAN/CSA-B137.10, "Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Composite Pressure-Pipe Systems." (See Note A-2.2.5.13.(1).)

2.2.5.14. Polypropylene Pipe and Fittings

1) Polypropylene pipe and fittings used for hot and cold *potable water systems* shall conform to CAN/CSA-B137.11, "Polypropylene (PP-R) Pipe and Fittings for Pressure Applications." (See Note A-2.2.5.14.(1).)

2.2.6. Ferrous Pipe and Fittings

(For a summary of pipe applications, see Note A-2.2.5., 2.2.6. and 2.2.7.)

2.2.6.1. Cast-Iron Drainage and Vent Pipe and Fittings

1) Drainage piping, vent piping and fittings made of cast iron shall conform to CSA B70, "Cast Iron Soil Pipe, Fittings, and Means of Joining."
2) Cast-iron soil pipe and fittings shall not be used in a *water system*.

2.2.6.2. Maintenance Holes and Catch Basins

1) Cast-iron frames and covers for maintenance holes and catch basins shall conform to CSA B70.1, "Frames and Covers for Maintenance Holes and Catchbasins."

2.2.6.3. Reserved

2.2.6.4. Threaded Cast-Iron Drainage Fittings

1) Threaded cast-iron drainage fittings shall conform to ASME B16.12, "Cast Iron Threaded Drainage Fittings."
2) Threaded cast-iron drainage fittings shall not be used in a *water system*.

2.2.6.5. Cast-Iron Water Pipes

1) Cast-iron water pipes shall conform to ANSI/AWWA C151/A21.51, "Ductile-Iron Pipe, Centrifugally Cast."
2) Cement mortar lining for cast-iron water pipes shall conform to ANSI/AWWA C104/A21.4, "Cement-Mortar Lining for Ductile-Iron Pipe and Fittings."
3) Cast-iron fittings for cast-iron or ductile-iron water pipes shall conform to ANSI/AWWA C110/A21.10, "Ductile-Iron and Gray-Iron Fittings."
4) Rubber gasket joints for cast-iron and ductile-iron pressure pipe for water shall conform to ANSI/AWWA C111/A21.11, "Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings."

2.2.6.6. Screwed Cast-Iron Water Fittings

1) Screwed cast-iron water fittings shall conform to ASME B16.4, "Gray Iron Threaded Fittings: Classes 125 and 250."
2) Screwed cast-iron water fittings used in a *water system* shall be cement-mortar lined or galvanized.
3) Screwed cast-iron water fittings shall not be used in a *drainage system*.

2.2.6.7. Screwed Malleable Iron Water Fittings

1) Screwed malleable iron water fittings shall conform to ASME B16.3, “Malleable-Iron Threaded Fittings: Classes 150 and 300.”

2) Screwed malleable iron water fittings used in a *water system* shall be cement-mortar lined or galvanized.

3) Screwed malleable iron water fittings shall not be used in a *drainage system*.

2.2.6.8. Steel Pipe

1) Except as provided in Sentences (2) and (3), welded and seamless steel pipe shall not be used in a *plumbing system*.

2) Galvanized steel pipe is permitted to be used in a *drainage system* or a *venting system* above ground inside a *building*.

3) Galvanized steel pipe and fittings shall not be used in a *water distribution system* except

a) in *buildings* of industrial *occupancy* as described in Book I (General) of this By-law, or

b) for the repair of existing galvanized steel piping systems.

(See Note A-2.2.6.8.(3).)

4) Galvanized steel pipe and fittings shall conform to ASTM A 53/A 53M, “Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.”

2.2.6.9. Corrugated Steel Pipe and Couplings

1) Corrugated steel pipe and couplings shall conform to CSA G401, “Corrugated Steel Pipe Products.”

2) Corrugated steel pipe shall only be used underground outside a *building* in a *storm drainage system*.

3) Couplings for corrugated steel pipe shall be constructed so that when installed they shall

a) maintain the pipe alignment,

b) resist the separation of adjoining lengths of pipe,

c) prevent root penetration, and

d) prevent the infiltration of surrounding material.

2.2.6.10. Sheet Metal Leaders

1) A sheet metal *leader* shall not be used except above ground outside a *building*.

2.2.6.11. Stainless Steel Pipe

1) Stainless steel pipe shall conform to

a) ASME B36.19M, “Stainless Steel Pipe,”

b) ASTM A 312/A 312M, “Seamless, Welded, and Heavily Cold Worked Stainless Steel Pipes,” and

c) NSF/ANSI 61, “Drinking Water System Components – Health Effects.”

2) Only grade 304/304L or 316/316L stainless steel pipe shall be used.

2.2.6.12. Stainless Steel Butt Weld Pipe Fittings

1) Stainless steel butt weld pipe fittings shall conform to

a) ASME B16.9, “Factory-Made Wrought Buttwelding Fittings,”

b) ASTM A 403/A 403M, “Wrought Austenitic Stainless Steel Piping Fittings,” and

c) NSF/ANSI 372, “Drinking Water System Components – Lead Content.”

2) Stainless steel butt weld pipe fittings shall be made of a material that matches the grade of the pipe material used.

2.2.6.13. Stainless Steel Pipe Flanges

1) Stainless steel pipe flanges shall conform to

a) ASME B16.5, “Pipe Flanges and Flanged Fittings: NPS ½ Through NPS 24 Metric/Inch Standard,”

b) NSF/ANSI 372, “Drinking Water System Components – Lead Content,” and

c) ASTM A 182/A 182M, “Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service” or AWWA C228, “Stainless-Steel Pipe Flanges for Water Service – Sizes 2 in. through 72 in. (50 mm through 1,800 mm).”

2) Stainless steel pipe flanges shall be made of a material that matches the grade of the pipe material used.

2.2.6.14. Stainless Steel Threaded Fittings

1) Stainless steel threaded fittings shall be schedule 40s or greater conforming to NSF/ANSI 372, “Drinking Water System Components – Lead Content,” and

a) ASTM A 182/A 182M, “Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service,” or

b) ASTM A 351/A 351M, “Castings, Austenitic, for Pressure-Containing Parts.”

2) Stainless steel threaded fittings shall be made of a material that matches the grade of the pipe material used.

2.2.6.15. Stainless Steel Tube

1) Stainless steel tube shall conform to

a) ASME B16.9, “Factory-Made Wrought Buttwelding Fittings,” and

b) ASTM A 269, “Seamless and Welded Austenitic Stainless Steel Tubing for General Service.”

2) Only grade 304/304L or 316/316L stainless steel tube shall be used.

2.2.6.16. Stainless Steel Pipe and Tube

1) The use of stainless steel pipe and tube shall conform to Table 2.2.6.16.

Table 2.2.6.16.
Permitted Uses of Stainless Steel Pipe and Tube
Forming Part of Sentence 2.2.6.16.(1)

Stainless Steel Pipe or Tube	Plumbing Purposes						
	Water Distribution System		*Building Sewer*	*Drainage System*		*Venting System*	
	Underground	Aboveground		Underground	Aboveground	Underground	Aboveground
Stainless steel pipe	P	P	P	P	P	P	P
Stainless steel tube	P	P	N	N	N	N	N
P = Permitted N = Not Permitted							

2.2.7. Non-Ferrous Pipe and Fittings

(For a summary of pipe applications, see Note A-2.2.5., 2.2.6. and 2.2.7.)

2.2.7.1. Copper and Brass Pipe

1) Copper pipe shall conform to ASTM B 42, “Seamless Copper Pipe, Standard Sizes.”

2) Brass pipe shall conform to ASTM B 43, “Seamless Red Brass Pipe, Standard Sizes.”

2.2.7.2. Brass or Bronze Pipe Flanges and Flanged Fittings

1) Brass or bronze pipe flanges and flanged fittings shall conform to ASME B16.24, “Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500.”

2.2.7.3. Brass or Bronze Threaded Water Fittings

1) Brass or bronze threaded water fittings shall conform to ASME B16.15, "Cast Copper Alloy Threaded Fittings: Classes 125 and 250."

2) Brass or bronze threaded water fittings shall not be used in a *drainage system*.

2.2.7.4. Copper Tube

1) Copper tube shall conform to

a) ASTM B 88, "Seamless Copper Water Tube," or

b) ASTM B 306, "Copper Drainage Tube (DWV)."

2) Except as provided in Sentence (3), the use of copper tube shall conform to Table 2.2.7.4.

3) Copper tube shall not be used for the *fixture drain* or the portion of the *vent pipe* below the *flood level rim* of manually flushing or waterless urinals.

Table 2.2.7.4.
Permitted Use of Copper Tube and Pipe
Forming Part of Sentence 2.2.7.4.(2)

Type of Copper Tube or Pipe	Plumbing Purposes							
	Water Service Pipe	*Water Distribution System*		*Building Sewer*	*Drainage System*		*Venting System*	
		Under-ground	Above-ground		Under-ground	Above-ground	Under-ground	Above-ground
K & L hard temper	N	N	P	P	P	P	P	P
K & L soft temper	P	P	P	N	N	N	N	N
M hard temper	N	N	N	N	N	P	N	P
M soft temper	N	N	N	N	N	N	N	N
DWV	N	N	N	N	N	P	N	P
P = Permitted N = Not Permitted								

2.2.7.5. Solder-Joint Drainage Fittings

1) Solder-joint fittings for *drainage systems* shall conform to

a) ASME B16.23, "Cast Copper Alloy Solder Joint Drainage Fittings: DWV," or

b) ASME B16.29, "Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings – DWV."

2) Solder-joint fittings for *drainage systems* shall not be used in a *water system*.

2.2.7.6. Solder-Joint Water Fittings

1) Except as provided in Sentence (2), solder-joint fittings for *water systems* shall conform to

a) ASME B16.18, "Cast Copper Alloy Solder-Joint Pressure Fittings," or

b) ASME B16.22, "Wrought Copper and Copper Alloy Solder Joint Pressure Fittings."

2) Solder-joint fittings for *water systems* not made by casting or the wrought process shall conform to the applicable requirements of ASME B16.18, "Cast Copper Alloy Solder-Joint Pressure Fittings."

2.2.7.7. Flared-Joint Fittings for Copper Water Systems

1) Flared-joint fittings for copper tube *water systems* shall conform to ASME B16.26, "Cast Copper Alloy Fittings for Flared Copper Tubes."
2) Flared-joint fittings for copper tube *water systems* not made by casting shall conform to the applicable requirements of ASME B16.26, "Cast Copper Alloy Fittings for Flared Copper Tubes."

2.2.7.8. Lead Waste Pipe and Fittings
1) Lead *waste pipe* and fittings shall not be used in a *water system* or as a *building sewer*.
2) When there is a change in *size* of a lead closet bend, the change shall be in the vertical section of the bend or made in a manner that prevents the retention of liquid in the bend.

2.2.8. Corrosion-Resistant Materials

2.2.8.1. Pipes and Fittings
1) Pipes and fittings to be used for drainage and venting of acid and corrosive wastes shall conform to
- a) ASTM A 518/A 518M, "Corrosion-Resistant High-Silicon Iron Castings,"
- b) ASTM C 1053, "Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications," or
- c) CAN/CSA-B181.3, "Polyolefin and Polyvinylidene Fluoride (PVDF) Laboratory Drainage Systems."

2.2.9. Jointing Materials

2.2.9.1. Cement Mortar
1) Cement mortar shall not be used for jointing.

2.2.9.2. Solders and Fluxes
1) Solders for solder joint fittings shall conform to ASTM B 32, "Solder Metal."
2) Solders and fluxes having a lead content in excess of 0.2% shall not be used in a *potable water system*.
3) Fluxes for soldered joints shall conform to ASTM B 813, "Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube."
4) Brazing alloys shall conform to ANSI/AWS A5.8M/A5.8, "Filler Metals for Brazing and Braze Welding," BCuP range.

2.2.10. Miscellaneous Materials

2.2.10.1. Brass Floor Flanges
1) Brass floor flanges shall conform to CSA B158.1, "Cast Brass Solder Joint Drainage, Waste and Vent Fittings."

2.2.10.2. Screws, Bolts, Nuts and Washers
1) Every screw, bolt, nut and washer shall be of corrosion-resistant materials when used
- a) to connect a water closet to a floor flange,
- b) to anchor the floor flange to the floor, or
- c) to anchor the water closet to the floor.

2.2.10.3. Cleanout Fittings
1) Every plug, cap, nut or bolt that is intended to be removable from a ferrous fitting shall be of a non-ferrous material.
2) A *cleanout* fitting that, as a result of normal maintenance operations, cannot withstand the physical stresses of removal and reinstallation or cannot ensure a gas-tight seal shall not be installed.

2.2.10.4. Mechanical Couplings

1) Groove- and shoulder-type mechanical couplings for pressure applications shall conform to CSA B242, “Groove- and Shoulder-Type Mechanical Pipe Couplings.”

2) Mechanical couplings for non-pressure applications shall conform to CAN/CSA-B602, “Mechanical Couplings for Drain, Waste, and Vent Pipe and Sewer Pipe.”

2.2.10.5. Saddle Hubs

1) A saddle hub or fitting shall not be installed in *drainage*, *venting* or *water systems.* (See Note A-2.2.10.5.(1).)

2.2.10.6. Supply and Waste Fittings

1) Supply fittings shall conform to

a) ASME A112.18.1/CSA B125.1, “Plumbing Supply Fittings,” or

b) CSA B125.3, “Plumbing Fittings.”

2) Supply fittings and individual shower heads shall have an integral means of limiting the maximum water flow rate to that specified in Table 2.2.10.6. (See Note A-2.2.10.6.(2).)

Table 2.2.10.6.
Water Flow Rates from Supply Fittings
Forming Part of Sentence 2.2.10.6.(2)

Supply Fittings	Maximum Water Flow Rate, L/min
Kitchen faucet (non-residential)	8.3
Kitchen faucet (residential)	6.8(1)
Lavatory faucet (for *private use*)	5.7
Lavatory faucet (for *public use*)	1.9(2)(3)
Pre-rinse spray valve	4.8(4)
Shower head	7.6(5)
Wash fountain, per *plumbing fixture* fitting	6.8(6)

Notes to Table 2.2.10.6.:

(1) May be temporarily increased to a maximum flow rate of 8.3 L/min but must default to the lower flow rate upon release of the activation mechanism or closure of the faucet valve.

(2) A *metering fixture* faucet is limited to 1.0 L per cycle.

(3) A lavatory faucet in a health care facility is permitted a maximum flow rate of 8.3 L/min. The *Chief Building Official* may, for human health reasons, permit exemptions within other facilities, to a maximum flow rate of 8.3 L/min.

(4) Each *pre-rinse spray valve* shall be equipped with an automatic shut-off.

(5) Emergency and safety *shower heads* and *shower heads* in health care facilities and detention facilities are exempted from this requirement.

(6) A maximum flow rate of 6.8 L/min is permitted for each 500 mm of circumference. For a wash fountain with *metering fixture* faucets, a maximum of one *metering fixture* faucet is permitted for each 500 mm of circumference. *A metering fixture* faucet is limited to 1.0 L per cycle.

3) An automatic compensating valve serving an individual shower head addressed in Sentence (1) shall have a water flow rate equal to or less than the shower head it serves. (See Note A-2.2.10.6.(3).)

4) Where multiple shower heads installed in a public showering facility are served by one temperature control, each shower head shall be equipped with a device capable of automatically shutting off the flow of water when the shower head is not in use. (See Note A-2.2.10.6.(4) and (5).)

5) Each lavatory in a public washroom and each wash fountain shall be equipped with a device capable of automatically shutting off the flow of water when the lavatory is not in use. (See Note A-2.2.10.6.(4) and (5).)

6) Waste fittings shall conform to ASME A112.18.2/CSA B125.2, “Plumbing Waste Fittings.”

2.2.10.7. Water Temperature Control

(See Note A-2.2.10.7.)

1) Except as provided in Sentence (2), valves supplying fixed-location shower heads shall be individual pressure-balanced or thermostatic-mixing valves conforming to ASME A112.18.1/CSA B125.1, "Plumbing Supply Fittings."

2) Individual pressure-balanced or thermostatic-mixing valves shall not be required for shower heads having a single tempered water supply that is controlled by an automatic compensating valve conforming to CSA B125.3, "Plumbing Fittings."

3) Mixing valves that supply shower heads shall be of the pressure-balanced, thermostatic, or combination pressure-balanced/thermostatic type capable of

a) maintaining a water outlet temperature that does not exceed 49°C, and

b) limiting thermal shock.

4) The temperature of water discharging into a bathtub shall not exceed 49°C.

2.2.10.8. Direct Flush Valves

1) Direct flush valves shall

a) open fully and close positively under service pressure,

b) complete their cycle of operation automatically,

c) be provided with a means of regulating the volume of water that they discharge, and

d) be provided with a *vacuum breaker* unless the *fixture* is designed so that *back-siphonage* cannot occur.

2.2.10.9. Drinking Fountain Bubblers

1) The orifice of drinking fountain bubblers shall

a) be of the shielded type, and

b) direct the water upward at an angle of approximately 45°.

2) Drinking fountain bubblers shall include a means of regulating the flow to the orifice.

3) Bubblers shall be installed only on drinking fountains. (See Note A-2.2.10.9.(3).)

2.2.10.10. Back-Siphonage Preventers and Backflow Preventers

1) Except as provided in Sentence (2), *back-siphonage preventers* and *backflow preventers* shall conform to

a) CSA B64.0, "Definitions, General Requirements, and Test Methods for Vacuum Breakers and Backflow Preventers,"

b) CSA B64.1.1, "Atmospheric Vacuum Breakers (AVB),"

c) CSA B64.1.2, "Pressure Vacuum Breakers (PVB),"

d) CSA B64.1.3, "Spill-Resistant Pressure Vacuum Breakers (SRPVB),"

e) CSA B64.2, "Hose Connection Vacuum Breakers (HCVB),"

f) CSA B64.2.1, "Hose Connection Vacuum Breakers (HCVB) with Manual Draining Feature,"

g) CSA B64.2.2, "Hose Connection Vacuum Breakers (HCVB) with Automatic Draining Feature,"

h) CSA B64.3, "Dual Check Valve Backflow Preventers with Atmospheric Port (DCAP),"

i) CSA B64.4, "Reduced Pressure Principle (RP) Backflow Preventers,"

j) CSA B64.5, "Double Check Valve (DCVA) Backflow Preventers,"

k) CSA B64.6, "Dual Check Valve (DuC) Backflow Preventers ,"

l) CSA B64.7, "Laboratory Faucet Vacuum Breakers (LFVB)," or

m) CSA B64.8, "Dual Check Valve Backflow Preventers with Intermediate Vent (DuCV)."

2) *Back-siphonage preventers* for tank-type water closets (anti-siphon fill valves) shall conform to CSA B125.3, "Plumbing Fittings."

2.2.10.11. Relief Valves

1) Temperature-relief, pressure-relief, combined temperature- and pressure-relief, and vacuum-relief valves shall conform to ANSI Z21.22/CSA 4.4-M, "Relief Valves for Hot Water Supply Systems."

2.2.10.12. Reducing Valves

1) Direct-acting water-pressure-reducing valves for domestic water supply systems shall conform to CAN/CSA-B356, "Water Pressure Reducing Valves for Domestic Water Supply Systems."

2.2.10.13. Solar Domestic Hot Water

1) Equipment for solar heating of *potable* water shall conform to CAN/CSA-F379 SERIES, "Packaged Solar Domestic Hot Water Systems (Liquid-to-Liquid Heat Transfer)."

2.2.10.14. Vent Pipe Flashing

1) Flashing fabricated on-site for *vent pipes* shall be fabricated from

a) copper sheet not less than 0.33 mm thick,
b) aluminum sheet not less than 0.48 mm thick,
c) alloyed zinc sheet not less than 0.35 mm thick,
d) lead sheet not less than 1.73 mm thick,
e) galvanized steel sheet not less than 0.33 mm thick, or
f) polychloroprene (neoprene) not less than 2.89 mm thick.

2) Prefabricated flashing for *vent pipes* shall conform to CSA B272, "Prefabricated Self-Sealing Roof Vent Flashings." (See Article 2.5.6.5. for location of *vent pipe* terminals.)

2.2.10.15. Water Hammer Arresters

1) Water hammer arresters shall conform to ANSI/ASSE 1010, "Water Hammer Arresters."

2.2.10.16. Air Admittance Valves

1) *Air admittance valves* shall conform to ASSE 1051, "Individual and Branch Type Air Admittance Valves (AAVs) for Sanitary Drainage Systems." (See Note A-2.2.10.16.(1).)

2.2.10.17. Water Treatment Systems

(See Article 2.6.2.1. and Note A-2.2.10.17.)

1) Except as provided in Sentence (3), a water treatment device or apparatus may be connected to the *City* water system at the discretion of the *Chief Building Official* and, if permitted

a) an *operating permit* shall be obtained,
b) the *operating permit* number assigned to a water treatment device or apparatus shall be posted on a sign or plate that is securely fastened to the water treatment device or apparatus in a location that is conspicuously visible and constructed of a durable, weather resistant material, and
c) the *Chief Building Official* shall be notified within 30 days of any changes to the information that was last provided to the *City* with regard to the *operating permit*, in the form prescribed by the *Chief Building Official*.

2) Except as provided in Sentence (3), an existing water treatment device or apparatus shall comply with Clauses (1)(a), (b) and (c).

3) The requirements in Sentences (1) and (2) do not apply to a *building* used exclusively for *residential occupancy* containing no more than 4 principal *dwelling units*.

2.2.11. Building Appliances and Mechanical Systems

2.2.11.1. Building Appliances

1) Appliances listed in Table 2.2.11.1 shall comply with the applicable Energy Star program requirements.

Table 2.2.11.1.
Appliance Energy Star Program Requirements
Forming Part of Sentence 2.2.11.1.(1)

Appliance	Energy Star Program Requirements
Residential clothes washer(1)	Product Specification for Clothes Washers
Commercial clothes washer(1)	Product Specification for Clothes Washers
Residential dishwasher(2)	Product Specification for Residential Dishwashers
Commercial dishwasher(3)	Product Specification for Commercial Dishwashers
Commercial ice maker(4)	Product Specification for Automatic Commercial Ice Makers
Commercial steam cooker(5)	Product Specification for Commercial Steam Cookers
Combination oven(6)	Product Specification for Commercial Ovens

Notes to Table 2.2.11.1.:
(1) "Residential clothes washer" and "commercial clothes washer" are as defined by the Energy Star Program Requirements Product Specification for Clothes Washers.
(2) "Residential dishwasher" is as per the definition of "dishwasher" by the Energy Star Program Requirements Product Specification for Residential Dishwashers.
(3) "Commercial dishwasher" is as per the definition of "dishwashing machine" by the Energy Star Program Requirements Product Specification for Commercial Dishwashers. Dishwashers intended for laboratory applications are exempted.
(4) "Commercial ice maker" is as per the definition of "automatic commercial ice maker" by the Energy Star Program Requirements Product Specification for Automatic Commercial Ice Makers.
(5) "Commercial steam cooker" is as per the definition of "commercial steam cooker" by the Energy Star Program Requirements Product Specification for Commercial Steam Cookers.
(6) "Combination oven" is as per the definition of "combination oven" by the Energy Star Program Requirements Product Specification for Commercial Ovens.

2) Clothes washers with a top-loading design that are designed for use in applications in which the occupants of more than one household will be using the clothes washer, such as multi-family housing common areas and coin laundries, shall not be installed.

2.2.11.2. Residential Landscape Irrigation Systems

1) Residential landscape irrigation systems that apply herbicides, fungicides, insecticides, fertilizers, soil amendments or other chemicals or pesticides by means of irrigation water are prohibited.

2) Where the water pressure supplied to a property exceeds 550 kPa, the residential landscape irrigation system shall be equipped with a pressure reducing valve providing a maximum supplied pressure of 415 kPa and located downstream of the backflow preventer.

2.2.11.3. Vehicle Wash Facilities

1) The maximum flow rate of a spray wand, foam brush or similar *plumbing fixture* used at a vehicle wash facility shall not exceed 11.4 L/min.

2) Where a machine cleans a vehicle at a vehicle wash facility,

a) a water recycling system that recycles and reuses at least 60% of the water and rinse water shall be installed, used and maintained, and

b) discharge shall be directed to an *interceptor* dedicated exclusively to the vehicle wash facility and designed to trap oil, gasoline, sand, grit and similar materials. (See Article 2.4.4.3.)

2.2.11.4. Non-recirculating Applications

1) Except as provided in Sentence (2), the *City* water system shall not be connected to

a) *once through cooling equipment*,
b) venturi-type flow-through vacuum generators or aspirators in which running water is used solely for the venturi effect,
c) *non-recirculating liquid ring pumps*,
d) non-recirculating wet-hood scrubbers,
e) machinery powered by water,
f) non-recirculating ponds, waterways, water features, ornamental fountains, or swimming pools,
g) non-recirculating systems or equipment that use water for thermal conditioning of building surfaces or roofs, except that this does not apply to emergency fire protection of buildings, or
h) non-recirculating systems or equipment that use water for melting or thawing. (See also Sentence 2.4.4.2.(2).)

2) *Emergency once through cooling equipment* or *maintenance once through cooling equipment* may be connected to the *City* water system at the discretion of the *Chief Building Official* or *City Engineer* and, if permitted

a) an *operating permit* shall be obtained,
b) the *operating permit* number assigned to the *once through cooling equipment* shall be posted on a sign or plate that is securely fastened to the *once through cooling equipment* in a location that is conspicuously visible and constructed of a durable, weather resistant material,
c) the *Chief Building Official* shall be notified within 30 days of any changes to the information that was last provided to the *City* with regard to the *operating permit*, in the form prescribed by the *Chief Building Official*,
d) a water meter shall be installed on the *potable* water supply to the *once through cooling equipment* and shall be capable of recording the volume of *potable* water being supplied, and
e) the *once through cooling equipment* shall be capable of activating an *alert* whenever *potable* water is supplied to the *once through cooling equipment.* (See Note A-2.2.11.4.(2).)

2.2.11.5. Geoexchange Systems

1) Make-up water for a closed loop geoexchange (geothermal) ground heat exchanger shall be provided by a feeder tank isolated from the domestic water supply.

2) The use of a direct connection to the domestic water supply as a source of make-up water for a closed loop geoexchange (geothermal) ground heat exchanger is prohibited.

3) Methanol shall not be used for geoexchange (geothermal) applications.

4) An open loop geoexchange (geothermal) system serving a *building* used exclusively for *residential occupancy* containing no more than 4 principal *dwelling units* shall not be installed.

5) An open loop geoexchange (geothermal) system shall not discharge into the *sewer*.

Section 2.3. Piping

2.3.1. Application

2.3.1.1. General

1) This Section applies to the construction and use of joints and connections, and the arrangement, protection, support and testing of piping.

2.3.2. Construction and Use of Joints

2.3.2.1. Caulked Lead Drainage Joints

1) Caulked lead drainage joints shall not be used except for cast-iron pipe in a *drainage system* or *venting system*, or between such pipe and

a) other ferrous pipe,
b) brass and copper pipe,
c) a caulking ferrule, or
d) a *trap standard*.

2) Every caulked lead drainage joint shall be firmly packed with oakum and tightly caulked with lead to a depth of not less than 25 mm.
3) No paint, varnish or other coating shall be applied on the lead until after the joint has been tested.
4) A length of hub and spigot pipe and pipe fittings in a *drainage system* shall be installed with the hub at the upstream end.

2.3.2.2. Wiped Joints
1) Wiped joints shall not be used except for sheet lead or lead pipe, or between such pipe and copper pipe or a ferrule.
2) Wiped joints in straight pipe shall
a) be made of solder,
b) have an exposed surface on each side of the joint at least 19 mm wide, and
c) be not less than 10 mm thick at the thickest part.

3) Wiped flanged joints shall be reinforced with a lead flange that is not less than 19 mm wide.

2.3.2.3. Screwed Joints
1) In making a screwed joint, the ends of the pipe shall be reamed or filed out to the size of the bore and all chips and cuttings shall be removed.
2) No pipe-joint cement or paint shall be applied to the internal threads.

2.3.2.4. Soldered Joints
1) Soldered joints shall be made in accordance with ASTM B 828, “Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.”

2.3.2.5. Flared Joints
1) In making a flared joint, the pipe shall be expanded with a proper flaring tool.
2) Flared joints shall not be used for hard (drawn) copper tube.

2.3.2.6. Mechanical Joints
1) Mechanical joints shall be made with compounded elastomeric rings that are held in compression by
a) stainless steel or cast-iron clamps, or
b) groove and shoulder type mechanical couplings.

(See Note A-2.3.2.6.(1).)

2.3.2.7. Cold-Caulked Joints
1) Cold-caulked joints shall not be used except for bell and spigot pipe in a *water system*, a *drainage system* or a *venting system*.
2) Caulking compound used in cold-caulked joints shall be applied according to the manufacturer’s directions.
3) Cold-caulked joints in a *drainage system* shall be firmly packed with oakum and tightly caulked with cold caulking compound to a depth of not less than 25 mm.

2.3.2.8. Stainless Steel Welded Joints
1) Stainless steel welded joints shall conform to ASME B31.9, “Building Services Piping.”
2) Butt weld pipe fittings shall be at least as thick as the wall of the pipe used.

2.3.3. Joints and Connections

2.3.3.1. Drilled and Tapped Joints

1) Drilled and tapped joints shall not be made in a *soil-or-waste pipe* or *vent pipe* and fittings unless suitable provision has been made for drilling and tapping.

2.3.3.2. Extracted Tees

1) Tees may be extracted from the wall thickness of Types K and L copper tube used in a *water distribution system* provided that

a) a tool specifically designed for the purpose is used,
b) the branch is at least one *size* smaller than the tube in which the tee is formed,
c) the end of the branch incorporates a means to prevent it from penetrating into the run and thereby obstructing flow, and
d) the joint at the tee is brazed with a filler metal having a melting point not below 540°C.

2.3.3.3. Prohibition of Welding of Pipes and Fittings

1) Cast-iron soil pipe and fittings shall not be welded.
2) Galvanized steel pipe and fittings shall not be welded.

2.3.3.4. Unions and Slip Joints

(See Note A-2.2.3.1.(1) and (3).)
1) Running thread and packing nut connections and unions with a gasket seal shall not be used downstream of a *trap weir* in a *drainage system* or in a *venting system*.
2) Slip joints shall not be used

a) in a *venting system*, or
b) in a *drainage system*, except to connect a *fixture trap* to a *fixture drain* in an accessible location.

2.3.3.5. Increaser or Reducer

1) Connections between 2 pipes of different *sizes* shall be made with an increaser or a reducer fitting installed so that it permits the system to be completely drained.

2.3.3.6. Dissimilar Materials

1) Adaptors, connectors or mechanical joints used to join dissimilar materials shall be designed to accommodate the required transition.

2.3.3.7. Connection of Roof Drain to Leader

1) *Roof drains* shall be securely connected to a *leader* and provision shall be made for expansion.

2.3.3.8. Connection of Floor Outlet Fixtures

1) Pedestal urinals, floor-mounted water closets and S-*trap standards* shall be connected to a *fixture drain* by a floor flange or other means of connection, except that a cast-iron *trap standard* may be caulked to a cast-iron pipe.
2) Except as provided in Sentence (3), floor flanges shall be brass.
3) Where cast-iron or plastic pipe is used, a floor flange of the same material is permitted to be used.
4) Floor flanges and *fixtures* shall be securely set on a firm base and fastened to the floor or *trap* flange of the *fixture*.
5) Joints in a floor flange or between a *fixture* and the *drainage system* shall be sealed with a resilient watertight and gas-tight seal.
6) Where a lead water-closet stub is used, the length of the stub below the floor flange shall be not less than 75 mm.

2.3.3.9. Expansion and Contraction

(See Note A-2.3.3.9.)
1) The design and installation of every piping system shall include means to accommodate its expansion and contraction caused by temperature changes, movement of the soil, *building* shrinkage or structural settlement. (See Note A-2.3.3.9.(1).)

2.3.3.10. Copper Tube

1) Types M and DWV copper tube shall not be bent.

2.3.3.11. Indirect Connections

1) Where a *fixture* or device is *indirectly connected*, the connections shall be made by terminating the *fixture drain* above the *flood level rim* of a *directly connected fixture* to form an *air break*.
2) The size of the *air break* shall at least equal the *size* of the *fixture drain*, *branch* or pipe that terminates above the *directly connected fixture*, and it shall be not less than 25 mm. (See Note A-2.3.3.11.(2).)

2.3.3.12. Copper Joints Used Underground

1) Except as provided in Sentence (2), joints in copper tubes installed underground shall be made with either flared or compression fittings, or be brazed using a brazing alloy within the American Welding Society's AWS-BCuP range.
2) Compression fittings shall not be used underground under a *building*.

2.3.4. Support of Piping

2.3.4.1. Capability of Support

1) Piping shall be provided with support that is capable of keeping the pipe in alignment and bearing the weight of the pipe and its contents.
2) Floor-mounted and wall-mounted water-closet bowls shall be securely attached to the floor or wall by means of a flange and shall be stable.
3) Wall-mounted *fixtures* shall be supported so that no strain is transmitted to the piping.

2.3.4.2. Independence of Support

1) Piping, *fixtures*, tanks or devices shall be supported independently of each other.

2.3.4.3. Insulation of Support

1) Where a hanger or support for copper tube or brass or copper pipe is of a material other than brass or copper, it shall be suitably separated and electrically insulated from the pipe or tube.
2) Where a hanger or support for stainless steel pipe or tube is of a material other than stainless steel, it shall be suitably separated and electrically insulated from the pipe or tube.

2.3.4.4. Support for Vertical Piping

1) Except as provided in Sentence (2), vertical piping shall be supported at its base and at the floor level of alternate *storeys* by rests, each of which can bear the weight of pipe that is between it and the rest above it.
2) The maximum spacing of supports shall be 7.5 m.

2.3.4.5. Support for Horizontal Piping

1) *Nominally horizontal* piping that is inside a *building* shall be braced to prevent swaying and buckling and to control the effects of thrust.
2) *Nominally horizontal* piping shall be supported as stated in Table 2.3.4.5.
3) Where PVC, CPVC or ABS plastic pipe is installed

a) the pipe shall be aligned without added strain on the piping,
b) the pipe shall not be bent or pulled into position after being welded, and
c) hangers shall not compress, cut or abrade the pipe.

4) Where PEX, PP-R, PE/AL/PE or PEX/AL/PEX plastic pipe is installed, hangers shall not compress, cut or abrade the pipe.

Table 2.3.4.5.
Support for Nominally Horizontal Piping
Forming Part of Sentence 2.3.4.5.(2)

Piping Material	Maximum Horizontal Spacing of Supports, m	Additional Support Conditions
Galvanized iron or steel pipe		
diameter ≥ 6 inches	3.75	None
diameter < 6 inches	2.5	
Stainless steel pipe		
diameter ≥ 1 inch	3.0	None
diameter < 1 inch	2.5	
Stainless steel tube		
diameter ≥ 1 inch	3.0	None
diameter < 1 inch	2.5	
Lead pipe	Throughout length of pipe	None
Cast-iron pipe	3	At or adjacent to each hub or joint
Cast-iron pipe with mechanical joints that is ≤ 300 mm long between adjacent fittings	1	None
ABS or PVC plastic pipe	1.2	At the end of *branches* or *fixture drains* and at changes in direction and elevation
ABS or PVC plastic *trap arm* or *fixture drain* pipe > 1 m long	n/a	As close as possible to the *trap*
CPVC pipe	1	None
Copper tube or copper and brass pipe, hard temper, diameter > 1 inch	3	None
Copper tube or copper and brass pipe, hard temper, diameter ≤ 1 inch	2.5	None
Copper tube, soft temper	2.5	None
PE/AL/PE composite pipe	1	None
PEX/AL/PEX composite pipe	1	None
PEX plastic pipe	0.8	None

PP-R plastic pipe	1	At the end of *branches* and at changes in direction and elevation

5) Where hangers are used to support *nominally horizontal* piping, the hangers shall be
a) supported by metal rods of not less than
i) 6 mm diam to support piping 2 inches or less in *size*,
ii) 8 mm diam to support piping 4 inches or less in *size*, and
iii) 13 mm diam to support piping over 4 inches in *size*, or
b) solid or perforated metal straps of not less than
i) 0.6 mm nominal thickness and 12 mm wide to support piping 2 inches or less in *size*, and
ii) 0.8 mm nominal thickness and 18 mm wide to support piping 4 inches or less in *size*.

6) Where a hanger is attached to concrete or masonry, it shall be fastened by metal or expansion-type plugs that are inserted or built into the concrete or masonry.

2.3.4.6. Support for Underground Horizontal Piping

1) Except as provided in Sentence (2), *nominally horizontal* piping that is underground shall be supported on a base that is firm and continuous under the whole of the pipe. (See Note A-2.3.4.6.(1).)

2) *Nominally horizontal* piping installed underground that is not supported as described in Sentence (1) may be installed using hangers fixed to a foundation or structural slab provided that the hangers are capable of
a) keeping the pipe in alignment, and
b) supporting the weight of
i) the pipe,
ii) its contents, and
iii) the fill over the pipe.

2.3.4.7. Support for Vent Pipe above a Roof

1) Where a *vent pipe* that may be subject to misalignment terminates above the surface of a roof, it shall be supported or braced. (See Article 2.5.6.5. for location of *vent pipe* terminals.)

2.3.5. Protection of Piping

2.3.5.1. Backfilling of Pipe Trench

1) Where piping is installed underground, the backfill shall be
a) carefully placed and tamped to a height of 300 mm over the top of the pipe, and
b) free of stones, boulders, cinders and frozen earth. (See Note A-2.3.5.1.(1).)

2.3.5.2. Protection of Non-Metallic Pipe

1) Where vitrified clay is located less than 600 mm below a basement floor and the floor is constructed of other than 75 mm or more of concrete, the pipe shall be protected by a 75-mm layer of concrete installed above the pipe. (See Note A-2.3.5.2.(1).)

2.3.5.3. Isolation from Loads

1) Where piping passes through or under a wall, it shall be installed so that the wall does not bear on the pipe.

2.3.5.4. Protection Against Freezing

(See Note A-2.3.5.4.)

1) Where piping may be exposed to freezing conditions, it shall be protected from the effects of freezing.

2.3.5.5. Protection from Mechanical Damage

1) Plumbing, piping and equipment exposed to mechanical damage shall be protected.

2.3.5.6. Protection from Condensation

(See Note A-2.3.5.4.)

1) Piping used as an internal *leader*, which may be subject to condensation, shall be installed in a manner that limits the risk of damage to the *building* due to condensation.

2.3.6. Testing of Drainage or Venting Systems

2.3.6.1. Tests and Inspection of Drainage or Venting Systems

1) Except in the case of an external *leader*, after a section of a *drainage system* or a *venting system* has been roughed in, and before any *fixture* is installed or piping is covered, a water pressure test or an air pressure test shall be conducted.

2) After every *fixture* is installed and before any part of the *drainage system* or *venting system* is placed in operation, a final test shall be carried out when requested.

3) Where a prefabricated system is assembled off the *building* site in such a manner that it cannot be inspected and tested on site, off-site inspections and tests shall be conducted.

4) Where a prefabricated system is installed as part of a *drainage system* or *venting system*, all other plumbing work shall be tested and inspected and a final test shall be carried out on the complete system when requested.

5) When requested, a ball test shall be made to any pipe in a *drainage system*.

6) Siphonic roof drains and drainage systems shall be tested in accordance with ASME A112.6.9 "Siphonic Roof Drains."

2.3.6.2. Tests of Pipes in Drainage Systems

1) Pipes in a *drainage system*, except an external *leader* or *fixture outlet pipe*, shall be capable of withstanding without leakage a water pressure test, air pressure test and final test.

2) Pipes in a *drainage system* shall be capable of meeting a ball test.

2.3.6.3. Tests of Venting Systems

1) *Venting systems* shall be capable of withstanding without leakage a water pressure test, air pressure test and final test.

2.3.6.4. Water Pressure Tests

1) A water pressure test shall consist in applying a water column of at least 3 m to all joints.

2) In making a water pressure test,

a) every opening except the highest shall be tightly closed with a testing plug or a screw cap, and

b) the system or the section shall be kept filled with water for 15 min.

2.3.6.5. Air Pressure Tests

1) Air pressure tests shall be conducted in accordance with the manufacturer's instructions for each piping material, and

a) air shall be forced into the system until a pressure of 35 kPa is created, and

b) this pressure shall be maintained for at least 15 min without a drop in pressure.

2.3.6.6. Final Tests

1) Where a final test is made,

a) every *trap* shall be filled with water,

b) the bottom of the system being tested shall terminate at a *building trap*, test plug or cap,

c) except as provided in Sentence (2), smoke from smoke-generating machines shall be forced into the system,

d) when the smoke appears from all roof terminals they shall be closed, and

e) a pressure equivalent to a 25 mm water column shall be maintained for 15 min without the addition of more smoke.

2) The smoke referred to in Clauses (1)(c) and (d) is permitted to be omitted, provided the roof terminals are closed and the system is subjected to an air pressure equivalent to a 25 mm water column maintained for 15 min without the addition of more air.

2.3.6.7. Ball Tests

1) Where a ball test is made, a hard ball dense enough not to float shall be rolled through the pipe.

2) The diameter of the ball shall be not less than

a) 50 mm where the *size* of the pipe is 3 inches or more, or

b) 25 mm where the *size* of the pipe is less than 3 inches.

2.3.7. Testing of Potable Water Systems

2.3.7.1. Application of Tests

1) After a section of a *potable water system* has been completed, and before it is placed in operation, a water pressure test shall be conducted, except that an air pressure test may be used in freezing conditions.

2) A pressure test may be applied to each section of the system or to the system as a whole.

3) Where a prefabricated system is assembled off the *building* site in such a manner that it cannot be inspected and tested on site, off-site inspections and pressure tests shall be conducted.

4) Where a prefabricated system is installed as part of a *water system*,

a) all other plumbing work shall be tested and inspected, and

b) the complete system shall be pressure tested when requested.

2.3.7.2. Pressure Tests of Potable Water Systems

1) Except as required in Sentence (2), *potable water systems* shall be able to withstand

a) without leaking, a water pressure that is at least equal to the maximum in-service pressure, or

b) an air pressure of not less than 700 kPa for at least 2 h without a drop in pressure.

2) If a manufacturer states that an air pressure test is not recommended, a water pressure test shall be performed. (See Note A-2.3.7.2.(2).)

2.3.7.3. Water Pressure Tests

1) Where a water pressure test is made, all air shall be expelled from the system before *fixture* control valves or faucets are closed.

2) *Potable* water shall be used to test a *potable water system*.

Section 2.4. Drainage Systems

2.4.1. Application

2.4.1.1. General

1) This Section applies to *sanitary drainage systems*, *storm drainage systems*, *combined building drains* or *combined building sewers*.

2.4.2. Connections to Drainage Systems

2.4.2.1. Connections to Sanitary Drainage Systems

1) *Fixtures* shall be *directly connected* to a *sanitary drainage system*, except that
- a) drinking fountains are permitted to be
  - i) *indirectly connected* to a *sanitary drainage system*, or
  - ii) connected to a *storm drainage system* provided that where the system is subject to *backflow*, a *backwater valve* is installed in the fountain *waste pipe* (See Note A-2.4.2.1.(1)(a)(ii) and (e)(vi).),
- b) drainage pans on heating/cooling units are permitted to be connected to a *storm drainage system*, provided that where the system is subject to *backflow*, a *backwater valve* is installed,
- c) a floor drain is permitted to be connected to a *storm drainage system*, provided it is located where it can receive only *clear-water waste* or *storm water*,
- d) *fixtures* or appliances that discharge only *clear-water waste* are permitted to be connected to a *storm drainage system* or be drained onto a roof, and
- e) the following devices shall be *indirectly connected* to a *drainage system:*
  - i) a device for the display, storage, preparation or processing of food or drink,
  - ii) a sterilizer,
  - iii) a device that uses water as a cooling or heating medium,
  - iv) a water operated device,
  - v) a water treatment device, or
  - vi) a drain or overflow from a *water system* or a heating system. (See Note A-2.4.2.1.(1)(a)(ii) and (e)(vi).)

2) The connection of a *soil-or-waste pipe* to a *nominally horizontal soil-or-waste pipe* or to a *nominally horizontal offset* in a *soil-or-waste stack* shall be not less than 1.5 m measured horizontally from the bottom of a *soil-or-waste stack* or from the bottom of the upper vertical section of the *soil-or-waste stack* that
- a) receives a discharge of 30 or more *fixture units*, or
- b) receives a discharge from *fixtures* located on 2 or more *storeys*.

(See Note A-2.4.2.1.(2).)

3) No other *fixture* shall be connected to a lead bend or stub that serves a water closet.

4) Where a change in direction of more than 45° occurs in a *soil-or-waste pipe* that serves more than one clothes washer, and in which pressure zones are created by detergent suds, no other *soil-or-waste pipe* shall be connected to it within a length less than
- a) 40 times the *size* of the *soil-or-waste pipe* or 2.44 m maximum vertical, whichever is less, before changing direction, and
- b) 10 times the *size* of the *nominally horizontal soil-or-waste pipe* after changing direction.

(See Note A-2.4.2.1.(4).)

5) Where a *vent pipe* is connected into the suds pressure zone referred to in Sentence (4), no other *vent pipe* shall be connected to that *vent pipe* within the height of the suds pressure zone. (See Note A-2.4.2.1.(4).)

2.4.2.2. Connection of Overflows from Rainwater Tanks

1) An overflow from a rainwater tank shall not be *directly connected* to a *drainage system*.

2.4.2.3. Direct Connections

1) Two or more *fixture outlet pipes* that serve outlets from a single *fixture* that is listed in Clause 2.4.2.1.(1)(e) are permitted to be *directly connected* to a *branch* that
- a) has a *size* of not less than 1.25 inches, and
- b) is terminated above the *flood level rim* of a *directly connected fixture* to form an *air break*.

2) *Fixture drains* from *fixtures* that are listed in Subclauses 2.4.2.1.(1)(e)(i) and (ii) are permitted to be *directly connected* to a pipe that
- a) is terminated to form an *air break* above the *flood level rim* of a *fixture* that is *directly connected* to a *sanitary drainage system*, and

b) is extended through the roof when *fixtures* on 3 or more *storeys* are connected to it. (See Note A-2.4.2.1.(1)(a)(ii) and (e)(vi).)

3) *Fixture drains* from *fixtures* that are listed in Subclauses 2.4.2.1.(1)(e)(iii) to (vi) are permitted to be *directly connected* to a pipe that

a) is terminated to form an *air break* above the *flood level rim* of a *fixture* that is *directly connected* to a *storm drainage system*, and

b) is extended through the roof when *fixtures* on 3 or more *storeys* are connected to it.

2.4.3. Location of Fixtures

2.4.3.1. Urinals

1) Urinals shall not be installed adjacent to wall and floor surfaces that are pervious to water. (See Article 3.7.2.6. of Division B of Book I (General) of this By-law.)

2.4.3.2. Restricted Locations of Indirect Connections and Traps

1) Indirect connections or any *trap* that may overflow shall not be located in a crawl space or any other unfrequented area.

2.4.3.3. Equipment Restrictions Upstream of Grease Interceptors

1) Except as provided in Sentence (2), equipment discharging waste with organic solids shall not be located upstream of a grease *interceptor*. (See Note A-2.4.3.3.(1).)

2) An organic solids *interceptor* is permitted to be installed upstream of a grease *interceptor*.

2.4.3.4. Fixtures Located in Chemical Storage Locations

1) A floor drain or other *fixture* located in an oil transformer vault, a high voltage room or any room where flammable, dangerous or toxic chemicals are stored or handled shall not be connected to a *drainage system*.

2.4.3.5. Macerating Toilet Systems

1) A macerating toilet system shall only be installed where no connection to a gravity *sanitary drainage system* is available.

2.4.3.6. Drains Serving Elevator Pits

1) Where a drain is provided in an elevator pit,

a) it shall be connected directly to a sump located outside the elevator pit, and

b) the drain pipe that connects the sump to the *drainage system* shall have a *backwater valve*.

2.4.4. Treatment of Sewage and Waste

2.4.4.1. Sewage Treatment

1) Where a *fixture* or equipment discharges *sewage* or waste that may damage or impair the *sanitary drainage system* or the functioning of a public or *private sewage disposal system*, provision shall be made for treatment of the *sewage* or waste before it is discharged to the *sanitary drainage system*.

2.4.4.2. Sewer Discharge

1) Sanitary and storm discharge shall conform to the Sewer and Watercourse By-law.

2) No systems or equipment shall be installed that allow for the use of *potable* water to temper or dilute condensate discharged to the *sewer*.

2.4.4.3. Interceptors

1) Where a *fixture* discharges *sewage* that includes fats, oils or grease and is located in a public kitchen, in a restaurant or in a *care or detention occupancy*, it shall discharge through a grease *interceptor*. (See Note A-2.4.4.3.(1).)
2) Where the discharge from a *fixture* may contain oil or gasoline, an oil *interceptor* shall be installed. (See Article 2.5.5.2. for venting requirements for oil *interceptors*.)
3) Where a *fixture* discharges sand, grit or similar materials, an *interceptor* designed for the purpose of trapping such discharges shall be installed.
4) *Interceptors* shall have sufficient capacity to perform the service for which it is provided.

2.4.4.4. Neutralizing and Dilution Tanks
1) Where a *fixture* or equipment discharges corrosive or acid waste, it shall discharge into a neutralizing or dilution tank that is connected to the *sanitary drainage system* through
a) a *trap*, or
b) an indirect connection.
(See Note A-2.4.4.4.(1).)
2) Neutralizing and dilution tanks shall have a method for neutralizing the liquid.

2.4.5. Traps

2.4.5.1. Traps for Sanitary Drainage Systems
1) Except as provided in Sentences (2) to (5) and in Article 2.4.5.2., *fixtures* shall be protected by a separate *trap*.
2) One *trap* is permitted to protect
a) all the trays or compartments of a 2- or 3-compartment sink,
b) a 2-compartment laundry tray, or
c) 2 similar single compartment *fixtures* located in the same room.
(See Note A-2.4.5.1.(2).)
3) One *trap* is permitted to serve a group of floor drains or shower drains, a group of washing machines or a group of laboratory sinks if the *fixtures*
a) are in the same room, and
b) are not located where they can receive food or other organic matter.
(See Note A-2.4.5.1.(3).)
4) An *indirectly connected fixture* that can discharge only *clear-water waste* other than a drinking fountain need not be protected by a *trap*. (See Clause 2.4.2.1.(1)(e) for indirect connections.)
5) An *interceptor* with an effective water seal of not less than 38 mm is permitted to serve as a *trap.* (See Note A-2.4.5.1.(5).)
6) Where a domestic dishwashing machine equipped with a drainage pump discharges through a direct connection into the *fixture outlet pipe* of an adjacent kitchen sink or disposal unit, the pump discharge line shall rise as high as possible to just under the counter and connect
a) on the inlet side of the sink *trap* by means of a Y fitting, or
b) to the disposal unit.

2.4.5.2. Sumps and Traps for Storm Drainage Systems
1) Where a *storm drainage system* is connected to a public *sewer*, a *sump* shall be installed between any opening in the system and the *sewer*, except that no *sump* is required if the opening is the upper end of a *leader* that terminates
a) at a roof that is used only for weather protection,
b) not less than 1 m above or not less than 3.5 m in any other direction from any air inlet, openable window or door, and
c) not less than 1.8 m from a property line.
(See Note A-2.4.5.2.(1).)

2) A floor drain that drains to a *storm drainage system* shall be protected by a *trap* that

a) is located between the floor drain and a *leader*, *storm building drain* or *storm building sewer*,
b) may serve all floor drains located in the same room, and
c) need not be protected by a *vent pipe*.

3) Where freezing conditions could cause *storm drainage systems* to freeze due to air circulation within the piping, a *trap* with a *cleanout* shall be installed in a heated location.

2.4.5.3. Connection of Subsoil Drainage Pipe to a Storm Drainage System

1) A *subsoil drainage pipe* shall be connected to a *sump*. (See Note A-2.4.5.3.(1).)
2) The *sump* referred to in Sentence (1) shall be connected to a *storm sewer* or to a *combined sewer*.
3) The *sump* referred to in Sentence (1) shall not be connected to a *sanitary sewer*.

2.4.5.4. Location and Cleanout for Building Traps

1) Where a *building trap* is installed, it shall

a) be provided with a *cleanout* fitting on the upstream side of and directly over the *trap*,
b) be located upstream of the *building cleanout*, and
c) be located
  i) inside the *building* as close as practical to the place where the *building drain* leaves the *building*, or
  ii) outside the *building* in a manhole.

(See Note A-2.4.5.4.(1).)

2.4.5.5. Trap Seals

1) Provision shall be made for maintaining the *trap* seal of a floor drain by

a) the use of a *trap* seal primer,
b) using the drain as a receptacle for an *indirectly connected* drinking fountain, or
c) other equally effective means.

(See Note A-2.4.5.5.(1).)

2.4.6. Arrangement of Drainage Piping

2.4.6.1. Separate Systems

1) No vertical *soil-or-waste pipe* shall conduct both *sewage* and *storm water*.
2) A *combined building drain* shall not be installed. (See Note A-2.1.2.1.(2).)
3) There shall be no unused open ends in a *drainage system* and *dead ends* shall be so graded that water will not collect in them.

2.4.6.2. Location of Soil-or-Waste Pipes

1) A *soil-or-waste pipe* shall not be located directly above

a) non-pressure *potable* water storage tanks,
b) manholes in pressure *potable* water storage tanks, or
c) food-handling or food-processing equipment.

2.4.6.3. Sumps or Tanks

(See Note A-2.4.6.3.)

1) Piping that is too low to drain into a *building sewer* by gravity shall be drained to a sump or receiving tank.
2) Where the sump or tank receives *sewage*, it shall be water- and air-tight and shall be vented.
3) Equipment such as a pump or ejector that can lift the contents of the sump or tank and discharge it into the *building drain* or *building sewer* shall be installed.
4) Where the equipment does not operate automatically, the capacity of the sump shall be sufficient to hold at least a 24 h accumulation of liquid.

5) Where there is a *building trap*, the discharge pipe from the equipment shall be connected to the *building drain* downstream of the *trap*.
6) The discharge pipe from every pumped sump shall be equipped with a union, a *backwater valve* and a shut-off valve installed in that sequence in the direction of discharge.
7) The discharge piping from a pump or ejector shall be sized for optimum flow velocities at pump design conditions.

2.4.6.4. Protection from Backflow

1) Except as permitted in Sentence (2), a *backwater valve* or a gate valve that would prevent the free circulation of air shall not be installed in a *building drain* or in a *building sewer*. (See Note A-2.4.6.4.(1).)
2) A *backwater valve* is permitted to be installed in a *building drain* provided that
- a) it is a "normally open" design conforming to
  - i) CSA B70, "Cast Iron Soil Pipe, Fittings, and Means of Joining,"
  - ii) CAN/CSA-B181.1, "Acrylonitrile-Butadiene-Styrene (ABS) Drain, Waste, and Vent Pipe and Pipe Fittings,"
  - iii) CAN/CSA-B181.2, "Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Drain, Waste, and Vent Pipe and Pipe Fittings," or
  - iv) CAN/CSA-B182.1, "Plastic Drain and Sewer Pipe and Pipe Fittings," and
- b) it does not serve more than one *dwelling unit*.

3) Except as provided in Sentences (4) and (5), where a *building drain* or a *branch* may be subject to *backflow*, a gate valve or a *backwater valve* shall be installed on every *fixture drain* connected to them when the *fixture* is located below the level of the adjoining street.
4) Where the *fixture* is a floor drain, a removable screw cap is permitted to be installed on the upstream side of the *trap*.
5) Where more than one *fixture* is located on a *storey* and all are connected to the same *branch*, the gate valve or *backwater valve* is permitted to be installed on the *branch*.
6) Except as provided in Sentence (7), where a storm *sump* is provided there shall be a *backwater valve* attached to the outlet pipe.
7) Notwithstanding Sentence (6), a *backwater valve* is not required if the storm *sump* and the storm *sump* piping are both located above the level of the next upstream manhole of the public storm *sewer*.

2.4.6.5. Mobile Home Sewer Service

1) A *building sewer* intended to serve a mobile home shall be
- a) not less than 4 inches in *size*,
- b) terminated above ground,
- c) provided with
  - i) a tamperproof terminal connection that is capable of being repeatedly connected, disconnected and sealed,
  - ii) a protective concrete pad, and
  - iii) a means to protect it from frost heave, and
- d) designed and constructed in accordance with good engineering practice.

2.4.7. Cleanouts

2.4.7.1. Cleanouts for Drainage Systems

1) *Sanitary drainage systems* and *storm drainage systems* shall be provided with *cleanouts* that will permit cleaning of the entire system.
2) A *cleanout* fitting shall be provided on the upstream side and directly over every running *trap*.
3) Interior *leaders* shall be provided with a *cleanout* fitting at the bottom of the *leader* or not more than 3 m upstream from the bottom of the *leader*.
4) Where a *cleanout* is required on a *building sewer* 8 inches or larger in *size*, it shall be a manhole.

5) A *building sewer* shall not change direction or slope between the *building* and public sewer or between *cleanouts*, except that pipes not more than 6 inches in *size* may change direction
a) by not more than 5° every 3 m, or
b) by the use of fittings with a cumulative change in direction of not more than 45°.
6) *Building drains* shall be provided with a *cleanout* fitting conforming to Sentence 2.4.7.2.(2) that is located as close as practical to the place where the *building drain* leaves the *building*. (See Note A-2.4.7.1.(6).)
7) *Soil-or-waste stacks* shall be provided with a *cleanout* fitting
a) at the bottom of the stack,
b) not more than 3 m upstream of the bottom of the stack, or
c) on a Y fitting connecting the stack to the *building drain* or *branch*.
8) A *cleanout* shall be provided to permit the cleaning of the piping downstream of an *interceptor*.
9) *Cleanouts* shall be installed so that the cumulative change in direction is not more than 90° between *cleanouts* in a drip pipe from a food receptacle or in a *fixture drain* serving a kitchen sink in a non-residential *occupancy*. (See Note A-2.4.7.1.(9).)
10) A *fixture outlet pipe*, a *trap* with a removable *trap dip*, or a separate *cleanout* shall be used as a *cleanout* for a *fixture drain*. (See Note A-2.4.7.1.(10).)
11) *Building drains* shall be provided with an additional *cleanout* for each cumulative horizontal change in direction exceeding 135°.

2.4.7.2. Size and Spacing of Cleanouts

1) Except as provided in Sentences (2) to (4), the *size* and spacing of *cleanouts* in *nominally horizontal* pipes of a *drainage system* shall conform to Table 2.4.7.2.

Table 2.4.7.2.
Permitted Size and Spacing of Cleanouts
Forming Part of Sentence 2.4.7.2.(1)

Size of Drainage Pipe, inches	Minimum *Size* of *Cleanout*, inches	Maximum Spacing, m	
		One-Way Rodding	Two-Way Rodding
less than 3	Same *size* as drainage pipe	7.5	15
3 and 4	3	15	30
over 4	4	26	52

2) *Cleanout* fittings for *building drains* shall be at least 4 inches in *size*.
3) The spacing between manholes serving a *building sewer*
a) 24 inches or less in *size* shall not exceed 90 m, and
b) over 24 inches in *size* shall not exceed 150 m.
4) The *developed length* of a *building sewer* between the *building* and the first manhole to which the *building sewer* connects shall not exceed 75 m.
5) Where a *building sewer* connects to another *building sewer* other than by a manhole, the *developed length* between the *building* and the *building sewer* to which it connects shall not exceed 30 m.
6) *Cleanouts* that allow rodding in one direction only shall be installed to permit rodding in the direction of flow.

2.4.7.3. Manholes

1) A manhole, including the cover, shall be designed to support all loads imposed upon it.

2) A manhole shall be provided with
a) a cover that provides an airtight seal if located within a *building*,
b) a rigid ladder of a corrosion-resistant material where the depth exceeds 1 m, and
c) a vent to the exterior if the manhole is located within a *building*.
3) A manhole shall have a minimum horizontal dimension of 1 m, except that the top 1.5 m may be tapered from 1 m down to a minimum of 600 mm at the top.
4) A manhole in a *sanitary drainage system* shall be channeled to direct the flow of effluent.

2.4.7.4. Location of Cleanouts
1) *Cleanouts* and access covers shall be located so that their openings are readily accessible for drain cleaning purposes.
2) A *cleanout* shall not be
a) located in a floor assembly in a manner that may constitute a hazard, or
b) used as a floor drain.
3) There shall be no change of direction between a *cleanout* fitting and the *trap* that it serves.
4) The piping between a *cleanout* fitting and the *drainage system* it serves shall not change direction by more than 45°.
5) *Cleanouts* serving *fixtures* in health care facilities, mortuaries, laboratories and similar *occupancies*, where contamination by body fluids is likely, shall be located a minimum of 150 mm above the *flood level rim* of the *fixture*.

2.4.8. Minimum Slope and Length of Drainage Pipes

2.4.8.1. Minimum Slope
1) Except as provided in Articles 2.4.10.8. and 2.4.10.9., drainage pipes that are 3 inches or less in *size* shall have a downward slope in the direction of flow of at least 1 in 50. (See Note A-2.4.8.1.(1).)

2.4.8.2. Length of Fixture Outlet Pipes
1) Except for *fixture outlet pipes* installed in conformance with Sentence 2.4.5.1.(3), the *developed length* of *fixture outlet pipes* shall not exceed 1 200 mm. (See Note A-2.4.8.2.(1).) (See also Note A-2.4.5.1.(2).)

2.4.9. Size of Drainage Pipes

2.4.9.1. No Reduction in Size
1) A *soil-or-waste pipe* shall be of a *size* not less than the *size* of
a) a *vent pipe* that is connected to it, or
b) the largest *soil-or-waste pipe* that drains into it.

2.4.9.2. Serving Water Closets
1) Drainage pipes that serve a water closet shall be not less than 3 inches in *size*.
2) *Branch* and *building drains* downstream of the third water closet *fixture drain* connection shall be not less than 4 inches in *size*.
3) *Soil-or-waste stacks* that serve more than 6 water closets shall be not less than 4 inches in *size*.
4) Discharge pipes serving a macerating toilet system shall be not less than ¾ inch in *size*.

2.4.9.3. Size of Fixture Outlet Pipes
1) Except as provided in Sentence (2), the *size* of *fixture outlet pipes* shall conform to Table 2.4.9.3.
2) The part of the *fixture outlet pipe* that is common to 3 compartments of a sink shall be one *size* larger than the largest *fixture outlet pipe* of the compartments that it serves. (See Note A-2.4.9.3.(2).)

Table 2.4.9.3.
Minimum Permitted Size of Fixture Outlet Pipe and Hydraulic Loads for Fixtures[(1)]
Forming Part of Sentences 2.4.9.3.(1) and 2.4.10.2.(1)

Fixture	Minimum *Size* of *Fixture Outlet Pipe*, inches	Hydraulic Load, *fixture units*
Autopsy table	1½	2
Bathroom group		
(a) with flush tank	n/a	6
(b) with direct flush valve	n/a	8
Bathtub (with or without shower)	1½	1½
Bath: foot, sitz or slab	1½	1½
Beer cabinet	1½	1½
Bidet	1¼	1
Clothes washer		
(a) domestic[(1)]	n/a	2 with 2-in. *trap*
(b) commercial	n/a	2 with 2-in. *trap*
Dental unit or cuspidor	1¼	1
Dishwasher		
(a) domestic type	1½	1½ no load when connected to garbage grinder or domestic sink
(b) commercial type	2	3
Drinking fountain	1¼	½
Floor drain[(2)]	2	2 with 2-in. *trap*
		3 with 3-in. *trap*
Garbage grinder, commercial type	2	3
Icebox	1¼	1
Laundry tray		
(a) single or double units or 2 single units with common *trap*	1½	1½
(b) 3 compartments	1½	2
Lavatory		
(a) barber or beauty parlor	1½	1½

(b) dental	1¼	1
(c) domestic type, single or	1¼	1 with 1¼-in. *trap*
2 single with common trap		1½ with 1½-in. *trap*
(d) multiple or industrial type	1½	according to Table 2.4.10.2.
Macerating toilet system	¾	4
Potato peeler	2	3
Shower drain		
(a) from 1 head	1½	1½
(b) from 2 or 3 heads	2	3
(c) from 4 to 6 heads	3	6
Sink		
(a) domestic and other small types with or without garbage grinders, single, double or 2 single with a common *trap*	1½	1½
(b) Other sinks	1½	1½ with 1½-in. *trap*
		2 with 2-in. *trap*
		3 with 3-in. *trap*
Urinal		
(a) pedestal, siphon-jet or blowout type	2	4
(b) stall, washout type	2	2
(c) wall		
(i) washout type	1½	1½
(ii) other types	2	3
Water closet		
(a) with flush tank	3	4
(b) with direct flush valve	3	6

Notes to Table 2.4.9.3.:
(1) See Note A-Table 2.4.9.3.
(2) No hydraulic load for *emergency floor drains*.

3) Where clothes washers do not drain to a laundry tray, the *trap* inlet shall be fitted with a vertical standpipe that is not less than 600 mm long measured from the *trap weir* and terminates above the *flood level rim* of the clothes washer. (See Note A-2.4.9.3.(3).)

2.4.9.4. Size of Building Drain and Building Sewer

1) *Building drains* and *building sewers* connected to the public sewer system downstream of the main *cleanout* (See Sentence 2.4.7.1.(6)) shall be not less than 4 inches in *size*.

2.4.9.5. Offset in Leaders

1) No change in the *size* of a *leader* with a *nominally horizontal offset* is required if the *offset*

a) is located immediately under the roof,
b) is not more than 6 m long, and
c) has a slope of not less than 1 in 50.

2) If the horizontal *offset* is more than 6 m long, the *leader* shall conform to Table 2.4.10.9.

2.4.10. Hydraulic Loads

(See Note A-2.4.10. for determination of hydraulic loads and drainage pipe sizes.)

2.4.10.1. Total Load on a Pipe

1) The hydraulic load on a pipe is the total load from

a) every *fixture* that is connected to the system upstream of the pipe,
b) every *fixture* for which provision is made for future connection upstream of the pipe, and
c) all roofs and paved surfaces that drain into the system upstream of the pipe.

2.4.10.2. Hydraulic Loads for Fixtures

1) The hydraulic load from a *fixture* that is listed in Table 2.4.9.3. is the number of *fixture units* set forth in the Table.

2) Except as provided in Sentence (1), the hydraulic load from a *fixture* that is not listed in Table 2.4.9.3. is the number of *fixture units* set forth in Table 2.4.10.2. for the *trap* of the *size* that serves the *fixture*.

Table 2.4.10.2.
Permitted Hydraulic Load from a Fixture Based on Size of Trap
Forming Part of Sentence 2.4.10.2.(2)

Size of *trap*, inches	Hydraulic Load, *fixture units*
1¼	1
1½	2
2	3
2½	4
3	5
4	6

2.4.10.3. Hydraulic Loads from Fixtures with a Continuous Flow

1) Except as provided in Sentence (2), the hydraulic load from a *fixture* that produces a continuous flow, such as a pump or an air-conditioning *fixture*, is 31.7 *fixture units* for each litre per second of flow.

2) Where a *fixture* or equipment that produces a continuous or semi-continuous flow drains to a *combined sewer* or to a *storm sewer*, the hydraulic load from the *fixture* is 900 L for each litre per second of flow.

2.4.10.4. Hydraulic Loads from Roofs or Paved Surfaces

1) Except as provided in Sentence (2), the hydraulic load in litres from a roof or paved surface is the maximum 15 min rainfall determined in conformance with Subsection 1.1.3. of Division B of Book I (General) of this By-law, multiplied by the sum of

a) the area in square metres of the horizontal projection of the surface drained, and
b) one-half the area in square metres of the largest adjoining vertical surface.

(See Note A-2.4.10.4.(1).)

2) *Flow control roof drains* may be installed, provided

a) the maximum drain down time does not exceed 24 h,
b) the roof structure is designed to carry the load of the stored water,
c) one or more scuppers are installed not more than 30 m apart along the perimeter of the *building* so that
  i) up to 200% of the 15-minute rainfall intensity can be handled, and
  ii) the maximum depth of controlled water is limited to 150 mm,
d) they are located not more than 15 m from the edge of the roof and not more than 30 m from adjacent drains, and
e) there is at least one drain for each 900 m^2.

3) Hydraulic loads, in litres per second, for *flow control roof drains* and restricted paved area drains shall be determined according to rain intensity-duration frequency curves as compiled by Environment Canada using 25-year frequencies.

4) Where the height of the parapet is more than 150 mm or exceeds the height of the adjacent wall flashing,

a) emergency roof overflows or scuppers described in Clause (2)(c) shall be provided, and
b) there shall be a minimum of 2 *roof drains*.

2.4.10.5. Conversion of Fixture Units to Litres

1) Except as provided in Sentence 2.4.10.3.(2), where the hydraulic load is to be expressed in litres, *fixture units* shall be converted as follows:

a) when the number of *fixture units* is 260 or fewer, the load is 2 360 L, and
b) when the number of *fixture units* exceeds 260, the load is 9.1 L for each *fixture unit*.

2.4.10.6. Hydraulic Loads to Soil-or-Waste Pipes

1) Except as provided in Sentence (2), the hydraulic load that is drained to every *soil-or-waste stack* shall conform to Table 2.4.10.6.-A.

2) Where the *nominally horizontal offset* in a *soil-or-waste stack* is 1.5 m or more, the hydraulic load that is served by it shall conform to Table 2.4.10.6.-B or Table 2.4.10.6.-C, whichever is the less restrictive.

Table 2.4.10.6.-A
Maximum Permitted Hydraulic Load Drained to a Soil-or-Waste Stack
Forming Part of Sentence 2.4.10.6.(1)

Size of Stack, inches	Maximum Hydraulic Load, *fixture units*	Maximum *Fixture Units* Drained from any 1 *Storey*
1¼	2	2
1½	8	2
2	24	6
3	102	18
4	540	100

5	1 400	250
6	2 900	500
8	7 600	830
10	15 000	2 700
12	26 000	4 680
15	50 000	9 000

Table 2.4.10.6.-B
Maximum Permitted Hydraulic Load Drained to a Branch
Forming Part of Sentence 2.4.10.6.(2) and Article 2.4.10.7.

Size of *Branch*, inches	Maximum Hydraulic Load, *fixture units*
1¼	2
1½	3
2	6
2½	12
3	27
4	180
5	390
6	700
8	1 600
10	2 500
12	3 900

Table 2.4.10.6.-C
Maximum Permitted Hydraulic Load Drained to a Sanitary Building Drain or Sewer
Forming Part of Sentence 2.4.10.6.(2) and Article 2.4.10.8.

Size of Drain or Sewer, inches	Maximum Hydraulic Load, *fixture units*					
	Slope					
	1 in 400	1 in 200	1 in 133	1 in 100	1 in 50	1 in 25
3	—	—	—	—	27	36
4	—	—	—	180	240	300
5	—	—	380	390	480	670

6	—	—	600	700	840	1 300
8	—	1 400	1 500	1 600	2 250	3 370
10	—	2 500	2 700	3 000	4 500	6 500
12	2 240	3 900	4 500	5 400	8 300	13 000
15	4 800	7 000	9 300	10 400	16 300	22 500

2.4.10.7. Hydraulic Loads on Branches

1) The hydraulic load that is drained to a *branch* shall conform to Table 2.4.10.6.-B.

2.4.10.8. Hydraulic Loads on Sanitary Building Drains or Sewers

1) The hydraulic load that is drained to a *sanitary building drain* or a *sanitary building sewer* shall conform to Table 2.4.10.6.-C.

2.4.10.9. Hydraulic Loads on Storm or Combined Building Drains or Sewers

1) The hydraulic load that is drained to a *storm building drain*, a *storm building sewer* or a *combined building sewer* shall conform to Table 2.4.10.9.

Table 2.4.10.9.
Maximum Permitted Hydraulic Load Drained to a Storm Building Drain or Sewer or a Combined Building Sewer
Forming Part of Article 2.4.10.9.

Size of Drain or Sewer, inches	Maximum Hydraulic Load, L						
	Slope						
	1 in 400	1 in 200	1 in 133	1 in 100	1 in 68	1 in 50	1 in 25
3	—	—	—	—	—	2 770	3 910
4	—	—	—	4 220	5 160	5 970	8 430
5	—	—	6 760	7 650	9 350	10 800	15 300
6	—	—	10 700	12 400	15 200	17 600	24 900
8	—	18 900	23 200	26 700	32 800	37 800	53 600
10	—	34 300	41 900	48 500	59 400	68 600	97 000
12	37 400	55 900	68 300	78 700	96 500	112 000	158 000
15	71 400	101 000	124 000	143 000	175 000	202 000	287 000

2.4.10.10. Hydraulic Loads to Roof Gutters

1) The hydraulic load that is drained to a *roof gutter* shall conform to Table 2.4.10.10.

Table 2.4.10.10.
Maximum Permitted Hydraulic Load Drained to a Roof Gutter
Forming Part of Article 2.4.10.10.

Size of Gutter, inches	Area of Gutter, cm²	Maximum Hydraulic Load, L			
		Slope			
		1 in 200	1 in 100	1 in 50	1 in 25
3	22.8	406	559	812	1 140
4	40.5	838	1 190	1 700	2 410
5	63.3	1 470	2 080	2 950	4 170
6	91.2	2 260	3 200	4 520	6 530
7	124.1	3 250	4 600	6 500	9 190
8	162.1	4 700	6 600	9 400	13 200
10	253.4	8 480	12 000	17 000	23 600

2.4.10.11. Hydraulic Loads on Leaders

1) The hydraulic load that is drained to a *leader* shall conform to Table 2.4.10.11.

Table 2.4.10.11.
Maximum Permitted Hydraulic Load Drained to a Leader
Forming Part of Article 2.4.10.11.

Circular *Leader*		Non-Circular *Leader*	
Size of *Leader*, inches	Maximum Hydraulic Load, L	Area of *Leader*, cm²	Maximum Hydraulic Load, L
2	1 700	20.3	1 520
2½	3 070	31.6	2 770
3	5 000	45.6	4 500
4	10 800	81.1	9 700
5	19 500	126.6	17 600
6	31 800	182.4	28 700
8	68 300	324.3	61 500

2.4.10.12. Hydraulic Loads from Fixtures with a Semi-continuous Flow

1) The hydraulic load from a *fixture* or equipment that produces a semi-continuous flow shall conform to Table 2.4.10.12.

Table 2.4.10.12.
Maximum Permitted Hydraulic Load from Fixtures with a Semi-continuous Flow
Forming Part of Sentence 2.4.10.12.(1)

Trap Size, inches	Flow, L/s	Hydraulic Load, *fixture units*
1½	0.00 - 0.090	3
2	0.091 - 0.190	6
3	0.191 - 0.850	27
4	0.851 - 5.700	180

2.4.10.13. Design of Storm Sewers

1) Except as provided in Sentences 2.4.10.4.(1) and (2), and Article 2.4.10.9., *storm sewers* may be designed in accordance with good engineering practice.

2.4.10.14. Design of Siphonic Roof Drainage Systems

1) Siphonic roof drainage systems are to be designed in accordance with ASPE/ANSI 45 "Siphonic Roof Drainage," and ASME A112.6.9, "Siphonic Roof Drains."

Section 2.5. Venting Systems

2.5.1. Vent Pipes for Traps

2.5.1.1. Venting for Traps

1) Except as provided in Sentences (3) and (4), *traps* shall be protected by a *vent pipe*.

2) *Drainage systems* may require additional protection as provided in Subsections 2.5.4. and 2.5.5. by the installation of

a) *branch vents*,
b) *vent stacks*,
c) *stack vents*,
d) *vent headers*,
e) *fresh air inlets*,
f) *relief vents*,
g) *circuit vents*,
h) *yoke vents*,
i) *offset relief vents*,
j) *additional circuit vents*,
k) *wet vents*,
l) *individual vents*,
m) *dual vents*, or
n) *continuous vents*.

3) A *trap* that serves a floor drain need not be protected where

a) the *size* of the *trap* is not less than 3 inches,
b) the length of the *fixture drain* is not less than 450 mm, and
c) the fall on the *fixture drain* does not exceed its *size*.

(See Note A-2.5.1.1.(3).)

4) A *trap* need not be protected by a *vent pipe*

a) where it serves

i) a *subsoil drainage pipe*, or
ii) a *storm drainage system*, or

b) where it forms part of an indirect *drainage system*. (See also Clause 2.4.2.3.(2)(b).)

(See Note A-2.5.1.1.(4).)

2.5.2. Wet Venting

2.5.2.1. Wet Venting

(See Note A-2.5.2.1.)

1) A *soil-or-waste pipe* is permitted to serve as a *wet vent*, provided

a) the hydraulic load is in accordance with Table 2.5.8.1.,
b) the number of wet-vented water closets does not exceed 2,
c) where 2 water closets are installed, they are connected at the same level by means of a double sanitary T fitting if the *vent pipe* is vertical and by means of a double Y fitting if the *vent pipe* is horizontal,
d) the water closets are installed downstream of all other *fixtures*,
e) *trap arms* and *fixture drains* connected to the *wet vent* do not exceed 2 inches in *size*, except for connections from *emergency floor drains* in accordance with Sentence 2.5.1.1.(3),
f) the total hydraulic load on the *wet vent* does not exceed the limits stated in Table 2.5.8.1. when separately vented *branches* or *fixture drains* in the same *storey*, having a total hydraulic load not greater than 2 *fixture units*, are connected to the *wet vent* or a wet-vented water closet *trap arm*,
g) the hydraulic load of separately vented *fixtures* that drain into the *wet vent* are not included when sizing the *continuous vent* that serves the *wet vent*,
h) where a *wet vent* extends through more than one *storey*, the total discharge from any one *storey* above the first *storey* does not exceed 4 *fixture units*,
i) there is not more than one *nominally horizontal offset* in the *wet vent*, and
  i) the *offset* does not exceed 1.2 m for pipes 2 inches or less in *size*, or
  ii) the *offset* does not exceed 2.5 m for pipes larger than 2 inches in *size*,
j) the wet-vented portion is not reduced in *size* except for the portion that is upstream of *emergency floor drains* in accordance with Sentence 2.5.1.1.(3), and
k) the length of the *wet vent* is not limited.

2.5.3. Circuit Venting

2.5.3.1. Circuit Venting

(See Note A-2.5.3.1.)

1) A section of horizontal *branch* is permitted to be circuit-vented, provided

a) a *circuit vent* is connected to it,
b) all *fixtures* served by the *circuit vent* are located in the same *storey*, and
c) no *soil-or-waste stack* is connected to it upstream of a circuit-vented *fixture*.

2) *Fixtures* with *fixture outlet pipes* less than 2 inches in *size* shall be separately vented or separately circuit-vented.

3) Except as provided in Sentences (4) and (5), a *relief vent* shall be connected to the *branch* that forms part of a circuit-vented system, downstream of the connection of the most downstream circuit-vented *fixture*.

4) A *soil-or-waste pipe* having a hydraulic load not greater than 6 *fixture units* is permitted to act as a *relief vent* for a *branch* that is circuit-vented.

5) A symmetrically connected *relief vent* is permitted to serve as a combined *relief vent* for a maximum of 2 *branches* that are circuit-vented, provided there are not more than 8 circuit-vented *fixtures* connected between the combined *relief vent* and each *circuit vent*.

6) *Additional circuit vents* shall be required

a) where each cumulative horizontal change in direction of a *branch* served by a *circuit vent* exceeds 45° between *vent pipe* connections, or

b) where more than 8 circuit-vented *fixtures* are connected to a *branch* between *vent pipe* connections.

7) A *soil-or-waste pipe* is permitted to serve as an *additional circuit vent* in accordance with Sentence (6), provided the *soil-or-waste pipe* is sized as a *wet vent* in conformance with Article 2.5.8.1. and is not less than 2 inches in *size*.

8) Connections to *circuit vents* and *additional circuit vents* in accordance with Sentence (6) shall conform to Sentence 2.5.4.5.(1).

9) A circuit-vented *branch*, including the *fixture drain* downstream of the *circuit vent* connection, shall be sized in accordance with Article 2.4.10.7., except that it shall be not less than

a) 2 inches, where *traps* less than 2 inches in *size* are circuit-vented, or

b) 3 inches, where *traps* 2 inches in *size* or larger are circuit-vented.

10) *Additional circuit vents* shall be sized in accordance with Table 2.5.7.1. and Sentence 2.5.7.3.(1).

11) The hydraulic load on a *circuit vent* shall include the hydraulic load from *fixtures* connected to the *branch* served by the *circuit vent*, but shall not include the hydraulic load from *fixtures* permitted by Sentences (3), (4) and (5).

2.5.4. Vent Pipes for Soil-or-Waste Stacks

2.5.4.1. Stack Vents

1) The upper end of every *soil-or-waste stack* shall terminate in a *stack vent*.

2.5.4.2. Vent Stacks

1) Except as provided in Sentence (2), every *soil-or-waste stack* draining *fixtures* from more than 4 *storeys* that contain plumbing *fixtures* shall have a *vent stack*.

2) A *soil-or-waste stack* that serves as a *wet vent* does not require a *vent stack*.

3) The *vent stack* required by Sentence (1) shall be connected to a vertical section of the *soil-or-waste stack* at or immediately below the lowest *soil-or-waste pipe* connected to the *soil-or-waste stack*.

4) *Fixtures* are permitted to be connected to a *vent stack*, provided

a) the total hydraulic load of the connected *fixtures* does not exceed 8 *fixture units*,

b) at least one *fixture* is connected to a vertical portion of the *vent stack* and upstream of any other *fixtures*,

c) no other *fixture* is connected downstream of a water closet,

d) all *fixtures* are located in the lowest *storey* served by the *vent stack*, and

e) the section of the *vent pipe* that acts as a *wet vent* conforms to the requirements regarding *wet vents*.

2.5.4.3. Yoke Vents

(See Note A-2.5.4.3.)

1) Except as provided in Sentence (4), where a *soil-or-waste stack* receives the discharge from *fixtures* located on more than 11 *storeys*, a *yoke vent* shall be installed

a) for each section of 5 *storeys* or part thereof counted from the top down, and

b) at or immediately above each *offset* or double *offset*.

2) The *yoke vent* shall be connected to the *soil-or-waste stack* by means of a drainage fitting at or immediately below the lowest *soil-or-waste pipe* from the lowest *storey* of the sections described in Sentence (1).

3) The *yoke vent* shall connect to the *vent stack* at least 1 m above the floor level of the lowest *storey* in the section described in Sentence (1).

4) A *yoke vent* need not be installed provided the *soil-or-waste stack* is interconnected with the *vent stack* in each *storey* of the section in which *fixtures* are located by means of a *vent pipe* equal in *size* to the *branch* or *fixture drain* or 2 inches in *size*, whichever is smaller.

2.5.4.4. Offset Relief Vents

1) A *soil-or-waste stack* that has a *nominally horizontal offset* more than 1.5 m long and above which the upper vertical portion of the stack passes through more than 2 *storeys* and receives a hydraulic load of more than 100 *fixture units* shall be vented by an *offset relief vent* connected to the vertical section immediately above the *offset* and by another *offset relief vent*

a) connected to the lower vertical section at or above the highest *soil-or-waste pipe* connection, or
b) extended as a vertical continuation of the lower section.

(See Note A-2.5.4.4.(1).)

2.5.4.5. Fixtures Draining into Vent Pipes

1) The *trap arm* of a *fixture* that has a hydraulic load of not more than 1½ *fixture units* may be connected to the vertical section of a *circuit vent*, *additional circuit vent*, *offset relief vent* or *yoke vent*, provided

a) not more than 2 *fixtures* are connected to the *vent pipe*,
b) where 2 *fixtures* are connected to the *vent pipe*, the connection is made by means of a double sanitary T fitting, and
c) the section of the *vent pipe* that acts as a *wet vent* is not less than 2 inches in *size*.

(See Note A-2.5.4.5.(1).)

2.5.5. Miscellaneous Vent Pipes

2.5.5.1. Venting of Sewage Sumps

1) Every sump that receives *sewage* shall be provided with a *vent pipe* that is connected to the top of the sump. (See Article 2.5.7.7. for sizing of these vents.)

2.5.5.2. Venting of Oil Interceptors

(See Note A-2.5.5.2.) (See also Article 4.3.5.2. of Division B of the NFC.)

1) Every oil *interceptor* shall be provided with 2 *vent pipes* that

a) connect to the *interceptor* at opposite ends,
b) extend independently to outside air, and
c) terminate not less than 2 m above ground and at elevations differing by at least 300 mm.

2) Adjacent compartments within an oil *interceptor* shall be connected to each other by a vent opening.

3) Where a secondary receiver for oil is installed in conjunction with an oil *interceptor*, it shall be vented in accordance with the manufacturer's recommendations, and the *vent pipe* shall

a) in no case be less than 1½ inches in *size*,
b) extend independently to outside air, and
c) terminate not less than 2 m above ground.

4) The *vent pipes* referred to in Sentence (1) are permitted to be one *size* smaller than the largest connected drainage pipe but not less than 1¼ inches in *size*, or can be sized in accordance with the manufacturer's recommendations.

5) A *vent pipe* that serves an oil *interceptor* and is located outside a *building* shall be not less than 3 inches in *size* in areas where it may be subject to frost closure.

2.5.5.3. Venting of Drain Piping and Dilution Tanks for Corrosive Waste

1) *Venting systems* for drain piping or dilution tanks conveying corrosive waste shall extend independently and terminate in outside air. (See Article 2.5.7.7. for sizing of these vents.)

2.5.5.4. Fresh Air Inlets

1) Where a *building trap* is installed, a *fresh air inlet* not less than 4 inches in *size* shall be connected upstream and within 1.2 m of the *building trap* and downstream of any other connection. (See Note A-2.4.5.4.(1).)

2.5.5.5. Provision for Future Installations

1) Where provision is made for a *fixture* to be installed in the future, the *drainage system* and *venting system* shall be sized accordingly and provision shall be made for the necessary future connections.
2) Except as required in Sentence 2.5.7.7.(2), where a *plumbing system* is installed in a *building*, every *storey* in which plumbing is or may be installed, including the basement of a single-family dwelling, shall have extended into it or passing through it a *vent pipe* that is at least 1½ inches in *size* for the provision of future connections.

2.5.6. Arrangement of Vent Pipes

2.5.6.1. Drainage of Vent Pipes

1) *Vent pipes* shall be installed without depressions in which moisture can collect.

2.5.6.2. Vent Pipe Connections

1) *Vent pipes* shall be installed in a *nominally vertical* position where it is practical to do so.
2) Except for *wet vents*, where a *vent pipe* is connected to a *nominally horizontal soil-or-waste pipe*, the connection shall be above the horizontal centre line of the *soil-or-waste pipe*. (See Note A-2.5.6.2.(2).)
3) Unused *vent pipes* installed for future connections shall be permanently capped with an end *cleanout* or an adapter and plug.

2.5.6.3. Location of Vent Pipes

1) Except as provided in Sentences (2) and (3), *vent pipes* that protect a *fixture trap* shall be located so that
a) the *developed length* of the *trap arm* is not less than twice the *size* of the *fixture drain*,
b) the total fall of the *trap arm* is not greater than its inside diameter, and
c) the *trap arm* does not have a cumulative change in direction of more than 135°.
(See Note A-2.5.6.3.(1).)
2) The *trap arm* of water closets, of S-*trap standards* or of any other *fixture* that also discharges vertically and depends on siphonic action for its proper functioning shall not have a cumulative change in direction of more than 225°. (See Note A-2.5.6.3.(2).)
3) A *vent pipe* that protects a water closet or any other *fixture* that also depends on siphonic action for its proper functioning shall be located so that the distance between the connections of the *fixture drain* to the *fixture* and the *vent pipe* does not exceed
a) 1 m in the vertical plane, and
b) 3 m in the horizontal plane.
(See Note A-2.5.6.3.(3).)
4) The maximum length of every *trap arm* shall conform to Table 2.5.6.3.

Table 2.5.6.3.
Length of Trap Arm
Forming Part of Sentence 2.5.6.3.(4)

Size of Trap Served, inches	Maximum Length of Trap Arm, m	Minimum Slope
1¼	1.5	1/50
1½	1.8	1/50
2	2.4	1/50

3	3.6	1/50
4	9.8	1/100

5) The vent pipe from a water closet or any fixture that has an integral siphonic flushing action may be connected to the vertical leg of its drainage pipe.

2.5.6.4. Connection of Vents above Fixtures Served

1) Except for a *wet vent*, every *vent pipe* shall extend above the *flood level rim* of every *fixture* that it serves before being connected to another *vent pipe*.
2) No *vent pipe* shall be connected in such a manner that a blockage in a *soil-or-waste pipe* would cause waste to drain through the *vent pipe* to the *drainage system*.

2.5.6.5. Terminals

1) Except as provided in Sentence (3), the upper end of every *vent pipe* that is not terminated in outside air shall be connected to a *venting system* that terminates through a roof to outside air.
2) The upper end of every *vent pipe* that is terminated in outside air, other than a *vent pipe* that serves an oil *interceptor* or a *fresh air inlet*, shall be extended above the roof.
3) A *vent pipe* is permitted to be erected outside a *building*, provided that
a) no single change in direction of the *vent pipe* exceeds 45°,
b) all parts of the *vent pipe* are *nominally vertical*,
c) in areas where the *vent pipe* may be subject to frost closure, it is increased to not less than 3 inches in *size* before penetrating a wall or roof, and
d) where the *building* is 4 *storeys* or less in height, the *vent pipe* terminates above the roof of the *building*.
4) Except for a *fresh air inlet*, where a *vent pipe* is terminated in outside air, the terminal shall be located
a) not less than 1 m above or not less than 3.5 m in any other direction from every air inlet, openable window or door,
b) not less than 2 m above or not less than 3.5 m in any other direction from a roof that supports an *occupancy*,
c) not less than 2 m above ground, and
d) not less than 1.8 m from every property line.
(See Note A-2.5.6.5.(4).)
5) Where a *vent pipe* passes through a roof, it shall
a) be terminated high enough to prevent the entry of roof drainage but not less than 150 mm above the roof or above the surface of *storm water*, which could pond on the roof (See Note A-2.5.6.5.(4)), and
b) be provided with flashing to prevent the entry of water between the *vent pipe* and the roof (See Article 2.2.10.14.).
6) Where a *vent pipe* passes through a roof and may be subject to frost closure, it shall be protected from frost closure by
a) increasing its diameter at least one *size*, but not less than 3 inches in *size*, immediately before it penetrates the roof,
b)insulating the pipe, or
c) protecting it in some other manner.
(See Article 2.3.4.7.)

2.5.7. Minimum Size of Vent Pipes

2.5.7.1. General

1) The *size* of every *vent pipe* shall conform to Table 2.5.7.1.

Table 2.5.7.1.
Minimum Permitted Size of Vent Pipe Based on Size of Trap Served
Forming Part of Sentences 2.5.7.1.(1) and 2.5.8.2.(1)

Size of *Trap* Served, inches	Minimum *Size* of *Vent Pipe*, inches
1¼	1¼
1½	1¼
2	1½
3	1½
4	1½
5	2
6	2

2.5.7.2. Size Restriction

1) The *size* of a *branch vent*, *stack vent*, *vent stack* or *vent header* shall be not less than the *size* of the *vent pipe* to which it is connected.
2) *Building drains* shall be provided with at least one vent that is not less than 3 inches in *size*.

2.5.7.3. Additional Circuit Vents and Relief Vents

1) Except as provided in Article 2.5.7.1. and Sentence 2.5.3.1.(7), the minimum *size* of an *additional circuit vent* or *relief vent* installed in conjunction with a *circuit vent* is permitted to be one *size* smaller than the required *size* of the *circuit vent*, but need not be larger than 2 inches.
2) The *size* of the *soil-or-waste pipe* acting as a *relief vent* in accordance with Sentence 2.5.3.1.(4) shall be in conformance with Tables 2.4.10.6.-A, 2.4.10.6.-B or 2.5.8.1., and Article 2.5.7.1., whichever *size* is the largest considering the hydraulic load drained into the *soil-or-waste pipe*.

2.5.7.4. Offset Relief Vents

1) Except as provided in Article 2.5.7.1., the minimum *size* of an *offset relief vent* is permitted to be one *size* smaller than the *size* of the *stack vent*.

2.5.7.5. Yoke Vents

1) *Yoke vents* required by Sentence 2.5.4.3.(1) are permitted to be one *size* smaller than the *size* of the smallest pipe to which they are connected.

2.5.7.6. Vent Pipes for Manholes

1) The minimum *size* of a *vent pipe* that serves a manhole within a *building* shall be 2 inches.

2.5.7.7. Vents for Sewage Sumps, Dilution Tanks and Macerating Toilet Systems

1) Except as provided in Sentences (2) and (3), the minimum *size* of the *vent pipe* for a *sewage* sump or dilution tank shall be one *size* smaller than the *size* of the largest *branch* or *fixture drain* draining to the sump.
2) The *size* of every *vent pipe* for a *sewage* sump or dilution tank shall be not less than 2 inches, but need not be greater than 4 inches.
3) The *size* of a *vent pipe* for a macerating toilet system with a sump shall be not less than 1½ inches.

2.5.8. Sizing of Vent Pipes

(See Note A-2.5.8. for an explanation on the sizing of *vent pipes*.)

2.5.8.1. Hydraulic Loads Draining to Wet Vents

1) The hydraulic load that drains to a *wet vent* shall conform to Table 2.5.8.1.

2) When determining the *size* of a *wet vent*, the hydraulic load from the most downstream *fixture* or symmetrically connected *fixtures* shall not be included. (See Note A-2.5.8.1.(2).)

Table 2.5.8.1.
Maximum Permitted Hydraulic Loads Drained to a Wet Vent
Forming Part of Sentence 2.5.8.1.(1)

Size of *Wet Vent*, inches	Maximum Hydraulic Load, *fixture units*	
	Not Serving Water Closets	*Fixtures*, Other Than Water Closets, That Serve Not More Than 2 Water Closets
1½	2	—
2	4	3
3	12	8
4	36	14
5	—	18
6	—	23

2.5.8.2. Individual Vents and Dual Vents

1) The *size* of *individual vents* and *dual vents* shall be determined using Table 2.5.7.1. based on the largest *trap* served.

2) When sizing an *individual vent* or a *dual vent*, the length is not taken into consideration.

2.5.8.3. Branch Vents, Vent Headers, Continuous Vents and Circuit Vents

(See Note A-2.5.8.3. and 2.5.8.4.)

1) *Branch vents*, *vent headers*, *circuit vents* and *continuous vents* shall be sized in accordance with Table 2.5.8.3., unless they are *individual vents* or *dual vents*.

2) For the purposes of Table 2.5.8.3., the length of a *branch vent* shall be its *developed length* from the most distant *soil-or-waste pipe* connection to a *vent stack*, *stack vent*, *vent header* or outside air.

3) For the purposes of Table 2.5.8.3., the length of a *vent header* shall be its *developed length* from the most distant *soil-or-waste pipe* connection to outside air.

4) For the purposes of Table 2.5.8.3., the length of a *circuit vent* shall be its *developed length* from the horizontal *soil-or-waste pipe* connection to a *vent stack*, *stack vent*, *vent header* or outside air.

5) For the purposes of Table 2.5.8.3., the length of a *continuous vent* shall be its *developed length* from the vertical *soil-or-waste pipe* connection to a *vent stack*, *stack vent*, *vent header* or outside air.

Table 2.5.8.3.
Sizing of Branch Vents, Vent Headers, Circuit Vents and Continuous Vents
Forming Part of Article 2.5.8.3.

Total Hydraulic Load Served by *Vent Pipe*, *fixture units*	*Size* of *Vent Pipe*, inches							
	1¼	1½	2	3	4	5	6	8
	Maximum Length of *Vent Pipe*, m							
2	9							
8	9	30	61					
20	7.5	15	46			Not Limited		
24	4.5	9	30					
42		9	30					
60		4.5	15	120				
100			11	79	305			
200			9	76	275			
500			6	55	215			
1 100				15	61	215		
1 900				6	21	61	215	
2 200		Not Permitted			9	27	105	335
3 600					7.5	18	76	245
5 600						7.5	18	76

2.5.8.4. Vent Stacks or Stack Vents
(See Note A-2.5.8.3. and 2.5.8.4.)
1) A *vent stack* or *stack vent* shall be sized in accordance with Table 2.5.8.4. based on
a) the length of the *vent stack* or *stack vent*, and
b) the total hydraulic load that is drained to the lowest section of *soil-or-waste stack* or stacks served by the *vent pipe*, plus any additional vent loads connected to the *vent stack* or *stack vent*.
2) For the purposes of Table 2.5.8.4., the length of a *stack vent* or *vent stack* shall be its *developed length* from its lower end to outside air.
3) The minimum *size* of a *vent stack* or *stack vent* shall be one-half the *size* of the *soil-or-waste stack* at its base.
4) A *stack vent* serving a *wet vent* stack that is over 4 *storeys* high shall extend the full *size* of the *wet vent* to outside air.
5) Every *building sewer* shall be provided with at least one vent that is not less than 3 inches in *size*.

Table 2.5.8.4.
Size and Developed Length of Stack Vents and Vent Stacks
Forming Part of Sentences 2.5.8.4.(1) and (2)

Size of *Soil-or-waste stack*, inches(1)	Total Hydraulic Load Being Vented, *fixture units*	*Size* of *Stack Vent* or *Vent Stack*, inches									
		1¼	1½	2	3	4	5	6	8	10	12
		Maximum Length of *Stack Vent* or *Vent Stack*, m									
1¼	2	9									
1½	8	15	46								
2	12	9	23	61							
	24	8	15	46							
3	10		13	46	317						
	21		10	33.5	247			Not Limited			
	53		8	28.5	207						
	102		7.5	26	189						
4	43			10.5	76	299					
	140			8	61	229					
	320			7	52	195					
	540			6.5	46	177					
5	190				25	97.5	302				
	490				19	76	232				
	940				16	64	204				
	1 400				15	58	180				
6	500				10	39.5	122	305			
	1 100				8	30.5	94.5	238			
	2 000				6.5	25.5	79	201			
	2 900				6	23.5	73	183			
8	1 800					9.5	29	73	287		
	3 400					7	22	58	219.5		

	5 600					6	19	49	186		
	7 600					5.5	17	43	170.5		
10	4 000						9.5	24	94.5	292.5	
	7 200						7	18	73	225.5	
	11 000						6	15.5	61	192	
	15 000						5.5	14	55	174	
12	7 300							9.5	36.5	116	287
	13 000							7	28.5	91	219.5
	20 000		Not Permitted					6	24	76	186
	26 000							5.5	22	70	152
15	15 000								12	39.5	94.5
	25 000								9.5	29	73
	38 000								8	24.5	61
	50 000								7	22.5	55

Notes to Table 2.5.8.4.:
(1) *Soil-or-waste stacks* shall be sized using Table 2.4.10.6.-A.

2.5.8.5. Lengths of Other Vent Pipes

1) When sizing an *additional circuit vent*, *offset relief vent*, *relief vent*, *yoke vent*, and the *vent pipe* for an *interceptor*, dilution tank, *sewage* tank, sump, or manhole, length is not taken into consideration.

2.5.9. Air Admittance Valves

(See Note A-2.2.10.16.(1).)

2.5.9.1. Air Admittance Valve as a Vent Terminal

1) *Individual vents* and *dual vents* are permitted to terminate with a connection to an *air admittance valve* as provided in Articles 2.5.9.2. and 2.5.9.3. (See also Sentence 2.2.10.16.(1).)

2.5.9.2. Air Admittance Valves

1) *Air admittance valves* shall only be used to vent
- a) *fixtures* located in island counters,
- b) *fixtures* that may be affected by frost closure of the vent due to local climatic conditions,
- c) *fixtures* in one- and two-family dwellings undergoing renovation, or
- d) installations where connection to a vent may not be practical.

2) *Air admittance valves* shall be located
- a) not less than 100 mm above the *fixture drain* being vented,
- b) within the maximum *developed length* permitted for the vent, and
- c) not less than 150 mm above insulation materials.

2.5.9.3. Installation Conditions

1) *Air admittance valves* shall not be installed in supply or return air plenums, or in locations where they may be exposed to freezing temperatures.

2) *Air admittance valves* shall be installed in accordance with the manufacturer's installation instructions.
3) *Air admittance valves* shall be rated for the *size* of *vent pipe* to which they are connected.
4) Installed *air admittance valves* shall be
a) accessible, and
b) located in a space that allows air to enter the valve.
5) *Drainage systems* shall have at least one vent that terminates to the outdoors in conformance with Sentence 2.5.6.5.(1).

Section 2.6. Potable Water Systems

2.6.1. Arrangement of Piping

2.6.1.1. Design

1) *Fixtures* supplied with separate hot and cold water controls shall have the hot water control on the left and the cold on the right.
2) In a hot *water distribution system* of a *developed length* of more than 30 m or supplying more than 4 *storeys*, the water temperature shall be maintained by
a) recirculation, or
b) a self-regulating heat tracing system.

2.6.1.2. Drainage

1) A *water distribution system* shall be installed so that the system can be drained or blown out with air.

2.6.1.3. Shut-off Valves

1) *Water service pipes* shall be provided with an accessible shut-off valve located as close as possible to where the *water service pipe* enters the *building*.
2) Pipes that convey water from a gravity water tank or from a *private water supply system* shall be fitted with a shut-off valve at the source of supply.
3) Except for *risers* that serve only one *dwelling unit*, *risers* shall be provided with a shut-off valve located at the source of supply.
4) Every *fixture* shall be fitted with a shut-off valve, located on each water supply serving the *fixture*.
5) In *buildings* of residential *occupancy* that contain more than one *dwelling unit*, a shut-off valve shall be installed where the water supply enters each *dwelling unit*, so that, when the water supply to one *suite* is shut off, the water supply to the remainder of the *building* is not interrupted. (See Note A-2.6.1.3.(5).)
6) **Deleted**.
7) Pipes that supply water to a hot water tank shall be provided with a shut-off valve located close to the tank.

2.6.1.4. Protection for Exterior Water Supply

1) Pipes that pass through an exterior wall to supply water to the exterior of the *building* shall be provided with
a) a frost-proof hydrant, or
b) a stop-and-waste cock located inside the *building* and close to the wall.

2.6.1.5. Check Valves

1) A *check valve* shall be installed at the *building* end of a *water service pipe* where the pipe is made of plastic that is suitable for cold water use only.

2.6.1.6. Flushing Devices

1) Flushing devices that serve water closets or urinals shall have sufficient capacity and be adjusted to deliver at each operation a volume of water that will thoroughly flush the *fixture* or *fixtures* they serve.
2) Where a manually operated flushing device is installed, it shall serve only one *fixture*.
3) Except as provided in Sentence (4), water closets and urinals shall have an integral means of limiting the maximum amount of water used in each flush cycle to that specified in Table 2.6.1.6.

Table 2.6.1.6.
Water Usage per Flush Cycle
Forming Part of Sentence 2.6.1.6.(3)

Fixtures	Maximum Water Usage per Flush Cycle, Lpf
Water closets[1]	4.8
Urinals	1.9

Notes to Table 2.6.1.6.:
[1] The full flush mode of a dual-flush toilet shall not exceed 4.8 L.

4) A maximum flush cycle of 6.0 L may be permitted for a water closet where, in the opinion of the *Chief Building Official*, the existing *plumbing system* cannot accommodate and cannot be updated to accommodate the required flush cycle.
5) Except where installed in *buildings* not intended to be occupied year-round, flush-tank-type urinals shall be equipped with a device capable of preventing flush cycles when they are not in use. (See Note A-2.6.1.6.(5).)

2.6.1.7. Relief Valves

1) In addition to the requirements in Sentence (2), the hot water tank of a *storage-type service water heater* shall be equipped with a pressure-relief valve
- a) designed to open when the water pressure in the tank reaches the rated working pressure of the tank, and
- b) so located that the pressure in the tank shall not exceed the pressure at the relief valve by more than 35 kPa under any condition of flow within the distribution system.

2) The hot water tank of a *storage-type service water heater* shall be equipped with a temperature-relief valve with a temperature-sensing element
- a) located within the top 150 mm of the tank, and
- b) designed to open and discharge sufficient water from the tank to keep the temperature of the water in the tank from exceeding 99°C under all operating conditions.

3) A pressure-relief valve and temperature-relief valve may be combined where Sentences (1) and (2) are complied with.
4) *Indirect service water heaters* shall be equipped with
- a) a pressure-relief valve, and
- b) a temperature-relief valve on every storage tank that forms part of the system.

5) Pipes that convey water from a temperature-relief, pressure-relief or combined temperature- and pressure-relief valve shall
- a) be of a *size* at least equal to the *size* of the outlet of the valve,
- b) be rigid, slope downward from the valve, and terminate with an indirect connection above a floor drain, sump, or other safe location, with an *air break* of not more than 300 mm,
- c) have no thread at its outlet, and
- d) be capable of operating at a temperature of not less than 99°C.

(See Note A-2.6.1.7.(5).)
6) The temperature-relief valve required in Clause (4)(b) shall
- a) have a temperature-sensing element located within the top 150 mm of the tank, and

b) be designed to open and discharge sufficient water to keep the temperature of the water in the tank from exceeding 99°C under all operating conditions.

7) No shut-off valve shall be installed on the pipe between any tank and the relief valves or on the discharge lines from such relief valves.

8) A vacuum-relief valve shall be installed when any tank may be subject to *back-siphonage*.

9) *Storage-type service water heaters* that are located in a ceiling or roof space, or over a floor of wood construction, shall be installed within a corrosion-resistant watertight drain pan, as described in Sentence (10).

10) The drain pan referred to in Sentence (9) shall

a) be not less than 50 mm larger than the tank and have side walls not less than 25 mm high,

b) be drained by a pipe two *sizes* larger than the relief valve discharge pipe, and

c) have a drain that is located directly under the relief valve discharge pipe and that discharges directly to a floor drain or other acceptable location.

2.6.1.8. Solar Domestic Hot Water Systems

1) Systems for solar heating of *potable* water shall be installed in conformance with CAN/CSA-F383, "Installation of Packaged Solar Domestic Hot Water Systems."

2.6.1.9. Water Hammer

1) Provision shall be made to protect the *water distribution system* from the adverse effects of water hammer. (See Note A-2.6.1.9.(1).)

2.6.1.10. Mobile Home Water Service

1) A *water service pipe* intended to serve a mobile home shall

a) be not less than ¾ inch in *size*,

b) terminate above ground, and

c) be provided with

i) a tamperproof terminal connection that is capable of being repeatedly connected, disconnected and sealed,

ii) a protective concrete pad,

iii) a means to protect it from frost heave, and

iv) a curb stop and a means of draining that part of the pipe located above the frost line when not in use.

2.6.1.11. Thermal Expansion

1) Protection against thermal expansion shall be required when a *check valve* is required by Article 2.6.1.5., a *backflow preventer* by Article 2.6.2.6., or a pressure-reducing valve by Article 2.6.3.3. (See Note A-2.6.1.11.(1).)

2.6.1.12. Service Water Heaters

1) Thermostat controls for electric *storage-type service water heaters* shall be set at a temperature of 60°C. (See Note A-2.6.1.12.(1).)

2.6.2. Protection from Contamination

2.6.2.1. Connection of Systems

1) Except as provided in Sentence (2), connections to *potable water systems* shall be designed and installed so that non-*potable* water or substances that may render the water non-*potable* cannot enter the system.

2) A water treatment device or apparatus shall not be installed unless it can be demonstrated that the device or apparatus will not introduce substances into the system that may endanger health. (See Article 2.2.10.17.)
3) *Backflow preventers* shall be selected and installed in conformance with CSA B64.10, "Selection and Installation of Backflow Preventers." (See Note A-2.6.2.1.(3).)
4) *Backflow preventers* shall be maintained and field tested in conformance with the Water Works By-law.

2.6.2.2. Back-Siphonage

1) *Potable* water connections to *fixtures*, tanks, vats or other devices not subject to pressure above atmospheric and containing other than *potable* water shall be installed so as to prevent *back-siphonage* in conformance with Sentence (2).
2) Except as provided in Sentence 2.6.2.10.(2), *back-siphonage* shall be prevented by the installation of

- a) an *air gap*,
- b) an atmospheric *vacuum breaker*,
- c) a pressure *vacuum breaker*,
- d) a spill-resistant pressure *vacuum breaker*,
- e) a hose connection *vacuum breaker*,
- f) a dual *check valve backflow preventer* with atmospheric port,
- g) a double *check valve* assembly,
- h) a reduced pressure principle *backflow preventer*,
- i) a dual *check valve backflow preventer*,
- j) a laboratory faucet type *vacuum breaker*, or
- k) a dual *check valve backflow preventer* with vent.

2.6.2.3. Backflow Caused by Back Pressure

1) *Potable* water connections to *fixtures*, tanks, vats, boilers or other devices containing other than *potable* water and subject to pressure above atmospheric shall be arranged to prevent *backflow* caused by *back pressure* in conformance with Sentences (2) and (3).
2) Except as provided in Article 2.6.2.4., *backflow* caused by *back pressure* of non-toxic substances into a *potable water system* shall be prevented by the installation of

- a) an *air gap*,
- b) a dual *check valve backflow preventer* with atmospheric port,
- c) a dual *check valve backflow preventer*,
- d) a dual *check valve backflow preventer* with vent,
- e) a double *check valve* assembly, or
- f) a reduced pressure principle *backflow preventer*.

3) *Backflow* caused by *back pressure* of toxic substances into a *potable water system* shall be prevented by the installation of

- a) an *air gap*, or
- b) a reduced pressure principle *backflow preventer*.

2.6.2.4. Backflow from Fire Protection Systems

1) *Backflow* caused by *back-siphonage* or *back pressure* from fire *sprinkler systems* where water treatment is not added shall be prevented by the installation of a double *check valve* assembly or an *approved* dual *check valve* when the *building* is sprinklered to NFPA 13D, "Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes" and a flow through system is installed.
2) *Backflow* caused by *back-siphonage* or *back pressure* from fire sprinkler or standpipe systems where water treatment is added shall be prevented by the installation of a reduced pressure principal *backflow preventer*. (See Note A-2.6.2.4.(2).)
3) Deleted.
4) Deleted.

2.6.2.5. Separation of Water Supply Systems

1) No *private water supply system* shall be interconnected with a public water supply system.

2.6.2.6. Premise Isolation

1) In addition to the *backflow preventer* required by this Subsection for *buildings* or facilities where a potentially severe health hazard may be caused by *backflow*, the *potable water system* shall be provided with premise isolation by the installation of a reduced pressure principle *backflow preventer*. (See Note A-2.6.2.6.(1).)

2.6.2.7. Hose Bibb

1) Where a hose bibb is installed outside a *building*, inside a garage or in an area where there is an identifiable risk of contamination, the *potable water system* shall be protected against *backflow* through the hose bibb.

2.6.2.8. Cleaning of Systems

1) A newly installed part of a *potable water system* shall be cleaned and then flushed with *potable* water before the system is put into operation.

2.6.2.9. Air Gap

1) *Air gaps* shall not be located in a noxious environment.
2) *Air gaps* shall be not less than 25 mm high and at least twice the diameter of the opening of the water supply outlet in height. (See Note A-2.6.2.9.(2).)

2.6.2.10. Vacuum Breakers

1) Where the *critical level* is not marked on an atmospheric *vacuum breaker*, pressure *vacuum breaker*, or spill-resistant pressure *vacuum breaker*, the *critical level* shall be taken as the lowest point on the device.
2) Where an atmospheric *vacuum breaker* is installed, it shall be located on the downstream side of the *fixture* control valve or faucet so that it will be subject to water supply pressure
- a) only when the valve or faucet is open, and
- b) for periods of continuous use not exceeding 12 h.

(See Note A-2.6.2.10.(2).)
3) An atmospheric *vacuum breaker* shall be installed so that the *critical level* is at least the distance specified by the manufacturer at which the device will operate safely but not less than 25 mm above
- a) the *flood level rim* of a *fixture* or tank, or
- b) the highest point open to atmosphere in an irrigation system.

4) A pressure *vacuum breaker* or spill-resistant pressure *vacuum breaker* shall be installed so that the *critical level* is not less than 300 mm above
- a) the *flood level rim* of a *fixture* or tank, or
- b) the highest point open to atmosphere in an irrigation system.

2.6.2.11. Tank-Type Water Closets

1) Tank-type water closets shall be provided with a *back-siphonage preventer* in conformance with Sentence 2.2.10.10.(2).

2.6.2.12. Backflow Preventers

1) No bypass piping or other device capable of reducing the effectiveness of a *backflow preventer* shall be installed in a water supply system.

2.6.3. Size and Capacity of Pipes

(See Note A-2.6.3.)

2.6.3.1. Design, Fabrication and Installation

(See Note A-2.6.3.1.)

1) *Water distribution systems* shall be designed to provide peak demand flow when the flow pressures at the supply openings conform to the plumbing supply fitting manufacturer's specifications.

2) *Potable water systems* shall be designed, fabricated and installed in accordance with good engineering practice, such as that described in the ASHRAE Handbooks and ASPE Data Books. (See Note A-2.6.3.1.(2).)

3) In one- and two-family *dwelling units* and manufactured homes, multi-purpose systems that combine *potable water systems* and residential fire sprinkler systems shall be designed, fabricated and installed in accordance with NFPA 13D, "Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes."

2.6.3.2. Hydraulic Load

1) Except as provided in Sentence (3), the hydraulic load of a *fixture* or device that is listed in Table 2.6.3.2.-A shall be the number of *fixture units* given in the Table.

2) Except as provided in Sentences (1) and (3), the hydraulic load of a *fixture* that is not listed in Table 2.6.3.2.-A is the number of *fixture units* listed in Table 2.6.3.2.-D.

3) Where *fixtures* are supplied with both hot and cold water, the hydraulic loads for maximum separate demands shall be 75% of the hydraulic load of the *fixture units* given in Tables 2.6.3.2.-A and 2.6.3.2.-D when using a detailed engineering design method.

4) The hydraulic load of urinals and water closets with direct flush valves shall be the number of *fixture units* listed in Tables 2.6.3.2.-B and 2.6.3.2.-C. (See Note A-2.6.3.2.(4).)

Table 2.6.3.2.-A
Sizing of Water Distribution Systems(1)(2)
Forming Part of Sentences 2.6.3.2.(1), (2) and (3), and 2.6.3.4.(2), (3) and (5)

Fixture or Device	Minimum *Size* of Supply Pipe, inches	*Private Use* Hydraulic Load, *fixture units*			*Public Use* Hydraulic Load, *fixture units*		
		Cold	Hot	Total	Cold	Hot	Total
Bathroom group with 6 LPF flush tank(3)	n/a	2.7	1.5	3.6	–	–	–
Bathroom group with greater than 6 LPF flush tank(3)	n/a	4	3	6	–	–	–
Bathroom group with more than 3 *fixtures*	–	–	–	(4)	–	–	–
Bathtub with or without shower head	½	1	1	1.4	3	3	4
Bathtub with ¾ inch spout	¾	7.5	7.5	10	7.5	7.5	10
Bedpan washer	1	–	–	–	7.5	7.5	10
Bidet	⅜	1.5	1.5	2	–	–	–
Clothes washer 3.5 kg	½	1	1	1.4	2.25	2.25	3
Clothes washer 6.8 kg	½	–	–	–	3	3	4

Clothes washer, commercial(5)	-	–	–	–	–	–	–
Dental lavatory	⅜	–	–	–	1.5	1.5	2
Dental unit, cuspidor	⅜	–	–	–	1	–	1
Dishwasher, commercial(5)	–	–	–	–	–	–	–
Dishwasher, domestic	⅜	–	1.4	1.4	–	–	–
Drinking fountain or water cooler	⅜	–	–	–	0.25	–	0.25
Hose bibb	½	2.5	–	2.5	2.5	–	2.5
Hose bibb	¾	3	–	3	6	–	6
Hose bibb, combination hot and cold	½	1.9	1.9	2.5	1.9	1.9	2.5
Lavatory, 8.3 LPM or less	⅜	0.5	0.5	0.7	1.5	1.5	2
Lavatory, greater than 8.3 LPM	⅜	0.75	0.75	1	1.5	1.5	2
Sink, bar	⅜	0.75	0.75	1	1.5	1.5	2
Sink, clinic service faucet	½	–	–	–	2.25	2.25	3
Sink, clinic service with direct flush valve	1	–	–	–	6	–	6
Sink, kitchen commercial, per faucet	½	–	–	–	3	3	4
Sink, kitchen domestic, 8.3 LPM	⅜	1	1	1.4	1	1	1.4
Sink, kitchen domestic, greater than 8.3 LPM	⅜	1.5	1.5	2	1.5	1.5	2
Sink, laboratory	⅜	–	–	–	1.5	1.5	2
Sink, laundry (1 or 2 compartments)	⅜	1	1	1.4	1	1	1.4
Sink, service or mop basin	½	–	–	–	2.25	2.25	3
Sink, washup, per faucet	½	–	–	–	1.5	1.5	2
Shower head, 9.5 LPM or less per head	½	1	1	1.4	3	3	4
Shower head, greater than 9.5 LPM per head	½	1.5	1.5	2	3	3	4
Shower, spray, multi-head, *fixture unit* per head	(5)	1	1	1.4	3	3	4
Urinal, with direct flush valve	¾	(6)	–	(6)	(6)	–	(6)
Urinal, with flush tank	⅜	3	–	3	3	–	3
Urinal, with self-closing metering valve	½	2	–	2	4	–	4

Water closet, 6 LPF or less with flush tank	⅜	2.2	–	2.2	2.2	–	2.2
Water closet, greater than 6 LPF with flush tank	⅜	3	–	3	5	–	5
Water closet, with direct flush valve	1	(6)	–	(6)	(6)	–	(6)

Notes to Table 2.6.3.2.-A:
(1) The *fixture unit* values in this Table are not applicable in certain assembly *occupancies* because of surges in use by the occupants. For such *occupancies*, refer to specific design information.
(2) For *fixtures* not indicated in this Table, refer to Table 2.6.3.2.-D.
(3) *Bathroom group* is based on a ½-inch *size* bathtub supply pipe.
(4) Add additional *fixture* to the *fixture* load for *bathroom group*.
(5) Refer to manufacturer's recommendations.
(6) For *fixture unit* values for *fixtures* with direct flush valves, see Sentence 2.6.3.2.(4) and Tables 2.6.3.2.-B and 2.6.3.2.-C.

Table 2.6.3.2.-B
Sizing of Water Distribution Systems for Urinals with Direct Flush Valves
Forming Part of Sentences 2.6.3.2.(4) and 2.6.3.4.(5)

Number of Valves	Individual *Fixture Unit* Assigned in Decreasing Values	*Fixture Units* in Accumulative Values(1)
1	20	20
2	15	35
3	10	45
4	8	53
5 or more	5 each	58, plus 5 for each additional *fixture* in excess of 5

Notes to Table 2.6.3.2.-B:
(1) The accumulative *fixture unit* values are the total values to be used in conjunction with Table 2.6.3.2.-A.

Table 2.6.3.2.-C
Sizing of Water Distribution Systems for Water Closets with Direct Flush Valves
Forming Part of Sentences 2.6.3.2.(4) and 2.6.3.4.(5)

Number of Valves	Individual *Fixture Unit* Assigned in Decreasing Values	*Fixture Units* in Accumulative Values(1)
1	40	40
2	30	70
3	20	90
4	15	105
5 or more	10 for each *public use* and 6 for each *private use*	115, plus 10 for each *public use* additional *fixture* in excess of 5 and 111, plus 6 for each *private use* additional

		fixture in excess of 5

Notes to Table 2.6.3.2.-C:
(1) The accumulative *fixture unit* values are the total values to be used in conjunction with Table 2.6.3.2.-A.

Table 2.6.3.2.-D
Hydraulic Loads of Fixtures Not Listed in Table 2.6.3.2.A.
Forming Part of Sentences 2.6.3.2.(2) and (3) and 2.6.3.4.(5)

Size of Supply Pipe, inches	Hydraulic Load, *fixture units*	
	Private Use	*Public Use*
⅜	1	2
½	2	4
¾	3	6
1	6	10

2.6.3.3. Static Pressure

1) Where the static pressure at any *fixture* may exceed 550 kPa, a pressure-reducing valve shall be installed to limit the maximum static pressure at the *fixture* to 550 kPa.

2.6.3.4. Size

1) *Water service pipes* shall be sized according to the peak demand flow but shall not be less than ¾ inch *size*.
2) Except as provided in Sentence (3), the *size* of a supply pipe that serves a *fixture* shall conform to Table 2.6.3.2.-A.
3) For *fixtures* listed in Table 2.6.3.2.-A that are permitted to have a supply pipe 3/8 inch in *size*, a connector not more than 750 mm long and not less than 6.3 mm inside diameter may be used to supply water to the *fixture*.
4) Reserved.
5) Where both hot and cold water is supplied to *fixtures* in residential *buildings* containing one or two *dwelling units* or row houses with separate *water service pipes*, the *water system* may be sized in accordance with Table 2.6.3.4., where
a) the hydraulic loads for maximum separate demands on *water distribution system* piping are not less than 100% of the total hydraulic load of the *fixture units* given in Table 2.6.3.2.-A, 2.6.3.2.-B, 2.6.3.2.-C or 2.6.3.2.-D for *private use*,
b) the minimum water pressure at the entry to the *building* is 200 kPa, and
c) the total maximum length of *water system* is 90 m.
(See Note A-2.6.3.4.(5).)

Table 2.6.3.4.
Water Pipe Sizing for Buildings Containing One or Two Dwelling Units or Row Houses with Separate Water Service Pipes
Forming Part of Sentence 2.6.3.4.(5)

Size of Water Pipe, inches	Water Velocity, m/s(1)		
	3.0	2.4	1.5

	Hydraulic Load, *fixture units*		
½	8	7	4
¾	21	16	9
1	43	31	18
1¼	83	57	30

Notes to Table 2.6.3.4.:
(1) Table 2.6.3.4. is not intended to limit water velocities that are permitted by Sentence 2.6.3.5.(1).

2.6.3.5. Velocity

1) The maximum permitted water velocities shall be those recommended by the pipe and fitting manufacturer.

Section 2.7. Non-Potable Water Systems

2.7.1. Connection

2.7.1.1. Not Permitted

1) A non-*potable water system* shall not be connected to a *potable water system*.

2.7.2. Piping Identification

2.7.2.1. Piping Identification

1) All non-*potable* water distribution system piping shall be purple in colour and conform to the requirements of NSF-rw and NSF/ANSI 14, "Plastics Piping System Components and Related Materials."
2) All other non-*potable* water piping shall conform to the requirements of CAN/CSA-B128.1, "Design and Installation of Non-Potable Water Systems."

2.7.3. Location

2.7.3.1. Pipes

1) Non-*potable* water piping shall not be located
- a) where food is prepared in a food-processing plant,
- b) above food-handling equipment,
- c) above a non-pressurized *potable* water tank, or
- d) above a cover of a pressurized *potable* water tank.

2.7.3.2. Outlets

1) An outlet from a non-*potable water system* shall not be located where it can discharge into
- a) a sink or lavatory,
- b) a *fixture* into which an outlet from a *potable water system* is discharged, or
- c) a *fixture* that is used for the preparation, handling or dispensing of food, drink or products that are intended for human consumption.

(See Note A-2.7.3.2.(1).)

2.7.4. Alternate Water Source Systems Installed Prior to January 1, 2019

2.7.4.1. Requirements for Alternate Water Source Systems Installed Prior to January 1, 2019

1) An *operating permit* shall be obtained.
2) The *operating permit* number assigned to the *alternate water source system* shall be posted on a sign or plate that is securely fastened to the *alternate water source system* in a location that is conspicuously visible and constructed of a durable, weather resistant material.
3) The *Chief Building Official* shall be notified within 30 days of any changes to the information that was last provided to the *City* with regard to the *operating permit*, in the form prescribed by the *Chief Building Official*.
4) Water quality shall comply with the water quality standards, testing, documentation, and reporting requirements set out in Articles 2.7.7.1. and 2.7.7.2.
5) If a test result shows that the water quality fails to meet any of the standards set out in Table 2.7.7.1., the response set out in Table 2.7.4.1. shall be undertaken.

Table 2.7.4.1.
Required Response to Failure to Meet Water Quality Standards
Forming part of Sentence 2.7.4.1.(5)

Parameter	Test Result	Required Response
E. coli	100 or more CFU (Colony Forming Units) per 100 mL or 100 or more MPN (Most Probable Number) per 100 mL	1. Immediately supply the *alternate water source system* with *potable* water only; and 2. Immediately notify the *Chief Building Official*
Turbidity	> 15 NTU (Nephelometric Turbidity Units)	
Temperature	> 25°C	

6) The *alternate water source system* shall be maintained in accordance with any manufacturer's specifications.
7) If the *alternate water source system* is in use, cross connection control tests shall be performed as required by CAN/CSA-B128.1, "Design and Installation of Non-Potable Water Systems."

2.7.4.2. No Other Requirements

1) *Alternate water source systems* installed prior to January 1, 2019 need not comply with any other requirements set out in Subsections 2.7.5. through 2.7.8.

2.7.5. Alternate Water Source Systems

2.7.5.1. Alternate Water Sources

1) An *alternate water source system* shall collect only rainwater from roof surfaces or similar areas that do not allow the passage of vehicular traffic and are above grade, and where hydrocarbon-based fuels, hazardous materials, or fertilizers are not stored or used on such surfaces, or *clear-water waste*, or both.
2) An *alternate water source system* shall not collect *perimeter drainage water*, *groundwater*, *storm water*, *greywater*, or *blackwater*.

2.7.5.2. Mandatory and Optional Uses

1) An *alternate water source system* shall use treated non-*potable* water in lieu of *potable* water for the mandatory uses set out in Table 2.7.5.2.
2) An *alternate water source system* may use treated non-*potable* water in lieu of *potable* water for the optional uses set out in Table 2.7.5.2.
3) Non-*potable* water shall not be used in lieu of *potable* water for any other uses.

Table 2.7.5.2.
Mandatory and Optional Uses for Treated Non-potable Water
Forming part of Sentences 2.7.5.2.(1) and (2)

Non-*potable* Water Source	Mandatory Uses for Treated Non-*potable* Water	Optional Uses for Treated Non-*potable* Water
Rainwater from roof surfaces or similar areas that do not allow the passage of vehicular traffic and are above grade, and where hydrocarbon-based fuels, hazardous materials, or fertilizers are not stored or used on such surfaces	Water closets, urinals and trap primers	Irrigation of non-food purpose plants, make-up water for boilers, make-up water for cooling towers or tempering of discharge.
Clear-water waste	Water closets, urinals and trap primers	Irrigation of non-food purpose plants, make-up water for boilers, make-up water for cooling towers or tempering of discharge.
Perimeter drainage water	Not permitted	Not permitted
Groundwater	Not permitted	Not permitted
Storm water	Not permitted	Not permitted
Greywater	Not permitted	Not permitted
Blackwater	Not permitted	Not permitted

2.7.5.3. Occupancy

1) Before occupancy of a *building* is permitted, an *alternate water source system* shall be commissioned in accordance with Article 2.7.5.4., and an *operating permit* shall be obtained in accordance with Article 2.7.5.5.

2.7.5.4. Commissioning

1) In order to commission an *alternate water source system*
a) the non-*potable* water shall be tested by an *accredited laboratory* for *E. coli* weekly for a period of 4 weeks with samples being drawn from the sampling port as referenced in Sentence 2.7.6.9.(1), and test results shall be provided to the *Chief Building Official*,
b) written confirmation that the *alternate water source system* operates in conformance with the operating manual shall be provided to the *Chief Building Official* by the *registered professional of record*, and a cross connection control test shall be performed and witnessed by the *Chief Building Official*.

2.7.5.5. Operating Permit

1) An *operating permit* shall be obtained for an *alternate water source system*.
2) The *operating permit* number assigned to the *alternate water source system* shall be posted on a sign or plate that is securely fastened to the *alternate water source system* in a location that is conspicuously visible and constructed of a durable, weather resistant material.
3) The *Chief Building Official* shall be notified within 30 days of any changes to the information that was last provided to the *City* with regard to the *operating permit*, in the form prescribed by the *Chief Building Official*.

2.7.5.6. Continued Operation

1) Once an *operating permit* has been issued, an *alternate water source system* shall operate continuously unless written approval to discontinue its use has been obtained from the *Chief Building Official* or *City Engineer*.

2.7.6. Design

2.7.6.1. Professional Design

1) An *alternate water source system* shall be designed by a *registered professional* and shall be designed to prioritize the use of non-*potable* water.

2.7.6.2. Pipe Sizing

1) Except as required by Sentence (2), non-*potable* distribution piping shall be sized according to Subsection 2.6.3.

2) *Dwelling units* within a *building* with an *alternate water source system* shall be equipped with
a) tank type water closets, and
b) non-*potable* distribution piping sized in conformance with the IAPMO Water Demand Calculator.

2.7.6.3. Continuity of Supply

1) A secondary water supply shall be provided.

2.7.6.4. Backflow Prevention

1) An *air gap* at least two times the size of the discharge opening shall be installed for the *potable* water make-up supply.

2.7.6.5. Removal of Particulates and Impurities

1) Provision shall be made upstream of the *cistern* to remove the accumulation of particulates and impurities before they enter the *cistern*.

2.7.6.6. Cistern Security

1) *Cisterns* shall be secured to prevent tampering and unintended or unauthorized entry either by a lockable device or another *approved* method, and all penetrations shall be sealed to prevent insect or vermin entry.

2.7.6.7. Minimum Withdrawal Level

(See Note A-2.7.6.7, 2.7.6.8. and 2.7.6.9.)

1) Water shall be withdrawn a minimum of 0.3 m from the base of the *cistern*.

2.7.6.8. Water Metering Requirements

(See Note A-2.7.6.7, 2.7.6.8. and 2.7.6.9.)

1) A water meter shall be installed and located within 1.5 m of the *potable* water make-up supply and shall be capable of recording the volume of *potable* water being supplied.

2) A water meter shall be installed and located on the non-*potable* water outlet prior to distribution and shall be capable of recording the volume of non-*potable* water being supplied to the distribution piping.

2.7.6.9. Water Quality Sampling Locations

(See Note A-2.7.6.7, 2.7.6.8. and 2.7.6.9.)

1) A sampling port, and provision for continuous in-line measurements required in order to conform with Table 2.7.7.1., shall be installed and located downstream of the water meter at the non-*potable* water outlet and prior to distribution.

2.7.6.10. Alerts

1) All monitoring devices referred to in Sentence 2.7.6.9.(1) above shall be capable of activating an *alert* that is designed to activate continuously for the duration of the *alert* condition whenever the water quality fails to meet the standards set out in Table 2.7.7.1.

2.7.6.11. Power Interruption

1) If a *building* is required to have an emergency system generator, provision shall be made for the continued operation of any mandatory uses for non-*potable* water listed in Table 2.7.5.2. in the event of a power interruption.

2.7.7. Water Quality Standards

2.7.7.1. Water Quality Standards, Testing, and Documentation

1) Water quality shall meet the standards set out in in Table 2.7.7.1.
2) Water quality shall be tested as set out in Table 2.7.7.1.
3) All test results shall be documented as set out in Table 2.7.7.1., and documentation shall be retained for no less than 24 months.

Table 2.7.7.1.
Water Quality Standards, Testing, and Documentation
Forming part of Sentences 2.7.7.1.(1), (2), and (3)

Applicability	Parameter	Standard	Testing Type and Frequency	Testing Result Documentation Requirement
Any non-*potable* water source	Temperature	< 20°C	Continuous	Daily
Any non-*potable* water source	Turbidity	< 10 NTU (Nephelometric Turbidity Units)	Daily, and one laboratory sample tested every 3 months	Daily, plus all laboratory tests
Any non-*potable* water source	*E. coli*	< 100 CFU (Colony Forming Units) per 100 mL or < 100 MPN (Most Probable Number) per 100 mL	One laboratory sample tested by an accredited laboratory every 3 months	All laboratory tests

2.7.7.2. Water Quality Reporting

1) Water quality reports containing all documentation required by Sentence 2.7.7.1.(3) shall be submitted to the *Chief Building Official* before the end of the third month following the issuance of an *operating permit*, and then every 3 months thereafter.

2.7.7.3. Required Response to Failure to Meet Water Quality Standards

1) If a test result shows that the water quality fails to meet a standard set out in Table 2.7.7.1., the response set out in Table 2.7.7.3 shall be undertaken.

Table 2.7.7.3.
Required Response to Failure to Meet Water Quality Standards
Forming part of Sentence 2.7.7.3.(1)

Parameter	Test Result	Required Response
Turbidity	Between 10 and 15 NTU (Nephelometric Turbidity Units)	Take the appropriate corrective action as set out in the operating manual.
Temperature	20°C to 25°C	

E. coli	100 or more CFU (Colony Forming Units) per 100 mL or 100 or more MPN (Most Probable Number) per 100 mL	1. Immediately supply the *alternate water source system* with *potable* water only; 2. Immediately notify the *Chief Building Official*; and 3. Take the appropriate corrective action as set out in the operating manual.
Turbidity	> 15 NTU (Nephelometric Turbidity Units)	
Temperature	> 25°C	

2.7.8. Operating Manual and Maintenance

2.7.8.1. Operating Manual

1) An operating manual shall be supplied to the *owner* or representative of the *owner* by the designer of the *alternate water source system* and shall be stamped by a *registered professional of record*, and shall include the following

a) address and location of the *alternate water source system*,
b) system designer contact details,
c) a simplified process flow diagram,
d) a schematic of the entire system showing locations of all system components,
e) instructions on operating, maintaining, and inspecting the system,
f) required frequency of maintenance and inspections,
g) instructions on deactivating and restarting the system for repair or other purposes,
h) details on the corrective action that shall be taken if the water quality fails to meet the standards set out in Table 2.7.7.1., and
i) safety data sheets.

2.7.8.2. Maintenance

1) *Alternate water source systems* shall be maintained in accordance with the operating manual and any manufacturer's specifications.

2) Cross connection control tests shall be performed as required by CAN/CSA-B128.1, "Design and Installation of Non-Potable Water Systems."

3) A maintenance log shall be maintained and shall include

a) the address and location of the *alternate water source system,*
b) the name and contact information of the *owner*,
c) a record of inspections and any maintenance performed within the last 24 months,
d) details of any changes or alterations made to the system at any time after commissioning,
e) a record of water quality test results as set out in Article 2.7.7.1., including the name of the person and company conducting the test,
f) copies of water quality reports prepared and submitted in accordance with Article 2.7.7.2 within the last 24 months, and
g) if a water quality test fails to meet a standard defined in Table 2.7.7.1., a description of the extent of the deviation from the standard, the corrective action taken, a record of any required notification, and the outcome of the corrective action, including all applicable dates and times.

2.7.8.3. Request for Operating Manual or Maintenance Log

1) The operating manual and the maintenance log shall be made available on such request to the *Chief Building Official* or *City Engineer*.

Section 2.8. Objectives and Functional Statements

2.8.1. Objectives and Functional Statements

2.8.1.1. Attribution to Acceptable Solutions

1) For the purposes of compliance with this By-law as required in Clause 1.2.1.1.(1)(b) of Division A, the objectives and functional statements attributed to the acceptable solutions in this Part shall be the objectives and functional statements listed in Table 2.8.1.1. (See Note A-1.1.2.1.(1).)

Table 2.8.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 2
Forming Part of Sentence 2.8.1.1.(1)

Functional Statements and Objectives(1)	
2.1.2.1. Sanitary Drainage Systems	
(1)	[F72-OH2.1]
(2)	[F72-OH2.1]
	[F72-OP5]
2.1.2.2. Storm Drainage Systems	
(1)	[F72-OP5]
2.1.2.3. Water Distribution Systems	
(1)	[F46-OH2.2]
2.1.2.4. Separate Services	
(1)	[F71-OH2.1,OH2.3] [F70-OH2.1]
2.1.3.1. Lighting and Ventilation Requirements	
(1)	[F40-OH1.1] Applies to the requirement for ventilation.
	[F30-OS3.1] Applies to the requirement for lighting.
2.1.3.2. Accessibility	
(1)	[F40-OH2.1] [F41-OH2.4] [F71-OH2.3]
	[F82-OH2.1,OH2.2,OH2.3,OH2.4]
	[F71-OH2.3] [F81-OH2.4]
	[F81-OP5]
2.2.1.1. Exposure of Materials	
(1)	[F80-OH2.1,OH2.2,OH2.3,OH2.4]
	[F80-OP5]
(2)	[F80-OH2.1]
	[F80-OP5]

2.2.1.2. Restrictions on Re-Use	
(1)	[F70-OH2.2]
2.2.1.5. Withstanding Pressure	
(1)	[F20,F81-OH2.1,OH2.3] [F46-OH2.2]
	[F20-OP5]
2.2.1.6. Working Pressure of a Water Service Pipe	
(1)	[F20,F81-OH2.3]
	[F20-OP5]
2.2.2.1. Surface Requirements	
(1)	[F41-OH2.4]
2.2.2.2. Conformance to Standards	
(1)	[F80-OH2.1,OH2.4]
	[F80-OS3.1]
2.2.2.3. Showers	
(1)	[F80-OH2.1]
	[F80-OP5]
(2)	[F80-OH2.1]
	[F40-OP5]
(3)	[F45-OH2.1]
(4)	[F45-OH2.1]
2.2.2.4. Concealed Overflows	
(1)	[F41,F81-OH2.1,OH2.4]
2.2.2.5. Water Closets in Public Washrooms	
(1)	[F30-OH2.1,OH2.4]
2.2.3.1. Traps	
(1)	[F81,F40-OH1.1]
(2)	[F81-OH1.1]
	[F81-OP5]
(3)	[F81-OH2.1,OH2.3,OH2.4]
	[F81-OP5]

(4)	[F81-OH1.1]
(5)	[F81-OH1.1]
(6)	[F81-OH1.1]
2.2.3.2. Interceptors	
(1)	[F81-OH2.1,OH2.3,OH2.4]
(2)	[F81-OH2.1,OH2.3,OH2.4] [F46-OH2.2]
(3)	[F81-OH2.1]
2.2.3.3. Tubular Traps	
(1)	[F82-OH2.1,OH2.4]
	[F82-OP5]
2.2.4.1. T and Cross Fittings	
(1)	[F81-OH2.1,OH2.4]
(2)	[F81-OH2.1,OH2.4]
2.2.4.2. Sanitary T Fittings	
(1)	[F81-OH2.1,OH2.4]
(2)	[F81-OH2.1,OH2.4]
	[F81-OP5]
2.2.4.3. 90° Elbows	
(1)	[F81-OH2.1,OH2.4]
(2)	[F81-OH2.1,OH2.4]
2.2.5.1. Asbestos-Cement Pipe and Fittings	
(3)	[F40-OH2.4] [F41,F43-OP5] as it applies to the installation of piping
2.2.5.2. Concrete Pipe and Fittings	
(1)	[F20-OH2.1]
(2)	[F20-OH2.1]
(3)	[F20-OH2.1]
(4)	[F20-OH2.1]
(5)	[F20-OH2.1]
2.2.5.3. Vitrified Clay Pipe and Fittings	
(1)	[F20-OH2.1]

(2)	[F20-OH2.1]
(3)	[F20-OH2.1]
2.2.5.4. Polyethylene Pipe and Fittings	
(1)	[F20-OH2.1,OH2.2,OH2.3]
	[F20-OP5]
(2)	[F20-OP5]
(3)	[F20-OP5]
2.2.5.5. Polyethylene Pipe Used Underground	
(1)	[F72-OH2.1,OH2.3]
2.2.5.6. Crosslinked Polyethylene Pipe and Fittings	
(1)	[F20-OH2.2]
	[F20-OP5]
2.2.5.7. PVC Pipe and Fittings	
(1)	[F20-OH2.1,OH2.2,OH2.3]
	[F20-OP5]
(2)	[F20-OH2.1,OH2.2,OH2.3]
	[F20-OP5]
(3)	[F20-OH2.1,OH2.2,OH2.3]
	[F20-OP5]
(4)	[F20-OP5]
2.2.5.8. CPVC Pipe, Fittings and Solvent Cements	
(1)	[F20-OH2.2,OH2.3,OH2.4]
	[F20-OP5]
(2)	[F20-OP5]
2.2.5.9. Plastic Pipe, Fittings and Solvent Cement Used Underground	
(1)	[F20,F80,F81-OH2.1,OH2.3]
	[F20,F80-OP5]
2.2.5.10. Transition Solvent Cement	
(1)	[F20,F80,F81-OH2.1,OH2.3]
(2)	[F20,F80,F81-OH2.1,OH2.3]

2.2.5.11. Plastic Pipe, Fittings and Solvent Cement Used in Buildings	
(1)	[F20,F80,F81-OH2.1,OH2.3]
2.2.5.12. Polyethylene/Aluminum/Polyethylene Composite Pipe and Fittings	
(1)	[F20,F80,F81-OH2.1,OH2.2,OH2.3]
	[F20-OP5]
(2)	[F20-OP5]
	[F20-OH2.1,OH2.2,OH2.3]
(3)	[F20-OP5]
	[F20-OH2.1,OH2.2,OH2.3]
(4)	[F20-OP5]
	[F20-OH2.1,OH2.2,OH2.3]
2.2.5.13. Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene Composite Pressure Pipe and Fittings	
(1)	[F20-OH2.1,OH2.2,OH2.3]
	[F20-OP5]
2.2.5.14. Polypropylene Pipe and Fittings	
(1)	[F20-OH2.1,OH2.2,OH2.3]
	[F20-OP5]
2.2.6.1. Cast-Iron Drainage and Vent Pipe and Fittings	
(1)	[F20-OH2.1,OH2.3]
(2)	[F20-OH2.2]
2.2.6.2. Maintenance Holes and Catch Basins	
(1)	[F40,F81-OH1.1]
	[F20,F30-OS2.1]
	[F20,F30-OS3.1]
2.2.6.4. Threaded Cast-Iron Drainage Fittings	
(1)	[F20-OH2.1,OH2.3]
(2)	[F20-OP5]
2.2.6.5. Cast-Iron Water Pipes	
(1)	[F20-OP5]
	[F20-OH2.1,OH2.2,OH2.3]

(2)	[F80-OH2.2]
(3)	[F20-OP5]
(4)	[F20-OP5]
2.2.6.6. Screwed Cast-Iron Water Fittings	
(1)	[F20-OP5]
(2)	[F80-OH2.2]
(3)	[F81-OH2.1,OH2.3]
2.2.6.7. Screwed Malleable Iron Water Fittings	
(1)	[F81-OP5]
(2)	[F80-OH2.2]
(3)	[F81-OH2.1,OH2.3]
2.2.6.8. Steel Pipe	
(1)	[F80-OH2.1,OH2.3] [F46-OH2.2]
(3)	[F46-OH2.2]
(4)	[F80-OH2.1,OH2.3]
	[F80-OP5]
2.2.6.9. Corrugated Steel Pipe and Couplings	
(1)	[F80-OP5]
(2)	[F81-OP5]
(3)	[F81-OP5]
2.2.6.10. Sheet Metal Leaders	
(1)	[F80-OP5]
2.2.6.11. Stainless Steel Pipe	
(1)	[F71,F80-OH2.1,OH2.3] Applies to *drainage systems* and *venting systems*. [F46-OH2.2] Applies to *water systems*.
	[F80-OP5]
(2)	[F71,F80-OH2.1,OH2.3] Applies to *drainage systems* and *venting systems*. [F46-OH2.2] Applies to *water systems*.
	[F80-OP5]
2.2.6.12. Stainless Steel Butt Weld Pipe Fittings	
(1)	[F71,F80-OH2.1,OH2.3] Applies to *drainage systems* and *venting systems*.

	[F46-OH2.2] Applies to *water systems*.
	[F80-OP5]
(2)	[F71,F80-OH2.1,OH2.3] Applies to *drainage systems* and *venting systems*. [F46-OH2.2] Applies to *water systems*.
	[F80-OP5]
2.2.6.13. Stainless Steel Pipe Flanges	
(1)	[F71,F80-OH2.1,OH2.3] Applies to *drainage systems* and *venting systems*. [F46-OH2.2] Applies to *water systems*.
	[F80-OP5]
(2)	[F71,F80-OH2.1,OH2.3] Applies to *drainage systems* and *venting systems*. [F46-OH2.2] Applies to *water systems*.
	[F80-OP5]
2.2.6.14. Stainless Steel Threaded Fittings	
(1)	[F20-OP5]
(2)	[F20-OP5]
2.2.6.15. Stainless Steel Tube	
(1)	[F46-OH2.2]
(2)	[F46-OH2.2]
2.2.6.16. Stainless Steel Pipe and Tube	
(1)	[F80-OH2.1,OH2.2,OH2.3]
2.2.7.1. Copper and Brass Pipe	
(1)	[F80-OH2.1,OH2.3] Applies to *drainage systems* and *venting systems*. [F46-OH2.2] Applies to *water systems*.
	[F80-OP5]
(2)	[F80-OH2.1,OH2.3] Applies to *drainage systems* and *venting systems*. [F46-OH2.2] Applies to *water systems*.
	[F80-OP5]
2.2.7.2. Brass or Bronze Pipe Flanges and Flanged Fittings	
(1)	[F80-OH2.1,OH2.3] Applies to *drainage systems* and *venting systems*. [F46-OH2.2] Applies to *water systems*.
	[F80-OP5]
2.2.7.3. Brass or Bronze Threaded Water Fittings	
(1)	[F80-OP5]

(2)	[F80-OH2.1,OH2.3]
2.2.7.4. Copper Tube	
(1)	[F80-OH2.1,OH2.3] Applies to *drainage systems* and *venting systems*. [F46-OH2.2] Applies to *water systems*.
	[F80-OP5]
(2)	[F80-OH2.1,OH2.2,OH2.3]
(3)	[F80-OH2.1,OH2.4]
2.2.7.5. Solder-Joint Drainage Fittings	
(1)	[F80-OH2.1,OH2.4]
(2)	[F20-OP5]
2.2.7.6. Solder-Joint Water Fittings	
(1)	[F20-OP5]
(2)	[F20-OP5]
2.2.7.7. Flared-Joint Fittings for Copper Water Systems	
(1)	[F20-OP5]
(2)	[F20-OP5]
2.2.7.8. Lead Waste Pipe and Fittings	
(1)	[F46,F20-OH2.2,OH2.3]
(2)	[F81-OH2.1,OH2.3,OH2.4]
2.2.8.1. Pipes and Fittings	
(1)	[F80,F81-OH2.1]
	[F80,F81-OS3.2,OS3.4]
2.2.9.1. Cement Mortar	
(1)	[F80-OP5]
	[F80-OH2.1,OH2.3]
2.2.9.2. Solders and Fluxes	
(1)	[F80-OP5]
	[F80-OH2.1,OH2.3]
(2)	[F46-OH2.2]
(3)	[F80-OH2.1,OH2.3]
(4)	[F20,F80,F81-OH2.1,OH2.3]

2.2.10.1. Brass Floor Flanges	
(1)	[F80-OH2.1]
2.2.10.2. Screws, Bolts, Nuts and Washers	
(1)	[F80-OH2.1,OH2.3]
2.2.10.3. Cleanout Fittings	
(1)	[F80-OH2.1,OH2.3] Applies to *drainage systems.* [F46-OH2.2] Applies to *water systems*.
(2)	[F80-OH2.1]
2.2.10.4. Mechanical Couplings	
(1)	[F80-OP5]
(2)	[F80-OH2.1,OH2.3]
2.2.10.5. Saddle Hubs	
(1)	[F81-OH2.1,OH2.3]
	[F81-OP5]
2.2.10.6. Supply and Waste Fittings	
(1)	[F80-OP5]
(2)	[F131-OE1.2]
(3)	[F30-OS3.1] [F31-OS3.2]
(4)	[F131-OE1.2]
(5)	[F131-OE1.2]
(6)	[F80-OH2.1,OH2.3]
2.2.10.7. Water Temperature Control	
(1)	[F80-OS3.2]
(3)	(a) [F31-OS3.2] (b) [F30-OS3.1]
(4)	[F31-OS3.2]
2.2.10.8. Direct Flush Valves	
(1)	(c) and (d) [F80-OH2.1] [F81-OH2.4]
	(a) and (b) [F80,F81-OP5]
2.2.10.9. Drinking Fountain Bubblers	
(1)	[F40,F46-OH2.4]

(2)	[F41,F46-OH2.2]
(3)	[F41,F46-OH2.2]
2.2.10.10. Back-Siphonage Preventers and Backflow Preventers	
(1)	[F46-OH2.2]
(2)	[F46-OH2.2]
2.2.10.11. Relief Valves	
(1)	[F31-OS3.2]
	[F31-OP5]
2.2.10.12. Reducing Valves	
(1)	[F81-OP5]
2.2.10.13. Solar Domestic Hot Water	
(1)	[F81-OS3.2]
	[F46-OH2.2]
	[F80,F81-OP5]
2.2.10.14. Vent Pipe Flashing	
(1)	[F80,F81-OP5]
(2)	[F80,F81-OP5]
2.2.10.15. Water Hammer Arresters	
(1)	[F20,F80-OP5]
2.2.10.16. Air Admittance Valves	
(1)	[F81-OH1.1]
2.2.10.17. Water Treatment Systems	
(1)	[F46,F70-OH2.2]
	[F30-OS3.1] [F46,F70-OS3.4]
	[F20,F30-OS2.1]
(2)	[F46,F70-OH2.2]
	[F30-OS3.1] [F46,F70-OS3.4]
	[F20,F30-OS2.1]
2.2.11.1. Building Appliances	
(1)	[F130-OE1.2]

(2)	[F130-OE1.2]
2.2.11.2. Residential Landscape Irrigation Systems	
(1)	[F40,F43,F46,F81-OS3.4,OH2.2,OH5]
(2)	[F30,F130-OS3.1,OP5,OE1.2]
2.2.11.3. Vehicle Wash Facilities	
(1)	[F130-OE1.2]
(2)	(a) [F130-OE1.2] (b) [F81-OS1.1,OH2.1] [F43-OH5]
2.2.11.4. Non-recirculating Applications	
(1)	[F81,F82,F130-OP5,OE1.2]
(2)	[F81,F82,F130-OP5,OE1.2]
2.2.11.5. Geoexchange Systems	
(1)	[F46,F81,F130-OH2.2,OH5,OP5,OE1.2]
(2)	[F46,F81,F130-OH2.2,OH5,OP5,OE1.2]
(3)	[F40,F43,F46-OS3.4,OH2.4,OH5]
(4)	[F72,F81,F82-OS3.4,OH2.1,OP5]
(5)	[F72,F81,F82-OS3.4,OH2.1,OP5]
2.3.2.1. Caulked Lead Drainage Joints	
(1)	[F80-OH2.1,OH2.3]
(2)	[F80-OH2.1]
(3)	[F81-OH2.1]
(4)	[F81-OH2.1]
2.3.2.2. Wiped Joints	
(1)	[F80,F81-OH2.1]
	[F80,F81-OP5]
(2)	[F80,F81-OH2.1,OH2.2,OH2.3]
(3)	[F80,F81-OH2.1,OH2.2,OH2.3]
2.3.2.3. Screwed Joints	
(1)	[F80,F81-OH2.1,OH2.2,OH2.3]
(2)	[F70-OH2.2]
2.3.2.4. Soldered Joints	

(1)	[F20,F81-OH2.1,OH2.2,OH2.3]
2.3.2.5. Flared Joints	
(1)	[F20,F81-OH2.1,OH2.2,OH2.3]
	[F20,F81-OP5]
(2)	[F20,F81-OH2.1,OH2.2,OH2.3]
	[F20,F81-OP5]
2.3.2.6. Mechanical Joints	
(1)	[F20-OH2.1,OH2.2,OH2.3]
	[F20-OP5]
2.3.2.7. Cold-Caulked Joints	
(1)	[F20,F81-OH1.1] Applies to bell and spigot joints in *venting systems*.
	[F20,F81-OH2.1,OH2.3] Applies to bell and spigot joints in *drainage systems* or *venting systems*.
	[F20,F81-OP5]
(2)	[F20,F81-OH1.1]
	[F20,F81-OP5]
	[F20,F81-OH2.1,OH2.2,OH2.3]
(3)	[F20-OH2.1,OH2.3]
2.3.2.8. Stainless Steel Welded Joints	
(1)	[F20,F81-OH2.1,OH2.2,OH2.3]
(2)	[F20,F81-OH2.1,OH2.2,OH2.3]
2.3.3.1. Drilled and Tapped Joints	
(1)	[F81-OH1.1]
	[F20,F81-OH2.2,OH2.3]
2.3.3.2. Extracted Tees	
(1)	[F81-OH2.1,OH2.3]
	[F20-OP5]
2.3.3.3. Prohibition of Welding of Pipes and Fittings	
(1)	[F20-OH1.1]
	[F20-OH2.1,OH2.2,OH2.3]
(2)	[F80-OH2.2]

	[F80-OP5]
2.3.3.4. Unions and Slip Joints	
(1)	[F81-OH1.1]
	[F81-OH2.1,OH2.3]
(2)	[F81-OH1.1]
	[F81-OH2.1,OH2.3]
2.3.3.5. Increaser or Reducer	
(1)	[F81-OH1.1]
	[F70,F80-OH2.2]
2.3.3.6. Dissimilar Materials	
(1)	[F80-OH1.1]
	[F80-OP5]
	[F80-OH2.1]
2.3.3.7. Connection of Roof Drain to Leader	
(1)	[F21,F81-OP5]
2.3.3.8. Connection of Floor Outlet Fixtures	
(1)	[F80-OH2.1,OH2.3]
(2)	[F80-OH2.1]
(4)	[F20-OH2.1]
	[F20-OS3.1]
(5)	[F81-OH2.1]
(6)	[F21-OH2.1]
2.3.3.9. Expansion and Contraction	
(1)	[F21-OH1.1]
	[F21-OH2.1]
	[F21-OP5]
2.3.3.10. Copper Tube	
(1)	[F20-OH1.1]
	[F20-OP5]
2.3.3.11. Indirect Connections	

(1)	[F81-OH2.2,OH2.4]
(2)	[F81-OH2.2,OH2.4]
2.3.3.12. Copper Joints Used Underground	
(1)	[F20,F80-OP5]
(2)	[F20,F80-OP5]
2.3.4.1. Capability of Support	
(1)	[F20-OH2.1,OH2.4]
	[F20-OS3.1]
	[F20-OP5]
(2)	[F20-OH2.1,OH2.3]
	[F20-OS3.1]
(3)	[F20-OS3.1]
	[F20-OH2.1,OH2.3]
2.3.4.2. Independence of Support	
(1)	[F20-OS3.1]
	[F20-OH2.1,OH2.3]
	[F20-OP5]
2.3.4.3. Insulation of Support	
(1)	[F80-OH2.1,OH2.3]
	[F80-OS3.1]
	[F80-OP5]
(2)	[F80-OH2.1,OH2.3]
	[F80-OS3.1]
	[F80-OP5]
2.3.4.4. Support for Vertical Piping	
(1)	[F20-OH2.1]
	[F20-OS3.1]
(2)	[F20-OH2.1]
	[F20-OS3.1]
	[F20-OP5]

2.3.4.5. Support for Horizontal Piping	
(1)	[F20-OS3.1]
	[F20-OH2.1,OH2.3]
	[F20-OP5]
(2)	[F20-OS3.1]
	[F20-OH2.1]
	[F20-OP5]
(3)	[F20-OP5]
	[F20,F81-OS3.1]
	[F20-OH2.1]
(4)	[F81-OP5]
	[F81-OS3.1]
(5)	[F20,F21-OP5]
	[F20-OS3.1]
	[F20-OH2.1]
(6)	[F20-OP5]
	[F20-OS3.1]
	[F20-OH2.1]
2.3.4.6. Support for Underground Horizontal Piping	
(1)	[F20-OP5]
	[F81-OH2.1]
2.3.4.7. Support for Vent Pipe above a Roof	
(1)	[F81-OS3.1]
	[F81-OP5]
2.3.5.1. Backfilling of Pipe Trench	
(1)	[F81-OP5]
	[F81-OH2.1,OH2.3]
2.3.5.2. Protection of Non-Metallic Pipe	
(1)	[F81-OH2.1,OH2.3]
2.3.5.3. Isolation from Loads	

(1)	[F81-OH2.1,OH2.3]
	[F81-OP5]
2.3.5.4. Protection Against Freezing	
(1)	[F81-OP5]
	[F81-OH2.1,OH2.3]
2.3.5.5. Protection from Mechanical Damage	
(1)	[F81-OH2.1,OH2.3]
	[F81-OP5]
2.3.5.6. Protection from Condensation	
(1)	[F81-OP5]
2.3.6.1. Tests and Inspection of Drainage or Venting Systems	
(1)	[F81-OH2.1,OH2.3] Applies to *drainage systems*.
	[F81-OH1.1] Applies to *venting systems*.
(2)	[F81-OH1.1] Applies to *venting systems*.
	[F81-OH2.1,OH2.3] Applies to *drainage systems*.
(3)	[F81-OH1.1]
	[F81-OH2.1,OH2.3]
(4)	[F81-OH1.1] Applies to *venting systems*.
	[F81-OH2.1,OH2.3] Applies to *drainage systems*.
(5)	[F81-OH2.1,OH2.3]
2.3.6.2. Tests of Pipes in Drainage Systems	
(1)	[F81-OH2.1,OH2.3]
(2)	[F81-OH2.1,OH2.3]
2.3.6.3. Tests of Venting Systems	
(1)	[F81-OH1.1]
2.3.6.4. Water Pressure Tests	
(1)	[F81-OH1.1]
	[F81-OH2.1,OH2.3]
(2)	[F81-OH1.1]
	[F81-OH2.1,OH2.3]

2.3.6.5. Air Pressure Tests	
(1)	[F81-OH1.1]
	[F81-OH2.1,OH2.3]
2.3.6.6. Final Tests	
(1)	[F81-OH1.1]
	[F81-OH2.1,OH2.3]
(2)	[F81-OH1.1]
	[F81-OH2.1,OH2.3]
2.3.6.7. Ball Tests	
(1)	[F81-OH2.1,OH2.3]
(2)	[F81-OH2.1,OH2.3]
2.3.7.1. Application of Tests	
(1)	[F81-OP5]
(3)	[F81-OP5]
(4)	[F81-OP5]
2.3.7.2. Pressure Tests of Potable Water Systems	
(1)	[F20-OP5]
(2)	[F20,F81-OS3.1]
2.3.7.3. Water Pressure Tests	
(1)	[F81-OP5]
(2)	[F70-OH2.2]
2.4.2.1. Connections to Sanitary Drainage Systems	
(1)	[F72-OH2.1] Applies to *fixtures* that are *directly connected* to *sanitary drainage systems*.
	(a) [F81-OH2.2]
	(b) [F81-OH2.2]
	(c) [F81-OH2.1]
	(d) [F81-OH2.1]
	(e) [F81-OH2.1]
(2)	[F81-OH1.1]
(3)	[F81-OH1.1]

(4)	[F81-OH1.1]
(5)	[F81-OH1.1]
2.4.2.2. Connection of Overflows from Rainwater Tanks	
(1)	[F81-OH2.2]
2.4.2.3. Direct Connections	
(1)	[F81-OH2.2]
(2)	[F81-OH2.1,OH2.4]
(3)	[F81-OH2.4]
2.4.3.1. Urinals	
(1)	[F81-OH2.4]
2.4.3.2. Restricted Locations of Indirect Connections and Traps	
(1)	[F81-OH2.1,OH2.4]
2.4.3.3. Equipment Restrictions Upstream of Grease Interceptors	
(1)	[F81-OH2.1]
2.4.3.4. Fixtures Located in Chemical Storage Locations	
(1)	[F81-OS1.1]
	[F43-OH5]
2.4.3.5. Macerating Toilet Systems	
(1)	[F72-OH2.1]
2.4.3.6. Drains Serving Elevator Pits	
(1)	[F62-OP5]
2.4.4.1. Sewage Treatment	
(1)	[F81-OH2.1]
2.4.4.2. Sewer Discharge	
(1)	[F81-OH2.1]
(2)	[F130-OE1.2]
2.4.4.3. Interceptors	
(1)	[F81-OH2.1]
(2)	[F81-OS1.1]
	[F43-OH5]

(3)	[F81-OH2.1]
(4)	[F81-OH2.1]
2.4.4.4. Neutralizing and Dilution Tanks	
(1)	[F80-OS3.4]
(2)	[F43-OH5]
	[F80-OH2.1]
2.4.5.1. Traps for Sanitary Drainage Systems	
(1)	[F81-OH1.1]
(6)	[F81-OH1.1]
	[F81-OP5]
2.4.5.2. Traps for Storm Drainage Systems	
(1)	[F81-OH1.1]
(2)	[F81-OH1.1]
(3)	[F81-OP5]
2.4.5.3. Connection of Subsoil Drainage Pipe to a Storm Drainage System	
(1)	[F81-OH2.1]
(2)	[F81-OH2.1]
(3)	[F81-OH2.1]
2.4.5.4. Location and Cleanout for Building Traps	
(1)	[F81-OH2.1]
2.4.5.5. Trap Seals	
(1)	[F81-OH1.1]
2.4.6.1. Separate Systems	
(1)	[F81-OH2.1]
(2)	[F81-OH2.1]
(3)	[F81-OH1.1]
2.4.6.2. Location of Soil-or-Waste Pipes	
(1)	[F81-OH2.2]
2.4.6.3. Sumps or Tanks	
(1)	[F81-OH2.1]

(2)	[F81-OH2.1] Applies to the watertightness of sumps or tanks.
	[F81-OH1.1]
(3)	[F81-OH2.1]
(4)	[F81-OH2.1]
(5)	[F81-OH2.1]
(6)	[F81-OH2.1]
(7)	[F81-OH2.1]
2.4.6.4. Protection from Backflow	
(1)	[F81-OH2.1]
	[F81-OH1.1]
(2)	[F81-OH1.1]
	[F81-OH2.1]
(3)	[F81-OH2.1]
(6)	[F81-OH2.1]
2.4.6.5. Mobile Home Sewer Service	
(1)	[F81-OH2.1]
2.4.7.1. Cleanouts for Drainage Systems	
(1)	[F81-OH2.1]
(2)	[F81-OH2.1]
(3)	[F81-OH2.1]
(4)	[F81-OH2.1]
(5)	[F81-OH2.1]
(6)	[F81-OH2.1]
(7)	[F81-OH2.1]
(8)	[F81-OH2.1]
(9)	[F81-OH2.1]
(10)	[F82-OH2.1]
	[F82-OP5]
(11)	[F81-OH2.1]
	[F81-OP5]

2.4.7.2. Size and Spacing of Cleanouts	
(1)	[F81-OH2.1]
(2)	[F81-OH2.1]
(3)	[F81-OH2.1]
(4)	[F81-OH2.1]
(5)	[F81-OH2.1]
(6)	[F81-OH2.1]
2.4.7.3. Manholes	
(1)	[F20-OS3.1]
(2)	(a) and (c) [F81-OH1.1]
	(a) and (c) [F81-OS1.1]
	(b) [F20-OS3.1]
(3)	[F30-OS3.1]
(4)	[F81-OH2.1]
2.4.7.4. Location of Cleanouts	
(1)	[F81-OH2.1]
(2)	(a) [F81-OS3.1]
	(b) [F81-OH2.1]
(3)	[F81-OH2.1]
(4)	[F81-OH2.1] Applies to drainage piping.
	[F81-OH1.1] Applies to vent piping.
(5)	[F43-OH2.1]
2.4.8.1. Minimum Slope	
(1)	[F81-OH2.1]
2.4.8.2. Length of Fixture Outlet Pipes	
(1)	[F81-OH1.1]
2.4.9.1. No Reduction in Size	
(1)	[F81-OH2.1]
	[F81-OH1.1]
2.4.9.2. Serving Water Closets	

(1)	[F81-OH2.1]
(2)	[F81-OH2.1]
(3)	[F81-OH2.1]
(4)	[F81-OH2.1]
2.4.9.3. Size of Fixture Outlet Pipes	
(1)	[F81-OH2.1]
(2)	[F81-OH2.1]
(3)	[F81-OP5]
	[F81-OH1.1]
2.4.9.4. Size of Building Drain and Building Sewer	
(1)	[F81-OH2.1]
2.4.9.5. Offset in Leaders	
(1)	[F81-OH2.1,OH2.3]
(2)	[F81-OH2.1]
2.4.10.1. Total Load on a Pipe	
(1)	[F81-OH2.1]
2.4.10.2. Hydraulic Loads for Fixtures	
(2)	[F81-OH2.1]
2.4.10.3. Hydraulic Loads from Fixtures with a Continuous Flow	
(1)	[F81-OH2.1]
(2)	[F81-OH2.1]
2.4.10.4. Hydraulic Loads from Roofs or Paved Surfaces	
(1)	[F81-OP5]
	[F20,F81-OS2.1]
(2)	[F20,F81-OP5]
	(a), (d) and (e) [F41,F81-OH2.4]
	(b) and (c) [F20,F81-OS2.1]
(3)	[F20,F81-OP5]
	[F20,F81-OS2.1]
(4)	[F21,F81-OP5]

	[F20,F81-OS2.1]
2.4.10.5. Conversion of Fixture Units to Litres	
(1)	[F81-OH2.1]
2.4.10.6. Hydraulic Loads to Soil-or-Waste Pipes	
(1)	[F72-OH2.1,OH2.3]
(2)	[F72-OH2.1,OH2.3]
2.4.10.7. Hydraulic Loads on Branches	
(1)	[F72-OH2.1,OH2.3]
2.4.10.8. Hydraulic Loads on Sanitary Building Drains or Sewers	
(1)	[F81-OH2.1,OH2.3]
2.4.10.9. Hydraulic Loads on Storm or Combined Building Drains or Sewers	
(1)	[F81-OH2.1,OH2.3]
2.4.10.10. Hydraulic Loads to Roof Gutters	
(1)	[F81-OP5]
2.4.10.11. Hydraulic Loads on Leaders	
(1)	[F81-OP5]
2.4.10.12. Hydraulic Loads from Fixtures with a Semi-continuous Flow	
(1)	[F81-OP5]
2.4.10.13. Design of Storm Sewers	
(1)	[F81-OH2.1]
2.4.10.14. Design of Siphonic Roof Drainage Systems	
(1)	[F81-OH2.1]
2.5.1.1. Venting for Traps	
(1)	[F81-OH1.1]
(2)	[F81-OH1.1]
2.5.2.1. Wet Venting	
(1)	[F40,F81-OH1.1]
2.5.3.1. Circuit Venting	
(1)	[F40,F81-OH1.1]
(2)	[F40,F81-OH1.1]

(3)	[F40,F81-OH1.1]
(4)	[F40,F81-OH1.1]
(5)	[F40,F81-OH1.1]
(6)	[F40,F81-OH1.1]
(7)	[F40,F81-OH1.1]
(8)	[F40,F81-OH1.1]
(9)	[F40,F81-OH1.1]
(10)	[F40,F81-OH1.1]
(11)	[F40,F81-OH1.1]
2.5.4.1. Stack Vents	
(1)	[F40,F81-OH1.1]
2.5.4.2. Vent Stacks	
(1)	[F40,F81-OH1.1]
(3)	[F40,F81-OH1.1]
(4)	[F40,F81-OH1.1]
2.5.4.3. Yoke Vents	
(1)	[F40,F81-OH1.1]
(2)	[F40,F81-OH1.1]
(3)	[F40,F81-OH1.1]
(4)	[F40,F81-OH1.1]
2.5.4.4. Offset Relief Vents	
(1)	[F40,F81-OH1.1]
2.5.4.5. Fixtures Draining into Vent Pipes	
(1)	[F40,F81-OH1.1]
2.5.5.1. Venting of Sewage Sumps	
(1)	[F40,F81-OH1.1]
2.5.5.2. Venting of Oil Interceptors	
(1)	[F40,F81-OS1.1]
	[F72,F81-OH2.1,OH2.3]
	[F40,F81-OH1.1]

(2)	[F40,F81-OS1.1]
	[F40,F81-OH1.1]
(3)	[F40,F81-OS1.1]
(4)	[F40,F81-OS1.1]
(5)	[F40,F81-OS1.1]
2.5.5.3. Venting of Drain Piping and Dilution Tanks for Corrosive Waste	
(1)	[F80,F81-OS3.4]
2.5.5.4. Fresh Air Inlets	
(1)	[F81-OH1.1]
2.5.5.5. Provision for Future Installations	
(1)	[F81-OH1.1] Applies to *venting systems*.
	[F81-OH2.1,OH2.3] Applies to *drainage systems*.
(2)	[F40,F81-OH1.1]
2.5.6.1. Drainage of Vent Pipes	
(1)	[F81-OH1.1]
	[F81-OS1.1]
2.5.6.2. Vent Pipe Connections	
(1)	[F81-OS1.1]
(2)	[F81-OH1.1]
(3)	[F40,F81-OH1.1]
2.5.6.3. Location of Vent Pipes	
(1)	[F81-OH1.1]
(2)	[F81-OH2.1,OH2.3]
(3)	[F81-OH1.1]
(4)	[F40,F81-OH1.1]
2.5.6.4. Connection of Vents above Fixtures Served	
(1)	[F81-OH1.1]
(2)	[F81-OH1.1]
2.5.6.5. Terminals	
(1)	[F81-OH1.1]

(2)	[F81-OH1.1]
(3)	[F81-OH1.1]
(4)	[F81-OH1.1]
(5)	[F81-OH1.1]
(6)	[F81-OH1.1]
2.5.7.1. General	
(1)	[F81-OH1.1]
2.5.7.2. Size Restriction	
(1)	[F81-OH1.1]
(2)	[F81-OH1.1]
2.5.7.3. Additional Circuit Vents and Relief Vents	
(1)	[F81-OH1.1]
(2)	[F81-OH1.1]
2.5.7.4. Offset Relief Vents	
(1)	[F81-OH1.1]
2.5.7.5. Yoke Vents	
(1)	[F81-OH2.1]
2.5.7.6. Vent Pipes for Manholes	
(1)	[F81-OH2.1]
2.5.7.7. Vents for Sewage Sumps, Dilution Tanks and Macerating Toilet Systems	
(1)	[F81-OH2.1]
(2)	[F81-OH2.1]
(3)	[F81-OH1.1]
2.5.8.1. Hydraulic Loads Draining to Wet Vents	
(1)	[F81-OH1.1]
(2)	[F81-OH1.1]
2.5.8.2. Individual Vents and Dual Vents	
(1)	[F81-OH1.1]
2.5.8.3. Branch Vents, Vent Headers, Continuous Vents and Circuit Vents	
(1)	[F81-OH1.1]

2.5.8.4. Vent Stacks or Stack Vents	
(3)	[F81-OH1.1]
(4)	[F81-OH1.1]
(5)	[F81-OH1.1]
2.5.9.2. Air Admittance Valves	
(1)	[F40,F81-OH1.1]
(2)	[F40,F81-OH1.1]
2.5.9.3. Installation Conditions	
(1)	[F40,F81-OH1.1]
(2)	[F40,F81-OH1.1]
(3)	[F40,F81-OH1.1]
(4)	[F40,F81-OH1.1]
(5)	[F40,F81-OH1.1]
2.6.1.1. Design	
(1)	[F31-OS3.2]
(2)	[F71-OH2.3]
2.6.1.2. Drainage	
(1)	[F81-OP5]
2.6.1.3. Shut-off Valves	
(1)	[F81-OP5]
(2)	[F81-OP5]
(3)	[F81-OP5]
(4)	[F81-OP5]
(5)	[F70,F72-OH2.1,OH2.3]
(7)	[F70,F81-OH2.1,OH2.3]
2.6.1.4. Protection for Exterior Water Supply	
(1)	[F81-OP5]
2.6.1.5. Check Valves	
(1)	[F20,F81-OP5]
2.6.1.6. Flushing Devices	

(1)	[F72-OH2.1]
(2)	[F72-OH2.1]
(3)	[F130-OE1.2]
(4)	[F81-OH2.1]
(5)	[F130-OE1.2]
2.6.1.7. Relief Valves	
(1)	[F31,F81-OS3.2]
(2)	[F81-OS3.1,OS3.2]
(4)	(a) [F31-OS3.2] [F81-OS1.1] (b) [F81-OS3.1,OS3.2]
(5)	[F31-OS3.2]
	(b) [F81-OH2.2] Applies to the size of *air breaks*.
(6)	[F31-OS3.2]
(7)	[F31-OS3.2]
(8)	[F81-OS3.2]
(9)	[F81-OP5]
(10)	[F81-OP5]
2.6.1.8. Solar Domestic Hot Water Systems	
(1)	[F31-OS3.2] [F81-OS3.4]
	[F70-OH2.2]
2.6.1.9. Water Hammer	
(1)	[F20,F81-OS3.2]
	[F20,F81-OP5]
2.6.1.10. Mobile Home Water Service	
(1)	[F71,F70,F46-OH2.2,OH2.3]
2.6.1.11. Thermal Expansion	
(1)	[F20,F81,F46-OP5]
2.6.1.12. Service Water Heaters	
(1)	[F40-OS3.4]
2.6.2.1. Connection of Systems	
(1)	[F70,F81,F46-OH2.1,OH2.2,OH2.3]

(2)	[F70,F81,F46-OH2.1,OH2.2,OH2.3]
(3)	[F70,F81,F82-OH2.2,OH2.3]
(4)	[F70,F81,F82-OH2.2,OH2.3]
2.6.2.2. Back-Siphonage	
(1)	[F70,F81,F46-OH2.1,OH2.2,OH2.3]
(2)	[F70,F81,F46-OH2.1,OH2.2,OH2.3]
2.6.2.3. Backflow Caused by Back Pressure	
(1)	[F70,F81,F46-OH2.1,OH2.2,OH2.3]
(2)	[F70,F81,F46-OH2.1,OH2.2,OH2.3]
(3)	[F70,F81,F46-OH2.1,OH2.2,OH2.3]
2.6.2.4. Backflow from Fire Protection Systems	
(2)	[F46,F70,F81-OH2.1,OH2.2,OH2.3]
2.6.2.5. Separation of Water Supply Systems	
(1)	[F70,F81,F46-OH2.1,OH2.2,OH2.3]
2.6.2.6. Premise Isolation	
(1)	[F70,F81,F82-OH2.1,OH2.2,OH2.3]
2.6.2.7. Hose Bibb	
(1)	[F70,F81,F46-OH2.1,OH2.2,OH2.3]
2.6.2.8. Cleaning of Systems	
(1)	[F70,F81,F46-OH2.1,OH2.2,OH2.3]
2.6.2.9. Air Gap	
(1)	[F70,F81,F46-OH2.1,OH2.2,OH2.3]
(2)	[F70,F81,F46-OH2.1,OH2.2,OH2.3]
2.6.2.10. Vacuum Breakers	
(2)	[F70,F81,F46-OH2.1,OH2.2,OH2.3]
(3)	[F70,F81,F46-OH2.1,OH2.2,OH2.3]
(4)	[F70,F81,F46-OH2.1,OH2.2,OH2.3]
2.6.2.11. Tank-Type Water Closets	
(1)	[F70,F81,F46-OH2.1,OH2.2,OH2.3]
2.6.2.12. Backflow Preventers	

(1)	[F70,F81,F46-OH2.1,OH2.2,OH2.3]
2.6.3.1. Design, Fabrication and Installation	
(1)	[F71,F72-OH2.1,OH2.3]
(2)	[F72-OH2.1] [F70-OH2.2] [F71-OH2.3]
(3)	[F81-OS1.4]
	[F70,F71-OH2.1,OH2.3]
	[F81-OP5]
2.6.3.2. Hydraulic Load	
(1)	[F71,F72-OH2.1,OH2.3]
(2)	[F71,F72-OH2.1,OH2.3]
(3)	[F71,F72-OH2.1,OH2.3]
(4)	[F81-OH2.1,OH2.2]
2.6.3.3. Static Pressure	
(1)	[F81-OS3.2]
2.6.3.4. Size	
(1)	[F71,F72-OH2.1,OH2.3]
(2)	[F71,F72-OH2.1,OH2.3]
(3)	[F71,F72-OH2.1,OH2.3]
(5)	[F71,F72-OH2.1,OH2.3]
2.6.3.5. Velocity	
(1)	[F81-OH2.1,OH2.3]
	[F81-OP5]
	[F81-OS3.1]
2.7.1.1. Not Permitted	
(1)	[F46-OH2.2]
2.7.2.1. Piping Identification	
(1)	[F46-OH2.2]
(2)	[F46-OH2.2]
2.7.3.1. Pipes	
(1)	[F46-OH2.2]

2.7.3.2. Outlets	
(1)	[F46-OH2.2]
2.7.4.1. Requirements for Alternate Water Source Systems Installed Prior to January 1, 2019	
(1)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
(2)	[F81-OH2.2]
(3)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
(4)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
(5)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
(6)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
(7)	[F46,F81,F82-OS3.4,OH2.1,OH2.2,OH5]
2.7.5.1. Alternate Water Sources	
(1)	[F40,F43,F46,F81-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
(2)	[F40,F43,F46,F81-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
2.7.5.2. Mandatory and Optional Uses	
(1)	[F130-OE1.2]
(2)	[F130-OE1.2]
(3)	[F46,F70-OS3.4,OH2.2,OH2.3]
2.7.5.3. Occupancy	
(1)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
2.7.5.4. Commissioning	
(1)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
2.7.5.5. Operating Permit	
(1)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
(2)	[F81-OH2.2]
(3)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
2.7.5.6. Continued Operation	
(1)	[F81,F82,F130-OH5,OP5,OE1.2]
2.7.6.1. Professional Design	
(1)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
2.7.6.2. Pipe Sizing	

(1)	[F71,F72-OH2.1,OH2.3]
(2)	[F71,F72-OH2.1,OH2.3]
2.7.6.3. Continuity of Supply	
(1)	[F71,F72-OH2.1,OH2.3]
2.7.6.4. Backflow Prevention	
(1)	[F46,F81,F82-OS3.4,OH2.1,OH2.2,OH5]
2.7.6.5. Removal of Particulates and Impurities	
(1)	[F40,F81-OH2.1,OH2.3]
2.7.6.6. Cistern Security	
(1)	[F40,F81-OH2.1,OH2.3]
2.7.6.7. Minimum Withdrawal Level	
(1)	[F40,F81-OH2.1,OH2.3]
2.7.6.8. Water Metering Requirements	
(1)	[F130-OE1.2]
2.7.6.9. Water Quality Sampling Locations	
(1)	[F82-OS3.4,OH2.1,OH2.3,OH5]
2.7.6.10. Alerts	
(1)	[F82-OS3.4,OH2.1,OH2.3,OH5]
2.7.6.11. Power Interruption	
(1)	[F71,F72,F81-OS3.4,OH2.1,OH2.3,OH5]
2.7.7.1. Water Quality Standards, Testing, and Documentation	
(1)	[F40,F43,F71,F72,F81,F82-OS3.4,OH2.1,OH2.3,OH5]
(2)	[F40,F43,F71,F72,F81,F82-OS3.4,OH2.1,OH2.3,OH5]
(3)	[F40,F43,F71,F72,F81,F82-OS3.4,OH2.1,OH2.3,OH5]
2.7.7.2. Water Quality Reporting	
(1)	[F40,F43,F71,F72,F81,F82-OS3.4,OH2.1,OH2.3,OH5]
2.7.7.3. Required Response to Failure to Meet Water Quality Standards	
(1)	[F40,F43,F71,F72,F81,F82-OS3.4,OH2.1,OH2.3,OH5]
2.7.8.1. Operating Manual	
(1)	[F82-OS3.4,OH2.1,OH2.3,OH5,OE1.2]

2.7.8.2. Maintenance	
(1)	[F82-OS3.4,OH2.1,OH2.3,OH5,OE1.2]
(2)	[F46,F81,F82-OS3.4,OH2.1,OH2.2,OH5]
(3)	[F82-OS3.4,OH2.1,OH2.3,OH5,OE1.2]
2.7.8.3. Request for Operating Manual or Maintenance Log	
(1)	[F82-OS3.4,OH2.1,OH2.3,OH5,OE1.2]

Notes to Table 2.8.1.1.:
(1) See Parts 2 and 3 of Division A.

Notes to Part 2
Plumbing Systems

A-2.1.2.1.(2) Combined Building Drains. Combined building drains may have proven acceptable on the basis of past performance in some localities and their acceptance under this Code may be warranted.

A-2.1.2.4.(1) Service Piping. The layout as shown in Figure A-2.1.2.4.(1)(c) may require special legal arrangements in some jurisdictions to ensure that access can be provided to all parts of the service pipes.

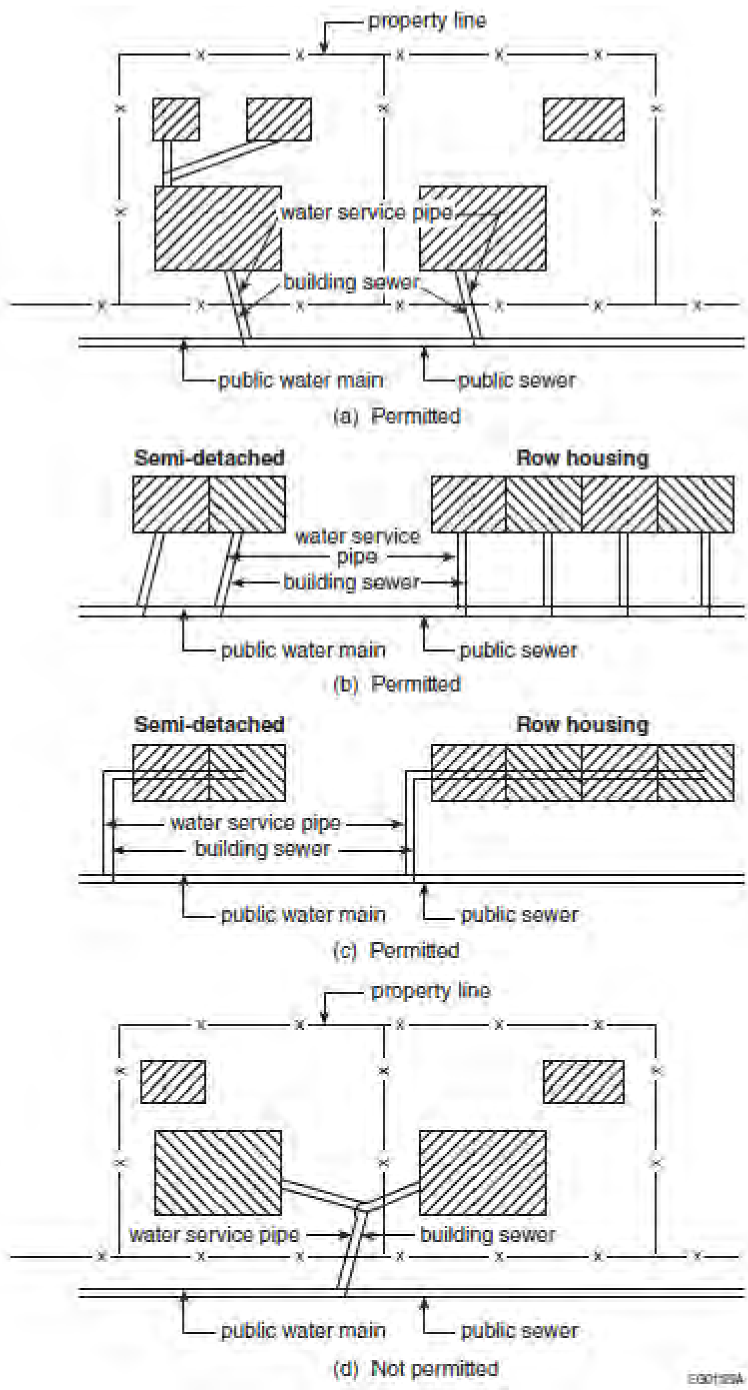


Figure A-2.1.2.4.(1)
Service Piping

A-2.2.2.3.(3) Shower Drainage (Plan View).

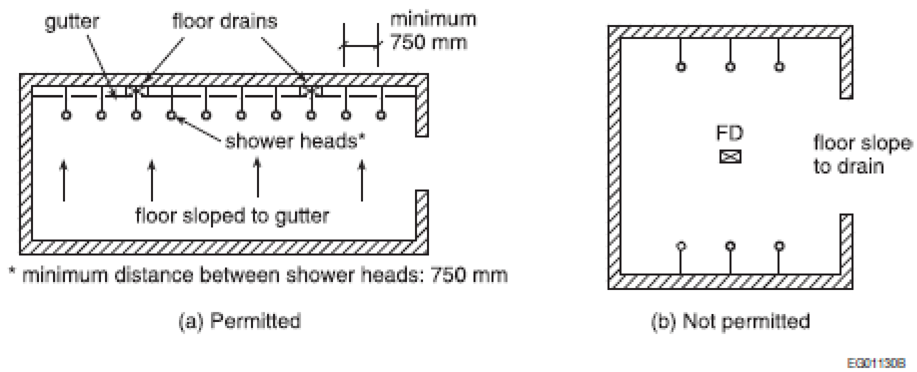


Figure A-2.2.2.3.(3)
Shower Drainage (Plan View)

A-2.2.2.4.(1) Concealed Overflows. The use of concealed overflows does not preclude the use of a standing waste.

A-2.2.3.1.(1) and (3) Trap Seal Depth and Trap Connections.

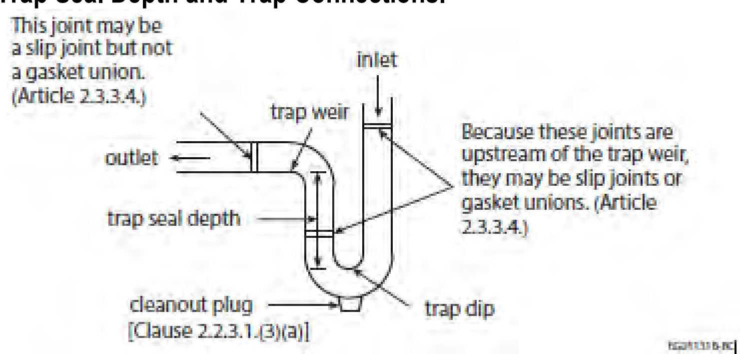


Figure A-2.2.3.1.(1) and (3)
Trap Seal Depth and Trap Connections

A-2.2.3.1.(4) Prohibited Traps. Except for an S-trap standard, the S trap shown in Figure A-2.2.3.1.(4)(b) is prohibited by Clause 2.5.6.3.(1)(b), which limits the fall on fixture drains. Crown vented traps shown in Figure A-2.2.3.1.(4)(c) are prohibited by Clause 2.5.6.3.(1)(a), which requires that the distance from the trap weir to the vent be not less than twice the size of the fixture drain.

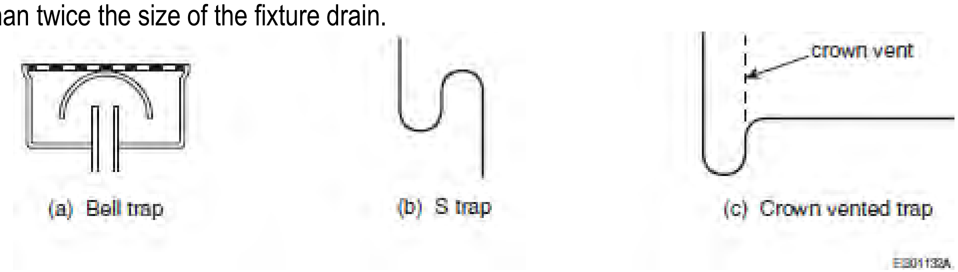


Figure A-2.2.3.1.(4)
Prohibited Traps

A-2.2.3.2.(3) Grease Interceptors. CSA B481.4, “Maintenance of Grease Interceptors,” is considered to represent good practice regarding procedures for the maintenance of grease interceptors.

A-2.2.4.1. T Fittings in Drainage Systems. The use of a cross fitting in a drainage system is prohibited, but such fitting may be used in a venting system to connect 4 vent pipes. In a drainage system, a T fitting can only be used as shown in Figure A-2.2.4.1.(a), and cannot be used as shown in Figure A-2.2.4.1.(b) because the T or cross fitting would change the direction of flow in the drainage system.

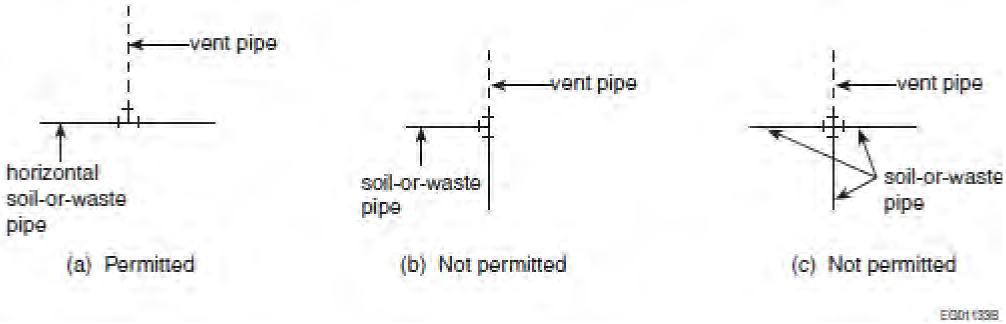


Figure A-2.2.4.1.
T Fittings in Drainage Systems

A-2.2.4.2. Sanitary T Fittings in Drainage Systems. A sanitary T fitting may be used to change the direction of flow in a drainage system from horizontal to vertical, but may not be used to change the direction of flow in a nominally horizontal drainage system. A combination Y and 1/8th bend fitting may also be used as shown in Figure A-2.2.4.2.(b).

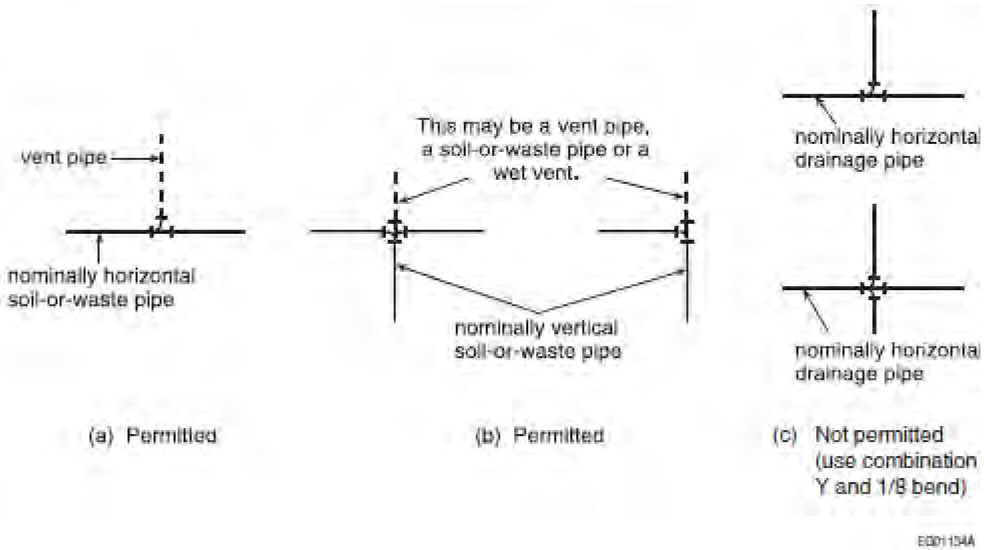


Figure A-2.2.4.2.
Sanitary T Fittings in Drainage Systems

A-2.2.5., 2.2.6. and 2.2.7. Pipe and Fitting Applications.

Table A-2.2.5., 2.2.6. and 2.2.7.
Summary of Pipe and Fitting Applications
Forming Part of Note A-2.2.5., 2.2.6. and 2.2.7.

Types of Piping and Fittings	Standard References	NPC References	Use of Piping and Fittings(1)								
			Drainage System			Venting System		Potable Water System			
			Above-ground inside building	Under-ground under building	Building sewer	Above-ground	Under-ground	Above-ground		Underground	
								Cold	Hot	Under building	Outside building

Concrete sewer pipe	CSA Series A257										
Sewer, storm drain and culvert	CSA A257.1	2.2.5.2.	N	P(2)	P	N	N	N	N	N	N
Reinforced culvert, storm drain and sewer	CSA A257.2	2.2.5.2.	N	P(2)	P	N	N	N	N	N	N
Vitrified clay pipe	CSA A60.1-M	2.2.5.3.	N	P	P	N	P	N	N	N	N
Polyethylene water pipe and tubing											
Series 160 sizes with compression fittings	CAN/CSA - B137.1	2.2.5.4.	N	N	N	N	N	N	N	P(3)	P(3)
Series 50, 75, 100 and 125		2.2.5.4.	N	N	N	N	N	N	N	N	N
Polyethylene (PE) plastic pipe (SDR-PR) based on outside diameter	ASTM F 714	2.2.5.5.(1)	N	P	P	N	P	N	N	N	N
Polyvinyl chloride (PVC) pressure fittings	CAN/CSA - B137.2	2.2.5.7.	N	N	N	N	N	P(4)(5)	N	P	P
Polyvinyl chloride (PVC) water pipe											
Dimension ratios (DR) or standard dimension ratios (SDR) 14, 17, 18, 21, 25 and 26	CAN/CSA - B137.3	2.2.5.7.	N	N	N	N	N	P	N	P(6)	P(6)
Schedule 40 in sizes from ½ inch to 2½ inches inclusively											

Schedule 80 in sizes from ½ inch to 6 inches inclusively											
PVC fittings, Schedule 40	ASTM D 2466	2.2.5.7.(2)	N	N	N	N	N	P(4)(5)	N	N	N
PVC fittings, Schedule 80	ASTM D 2467	2.2.5.7.(2)	N	N	N	N	N	P(4)(5)	N	P	P
Crosslinked polyethylene (PEX) pressure tubing	CAN/CSA - B137.5	2.2.5.6.	N	N	N	N	N	P(4)(5)	P(4)(5)	P	P
Chlorinated polyvinyl chloride (CPVC) water pipe	CAN/CSA - B137.6	2.2.5.8.	N	N	N	N	N	P(4)(5)(7)	P(4)(5)(7)	P(7)	P(7)
Polyethylene/Aluminum/ Polyethylene (PE/AL/PE) pressure pipe	CAN/CSA - B137.9	2.2.5.12.	N	N	N	N	N	P(4)(5)	N	P	P
Crosslinked Polyethylene/Aluminum/ Crosslinked Polyethylene (PEX/AL/PEX) pressure pipe	CAN/CSA - B137.10	2.2.5.13.	N	N	N	N	N	P(4)(5)	P(4)(5)	P	P
Polypropylene (PP-R) pressure pipe	CAN/CSA - B137.11	2.2.5.14.	N	N	N	N	N	P(4)(5)	P(4)(5)	P	P
Plastic sewer pipe PS ≥ 320 kPa	CAN/CSA - B182.1	2.2.5.9.	N	P	P	N	N	N	N	N	N
Acrylonitrile-butadiene-styrene (ABS) DWV pipe	CAN/CSA - B181.1	2.2.5.9.	P(4)(5)	P	P	P(4)(5)	P	N	N	N	N
		2.2.5.10.									
ABS Schedule 40 DWV pipe with a	ASTM F 628	2.2.5.9.	P(4)(5)	P	P	P(4)(5)	P	N	N	N	N

cellular core												
Polyvinyl chloride (PVC) DWV pipe	CAN/CSA - B181.2	2.2.5.9.	P(4)(5)	P	P	P(4)(5)	P	N	N	N	N
		2.2.5.10.									
PVC sewer pipe (PSM type) ≤ 35-SDR	CAN/CSA - B182.2	2.2.5.9.	N	P	P	N	P	N	N	N	N
Profile polyvinyl chloride (PVC) sewer pipe PS ≥ 320 kPa	CAN/CSA - B182.4	2.2.5.9. (1)(f)	N	P	P	N	P	N	N	N	N
Profile polyethylene sewer pipe PS ≥ 320 kPa	CAN/CSA - B182.6	2.2.5.9. (1)(g)	N	P	P	N	P	N	N	N	N
Polyolefin laboratory drainage systems	CAN/CSA - B181.3	2.2.8.1.	P(4)(5)	P	P	P(4)(5)	P	N	N	N	N
Cast-iron soil pipe	CSA B70	2.2.6.1.	P	P	P	P	P	N	N	N	N
Cast-iron water pipe	ANSI/AWWA C151/A21.51 (Ductile iron)	2.2.6.5.	P	P	P	P	P	P	P	P	P
Cast-iron screwed fittings	ASME B16.4 (Cast iron)	2.2.6.6.	N	N	N	N	N	P	P	P	P
	ASME B16.3 (Malleable iron)	2.2.6.7.	N	N	N	N	N	P	P	P	P
Stainless steel pipe	ASTM A 312/A 312M	2.2.6.11.	P	P	P	P	P	P	P	P	P
Stainless steel tube	ASTM A 269	2.2.6.15.	N	N	N	N	N	P	P	P	P

Welded and seamless steel galvanized pipe	ASTM A 53/A 53M	2.2.6.8.	P	N	N	P	N	P(8)	P(8)	P(8)	P(8)
Corrugated steel galvanized pipe	CSA G401	2.2.6.9.	N	N	P(9)	N	N	N	N	N	N
Sheet metal pipe(10)	—	2.2.6.10.	N	N	N	N	N	N	N	N	N
Copper and brass pipe	ASTM B 42 (Copper)	2.2.7.1.	P	P	P	P	P	P	P	P	P
	ASTM B 43 (Red brass)	2.2.7.1.	P	P	P	P	P	P	P	P	P
Brass or bronze threaded water fittings	ASME B16.15	2.2.7.3.	N	N	N	N	N	P	P	P	P
Copper tube											
Types K and L hard temper	ASTM B 88	2.2.7.4.	P	P	P	P	P	P	P	N	N
Types K and L soft temper	ASTM B 88	2.2.7.4.	N	N	N	N	N	P	P	P	P
Type M hard temper	ASTM B 88	2.2.7.4.	P	N	N	P	N	P	P	N	N
Type M soft temper	ASTM B 88	2.2.7.4.	N	N	N	N	N	N	N	N	N
Type DWV	ASTM B 306	2.2.7.4.	P(11)	N	N	P(11)	N	N	N	N	N
Solder-joint drainage fittings	ASME B16.23	2.2.7.5.	P	P	P	P	P	N	N	N	N
	ASME B16.29										
Solder-joint water fittings	ASME B16.18	2.2.7.6.	N	N	N	P	P	P	P	P	P
	ASME B16.22										
Lead waste pipe	—	2.2.7.8.	P(4)(5)	P	N	P(4)(5)	P	N	N	N	N

N = Not permitted P = Permitted

Notes to Table A-2.2.5., 2.2.6. and 2.2.7.:
(1) Where fire stops are pierced by pipes, the integrity of the fire stop must be maintained.
(2) Gasketted joints required.
(3) Permitted only for water service pipe.
(4) Combustible piping in noncombustible construction is subject to the requirements of Sentence 3.1.5.19.(1) of Division B of the NBC.
(5) Combustible piping that penetrates a fire separation is subject to the requirements in Articles 3.1.9.1., 9.10.9.6. and 9.10.9.7. of Division B of the NBC.
(6) Not permitted in hot water systems.
(7) Not to exceed design temperature and design pressure stated in Sentence 2.2.5.8.(2).
(8) Permitted only in buildings of industrial occupancy as described in the NBC, or for the repair of existing galvanized steel piping systems.
(9) Permitted underground only in a storm drainage system.
(10) Permitted only for an external leader.
(11) Not permitted for the fixture drain or vent below the flood level rim of a flush-valve-operated urinal.

A-2.2.5.2.(3) Concrete Fittings. Concrete fittings fabricated on the site from lengths of pipe may have proven acceptable on the basis of past performance in some localities and their acceptance under this Code may be warranted.

A-2.2.5.5.(1) Polyethylene Pipe Used Underground. Joints within the high-density polyethylene pipe (HDPE) shall be heat-fused according to the manufacturer’s instructions. Joints between HDPE pipes and other materials shall be made with a suitable hubless coupling.

A-2.2.5.6.(1) Crosslinked Polyethylene Pipe and Fittings. There are some special installation requirements for the use of crosslinked polyethylene pipe and its associated fittings. Reference should, therefore, be made to the installation information in CAN/CSA-B137.5, “Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.”

A-2.2.5.9. to 2.2.5.11. Solvent Cement. CAN/CSA-B137.6, “Chlorinated Polyvinylchloride (CPVC) Pipe, Tubing, and Fittings for Hot- and Cold-Water Distribution Systems,” CAN/CSA-B181.1, “Acrylonitrile-Butadiene-Styrene (ABS) Drain, Waste, and Vent Pipe and Pipe Fittings,” and CAN/CSA-B181.2, “Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Drain, Waste, and Vent Pipe and Pipe Fittings,” reference ASTM D 3138, “Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components,” which specifies the colour of the solvent cement. PVC cement shall be grey, ABS cement shall be yellow, CPVC cement shall be clear and transition cement shall be white. The standard colour allows Code users to readily determine if the correct solvent cement has been used. It should be noted that a transition cement is not an all-purpose cement.

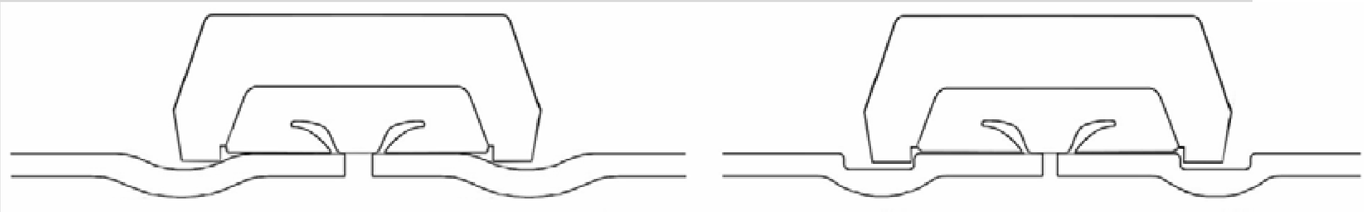
A-2.2.5.12.(1) Polyethylene/Aluminum/Polyethylene Composite Pipe and Fittings. There are some special installation requirements for the use of polyethylene/aluminum/polyethylene composite pipe and fittings. Reference should, therefore, be made to the installation information in CAN/CSA-B137.9, “Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure-Pipe Systems.”

A-2.2.5.13.(1) Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene Composite Pressure Pipe and Fittings. There are some special installation requirements for the use of crosslinked polyethylene/aluminum/crosslinked polyethylene composite pipe and fittings. Reference should, therefore, be made to the installation information in CAN/CSA-B137.10, “Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Composite Pressure-Pipe Systems.”

A-2.2.5.14.(1) Polypropylene Pipe and Fittings. There are some special installation requirements for the use of polypropylene pipe and fittings. Reference should, therefore, be made to the installation information in CAN/CSA-B137.11, “Polypropylene (PP-R) Pipe and Fittings for Pressure Applications.”

A-2.2.6.8.(3) Galvanized Steel Pipe. The use of galvanized steel pipe and fittings in a water distribution system may have proven acceptable on the basis of past performance in some localities and its acceptance under this Code may be warranted.

A-2.2.10.4.(1) Fittings in Pressure Piping Applications Piping used in pressure applications are to be grooved and constructed using tools specifically designed for that piping material. It is important that all groove profiles are to meet the fitting manufacturer's guidelines and conform to CSA-B242 "Groove and Shoulder-Type Mechanical Pipe Couplings." Overly shallow roll grooved or cut connections may result in reduced working pressures at the joint or the failure of the connection due to insufficient engagement of the coupling or from slippage at the joint. Conversely, grooves or cuts that are overly deep may result in failures of the pipe stemming from corrosion or stress concentrations at the joints.



Incorrect Correct

Note: Image is exaggerated for clarity

Figure A-2.2.10.4.(1)
Insufficient Key Engagement of Fitting in Roll Grooved Connection

A-2.2.10.5.(1) Saddle Hubs or Fittings. Saddle hubs or fittings may have proven acceptable on the basis of past performance in some localities and their acceptance under this Code may be warranted.

A-2.2.10.6.(2) Supply Fittings and Individual Shower Heads. Flow restriction devices within supply fittings should not be removed.
Due to the low flow rate of public lavatory faucets, design consideration should be given to the wait time for hot water to be delivered to each fixture.

A-2.2.10.6.(3) Automatic Compensating Valves. When replacing a shower head, the appropriate shower valve with a suitable compensating feature matching the flow rate should be chosen to decrease the possibility that users will suffer thermal shock. The water flow rate of automatic compensating mixing valves can be found in ASSE 1016/ASME 112.1016/CSA B125.16, "Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations."

A-2.2.10.6.(4) and (5) Automatic Shut-off of Water Flow. Examples of water shut-off devices include occupant sensors and self-closing valves.

A-2.2.10.7. Hot Water Temperature. Hot water delivered at 60°C will severely burn human skin in 1 to 5 seconds. At 49°C, the time for a full thickness scald burn to occur is 10 minutes. Children, the elderly and persons with disabilities are particularly at risk of scald burns. Compliance with Article 2.2.10.7. will reduce the risk of scalding in showers and bathtubs, and reduce the risk of thermal shock from wall-mounted shower heads. These requirements apply to all occupancies, not just residential occupancies. The water outlet temperature at other fixtures, such as lavatories, sinks, laundry trays or bidets, is not addressed by Article 2.2.10.7., but a scald risk may exist at such fixtures nonetheless.

A-2.2.10.9.(3) Bubblers. Bubblers installed on other than drinking fountains may have proven acceptable on the basis of past performance in some localities and their acceptance under this Code may be warranted.

A-2.2.10.16.(1) Air Admittance Valve. An air admittance valve is a device that is closed by gravity and seals the vent terminal at zero differential pressure (no flow conditions) and under positive internal pressures. The valve allows air to enter the drainage system without the use of a vent extended to outside air and prevents trap siphonage.

The material of the diaphragm can be damaged by exposure to acidic or corrosive fumes in the ambient atmosphere; therefore, air admittance valves should not be installed in locations where there is a potential for exposure to such fumes.

A-2.2.10.17. Water Treatment Systems. The potential risk for substances to be introduced into the drinking water that may endanger health must be considered. All proposals to install water treatment devices shall address:

- Seismic and environmental concerns,
- Monitoring and tampering detection,
- Protection of the city water supply and interface with the existing distribution system,
- Notification of end users and record keeping,
- Chemical storage and security and
- Spill containment and procedures in the event of an equipment malfunction such as incorrect dosing.

For proposed new installations, the *Chief Building Official* will require:

- A technical report from a *registered professional* with appropriate qualifications and training identifying the context of installation, performance specifications of the proposed equipment, and the technical basis for the installation and means to protect the general public and end users,
- A piping diagram of the proposed water distribution system showing the type of existing piping and equipment, and
- A letter from the owner(s) stating that all end users have been informed of the proposal to introduce such chemicals into the drinking water and a sign has been posted in a conspicuous place 30 days before the proposed date of installation detailing the scope of the installation, the name of the chemicals being introduced and the relevant safety data sheets (SDS).

A-2.2.11.4.(2) Non-recirculating Applications. Non-recirculating water systems, such as once-through cooling equipment, waste large volumes of drinking water. Only in exceptional circumstances will a request for an operating permit be considered, such as a life safety application for which a registered professional has formally documented that there is no practical alternative to once-through cooling.

A-2.3.2.6.(1) Mechanical Joints. Storm sewer blockage can cause mechanical joints at the base of leaders to fail, which results in flooding. The failure occurs because the cleanout joints at the base of the rainwater leaders are not able to withstand the water column pressure. To avoid such failures, it is necessary to ensure that storm water systems installed using mechanical joints be braced and/or restrained at the ends of branches, changes in direction and elevation, at dead ends and at other locations as required by the manufacturer to prevent the separation of joints due to internal pressure, mechanical stress or seismic events. Care should be taken to replace cleanouts properly after maintenance or testing.

A-2.3.3.9. Linear Expansion.

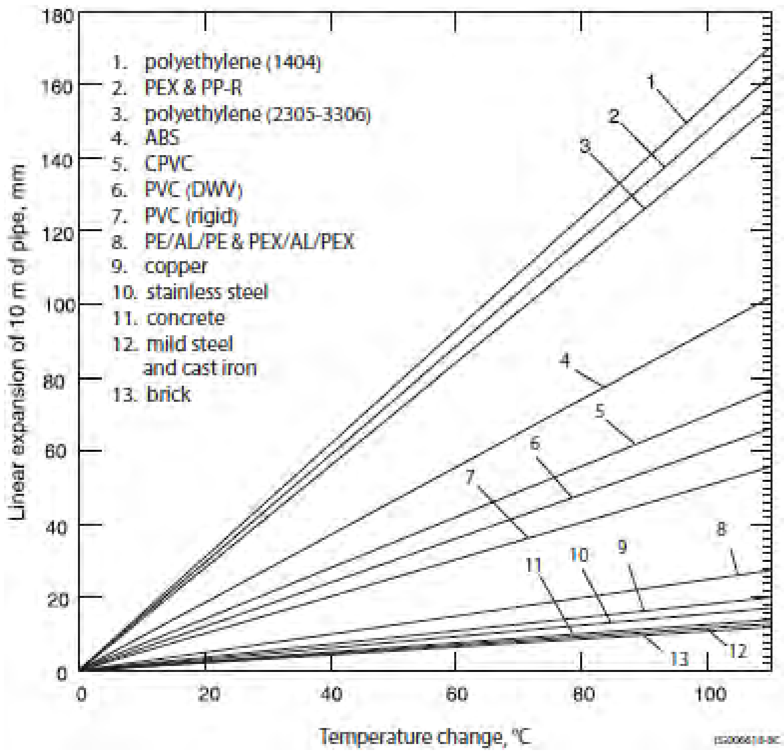


Figure A-2.3.3.9.
Linear Expansion

Example: To determine the expansion of 20 m of ABS pipe for a temperature change from 10°C to 60°C.
Temperature change = 60 – 10 = 50°C,
Enter the chart at 50°C, read up to ABS line, and then across to the mm scale = 47 mm/10 m of pipe,
∴ change in length of 20 m of pipe =

$$\frac{20}{10} \times 47 - 94mm$$

A-2.3.3.9.(1) Expansion and Contraction. Expansion and contraction in piping systems may be accommodated in a number of ways including, but not limited to, piping design and layout, material selection, and the inclusion of expansion joints.

A-2.3.3.11.(2) Air Break.

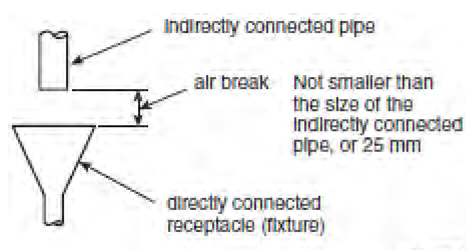


Figure A-2.3.3.11.(2)
Air Break

A-2.3.4.6.(1) Support for Underground Piping. See explanation for Subsection 2.3.5. for additional protection required for underground pipes. Permitted installations are shown in Figure A-2.3.4.6.(1)(a). The methods of support shown in Figure A-2.3.4.6.(1)(b) are not permitted because the base does not provide firm and continuous support for the pipe.

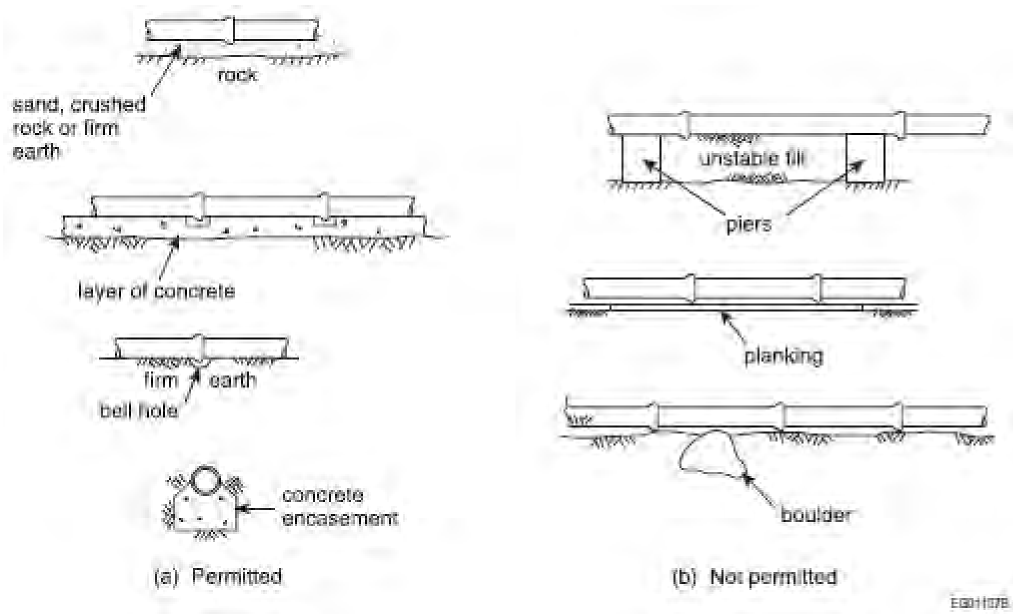


Figure A-2.3.4.6.(1)
Support for Underground Piping

A-2.3.5.1.(1) Backfilling of Pipe Trench. Stronger pipes may be required in deep fill or under driveways, parking lots, etc., and compaction for the full depth of the trench may be necessary.

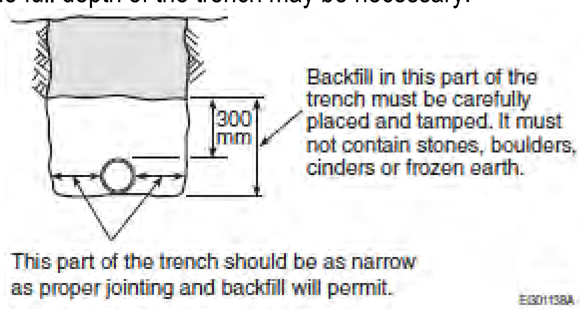


Figure A-2.3.5.1.(1)
Backfilling of Pipe Trench

A-2.3.5.2.(1) Protection of Underground Non-Metallic Pipes.

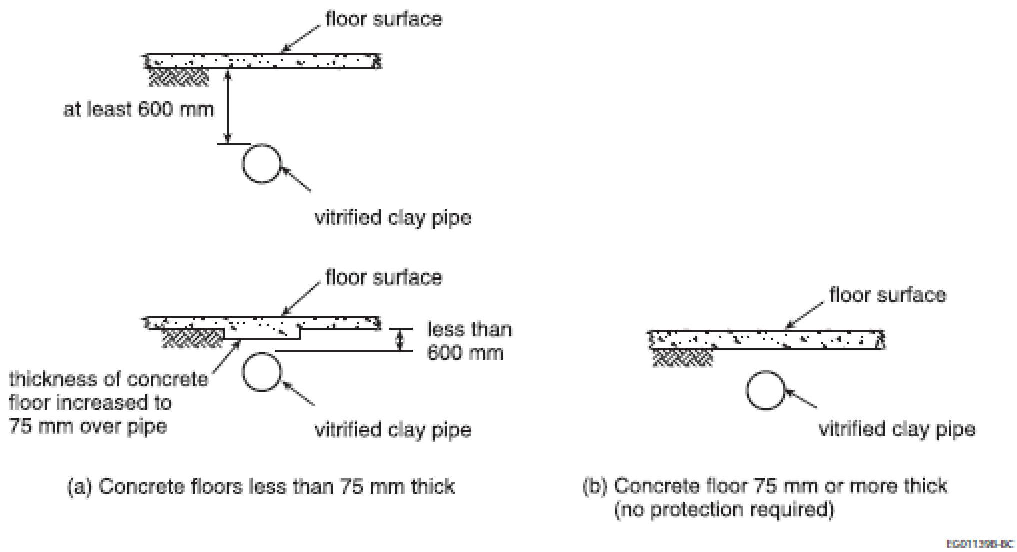


Figure A-2.3.5.2.(1)
Protection of Underground Non-Metallic Pipes

A-2.3.5.4. Protection of Piping Against Freezing. The TIAC "Mechanical Insulation Best Practices Guide" is a comprehensive source of information on the selection, installation and proper use of thermal insulation materials. (Note that Section 4 of this Guide is not included in the scope of this Note as it contains information on proprietary products, which are not within the mandate of the Code.)

A-2.3.7.2.(2) Pressure-Testing of Potable Water Systems. The plastic piping manufacturer should be consulted to determine the appropriateness of using air to pressure-test the piping system.

A-2.4.2.1.(1)(a)(ii) and (e)(vi) Indirect Connections. See Sentence 2.4.5.1.(4) for trapping requirements for indirectly connected fixtures.
See Sentence 2.4.7.1.(9) for cleanouts on drip pipes for food receptacles or display cases.

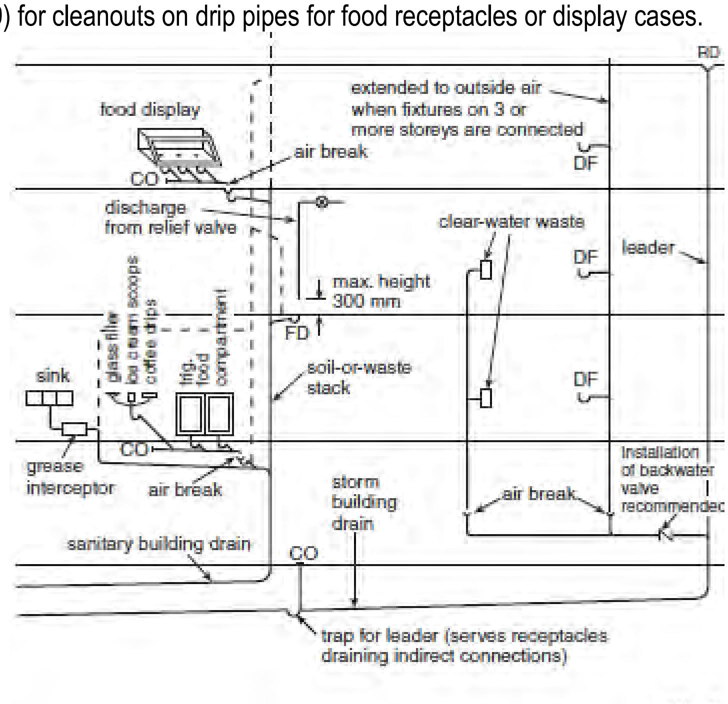


Figure A-2.4.2.1.(1)(a)(ii) and (e)(vi)

Indirect Connections

A-2.4.2.1.(2) Soil-or-Waste Pipe Connections.

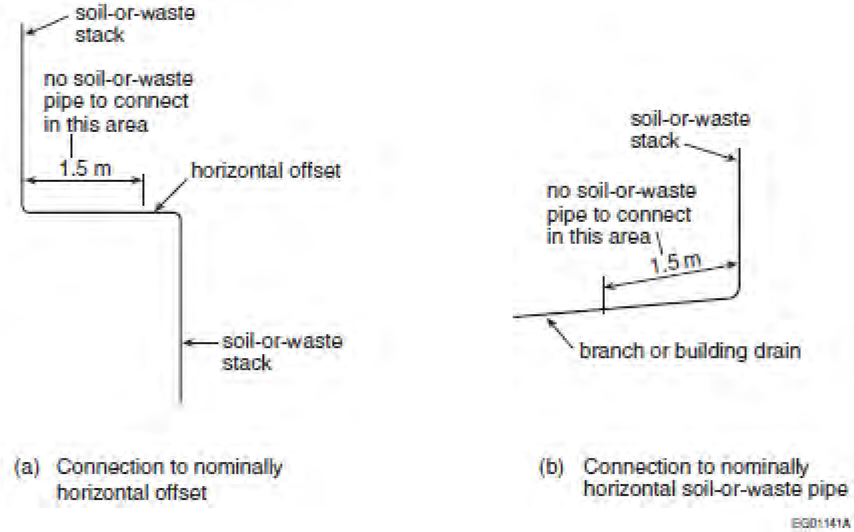


Figure A-2.4.2.1.(2)
Soil-or-Waste Pipe Connections

A-2.4.2.1.(4) Suds Pressure Zones. High sudsing detergents used in clothes washers produce suds that tend to disrupt the venting action of venting systems and can also spread through the lower portions of multi-storey drainage systems. The more turbulence, the greater the suds. One solution that avoids the creation of suds pressure zones involves connecting the suds-producing stack downstream of all other stacks and increasing the size of the horizontal building drain to achieve a greater flow of air and water. Using streamlined fittings, such as wyes, tends to reduce suds formation. Check valves or backwater valves in fixture outlet pipes have also been used to correct problem installations.

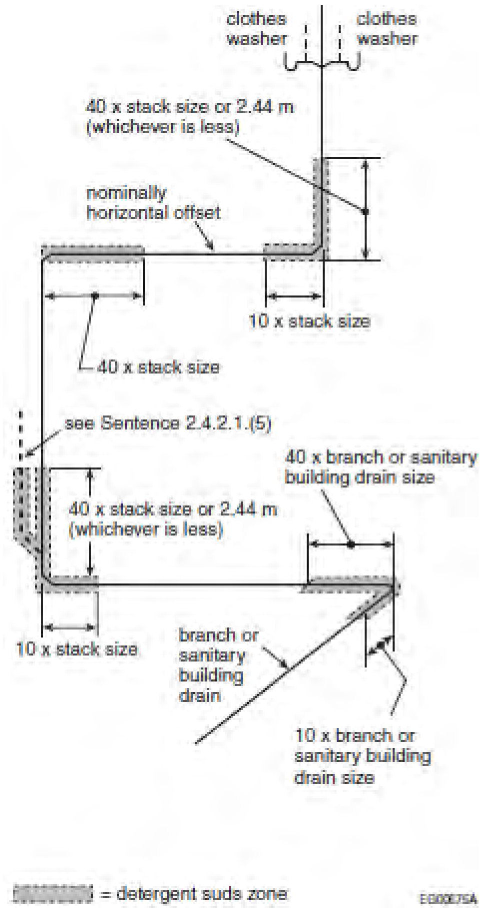


Figure A-2.4.2.1.(4)
Suds Pressure Zones

A-2.4.3.3.(1) Waste with Organic Solids. Equipment such as garbage grinders and potato peelers produces waste with organic solids. These devices reduce most waste into small-sized particles that will flow easily through the drainage system. However, if they are located upstream of the interceptor, the particles could block the interceptor.

A-2.4.4.3.(1) Grease Interceptors. Grease interceptors may be required when it is considered that the discharge of fats, oil or grease may impair the drainage system. Information on the design and sizing of grease interceptors can be found in ASPE 2012, "Plumbing Engineering Design Handbook, Volume 4, Chapter 8, Grease Interceptors."

A-2.4.4.4.(1) Bio-hazardous Waste. Chemically loaded and bio-hazardous wastes can be dangerous to private or public sewer systems and hazardous to people. The treatment of corrosive and acid waste is mandated by this Code. The treatment of chemically loaded effluents is usually regulated by sewage collecting and treatment authorities. The treatment of bio-hazardous waste should follow "good engineering practice," such as that described in Laboratory Biosafety Guidelines published by Health Canada. It should be noted that bio-hazardous waste disposal systems require specific engineering expertise and remain outside the scope of this Code.

A-2.4.5.1.(2) Trapping of Sinks and Laundry Trays.

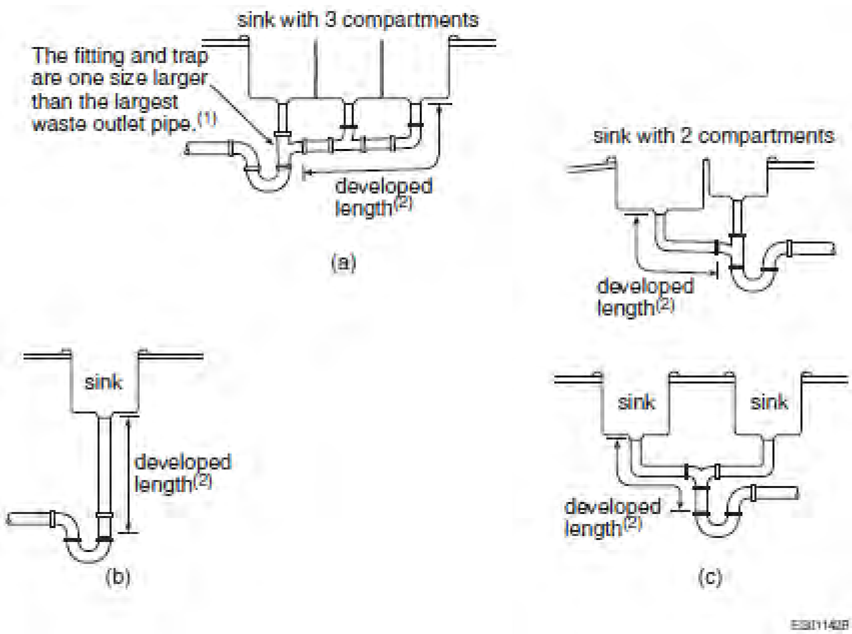


Figure A-2.4.5.1.(2)
Trapping of Sinks and Laundry Trays

Notes to Figure A-2.4.5.1.(2):
(1) See Sentence 2.4.9.3.(2).
(2) The developed length of the fixture outlet pipe shall not exceed 1 200 mm. See Article 2.4.8.2.

A-2.4.5.1.(3) Single Traps for Fixture Groups.

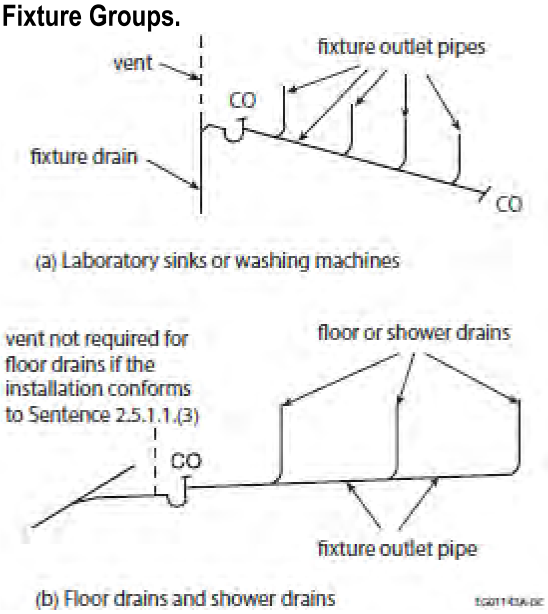


Figure A-2.4.5.1.(3)
Single Traps for Fixture Groups

A-2.4.5.1.(5) Location of Trap or Interceptor. An interceptor that replaces a trap must be vented in the same way as the trap it replaces. (See Note A-2.4.2.1.(1)(a)(ii) and (e)(vi).) Where an interceptor other than an oil interceptor serves a group of fixtures requiring more than one trap, each fixture must be properly trapped and vented. (See Article 2.5.5.2. for venting of oil interceptors.)

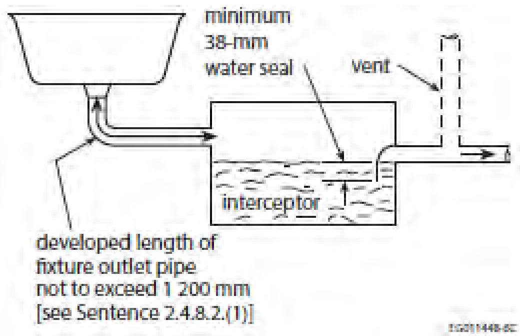


Figure A-2.4.5.1.(5)
Location of Trap or Interceptor

A-2.4.5.2.(1) Untrapped Leader. When an untrapped leader drains to a combined building sewer, clearance requirements are the same as for vent terminals. (See also Note A-2.5.6.5.(4).)

A-2.4.5.3.(1) Subsoil Drainage Connections. This Code does not regulate the installation of subsoil drainage pipes, but does regulate the connection of such pipes to the plumbing system. The intent of this Article is to place a trap between the subsoil drainage pipe and the sanitary drainage system. The cleanout must be installed in accordance with Sentence 2.4.7.1.(2). A trap or sump may be provided specifically for the subsoil drains, or advantage may be taken of the trap of a floor drain or storm water sump as shown in Figure A-2.4.5.3.(1).

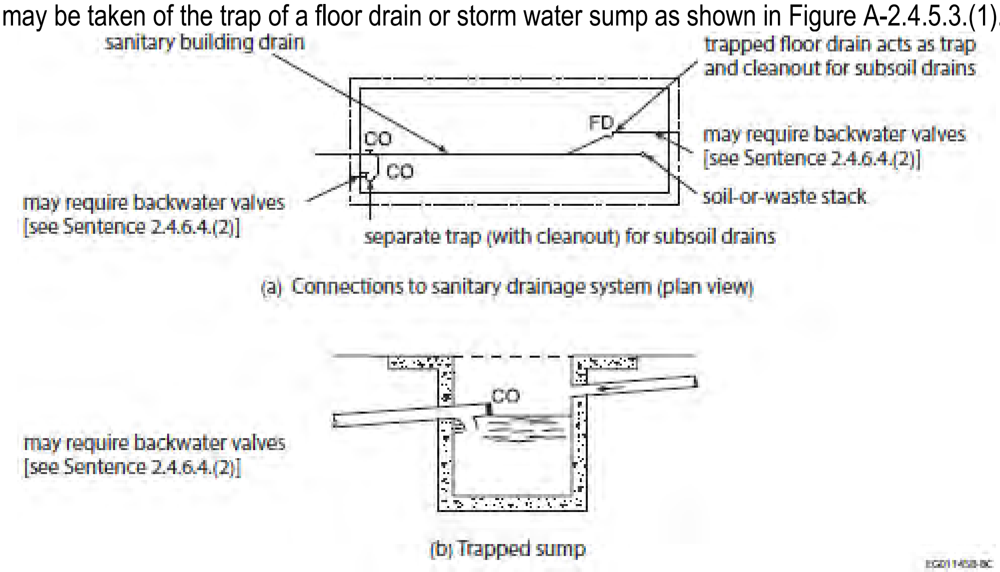


Figure A-2.4.5.3.(1)
Subsoil Drainage Connections

A-2.4.5.4.(1) Location of Building Traps.

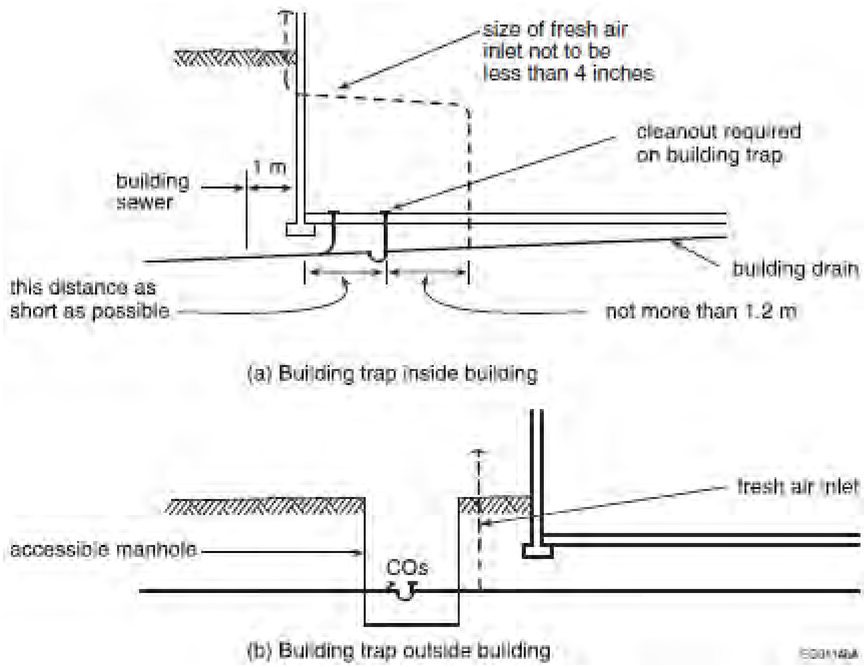


Figure A-2.4.5.4.(1)
Location of Building Traps

A-2.4.5.5.(1) Maintaining Trap Seals. Periodic manual replenishment of the water in a trap is considered to be an equally effective means of maintaining the trap seal in floor drains in residences. Under pressure differential conditions, special measures are necessary to maintain trap seals.

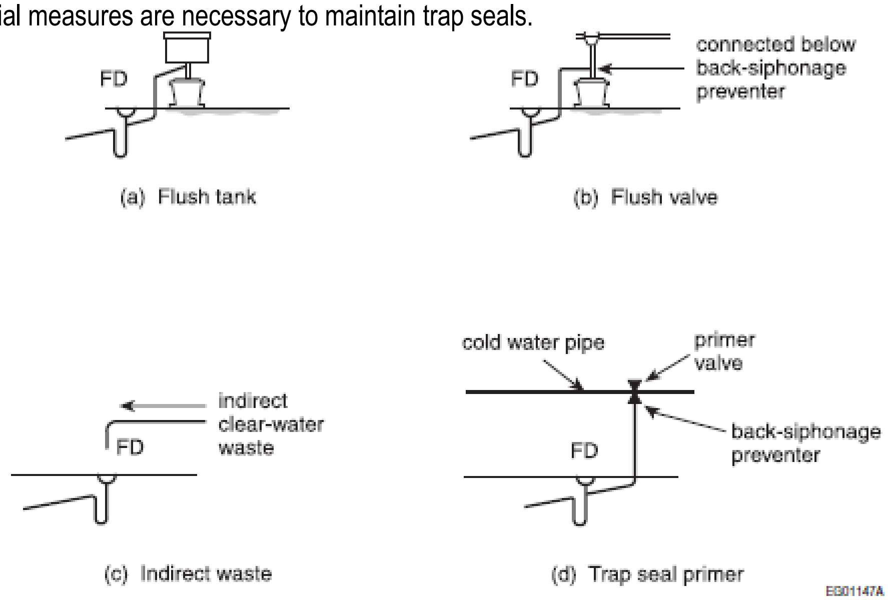


Figure A-2.4.5.5.(1)
Maintaining Trap Seals

A-2.4.6.3. Arrangement of Piping at Sump. In most installations, controls will be installed in conjunction with a float to automatically empty the sump. If such controls are not provided, the capacity of the sump should equal the maximum inflow to the sump that is expected to occur during any 24 h period.

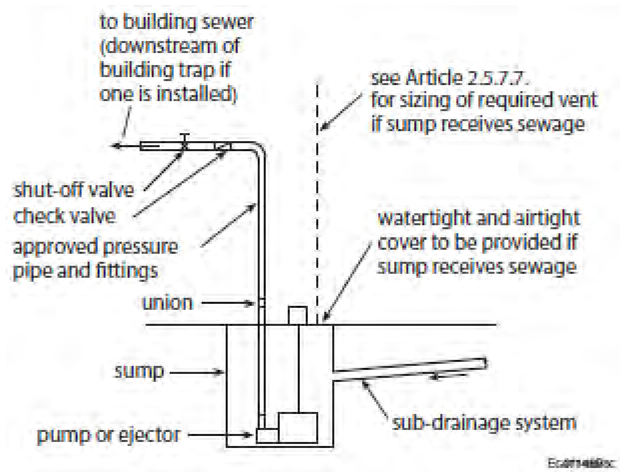


Figure A-2.4.6.3.
Arrangement of Piping at Sump

A-2.4.6.4.(1) Backwater Valve or Gate Valve. The installation of a backwater valve or a gate valve in a building drain or in a building sewer may have proven acceptable on the basis of past performance in some localities, and their acceptance under this Code may be warranted.

A-2.4.7.1.(6) Cleanouts for Drainage Systems. To accommodate the limitations of sewer cleaning equipment, the cleanout should be located as close as possible to the exterior wall of the building, either inside or outside, and be accessible for sewer cleaning equipment.

A-2.4.7.1.(9) Cleanouts for Food Receptacle Drip Pipes.

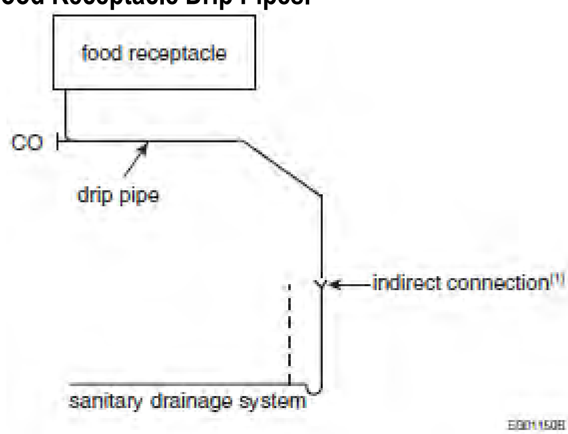


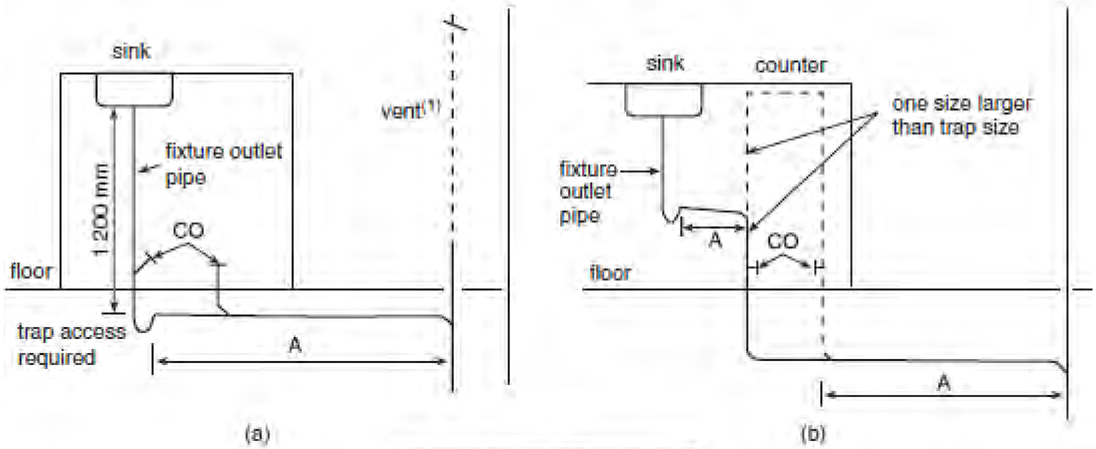
Figure A-2.4.7.1.(9)
Cleanouts for Food Receptacle Drip Pipes

Note to Figure A-2.4.7.1.(9):
(1) See Article 2.4.2.1.

A-2.4.7.1.(10) Cleanouts for Fixture Drains. A trap cleanout plug cannot be used as a cleanout for a fixture drain.

A-2.4.8.1.(1) Minimum Slope. Although slopes below 1 in 100 are permitted for pipes over 4 inches, they should be used only where necessary. Steeper slopes and higher velocities will help to keep pipes clean by moving heavier solids that might tend to clog the pipes.

A-2.4.8.2.(1) Island Fixture Installation.



Fixture trap size, in.	Length of A,(2) m
1½	1.8
2	2.4
3	3.6

Figure A-2.4.8.2.(1)
Island Fixture Installation(3)

Notes to Figure A-2.4.8.2.(1):
(1) Vent size to be in accordance with Article 2.5.6.3.
(2) Length of A depends on trap size. Fall cannot exceed size.
(3) See also Article 2.5.1.1.

A-Table 2.4.9.3. Hydraulic Loads for Laundry Traps and Floor Drains. When determining the hydraulic load on a pipe, no allowance need be made for a load from a domestic clothes washer when discharged to a laundry tray since the hydraulic load from the laundry tray is sufficient. Also no hydraulic load is required from a floor drain in a washroom since it is for emergency use only.

A-2.4.9.3.(2) Continuous Wastes. Fixture outlet pipes that are common to 2 or 3 compartments or fixtures are sometimes referred to as continuous wastes and are not considered to be branches. (See also Note A-2.4.5.1.(2).)

A-2.4.9.3.(3) Standpipe Illustration.

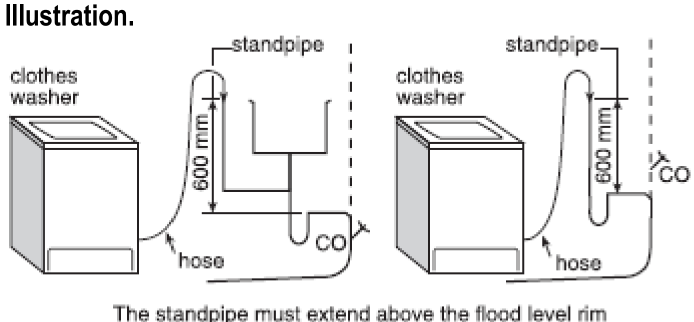


Figure A-2.4.9.3.(3)
Standpipe Installation for Clothes Washers

A-2.4.10. Determination of Hydraulic Loads and Drainage Pipe Sizes.

Hydraulic Loads

The hydraulic load that is imposed by a fixture is represented by a factor called a fixture unit. Fixture units are dimensionless and take into account the rate of discharge, time of discharge and frequency of discharge of the fixture.
Confusion often arises when attempts are made to convert fixture units to litres per second because there is no straightforward relationship between the two. The proportion of the total number of fixtures that can be expected to discharge simultaneously in a large system is smaller than in a small system. For example, doubling the number of fixtures in a system will not double the peak flow that the system must carry, although of course the flow will be increased somewhat. Figure A-2.4.10.-A shows the relationship that was used in constructing the tables of capacities of stacks, branches, sanitary building drains and sanitary building sewers (Tables 2.4.10.6.-A to 2.4.10.6.-C).
Although the curve in Figure A-2.4.10.-A was used to prepare the Code tables, it was not included in the National Plumbing Code. Instead, a single approximate conversion factor is given in the Code so that a continuous flow from a fixture may be converted from litres per second to fixture units in order to determine the total hydraulic load on the sanitary drainage system. The conversion factor, which is given in Sentence 2.4.10.3.(1), is 31.7 fixture units per litres per second. The discharge from a continuous flow fixture in litres per second when multiplied by 31.7 gives the hydraulic load in fixture units, and that load is added to the fixture unit load from other fixtures to give the total load that the sanitary drainage pipe must carry.

The hydraulic load that is produced by storm water runoff depends both on the size of the area that is drained and local rainfall intensity. The capacities of storm drainage pipes and combined sewers in Tables 2.4.10.9., 2.4.10.10. and 2.4.10.11. have been expressed in terms of the number of litres that they can carry when the local rainfall intensity is 1 mm in 15 min. The hydraulic load for a particular location is obtained by simply multiplying the rainfall intensity figure given in Appendix C of Division B of the NBC by the actual area drained as specified in Sentence 2.4.10.4.(1).

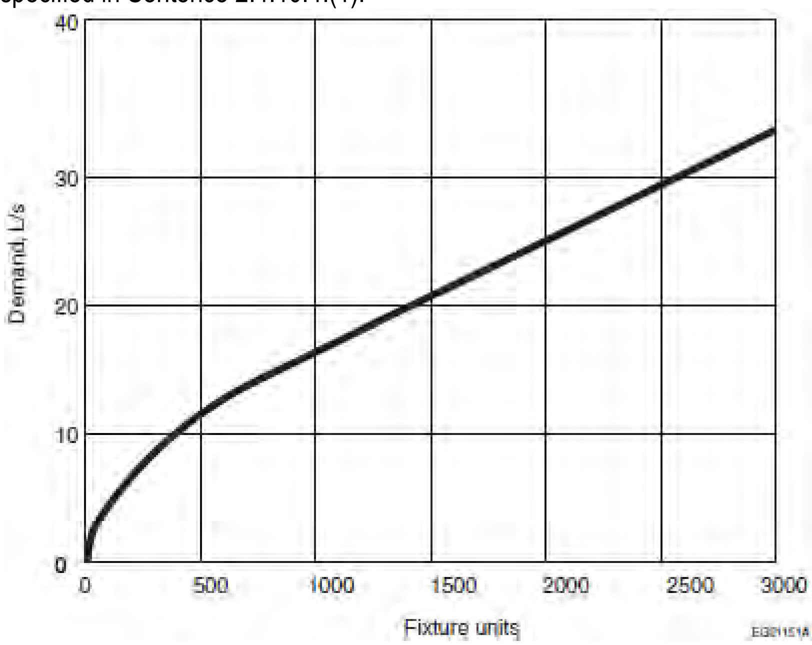


Figure A-2.4.10.-A

Relationship between Fixture Units and Demand

In the case of restricted-flow drains, the hydraulic load from storm water runoff must be calculated using manufacturer discharge flow rates of specific drains in the case of roofs, and water-flow restrictors in the case of paved areas.
When plumbing fixtures are connected to a combined sewer, the hydraulic load from the fixtures must be converted from fixture units to litres or, in the case of continuous flow, from litres per second to litres so that

these loads can be added to the hydraulic loads from roofs and paved surfaces. As already pointed out, the relationship between fixture units and litres per second and, consequently, the relationship between fixture units and litres is not straightforward, and an approximate conversion factor has been adopted. The conversion factor given in Sentence 2.4.10.5.(1) is 9.1 L/fixture unit, except where the load is less than 260 fixture units in which case a round figure of 2 360 L is to be used. In the case of continuous-flow fixtures that are connected to combined sewers or storm sewers, the conversion factor given in Sentence 2.4.10.3.(2) is 900 L per L/s. This conversion factor is not an approximation but an exact calculation.

The conversion factors given in Sentences 2.4.10.3.(1) and 2.4.10.5.(1) are designed to convert in one direction only, and must not be used to convert from fixture units to litres per second in the one instance, nor from litres to fixture units in the other instance.

In summary, it should be noted that

(a) in sanitary drainage systems, all hydraulic loads are converted to fixture units, and

(b) in storm drainage systems or combined drainage systems, all hydraulic loads are converted to litres.

Procedure for Selecting Pipe Sizes

The following is an outline, with examples, of the procedures to be followed in determining the size of each section of drainage piping.

(1) Sanitary drainage pipes, such as branches, stacks, building drains or building sewers:

(a) Determine the load in fixture units from all fixtures except continuous-flow fixtures;

(b) Determine the load in litres per second from all continuous-flow fixtures and multiply the number of litres per second by 31.7 to obtain the number of fixture units;

(c) Add loads (a) and (b) to obtain the total hydraulic load on the pipe in fixture units; and

(d) Consult the appropriate table from Table 2.4.10.6.-A, 2.4.10.6.-B or 2.4.10.6.-C to select the pipe size.

(Note that no pipe size may be smaller than that permitted in Subsection 2.4.9.)

(2) Storm drainage pipes, such as gutters, leaders, horizontal pipes, building drains or building sewers:

(a) Determine the area in square metres of roofs and paved surfaces according to Sentence 2.4.10.4.(1);

(b) Determine the local rainfall intensity (15 min rainfall) from Appendix C of Division B of the NBC;

(c) Multiply (a) by (b) to obtain the hydraulic load in litres;

(d) If a fixture discharges a continuous flow to the storm system, multiply its load in litres per second by 900 to obtain the hydraulic load in litres;

(e) If flow control roof drains are used, compute the discharge rate based on rain intensity, retention duration, accumulation height and roof area from the roof drain manufacturers' data;

(f) Add loads (c) or (e), and (d) to obtain the total hydraulic load on the pipe in litres; and

(g) Consult the appropriate table from Table 2.4.10.9., 2.4.10.10. or 2.4.10.11. to select the pipe or gutter size.

(Note that no pipe may be smaller than that permitted in Subsection 2.4.9.)

(3) Combined drainage pipes, such as building sewers:

(a) Determine the total load in fixture units from all fixtures except continuous-flow fixtures;

(b) If the fixture unit load exceeds 260, multiply it by 9.1 to determine the equivalent hydraulic load in litres. If the fixture unit load is 260 or fewer fixture units, the hydraulic load is 2 360 L;

(c) Obtain the hydraulic load from roofs and paved surfaces in the same manner as for storm drains (See 2(a), (b), (c) and (e));

(d) Obtain the hydraulic load in litres from any continuous-flow source that is connected to the sanitary or storm drainage system in the same manner as for storm drainage pipes (See 2(d));
(e) Add hydraulic loads (b), (c) and (d) to obtain the total hydraulic load on the pipe in litres; and
(f) Consult Table 2.4.10.9. to select the pipe size.
(Note that no pipe may be smaller than that permitted in Subsection 2.4.9.)

Examples
Example 1: Determination of the size of storm drainage components for the building shown in Figures A-2.4.10.-B and A-2.4.10.-C
Step No. 1: Determine the hydraulic load from the roofs.

Area drained by gutter	=	162 m^2
Area drained by roof drain	=	230.4 m^2
If the local rainfall intensity is 25 mm:		
the load on the gutter (leader No. 2) is (25 × 162)	=	4 050 L
the load on the roof drain (leader No. 1) is (25 × 230.4)	=	5 760 L
If the local rainfall intensity is 15 mm:		
the load on the gutter (leader No. 2) is (15 × 162)	=	2 430 L
the load on the roof drain (leader No. 1) is (15 × 230.4)	=	3 456 L

Step No. 2: Determine the size of storm drainage components.
Using the appropriate hydraulic loads, the size of storm drainage components can be determined from Tables 2.4.10.9., 2.4.10.10. and 2.4.10.11. These values are tabulated in Table A-2.4.10. for rainfall intensities of 25 mm and 15 mm in 15 min.

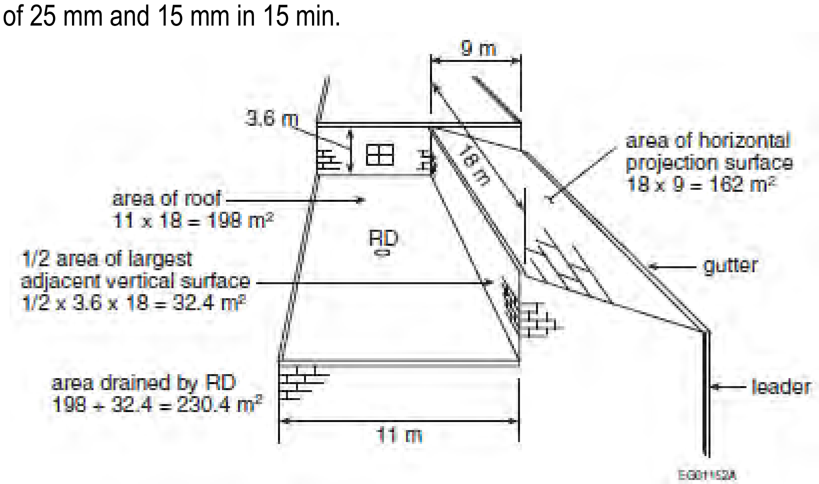


Figure A-2.4.10.-B
Storm Drainage Areas (Example 1)

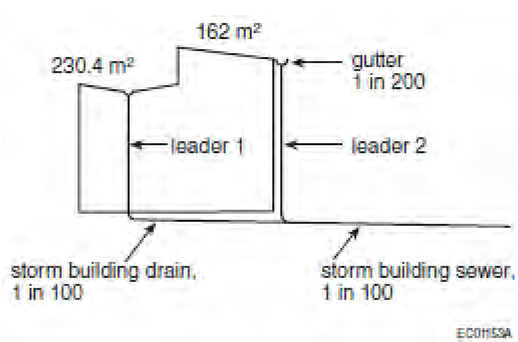


Figure A-2.4.10.-C
Storm Drainage Components (Example 1) (Elevation View)

Table A-2.4.10.
Storm Drainage Pipe Sizes (Example 1)
Forming Part of Note A-2.4.10.

	Area Drained, m^2	15-min Rainfall Intensity, mm				NPC Reference Table No.
		25		15		
		Hydraulic Load, L	Size, inches	Hydraulic Load, L	Size, inches	
Roof drain leader	230.4	5 760	4	3 456	3	2.4.10.11.
Gutter	162	4 050	8	2 430	7	2.4.10.10.
Gutter leader	162	4 050	3	2 430	2½	2.4.10.11.
Storm building drain	230.4	5 760	5	3 456	4	2.4.10.9.
Storm building sewer	395.8	9 895	6	5 936	5	2.4.10.9.

Example 2: Determination of the size of drainage pipes for buildings
Figure A-2.4.10.-D represents an office building with washrooms for men and women, a drinking fountain and cleaner's closet on each typical floor. The equipment room with facilities is located in the basement. The building is 18 m by 30 m and is to be built in Kitchener, Ontario.

A. Hydraulic Load per Typical Floor

5 WC @ 6	=	30 fixture units
2 UR @ 1½	=	3 fixture units
4 LAV @ 1½	=	6 fixture units
2 FD @ 3	=	6 fixture units
1 FS @ 3	=	3 fixture units
1 DF @ 1	=	1 fixture unit
		49 fixture units

The reader is left to calculate the size of the branches, one of which must be 4 inches and another 3 inches (See Subsection 2.4.9.). Therefore the smallest part of the stack must be 4 inches.

B. Hydraulic Load on Stack
5 storeys @ 49 fixture units = 245 fixture units
Table 2.4.10.6.-A permits 4-inch pipe. Use 4-inch pipe.

C. Hydraulic Load on Basement Branch

1 WC @ 6	=	6 fixture units
1 LAV @ 1	=	1 fixture unit
2 FD @ 3	=	6 fixture units
1 FS @ 3	=	3 fixture units

Semi-continuous Flow
0.23 L/s × 31.7 = 7 fixture units
23 fixture units
Table 2.4.10.6.-B permits 3-inch pipe. Use 3-inch pipe.

D. Hydraulic Load on Building Drain
From soil-or-waste stack 245 fixture units
From basement branch 23 fixture units
268 fixture units
Referring to Table 2.4.10.6.-C, at a slope of 1 in 50, a 4-inch pipe will carry 240 fixture units.
Referring to Table 2.4.10.6.-C, at a slope of 1 in 25, a 4-inch pipe will carry 300 fixture units.
For practical reasons, use a 4-inch pipe at a slope of not less than 1 in 32.

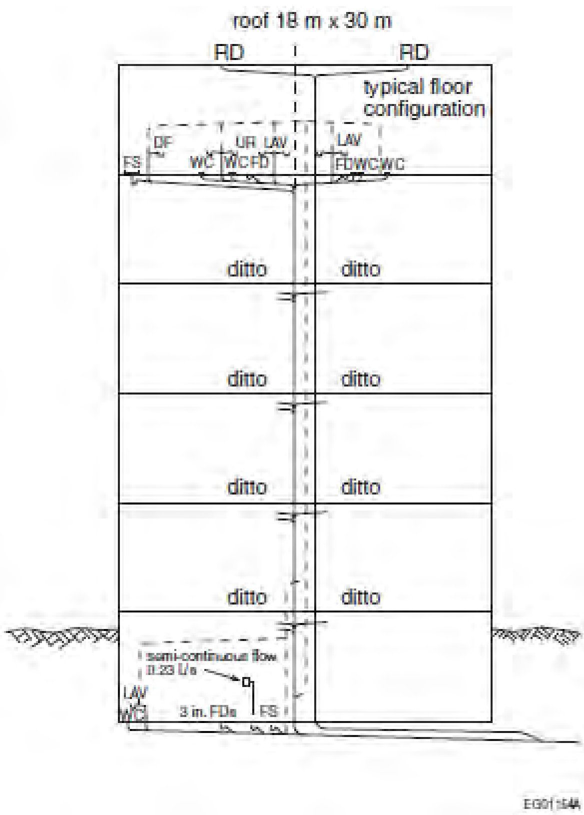


Figure A-2.4.10.-D
Building Drainage System (Example 2)

E. Storm Load
Area of roof 18 × 30 = 540 m^2
Rainfall intensity for Kitchener, taken from Appendix C of Division B of the NBC, is 28 mm in 15 min
Total hydraulic storm load = 28 × 540 = 15 120 L
Storm load on each roof drain = 15 120/2 = 7 560 L

F. Size of Horizontal Leaders
Referring to Table 2.4.10.9., at a slope of 1 in 25, a 4-inch pipe will carry a load of 8 430 L.
Referring to Table 2.4.10.9., at a slope of 1 in 100, a 5-inch pipe will carry a load of 7 650 L.
Referring to Table 2.4.10.9., at a slope of 1 in 133, a 6-inch pipe will carry a load of 10 700 L.
Therefore, use a 5-inch pipe at a slope of 1 in 100.

G. Size of Vertical Leader
Table 2.4.10.11. would permit a 5-inch pipe (19 500 L) but this size is not readily available. For practical reasons, use a 6-inch pipe.

H. Size of Storm Building Drains
Since a drainage pipe cannot be any smaller than any upstream pipes, the storm building drain must be at least 6 inches. Referring again to Table 2.4.10.9., a 6-inch pipe will carry a hydraulic load of 17 600 L at a slope of 1 in 50. Therefore use a 6-inch pipe at a slightly higher slope.

I. Size of Combined Building Sewer
(a) Total sanitary load excluding semi-continuous flow 260 fixture units converted to litres
(Clause 2.4.10.5.(1)(b)) × 9.1 = 2 366 L
(b) Semi-continuous flow 0.23 L/s converted to litres
(Sentence 2.4.10.3.(2)) × 900 = 207 L
(c) Storm load 15 120 L

Total hydraulic load 17 693 L
Referring to Table 2.4.10.9., at a slope of 1 in 50, a 6-inch pipe will carry 17 600 L.
Referring to Table 2.4.10.9., at a slope of 1 in 25, a 6-inch pipe will carry 24 900 L.
Therefore, use a 6-inch pipe at a slope of not less than 1 in 32.

A-2.4.10.4.(1) Rainfall Intensities. Climate information on rainfall intensities for various cities can be found in Appendix C of Division B of the NBC.

When calculating the hydraulic load from a roof or paved surface, it should be noted that a 1 mm depth of water on 1 m² of surface is equivalent to 1 L.

A-2.5.1.1.(3) Trapping of Floor Drains.

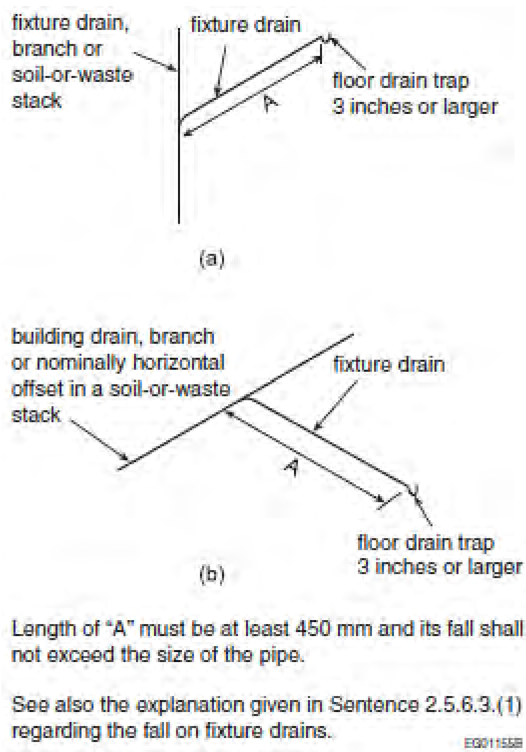


Figure A-2.5.1.1.(3)

Trapping of Floor Drains

A-2.5.1.1.(4) Venting not Required.

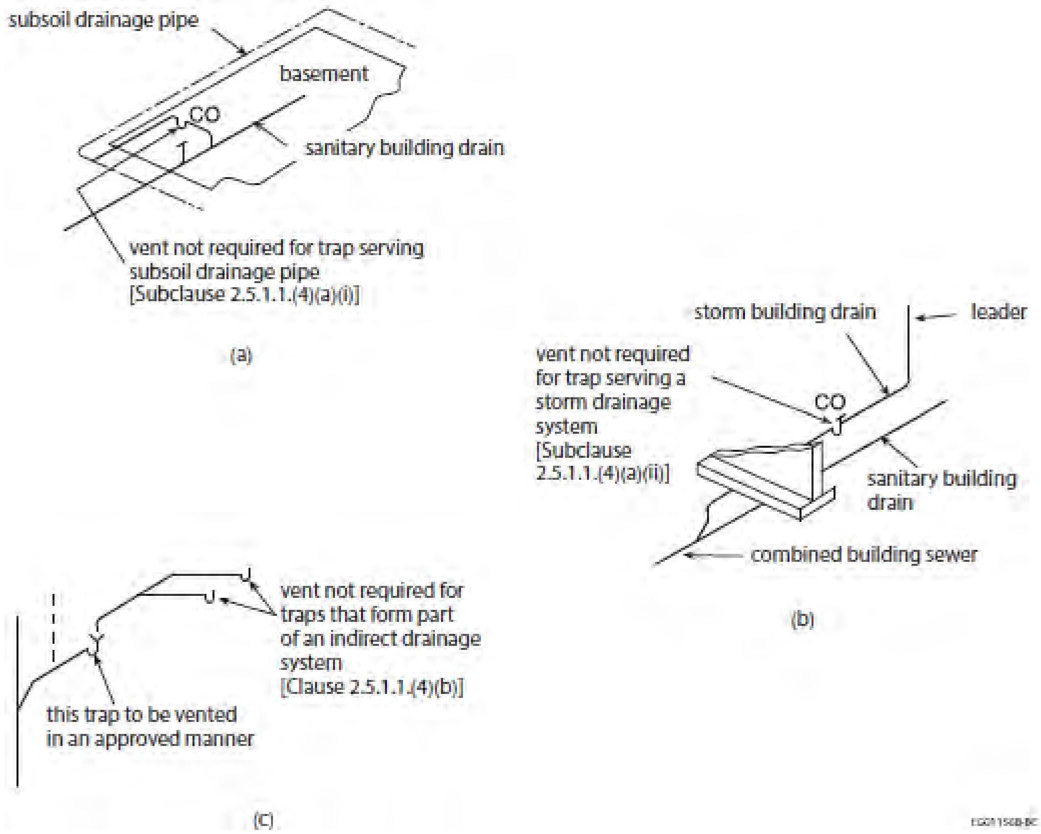


Figure A-2.5.1.1.(4)
Venting not Required

A-2.5.2.1. Wet Venting. Single-storey and multi-storey wet venting has been replaced with wet venting (Article 2.5.2.1.) and circuit venting (Article 2.5.3.1.).

The information and figures presented in this Note are examples of the most common installation practices that meet NPC requirements. However, the examples shown do not preclude other installations that would also conform to NPC requirements.

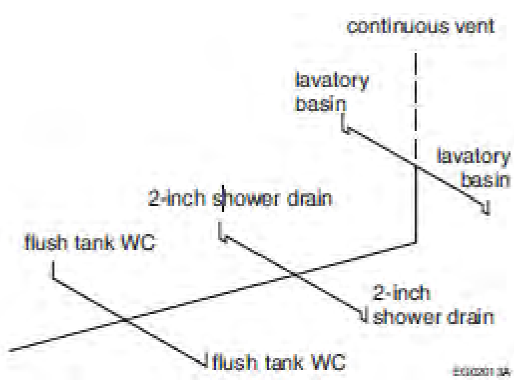


Figure A-2.5.2.1.-A
Example of Wet Venting Described in Clause 2.5.2.1.(1)(b)

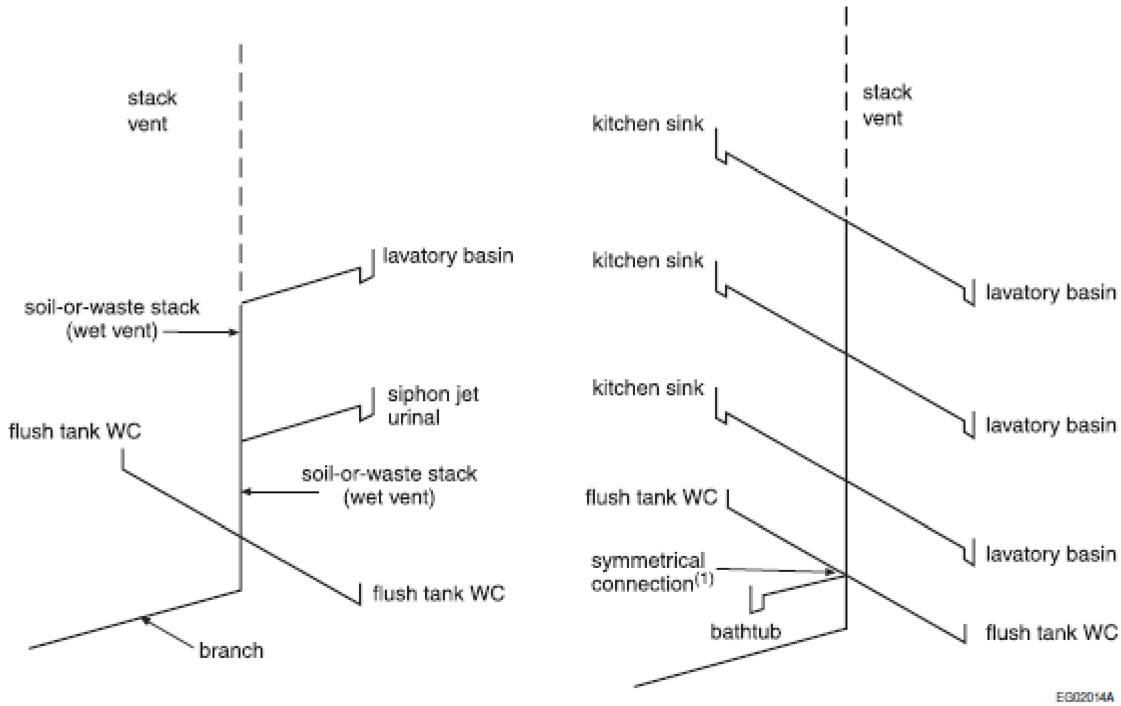


Figure A-2.5.2.1.-B
Example of Wet Venting Described in Clause 2.5.2.1.(1)(c)

Note to Figure A-2.5.2.1.-B:
(1) A symmetrical connection is accomplished with a manufactured fitting that has two or more inlets and connects two or more waste lines to a vent or wet vent.

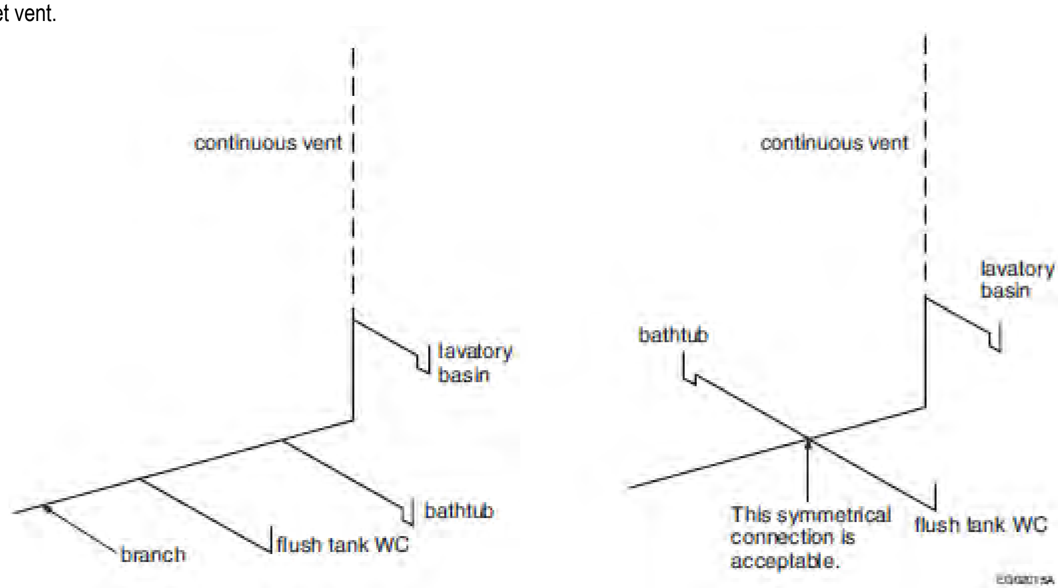


Figure A-2.5.2.1.-C
Example of Wet Venting Described in Clause 2.5.2.1.(1)(d)

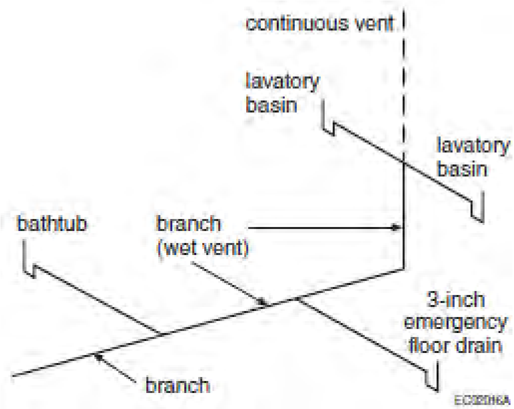


Figure A-2.5.2.1.-D
Example of Wet Venting Described in Clause 2.5.2.1.(1)(e)

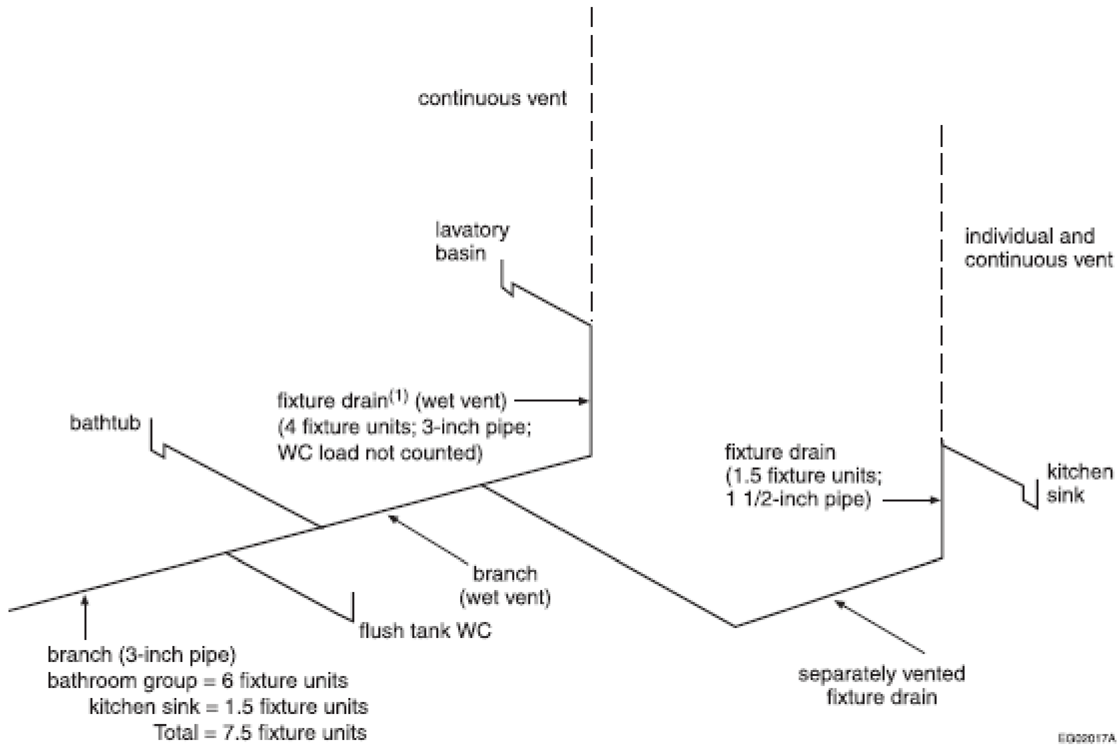


Figure A-2.5.2.1.-E
Example of Wet Venting Described in Clause 2.5.2.1.(1)(f)

Note to Figure A-2.5.2.1.-E:
(1) The load from the separately vented kitchen sink is included when sizing this pipe.

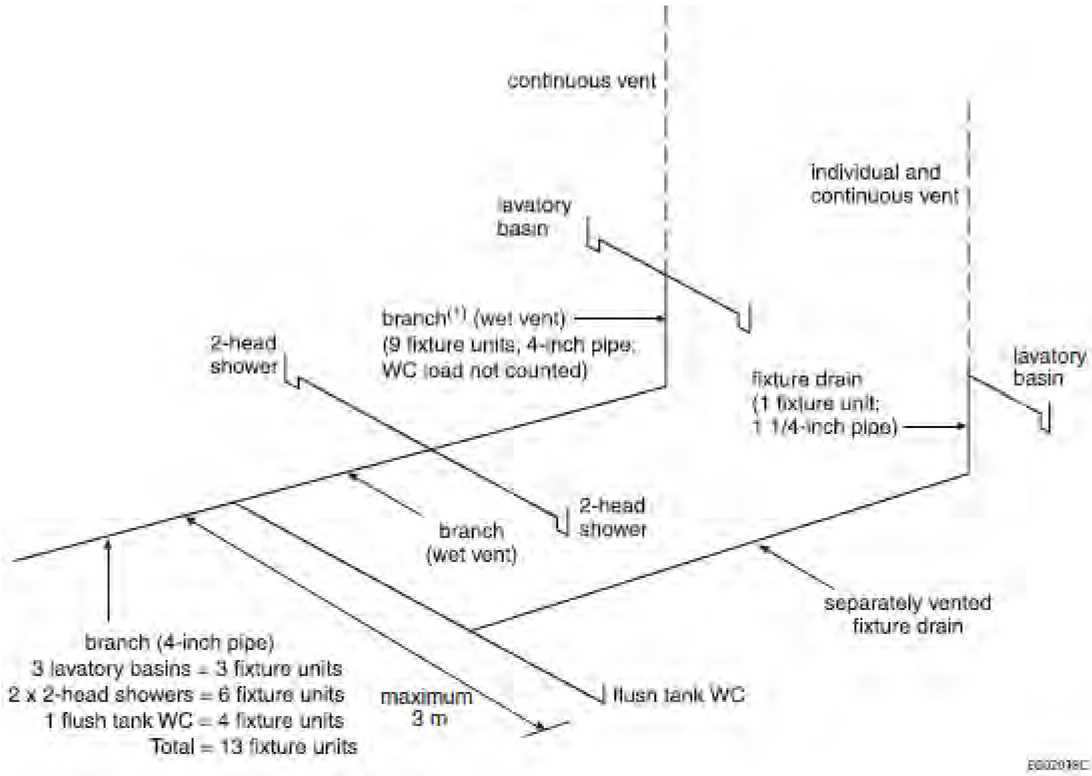


Figure A-2.5.2.1.-F
Example of Wet Venting Described in Clause 2.5.2.1.(1)(f)

Note to Figure A-2.5.2.1.-F:
(1) The load from the separately vented lavatory basin is included when sizing this pipe.

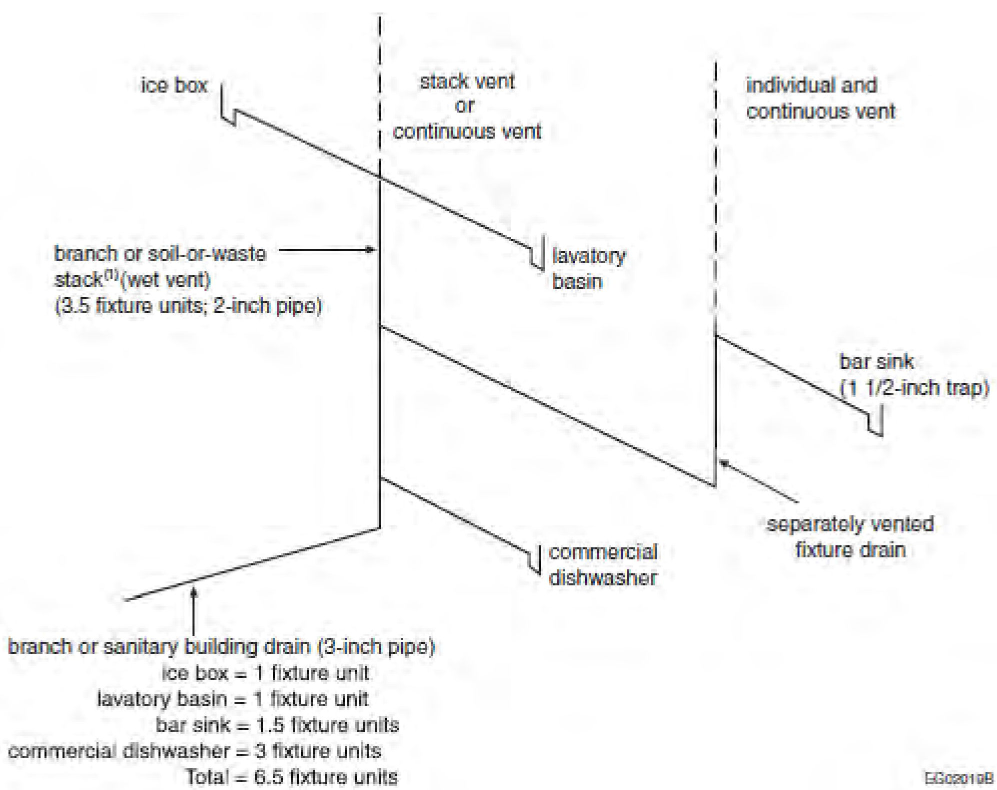


Figure A-2.5.2.1.-G
Example of Wet Venting Described in Clause 2.5.2.1.(1)(f)

Note to Figure A-2.5.2.1.-G:
(1) The load from the separately vented bar sink is included when sizing this pipe.

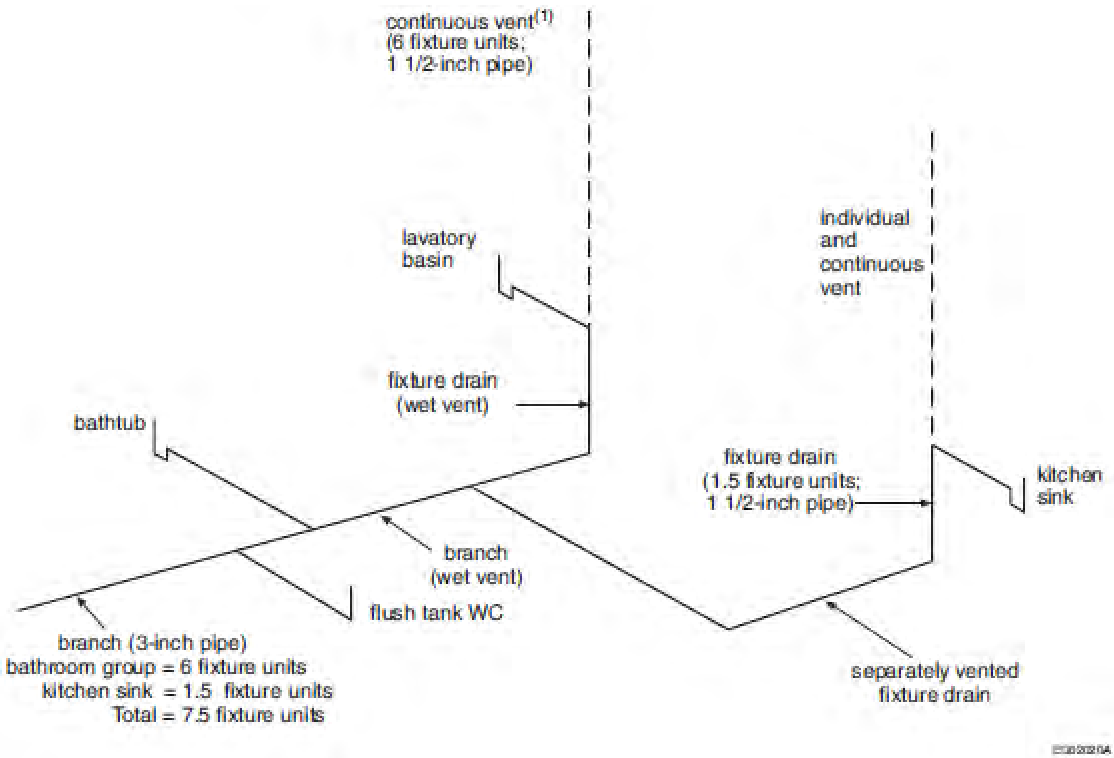


Figure A-2.5.2.1.-H
Example of Wet Venting Described in Clause 2.5.2.1.(1)(g)

Note to Figure A-2.5.2.1.-H:
(1) The load from the separately vented kitchen sink is not included when sizing this pipe.

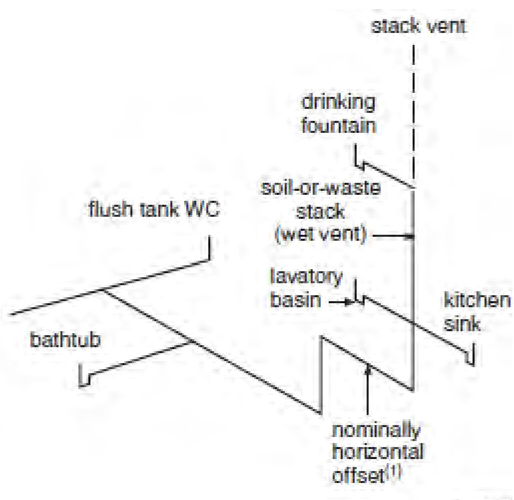


Figure A-2.5.2.1.-I
Example of Wet Venting Described in Clause 2.5.2.1.(1)(i)

Note to Figure A-2.5.2.1.-I:

(1) "Offset" means the piping that connects the ends of 2 pipes that are parallel.

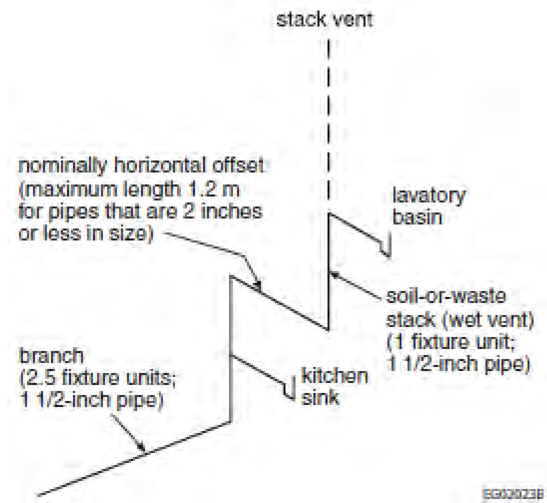


Figure A-2.5.2.1.-J
Example of Wet Venting Described in Subclause 2.5.2.1.(1)(i)(i)

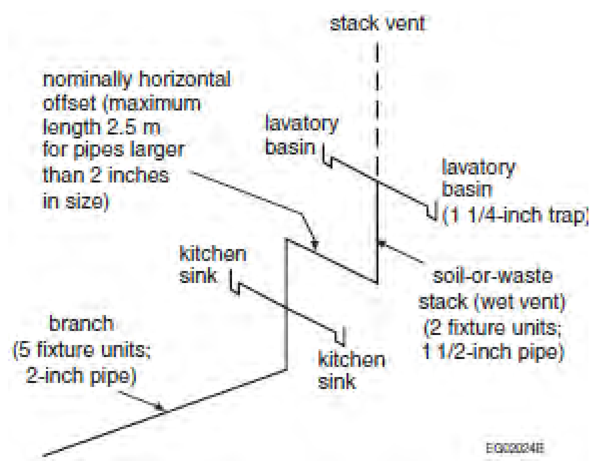


Figure A-2.5.2.1.-K
Example of Wet Venting Described in Subclause 2.5.2.1.(1)(i)(ii)

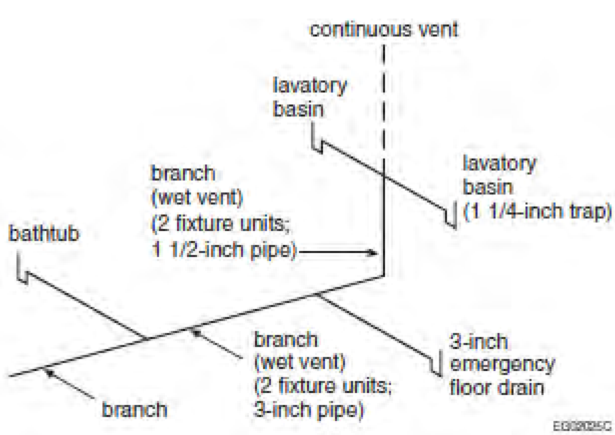


Figure A-2.5.2.1.-L
Example of Wet Venting Described in Clause 2.5.2.1.(1)(j)

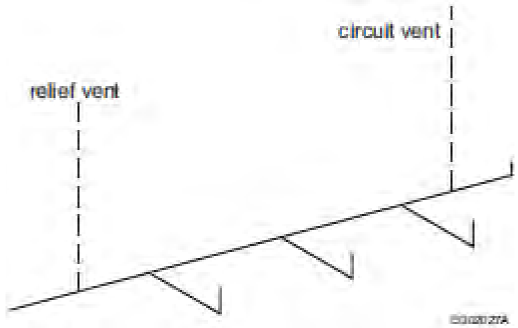


Figure A-2.5.2.1.-M
Example of Wet Venting Described in Clause 2.5.2.1.(1)(k)

A-2.5.3.1. Circuit Venting. Single-storey and multi-storey wet venting has been replaced with wet venting (Article 2.5.2.1.) and circuit venting (Article 2.5.3.1.).
The information and figures presented in this Note are examples of the most common installation practices that meet NPC requirements. However, the examples shown do not preclude other installations that would also conform to NPC requirements.

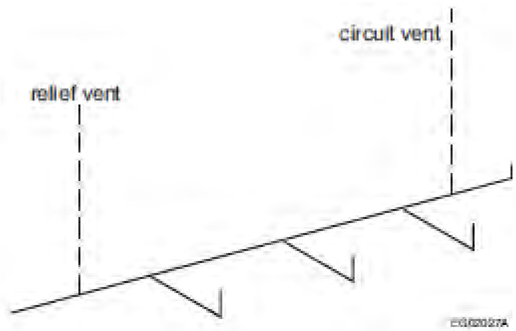


Figure A-2.5.3.1.-A
Example of Circuit Venting Described in Sentence 2.5.3.1.(1)

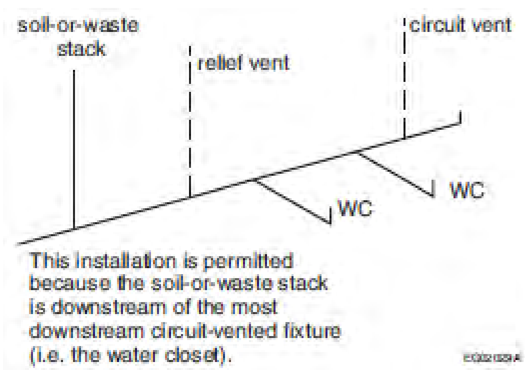


Figure A-2.5.3.1.-B
Example of Circuit Venting Described in Clause 2.5.3.1.(1)(c)

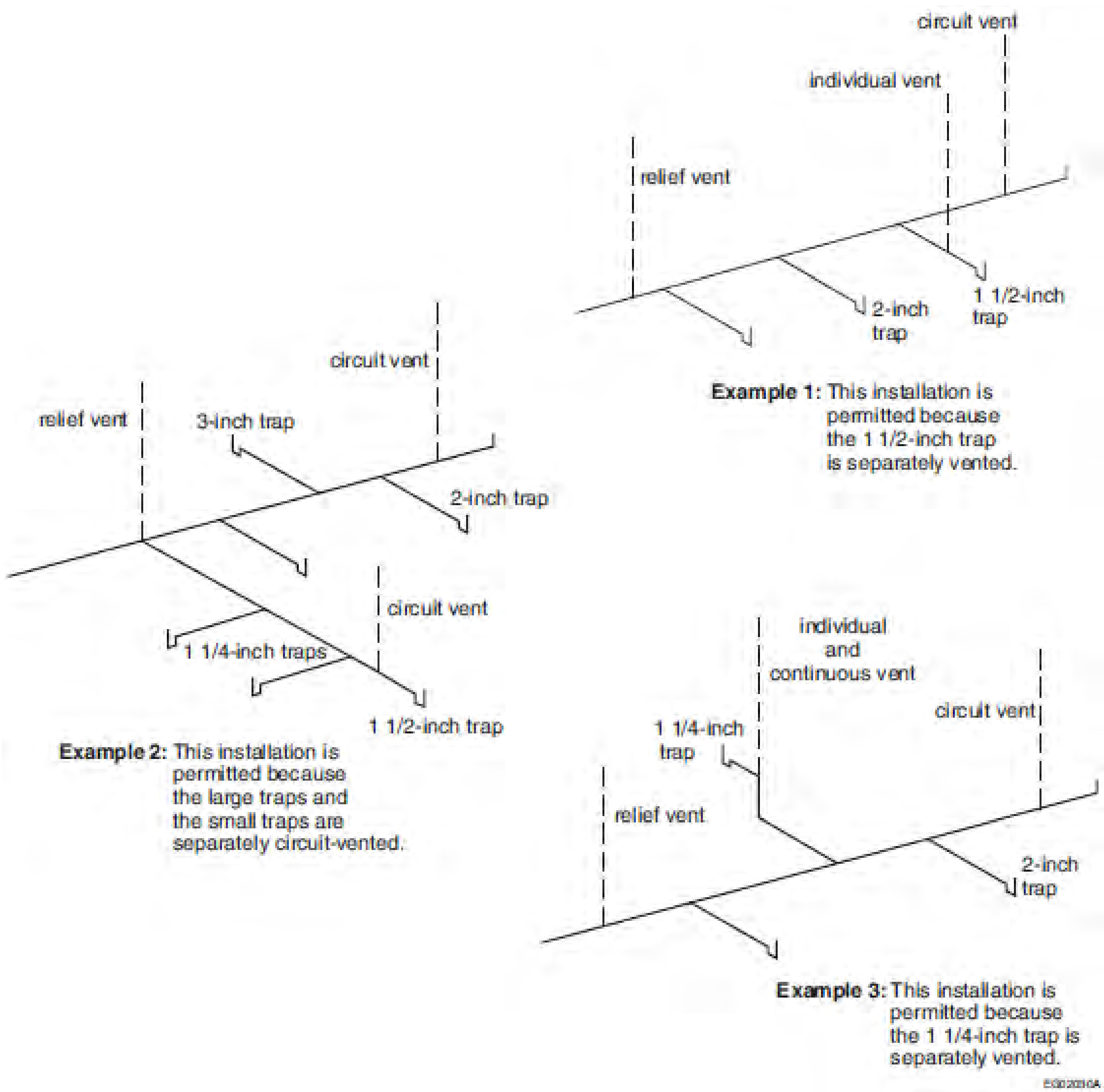


Figure A-2.5.3.1.-C
Example of Circuit Venting Described in Sentence 2.5.3.1.(2), which refers to fixture outlet pipe size

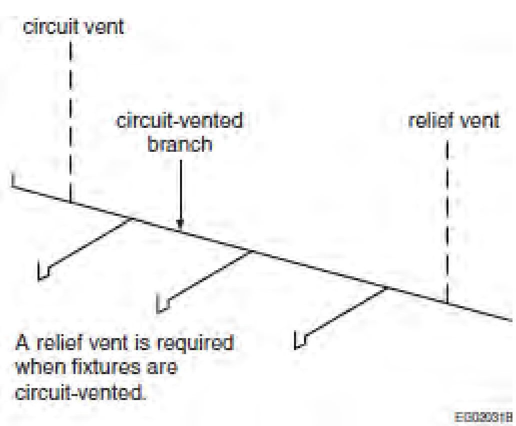


Figure A-2.5.3.1.-D
Example of Circuit Venting Described in Sentence 2.5.3.1.(3)

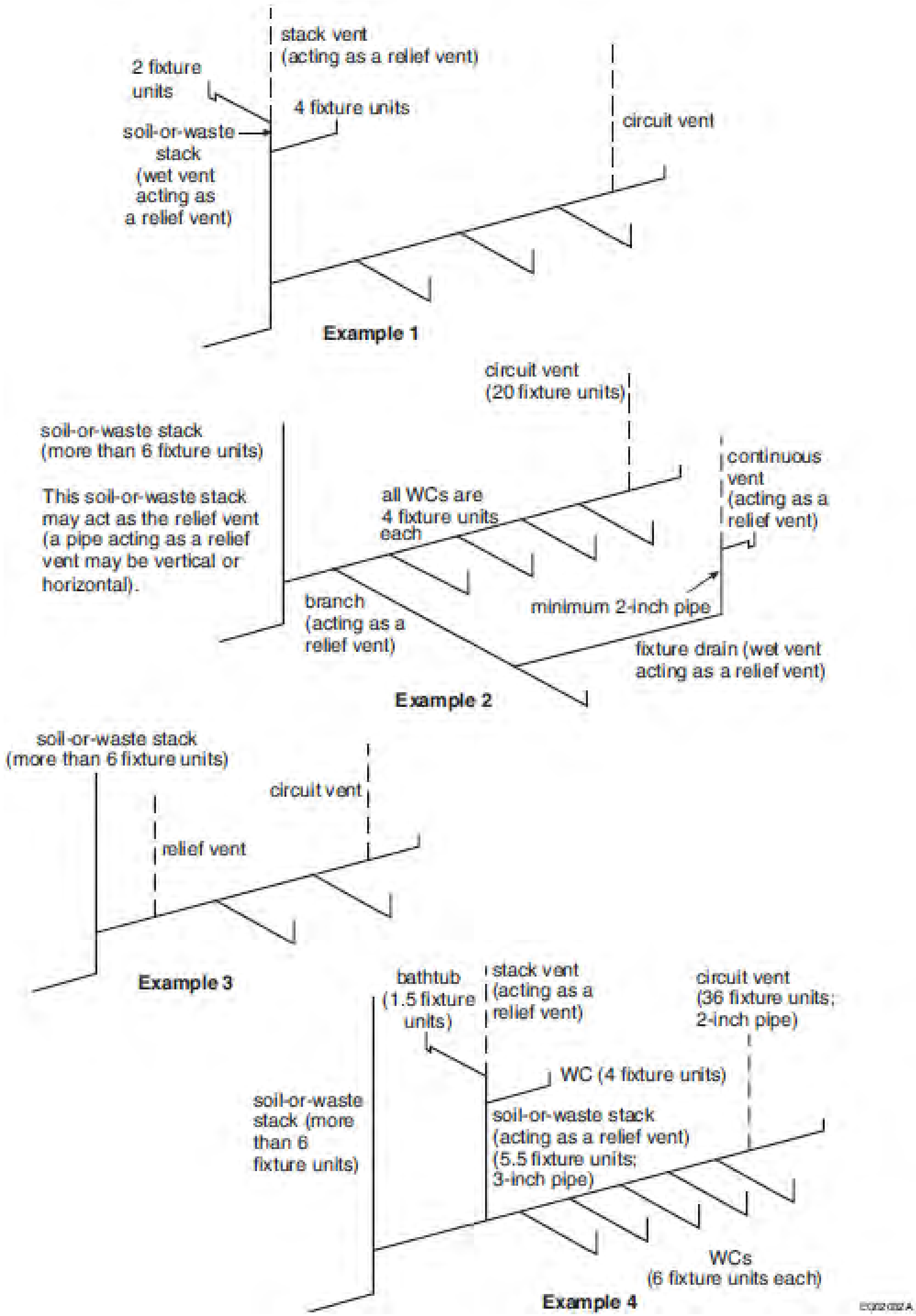


Figure A-2.5.3.1.-E
Example of Circuit Venting Described in Sentence 2.5.3.1.(4)

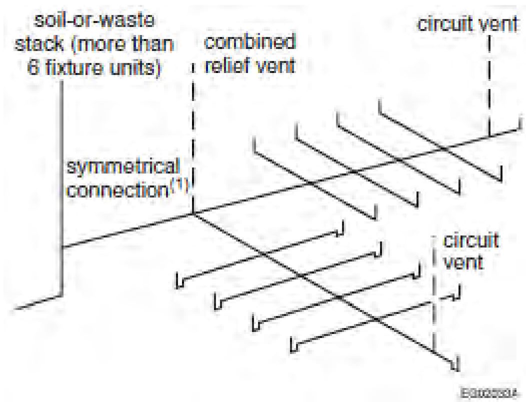


Figure A-2.5.3.1.-F
Example of Circuit Venting Described in Sentence 2.5.3.1.(5)

Note to Figure A-2.5.3.1.-F:

(1) A symmetrical connection is accomplished with a manufactured fitting that has two or more inlets and connects two or more waste lines to a vent or wet vent.

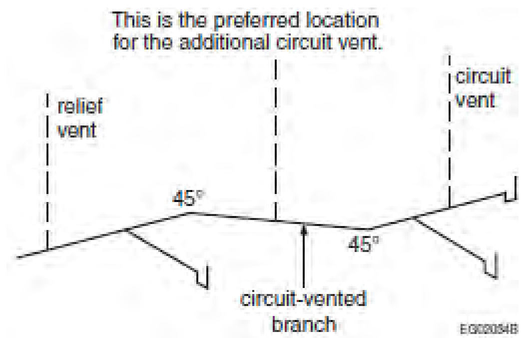


Figure A-2.5.3.1.-G
Example of Circuit Venting Described in Clause 2.5.3.1.(6)(a)

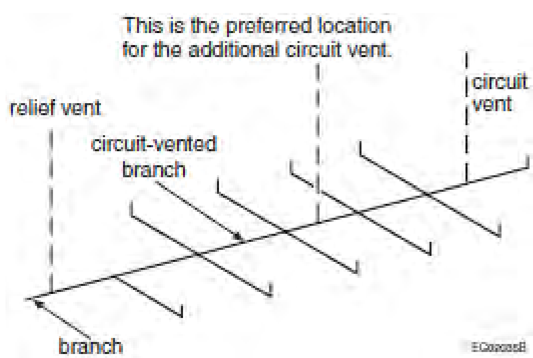


Figure A-2.5.3.1.-H
Example of Circuit Venting Described in Clause 2.5.3.1.(6)(b)

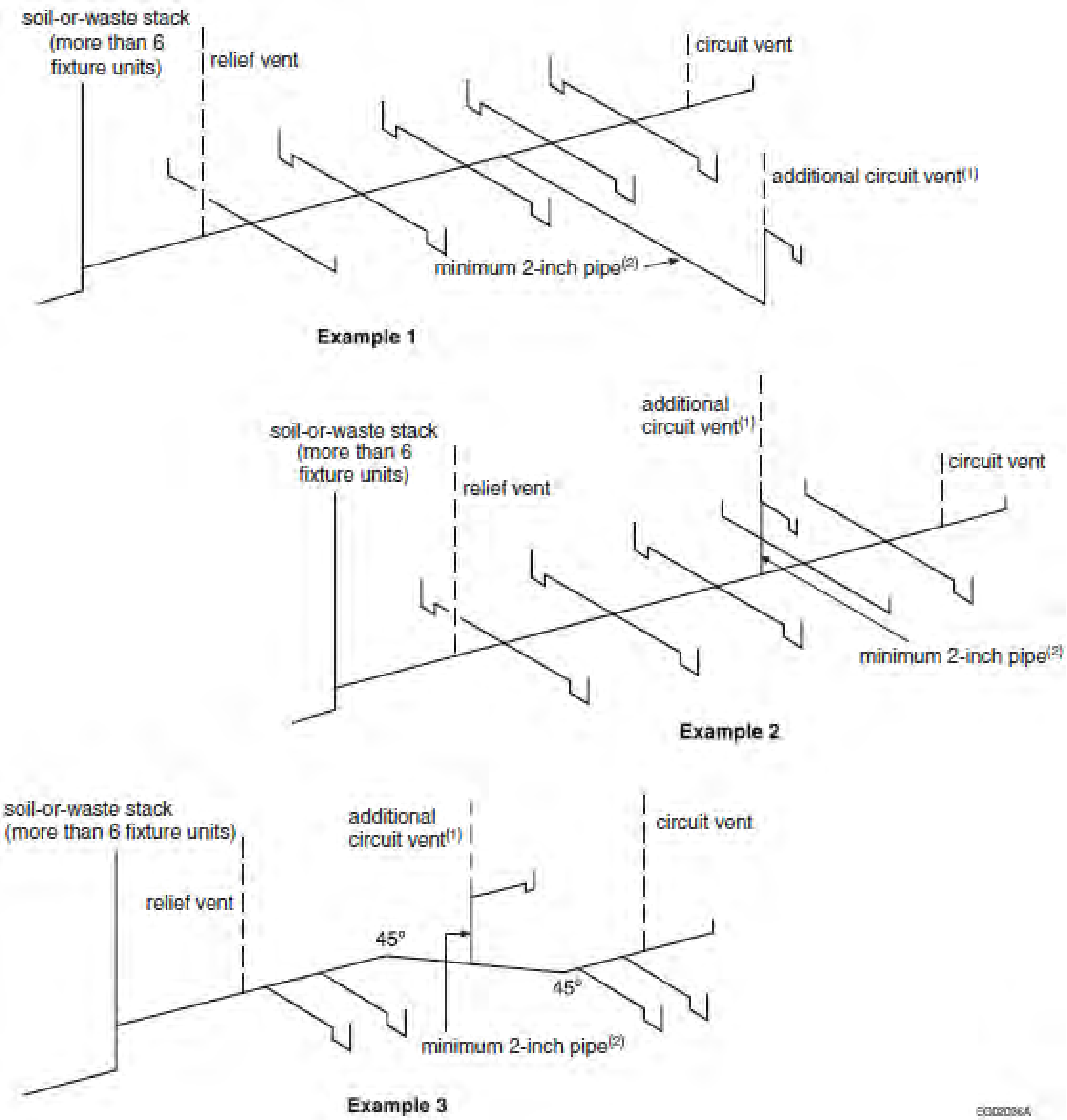


Figure A-2.5.3.1.-I
Example of Circuit Venting Described in Sentence 2.5.3.1.(7)

Notes to Figure A-2.5.3.1.-I:
(1) Size as per Article 2.5.7.1. and Sentence 2.5.7.3.(1).
(2) See Sentence 2.5.3.1.(7).

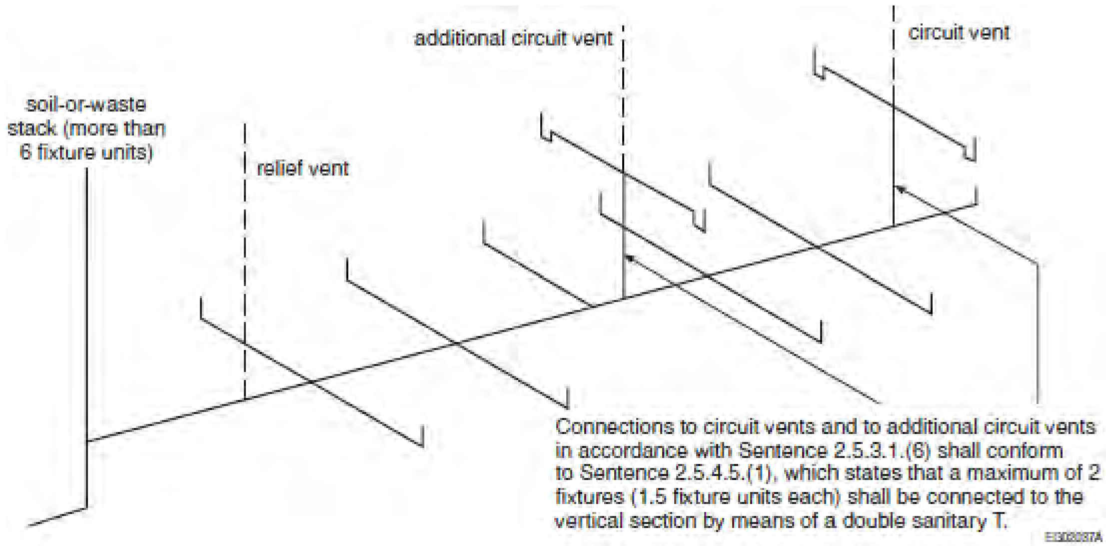


Figure A-2.5.3.1.-J
Example of Circuit Venting Described in Sentence 2.5.3.1.(8)

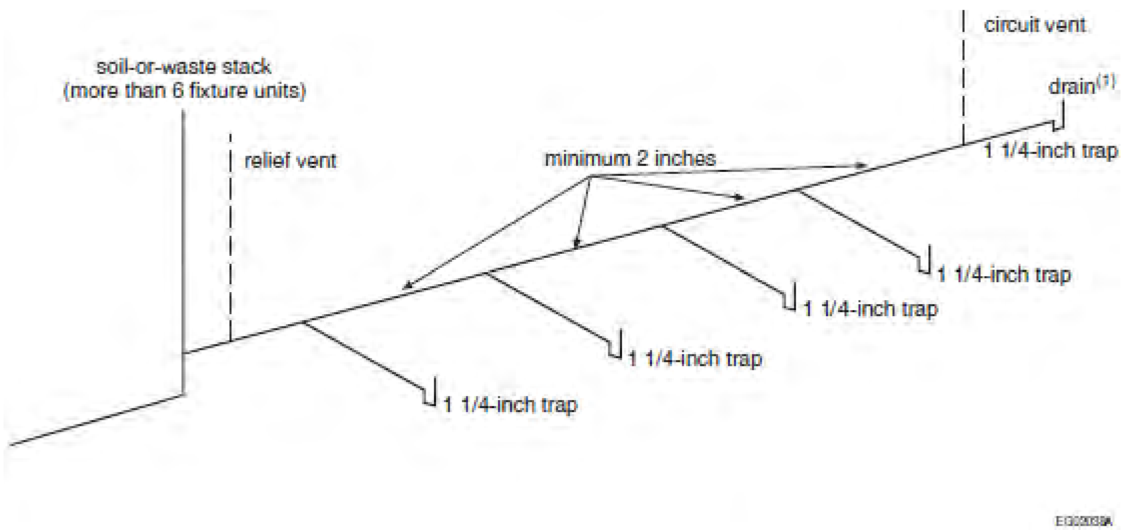


Figure A-2.5.3.1.-K
Example of Circuit Venting Described in Sentence 2.5.3.1.(9)

Note to Figure A-2.5.3.1.-K:
(1) The drain is sized as a branch. The size of the drain should be increased as the load increases.

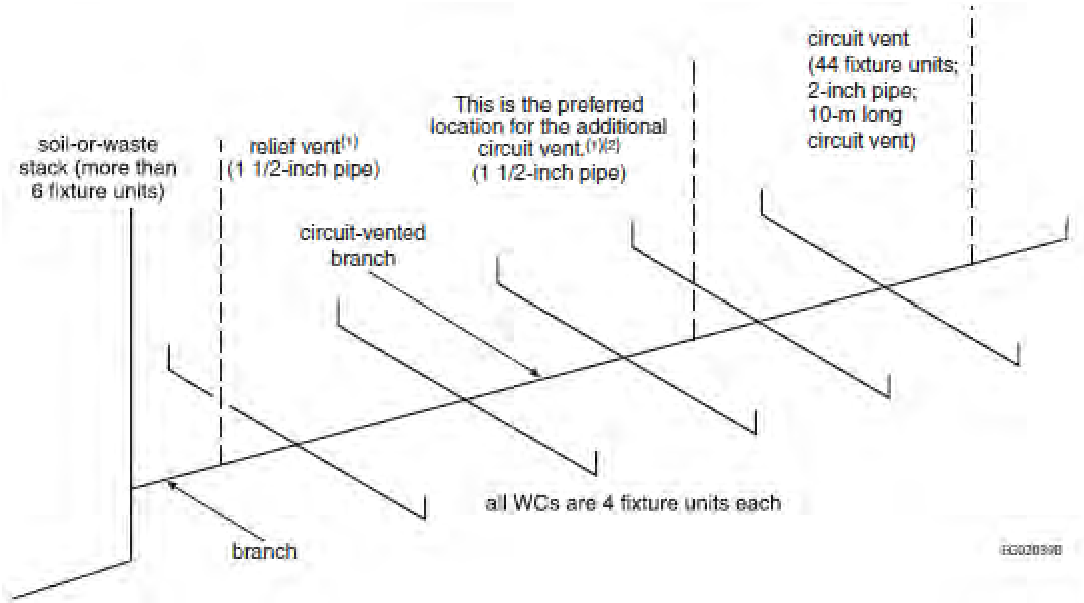


Figure A-2.5.3.1.-L
Example of Circuit Venting Described in Sentence 2.5.3.1.(10)

Notes to Figure A-2.5.3.1.-L:
(1) The relief vent and the additional circuit vent are one size smaller than the circuit vent.
(2) See Sentence 2.5.7.3.(1).

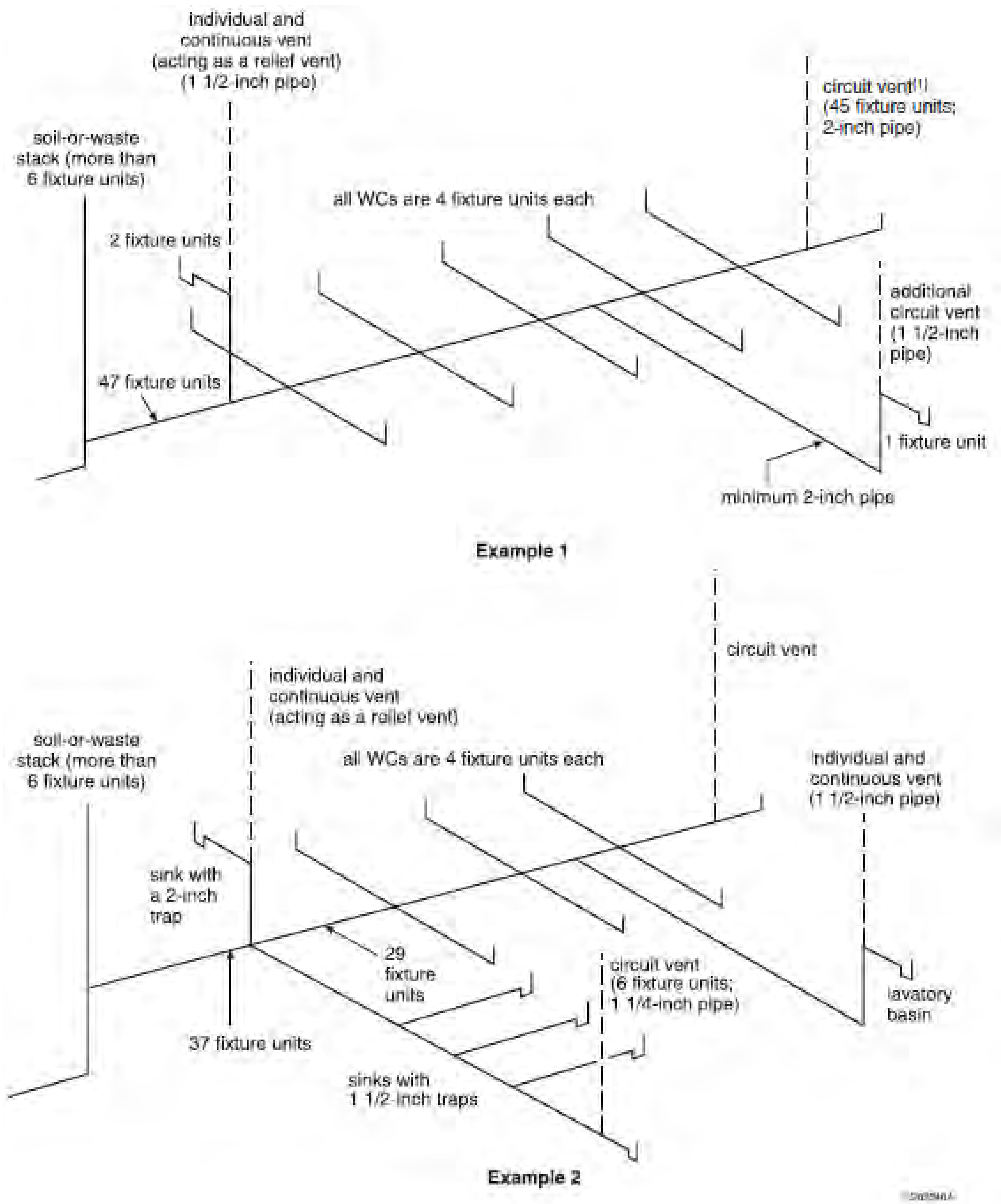


Figure A-2.5.3.1.-M
Example of Circuit Venting Described in Sentence 2.5.3.1.(11)

Note to Figure A-2.5.3.1.-M:

(1) When sizing the circuit vent, do not include fixtures with a hydraulic load of 2 fixture units that are connected downstream of the most downstream water closets.

A-2.5.4.3. Yoke Vent. In Ontario, yoke vents have traditionally been referred to as modified stack vents.

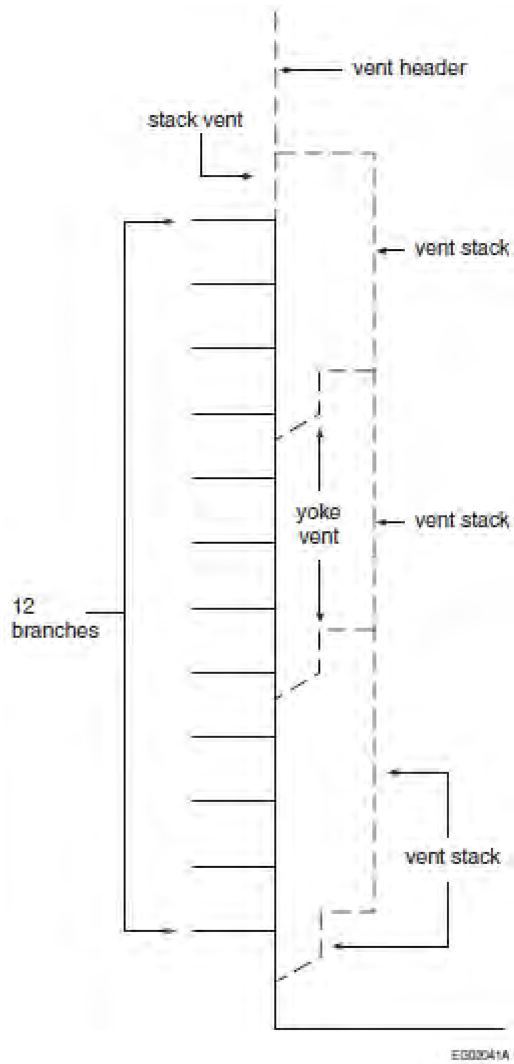


Figure A-2.5.4.3.
Yoke Vent

A-2.5.4.4.(1) Offset Relief Vents. When an offset is greater than 1.5 m, it must be sized the same way as a branch or building drain (See Sentence 2.4.10.6.(2)). An offset relief vent is required at points A and B or A and C in Figure A-2.5.4.4.(1).

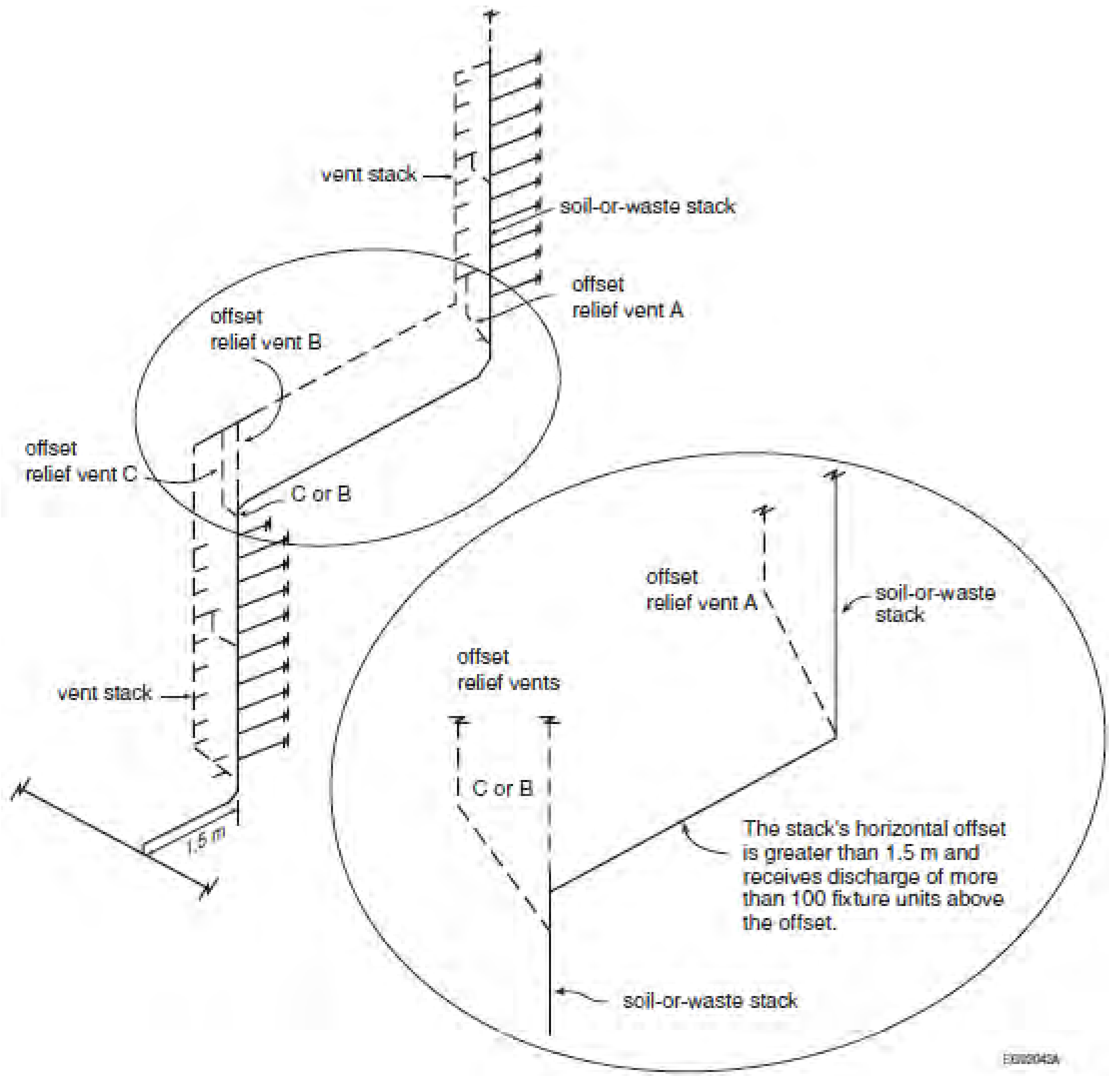


Figure A-2.5.4.4.(1)
Offset Relief Vents

A-2.5.4.5.(1) Fixture Connections to Vent Pipes. When one or more fixture drains are connected to a vent pipe, the vent pipe becomes a wet vent. It must then conform to all the requirements that can apply to it as a drainage pipe and a vent pipe.

A-2.5.5.2. Venting of Oil Interceptors.

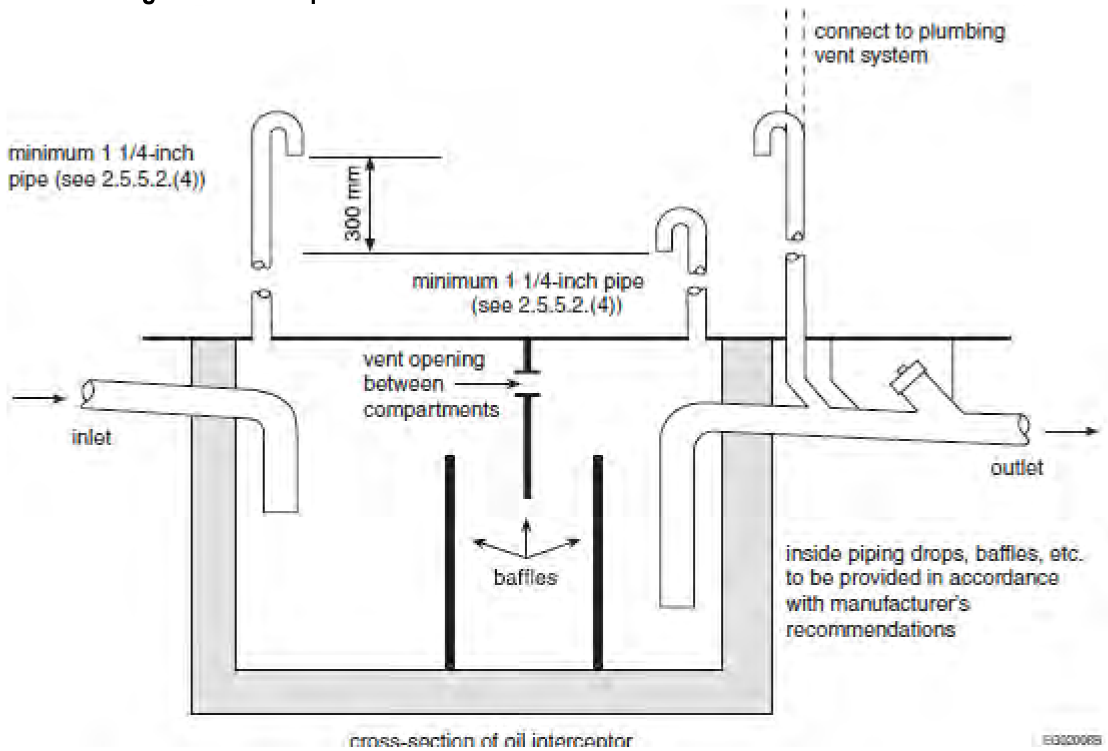


Figure A-2.5.5.2.
Venting of Oil Interceptors

A-2.5.6.2.(2) Vent Pipe Connections. Fittings used to connect vent pipes to nominally horizontal soil-or-waste pipes are specified in Subsection 2.2.4.

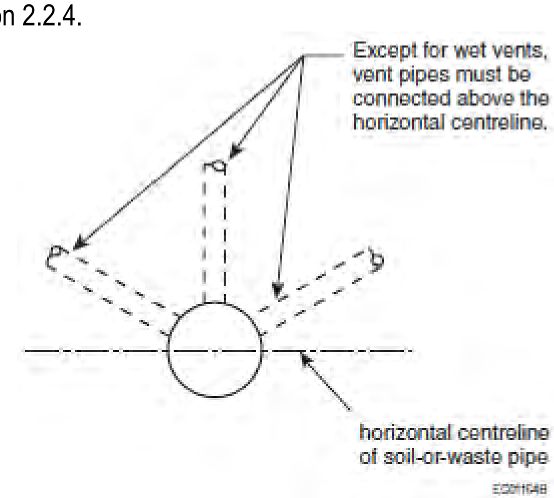


Figure A-2.5.6.2.(2)
Vent Pipe Connections

A-2.5.6.3.(1) Vent Connection and Location of Vent Pipes.

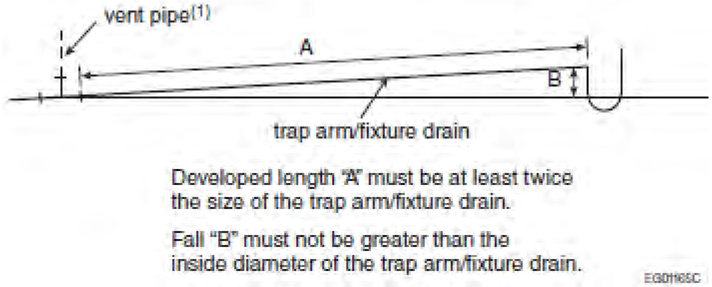


Figure A-2.5.6.3.(1)-A
Vent Connection

Note to Figure A-2.5.6.3.(1)-A:
(1) The vent pipe must be connected in accordance with Article 2.5.6.2.

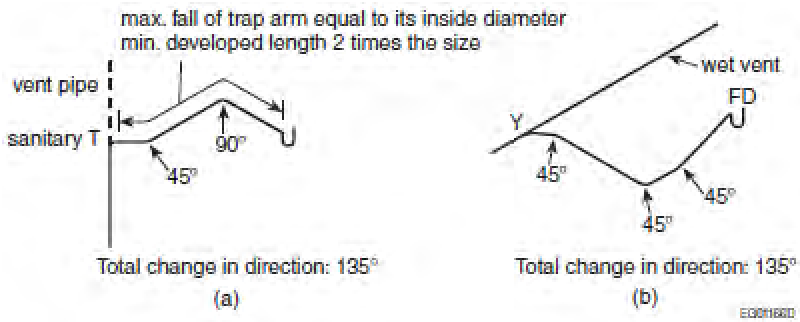


Figure A-2.5.6.3.(1)-B
Location of Vent Pipes That Protect Fixture Traps and Maximum Change in Direction of Trap Arms

A-2.5.6.3.(2) Location of Vent Pipes.

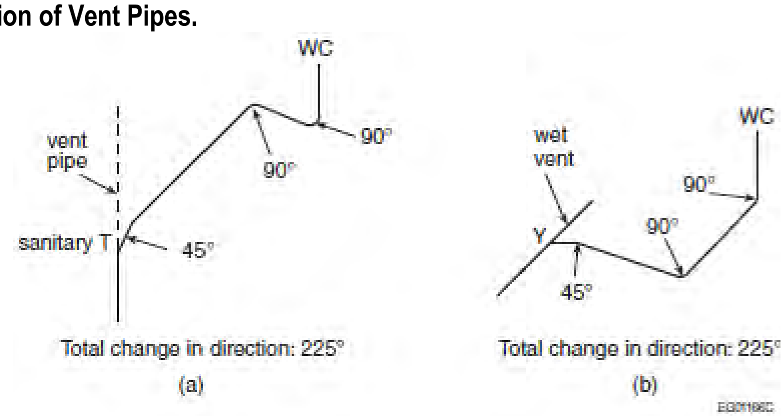


Figure A-2.5.6.3.(2)
Location of Vent Pipes and Maximum Change in Direction of Trap Arms for Fixtures That Depend on Siphonic Action

A-2.5.6.3.(3) Length of WC Fixture Drain.

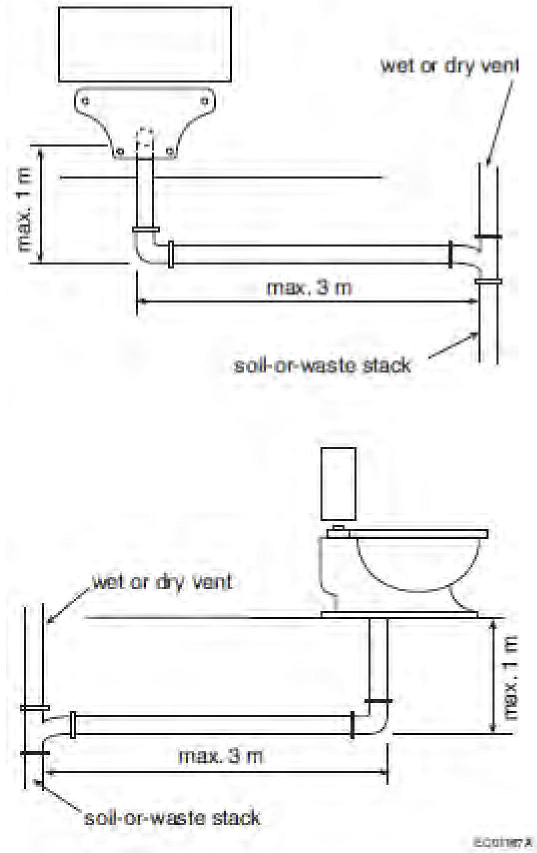


Figure A-2.5.6.3.(3)
Length of WC Fixture Drain
Note to Figure A-2.5.6.3.(3):
(1) Fall and length of WC fixture drain applies to floor-mounted and wall-hung WC's.

A-2.5.6.5.(4) Vent Terminals. No vent pipe other than a fresh air inlet may terminate within the limits indicated.

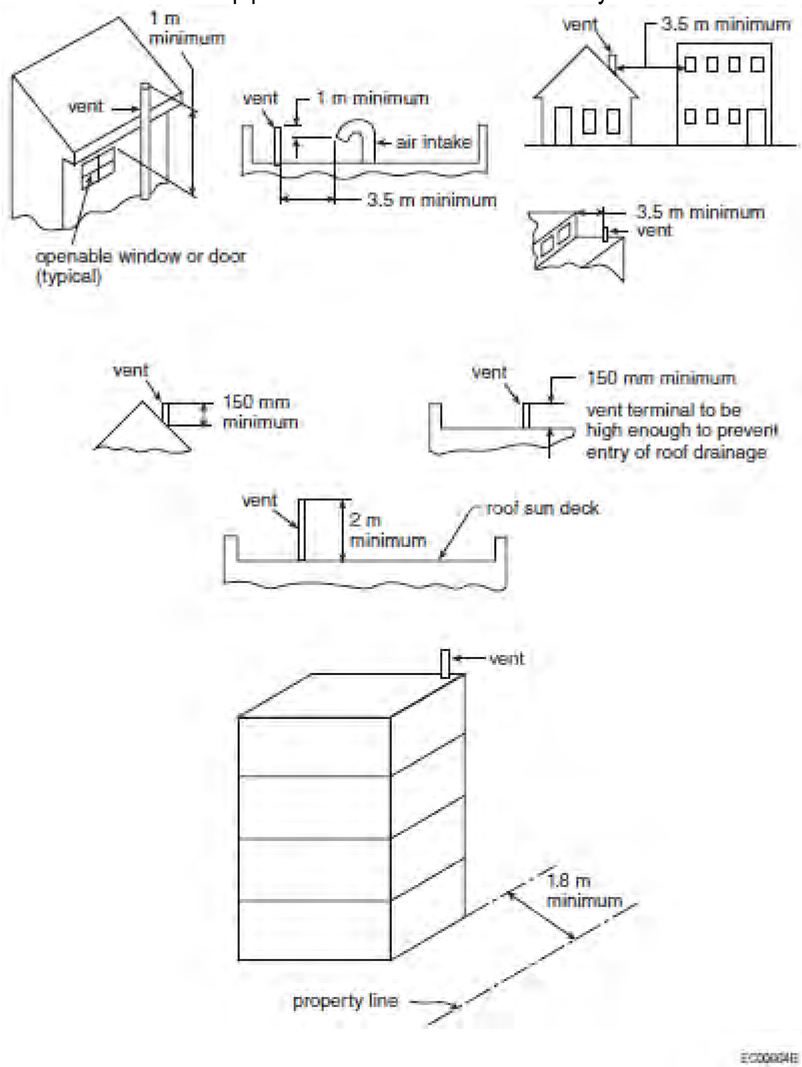


Figure A-2.5.6.5.(4)
Vent Terminals

A-2.5.8. Sizing of Venting Systems. Vent pipes are connected to the drainage system and terminate outside the building. They allow air to enter and circulate and they protect the trap seals in the drainage system. Except as permitted in Subsection 2.5.1., a trap shall always be protected by a vent pipe.

Sizing of Vent Pipes

The sizes stated in Table 2.5.7.1. take precedence over all other venting tables.

Sizing of Relief Vents

Length is not taken into consideration when sizing a relief vent and an additional circuit vent. A relief vent connected to a circuit-vented branch is sized according to Sentences 2.5.7.3.(1) and (2).

An offset relief vent is sized according to Sentence 2.5.7.4.(1), which permits the offset relief vent to be one size smaller than the stack vent.

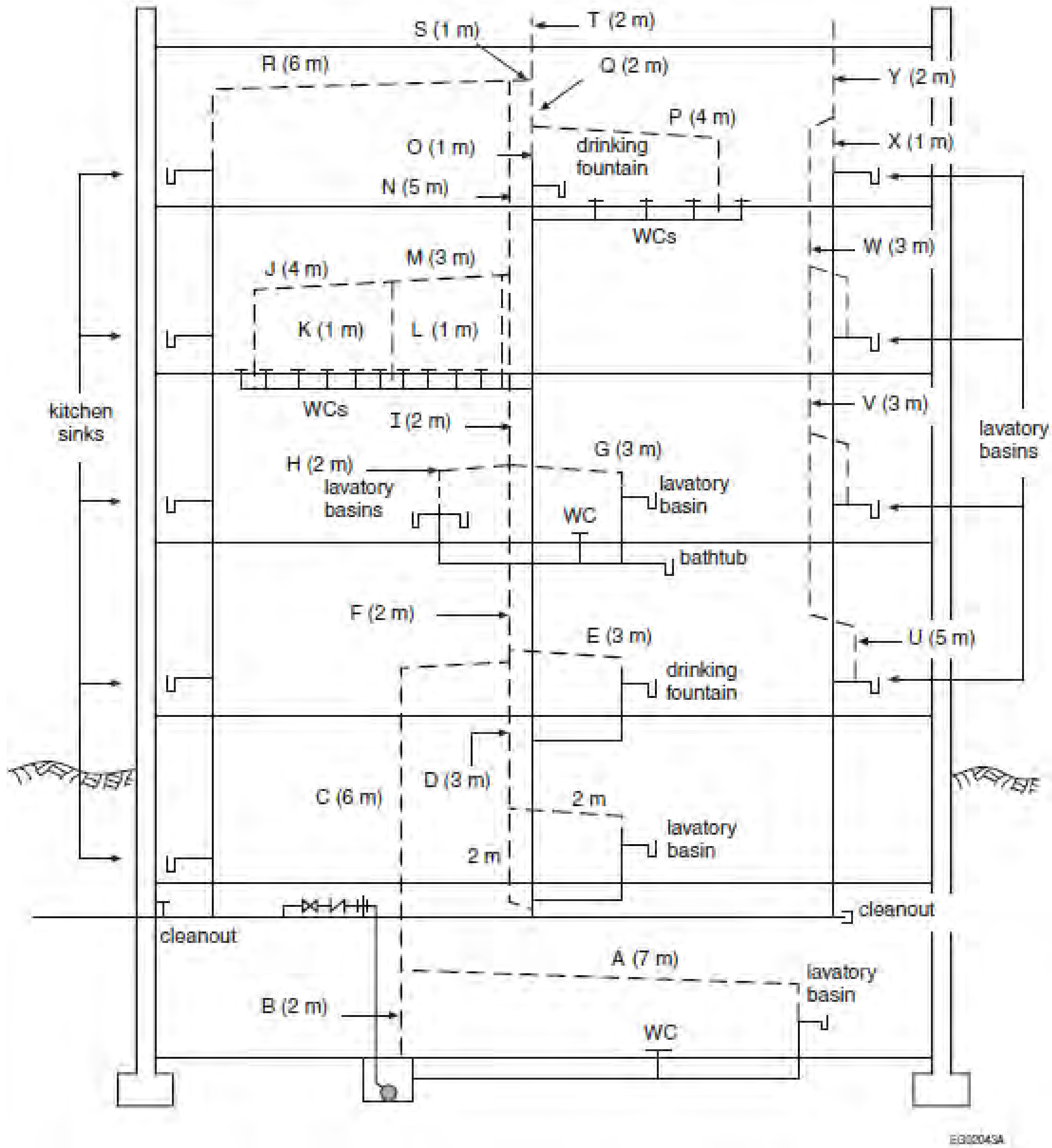


Figure A-2.5.8.
Sizing of a Venting System

Notes to Figure A-2.5.8.:

(1) All water closets are 4 fixture units each.

(2) The letters in columns 1 and 3 of Table A-2.5.8. correspond to the letters in this Figure.

Table A-2.5.8.
Sizing of Venting Systems
Forming Part of Note A-2.5.8.

Vent Pipe(1)	Vent Name	Developed Length Used to Determine Size, m(1)	Hydraulic Load Used to Determine Size, fixture units	Code Reference	Minimum Size, inches

A	Continuous vent	A+C=13	5	2.5.7.1.	1½
B	Sump vent	n/a	n/a	2.5.7.7.(1)	2
C	Branch vent	A+C=13	5	2.5.7.7.(2)	2
D	Vent stack	2+D+F+I+N+S+T=17	66	2.5.7.1. 2.5.7.2.	3
E	Individual and continuous vent	n/a	n/a	2.5.7.1.	1¼
F	Vent stack	Same as D=17	71	Same as D	3
G	Continuous vent	G=3	6	2.5.8.3.(5) 2.5.7.1.	1½
H	Dual and continuous vent	n/a	n/a	2.5.7.1.	1¼
I	Vent stack	Same as D=17	71	Same as D	3
J	Circuit vent	J+M=7	40	2.5.7.1. 2.5.8.3.(4)	1½
K	Additional circuit vent	n/a	n/a	2.5.7.1. 2.5.7.3.(1)	1½
L	Relief vent	n/a	n/a	2.5.7.1. 2.5.7.3.(1)	1½
M	Branch vent	J+M=7	40	2.5.7.1. 2.5.7.2.	1½
N	Vent stack	Same as D=17	71	Same as D	3
O	Stack vent	O+Q+T=5	66	2.5.7.1. 2.5.8.4.	2
P	Circuit vent	P=4	16	2.5.7.1. 2.5.8.3.(4)	1½
Q	Stack vent	Same as O=5	66	2.5.7.1. 2.5.8.4.	2
R	Stack vent	R+S+T=9	7.5	2.5.2.1.(1)(a)	3
S	Vent header	A+C+F+I+N+S+T=25	78.5	2.5.8.3.(3)	3
T	Vent header	Same as S=25	78.5	2.5.8.3.(3)	3

U	Individual vent	n/a	n/a	2.5.7.1.	1¼
V	Branch vent	U+V+W=11	2	2.5.7.1. 2.5.7.2.	1¼
W	Branch vent	Same as V=11	3	2.5.7.1. 2.5.7.2.	1¼
X	Stack vent	X+Y=3	4	2.5.7.1. 2.5.8.4.	1¼
Y	Stack vent	Same as X=3	4	2.5.7.1. 2.5.8.4.	1¼

Notes to Table A-2.5.8.:
(1) The letters in columns 1 and 3 correspond to the letters in Figure A-2.5.8.

A-2.5.8.1.(2) Sizing of Wet Vent Systems.

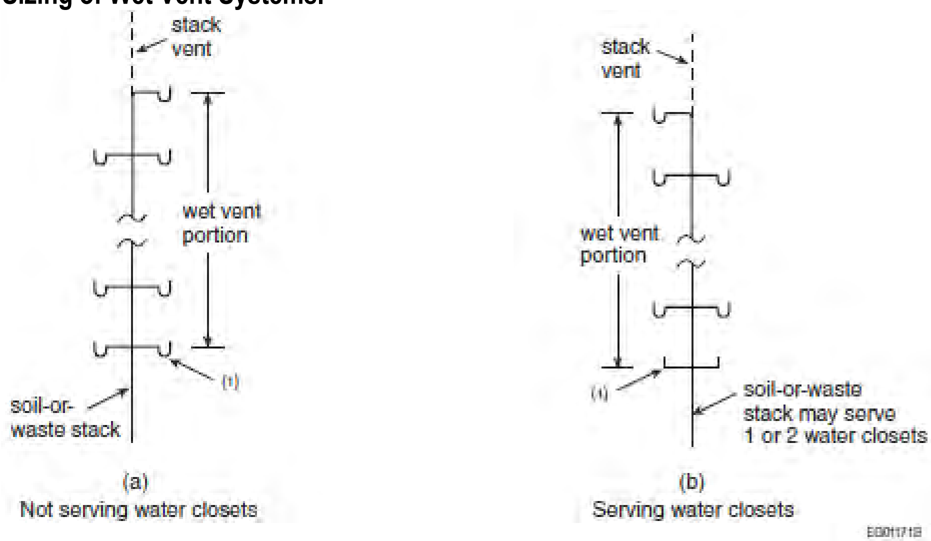
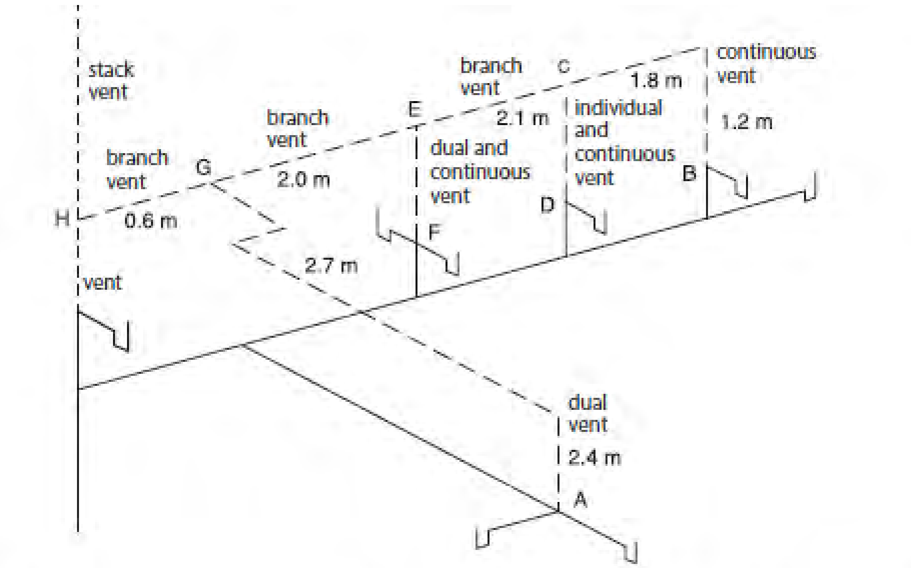


Figure A-2.5.8.1.(2)
Sizing of Wet Vent Systems

Note to Figure A-2.5.8.1.(2):
(1) These two fixtures are not included when determining the size of the wet vent portion using Table 2.5.8.1.

A-2.5.8.3. and 2.5.8.4. Lengths to be Considered When Sizing Vent Pipes.

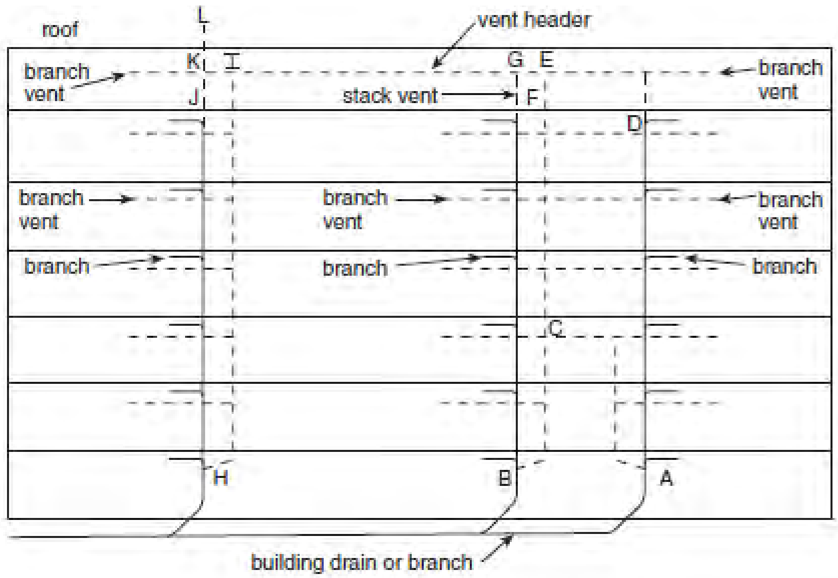


Vent	Length (for sizing purposes)	Code Reference
Dual vent (A-G)	Vent length not applicable	Note 1
Continuous vent (B-C)	BCEGH 1.2 + 1.8 + 2.1 + 2.0 + 0.6 = 7.7	Note 2
Individual and continuous vent (D-C)	Vent length not applicable	Note 1
Branch vent (C-E)	BCEGH 1.2 + 1.8 + 2.1 + 2.0 + 0.6 = 7.7	Note 2
Dual and continuous vent (F-E)	Vent length not applicable	Note 1
Branch vent (E-G)	BCEGH 1.2 + 1.8 + 2.1 + 2.0 + 0.6 = 7.7	Note 2
Branch vent (G-H)	BCEGH 1.2 + 1.8 + 2.1 + 2.0 + 0.6 = 7.7	Note 2

EG01172B

Figure A-2.5.8.3. and 2.5.8.4.-A
Lengths to be Considered When Sizing Vent Pipes

Notes to Figure A-2.5.8.3. and 2.5.8.4.-A:
(1) See Article 2.5.8.2.
(2) See Article 2.5.8.3.



Vent pipe	Length to be considered
Vent stack (A-C)	ACEGIKL[1]
Vent stack (B-C)	BCEGIKL[1]
Vent stack (H-I)	HIKL[1]
Stack vent (D-E)	DEGIKL[1]
Stack vent (F-G)	FGIKL[1]
Stack vent (J-K)	JKL[1]
Vent header or any section of it (CEGIKL)	ACEGIKL[2]

Figure A-2.5.8.3. and 2.5.8.4.-B
Lengths to be Considered When Sizing Vent Pipes

Notes to Figure A-2.5.8.3. and 2.5.8.4.-B:
(1) See Sentence 2.5.8.4.(2).
(2) See Sentence 2.5.8.3.(3).

A-2.6.1.3.(5) Shut-off Valves. Where multiple risers convey the water supply to dwelling units, each dwelling unit's water distribution system shall be provided with a shut-off valve located immediately where the water piping enters the suite so as to isolate the fixtures as well as the water distribution piping serving the dwelling unit's fixtures. Fixture stopcocks or shut-off valves located immediately adjacent to a fixture may not be adequate to protect the water distribution piping. Where a dwelling unit is served by a single shut-off valve on the water supply, additional shut-off valves may be required to achieve compliance with Sentences 2.6.1.3.(4) and (7).

A-2.6.1.6.(5) Flush-Tank-Type Urinals in Seasonal Buildings. Flush-tank-type urinals that are not in use for an extended period of time, such as those in seasonal buildings, are permitted to be set up to flush automatically at predetermined intervals. Automatic flushing prevents the depletion of the water seal due to evaporation or backflow conditions. The trap seal restricts the infiltration of gases, which can pose health and safety concerns.

A-2.6.1.7.(5) Relief Valves. If the discharge piping is longer than 2 m or more than two 90° elbows are used, the valve manufacturer's installation instructions should be followed to ensure that the piping does not affect the relief valves' discharge capacity.

A-2.6.1.9.(1) Water Hammer Prevention. Water hammer is a buildup of pressure in a length of horizontal or vertical pipe that occurs when a valve or faucet is closed suddenly. The longer the pipe and the greater the water velocity, the greater the pressure exerted on the pipe, which can be many times the normal static water pressure and be sufficient to damage the piping system. Since air chambers made from a piece of vertical pipe do not provide acceptable protection, pre-manufactured water hammer arresters are required to address this potential problem. Water hammer arresters need not be installed at every valve or faucet, nor in every piping system.

A-2.6.1.11.(1) Thermal Expansion. To accommodate the increase in pressure caused by thermal expansion within a closed water distribution system, one of the following should be installed:

(1) a suitably sized diaphragm expansion tank designed for use within a potable water system,
(2) an auxiliary thermal expansion relief valve (T.E.R. valve) conforming to CSA B125.3, “Plumbing Fittings,” set at a pressure of 550 kPa or less and designed for repeated use, or
(3) other means acceptable to the authority having jurisdiction.

A-2.6.1.12.(1) Service Water Heaters. Storing hot water at temperatures below 60°C in the hot water tank or in the delivery system may lead to the growth of legionella bacteria. Contemporary electric water heater tanks experience temperature stratification and thus tend to have legionella bacteria in the lower parts of the tank. Article 2.6.1.12. specifies a thermostat setting of 60°C, which addresses the concern over the growth of legionella bacteria in electric hot water storage tanks and is enforceable without introducing unnecessary complications. The growth of legionella bacteria is not a concern for other types of water heaters with different designs that use different fuels. Electrically heated water heaters are shipped with the thermostat set at 60°C. Article 2.6.1.12. is included in the NPC to formalize this de facto temperature setting as a requirement. The thermostats have graduated temperature markings to allow such a setting, which is not the case with gas- or oil-heated water heaters.

A-2.6.2.1.(3) Backflow Preventers. CSA B64.10.1, “Maintenance and Field Testing of Backflow Preventers,” is considered to represent good practice as regards procedures for the maintenance and field testing of backflow preventers.

A-2.6.2.4.(2) Backflow from Fire Protection Systems. The following document is considered to be good engineering practice when selecting a backflow preventer for installation on a fire protection system: AWWA M14, “Recommended Practice for Backflow Prevention and Cross-Connection Control.”

Table A-2.6.2.4.(2)
Selection Guide for Backflow Prevention Devices on Fire Sprinkler and Standpipe Systems
Forming Part of Sentence 2.6.2.4.(2)

CSA Standard Number	Type of Device(1)	Systems Made with Potable Water System Materials		Systems Not Made with Potable Water System Materials	
		Minor Hazard – Residential Partial Flow-Through System	Minor Hazard – Class 1 System	Moderate Hazard – Class 1, 2, 3 and 6 Systems	Severe Hazard – Any Class of System in which Antifreeze or Other Additives Are Used
CSA B64.6.1	DuCF	P	NP	NP	NP
CSA B64.9	SCVAF	P	P	NP	NP
CSA B64.5.1	DCVAF	P	P	P	NP
CSA B64.4.1	RPF	P	P	P	P
NP = Not permitted P = Permitted					

Notes to Table A-2.6.2.4.(2):
(1) The "F" indicates that the product is only recommended for use on fire sprinkler and standpipe systems.

A-2.6.2.4.(3) Deleted.

A-2.6.2.6.(1) Locations Requiring Premise Isolation. The following list is a guide to locations where premise isolation may be required:

- hospital buildings with operating, mortuary or laboratory facilities
- radioactive material processing plants
- petroleum processing facilities
- premises where inspection is restricted
- sewage treatment plants
- commercial laundries (excluding laundromats)
- plating or chemical plants
- docks and dockside facilities
- food and beverage processing plants
- steam plants
- trackside facilities for trains

An assessment of the hazard must be carried out to determine the need, if any, for a backflow prevention device.

A-2.6.2.9.(2) Installation of Air Gaps.

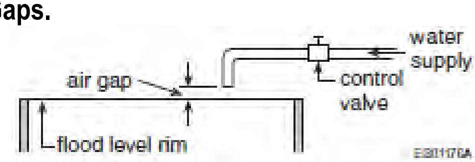


Figure A-2.6.2.9.(2)
Installation of Air Gaps

A-2.6.2.10.(2) Installation of Atmospheric Vacuum Breakers.

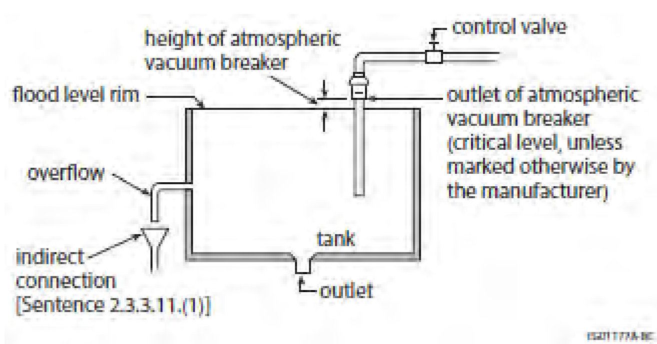


Figure A-2.6.2.10.(2)
Installation of Atmospheric Vacuum Breakers

A-2.6.3. Water Systems. Subsection 2.6.3. contains performance requirements for water systems. Two widely used references for the design of water systems are:

- NIST Building Materials and Structures Report BMS-79, "Water-Distributing Systems for Buildings," United States Department of Commerce, National Bureau of Standards, Washington, D.C., and
- McGraw-Hill 2009, "International Plumbing Codes Handbook," edited by V.T. Manas, McGraw-Hill Book Company, New York, U.S.A.

A-2.6.3.1. Water Quality. Water destined for use as potable water can originate from a variety of sources that are generally classified as surface waters or well waters, such as lakes, rivers, streams and aquifers. In some localities, there may be seasonal variations in the water supply, and surface and well waters may be blended at times.

Water composition is the primary consideration in determining the cause of corrosion in potable water systems. If the water has corrosive characteristics, water treatment may be necessary to control its corrosiveness: this may be as straightforward as adjusting the pH of the water at the treatment plant, or it may involve more extensive corrosion-control treatment methods. Water purveyors normally consult treatment specialists to develop methods suitable for specific conditions. The treatment of water from private wells may also require expert consultation.

The past performance of plumbing materials and products in different localities often provides insight into what can be expected with new installations. In areas where water-related corrosion is known to occur, adjustment of water chemistry may be sufficient or it may be necessary to select alternative piping and fitting materials or more robust products.

It is important to note that not all corrosion can be attributed to water conditions: the improper design and installation of potable water systems may result in erosion corrosion, galvanic corrosion, fatigue cracking, and so forth.

A-2.6.3.1.(2) Potable Water Systems. The design procedures contained in the following documents are considered good engineering practice in the field of potable water systems:

- ASHRAE 2011, "ASHRAE Handbook – HVAC Applications," chapter on Service Water Heating,
- ASHRAE 2013, "ASHRAE Handbook – Fundamentals," chapter on Pipe Sizing,
- ASPE 2010, "Plumbing Engineering Design Handbook, Volume 2,"chapter on Cold Water Systems, and
- ASPE 2010, "Plumbing Engineering Design Handbook, Volume 2," chapter on Domestic Water Heating Systems.

Alternatively, the following methods, which apply to both public and private water supplies, may be used in determining the size of each section of the water system using Table A-2.6.3.1.(2)-A (Small Commercial Building Method) and Table A-2.6.3.1.(2)-F (Average Pressure Loss Method). Where these methods are considered an alternative to a detailed engineering design method, the hydraulic loads shall be the sum of the total fixture units given in Tables 2.6.3.2.-A, 2.6.3.2.-B, 2.6.3.2.-C and 2.6.3.2.-D.

Method for Small Commercial Buildings

Information required if using this method:

a) The developed length:

i) from the property line or private water supply system when located outside the building to the water service entry point to the building, and

ii) from the water service entry point to the building to the most remote water outlet.

b) Minimum static pressure:

i) the minimum static pressure available at the property line or other water source (private water supply system), or

ii) where there is a wide fluctuation of pressure in the main throughout the day, the minimum static pressure available.

c) Pressure losses:

i) losses for meters, pressure-reducing valves, backflow preventers, water treatment systems, and any other devices, and

ii) losses or gains due to changes in elevation.

d) The number of fixture units (FU) as determined by using the sum of the total values given in Tables 2.6.3.2.-A, 2.6.3.2.-B, 2.6.3.2.-C and 2.6.3.2.-D.

e) The maximum velocities permitted in accordance with the manufacturer's recommendations for the pipe and fittings chosen for the installation.

Note that a private water supply system must be capable of meeting the demands of the water distribution system.

Pipe Sizing Procedures (See Figure A-2.6.3.1.(2)-A.)

Step 1: Water Service Piping (See Table A-2.6.3.1.(2)-B.)

a) Obtain the total fixture units required for the installation using the sum of the total values given in

Tables 2.6.3.2.-A, 2.6.3.2.-B, 2.6.3.2.-C and 2.6.3.2.-D and consider all other demands on the water supply.
b) Determine the minimum static pressure available at the property line or private water supply system and consider all pressure losses for the water service.
c) Select the pressure range group in Table A-2.6.3.1.(2)-A that is consistent with the minimum static pressure available including any other losses.
d) Select the length column in Table A-2.6.3.1.(2)-A that is equal to or greater than the developed length from the property line or private water supply system to the water service entry point to the building.
e) In that column, find the fixture unit value that is equal to or greater than the fixture unit demand for the installation and follow the row back to the first column to locate the water service pipe size.
f) To establish the adjusted static pressure available where the water service enters the building for sizing the water distribution system, subtract the actual static pressure losses for the water service from the minimum static pressure available at the property line.
g) The adjusted static pressure available where a private water supply system is installed should be the static pressure available from such a system at the entry to the building.

Step 2: Hot Water Piping (See Table A-2.6.3.1.(2)-C.)
a) Start with the most remote outlet in the most distant occupancy that requires hot water.
b) Use the sum of the total fixture unit values given in Tables 2.6.3.2.-A, 2.6.3.2.-B, 2.6.3.2.-C and 2.6.3.2.-D and work back toward the service water heater, adding in the fixture unit values as they occur.
c) Select the pressure range group in Table A-2.6.3.1.(2)-A that is consistent with the minimum static pressure available at the water service entry and any other losses (e.g. elevation or devices such as backflow preventers, etc.). Use this pressure range group for all portions (hot and cold) of the water distribution system.
d) Select the length column that is equal to or greater than the developed length from the water service entry point to the building to the most remote outlet served with either hot or cold water.
e) In that column, find the fixture unit value that is equal to or greater than the fixture unit demand at each pipe and follow the row back to the second column to locate the water distribution system pipe size.

Step 3: Cold Water Piping (See Table A-2.6.3.1.(2)-D.)
a) Start with the most remote outlet on the cold water piping using the established total developed length column and pressure range group in Table A-2.6.3.1.(2)-A and work through Steps 2(c), (d) and (e) for hot water piping.
b) Use the sum of the total fixture unit values given in Tables 2.6.3.2.-A, 2.6.3.2.-B, 2.6.3.2.-C and 2.6.3.2.-D and work back toward the water service entry.
c) Where the service water heater distribution pipe occurs, add in the fixture unit demand of the fixtures served only with hot water and those that have not yet been added in as served to the cold water side of the most remote fixtures requiring both a hot and cold water supply.
d) Continue by sizing the cold water main between the service water heater distribution pipe and the water service entry.
e) Add in the fixtures served with cold water only from the main within the most remote occupancy as they occur and all common distribution piping serving hot and cold water to other occupancies as they occur.
f) Complete by sizing all distribution piping served by the main within the most remote occupancy and then the other occupancies not yet sized using the previously established total developed length and pressure range group in Table A-2.6.3.1.(2)-A.

Table A-2.6.3.1.(2)-A
Pipe Sizes for Water Systems Based on Number of Fixture Units Served Using the Small Commercial Method(1)

Water Service Pipe, inches	Water Distribution System, inches	Maximum Allowable Length, m														
		12	18	24	30	46	61	76	91	122	152	183	213	244	274	305
		Number of Fixture Units Served														
						Flow Velocity, m/s			3.0	2.4	1.5					
Pressure Range 200 to 310 kPa																
¾	½	6	5	4	3	2	1	1	1	0	0	0	0	0	0	0
¾	⅝	12	10	9	7	5	3	3	3	2	2	1	1	1	1	0
¾	¾	18	16	14	12	9	6	5	5	4	4	3	2	2	2	1
1	1	36	31	27	25	20	17	15	13	12	10	8	6	6	6	6
1½	1¼	83	68	57	48	38	32	28	25	21	18	15	12	12	11	11
1½	1½	151	124	105	91	70	57	49	45	36	31	26	23	21	20	20
2	1½	151	151	132	110	80	64	53	46	38	32	27	23	21	20	20
2	2	359	329	292	265	217	185	164	147	124	96	70	61	57	54	51
2½	2½	445	418	390	370	330	300	280	265	240	220	198	175	158	143	133
Pressure Range 311 to 413 kPa																
¾	½	8	7	6	5	4	3	2	2	1	1	1	0	0	0	0
¾	⅝	13	13	12	11	9	7	5	5	3	3	2	2	1	1	1
¾	¾	21	21	19	17	14	11	9	8	6	5	4	4	3	3	3
1	1	42	42	41	36	30	25	23	20	18	15	12	10	9	8	8
1½	1¼	83	83	83	83	66	52	44	39	33	29	24	20	19	17	16
1½	1½	151	151	151	151	128	105	90	78	62	52	42	38	35	32	30
2	1½	151	151	151	151	150	117	98	84	67	55	42	38	35	32	30
2	2	359	359	359	359	359	318	280	250	205	165	142	123	110	102	94
2½	2½	611	611	610	580	535	500	470	440	400	365	335	315	285	267	250
Pressure Over 413 kPa																
¾	½	8	8	7	6	5	4	3	3	2	1	1	1	1	1	0
¾	⅝	13	13	13	13	11	8	7	6	5	4	3	3	3	2	2

¾	¾	21	21	21	21	17	13	11	10	8	7	6	6	5	4	4
1	1	42	42	42	42	38	32	29	26	22	18	14	13	12	12	11
1½	1¼	83	83	83	83	83	74	62	54	43	34	26	25	23	22	21
1½	1½	151	151	151	151	151	151	130	113	88	73	51	51	46	43	40
2	1½	151	151	151	151	151	151	142	122	98	82	64	51	46	43	40
2	2	359	359	359	359	359	359	359	340	288	245	204	172	153	141	129
2½	2½	611	611	611	611	611	611	610	570	510	460	430	404	380	356	329

Notes to Table A-2.6.3.1.(2)-A:

(1) Where total fixture unit values exceed those given in this Table, the system must be designed according to a detailed engineering design method.

Table A-2.6.3.1.(2)-B
Sizing of Water Service Pipe Using Figure A-2.6.3.1.(2)-A and Table A-2.6.3.1.(2)-A(1)

Fixture Units		Pipe Size, inches
Total demand from Table A-2.6.3.1.(2)-E	210.8	–
Add in fixture units for fire sprinkler system, irrigation system and any other demands on water service	n/a in this example	–
Total demand in this example	210.8	2

Notes to Table A-2.6.3.1.(2)-B:

(1) Based on 30 m developed length and minimum static pressure at property line of 565 kPa.

Table A-2.6.3.1.(2)-C
Sizing of Hot Water System Using Figure A-2.6.3.1.(2)-A and Table A-2.6.3.1.(2)-A with Pressure Drop(1)

Pipe Number	Fixture Units	Pipe Size, inches
1	8	¾
2	11	¾
3	15	1
4	6	⅝
5	21	1
Total Fixture Units	21	1

Notes to Table A-2.6.3.1.(2)-C:

(1) Based on 76 m developed length and adjusted static pressure at building entry of 540 kPa.

Table A-2.6.3.1.(2)-D
Sizing of Cold Water System Using Figure A-2.6.3.1.(2)-A and Table A-2.6.3.1.(2)-A[1]

Pipe Letter	Cold Water, fixture units	Pipe Size, inches
A	11	¾
B	21	1
C	21	1
D	29.8	1¼
E	20	1
F	49.8	1¼
G	20	1
H	69.8	1½
I	20	1
J	89.8	1½
K	20	1
L	109.8	1½
M	60	1¼
N	169.8	2
O	20	1
P	189.8	2
Q	21	1
R	210.8	2
Total Fixture Units	210.8	2

Notes to Table A-2.6.3.1.(2)-D:
(1) Based on 76 m developed length and minimum adjusted static pressure at building entry of 540 kPa.

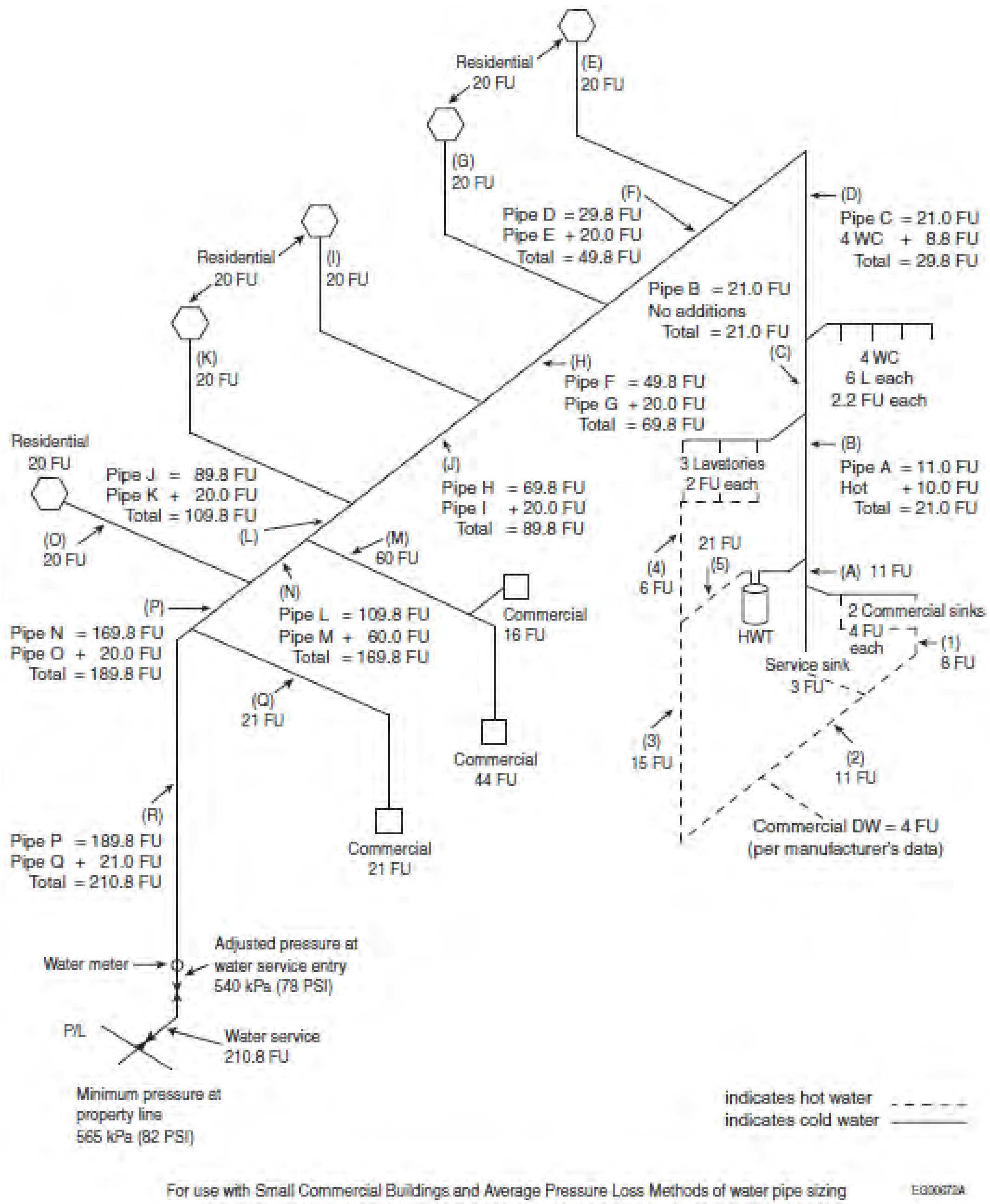


Figure A-2.6.3.1.(2)-A
Example of Commercial and Residential Development to be Used with Water Pipe Sizing Methods

Notes to Figure A-2.6.3.1.(2)-A:

(1) This example is a development with 4 commercial occupancies on the lower floor and 5 residential occupancies on the upper floor, all with separate service water heaters.

(2) For the purpose of water pipe sizing:

- the minimum adjusted pressure available at building entry is 540 kPa (78 PSI);
- the developed length of the water service is 30 m (98 ft); and
- the developed length of the water distribution system is 76 m (249 ft).

Table A-2.6.3.1.(2)-E
Fixture Units Summary for Figure A-2.6.3.1.(2)-A Using Tables 2.6.3.2.-A, -B, -C and -D

Fixtures	Quantity	100% Fixture Unit Values	Total Demand (Quantity x Fixture Unit Values)
Lavatory, 8.3 LPM or less	3	2	6
Commercial sink	2	4	8
Service sink	1	3	3
W.C., 6 LPF or less	4	2.2	8.8
Other	–	–	–
Commercial dishwasher	1	4	4
Commercial occupancy	1	16	16
Commercial occupancy	1	44	44
Commercial occupancy	1	21	21
Residential occupancy	5	20	100
		Total Fixture Units	210.8

Average Pressure Loss Method
Information required if using this method:

a) The developed length:
  i) from the property line or private water system when located outside the building to the water service entry point to the building, and
  ii) from the building entry of the water service to the most remote water outlet.

b) Minimum static pressure:
  i) the minimum static pressure available at the property line or other water source (private water supply system), or
  ii) where there is a wide fluctuation of pressure in the main throughout the day, the minimum static pressure available.

c) Pressure losses:
  i) losses for meters, pressure-reducing valves, backflow preventers, water treatment systems, and any other devices, and
  ii) losses or gains due to changes in elevation.

d) The number of fixture units as determined by using the sum of the total values given in Tables 2.6.3.2.-A, 2.6.3.2.-B, 2.6.3.2.-C and 2.6.3.2.-D.

e) The maximum velocities permitted in accordance with the manufacturer's recommendations for the pipe and fittings chosen for the installation.

Note: The private water supply system must be capable of meeting the demands of the water distribution system.

To use this method, calculate the pressure available for friction loss which must be 2.6 kPa per metre or more; if it is less than that, the system must be designed according to a detailed engineering design method.

Calculating Pressure Available for Friction Loss (See Figure A-2.6.3.1.(2)-B.)

a) Obtain the water service size, including pressure losses, and the design of the private water supply system if it is separate from the water distribution system.

b) To calculate the total equivalent length for the water distribution system, determine the developed length from the water service entry point to the building to the most remote water outlet, and

i) where fitting inside diameter dimensions are at least equal to the pipe size, multiply the developed length by 1.5 to allow for friction losses, and

ii) where insert fittings are used, apply additional losses in accordance with the fitting manufacturer's data.

c) To determine the adjusted pressure available at the water service entry for sizing the water distribution system, deduct the pressure losses for the water service from the minimum static pressure available at the property line or private water source.

d) To obtain the pressure available for friction loss, use the minimum adjusted static pressure available at the water service entry and deduct the minimum operating pressure necessary at the most remote water outlet, and losses for meters, pressure-reducing valves, backflow preventers, water treatment systems, and any other devices. Include pressure losses or gains due to changes in elevation between the water service entry and the most remote water outlet.

e) Divide the static pressure available for friction loss by the total equivalent length to obtain the pressure available for friction loss per metre.

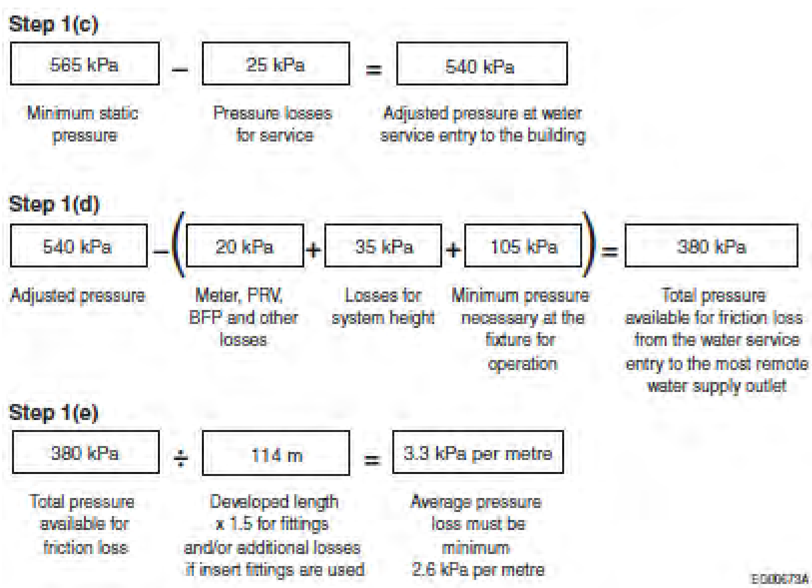


Figure A-2.6.3.1.(2)-B
Determination of Pressure Available for Friction Loss

Pipe Sizing Procedures (See Figure A-2.6.3.1.(2)-A)

Step 1: Water Service Piping (See Table A-2.6.3.1.(2)-G)

a) Obtain the total fixture units required for the installation using the sum of the total values given in Tables 2.6.3.2.-A, 2.6.3.2.-B, 2.6.3.2.-C and 2.6.3.2.-D and consider all other demands on the water supply.

b) Select the water service pipe size from Table A-2.6.3.1.(2)-F using the velocity column that is consistent with the pipe and fittings chosen for the installation.

c) Determine the minimum static pressure available at the property line or private water source and consider all pressure losses for the water service.

d) To establish the adjusted static pressure available where the water service enters the building for sizing the water distribution system, subtract the actual static pressure losses for the water service from the minimum static pressure available at the property line.

e) The adjusted static pressure available where a private water supply system is installed should be the static pressure available from such a system at the entry to the building.

Step 2: Hot Water Piping (See Table A-2.6.3.1.(2)-H)

a) Start with the most remote outlet in the most distant occupancy that requires hot water.

b) Use the sum of the total fixture unit values given in Tables 2.6.3.2.-A, 2.6.3.2.-B, 2.6.3.2.-C and 2.6.3.2.-D and work back toward the service water heater, adding in the fixture unit values as they occur.

c) Size the hot water system according to Table A-2.6.3.1.(2)-F using the velocity column that is consistent with the manufacturer's requirements for the pipe and fittings chosen when serving a hot water system.

Step 3: Cold Water Piping (See Table A-2.6.3.1.(2)-I)

a) Start with the most remote outlet requiring cold water in the most distant occupancy and working back towards the water service entry adding in the fixture unit values as they occur.

b) Obtain the fixture units using the sum of the total fixture unit values given in Tables 2.6.3.2.-A, 2.6.3.2.-B, 2.6.3.2.-C and 2.6.3.2.-D.

c) Size the cold water system to Table A-2.6.3.1.(2)-F using the velocity column that is consistent with the manufacturer's requirements for the pipe and fittings chosen when serving a cold water system.

d) Where the service water heater distribution pipe occurs, add in the fixture unit demand of the fixtures served with only hot water and those that have not yet been added in as served to the cold water side of the most remote fixtures requiring both hot and cold water supply.

e) Continue by sizing the cold water main between the service water heater distribution pipe and the water service entry.

f) Add in the fixtures served with only cold water from the main within the most remote occupancy as they occur and then all common distribution piping serving hot and cold water to other occupancies as they occur.

g) Complete by sizing all distribution piping served by the main in the most remote occupancy and then the other occupancies not yet sized using Table A-2.6.3.1.(2)-F.

Table A-2.6.3.1.(2)-F
Pipe Sizes for Water Systems Based on Number of Fixture Units Served Using the Average Pressure Loss Method

Pipe Size, inches	Water Velocity							
	3.0 m/s (10 ft/s)		2.4 m/s (8 ft/s)		1.5 m/s (5 ft/s)		1.2 m/s (4 ft/s)	
	Flow and Fixture Units Served							
	L/s	Fixture Units	L/s	Fixture Units	L/s	Fixture Units	L/s	Fixture Units
½	0.46	8	0.36	7	0.23	3.5	0.18	2.5
⅝	0.68	13	0.54	11	0.34	6.5	0.27	4.5
¾	0.95	21	0.77	17	0.48	9	0.38	7.5
1	1.62	42	1.26	30	0.81	18	0.65	14

1¼	2.47	83	1.8	54	1.24	29	0.99	22
1½	3.5	146	2.8	102	1.75	46	1.4	34
2	6.08	337	4.92	265	3.04	120	2.43	81
2½	9.39	692	7.89	500	4.69	245	3.75	170
3	13.23	1 018	10.73	750	6.7	400	5.36	295
4	23.94	2 480	18.9	1 800	11.78	850	9.42	600
5	37	4 400	29	3 350	18.35	1 625	14.68	1 125
6	52.1	6 600	42	4 800	26.38	2 875	21.11	2 125

Table A-2.6.3.1.(2)-G
Sizing of Water Service Pipe Using Figure A-2.6.3.1.(2)-A and Table A-2.6.3.1.(2)-F(1)

Fixture Units		Pipe Size, inches
Total demand from Table A-2.6.3.1.(2)-E	210.8	–
Add in fixture units for fire sprinkler system, irrigation system and any other demands on water service	n/a in this example	–
Total demand in this example	210.8	2

Notes to Table A-2.6.3.1.(2)-G:
(1) Based on 30 m developed length and minimum static pressure at property line of 565 kPa.

Table A-2.6.3.1.(2)-H
Sizing of Hot Water System Using Figure A-2.6.3.1.(2)-A and Table A-2.6.3.1.(2)-F with Flow Velocity(1)

Pipe Number	Fixture Units	Pipe Size, inches
1	8	¾
2	11	1
3	15	1
4	6	⅝
5	21	1¼
Total Fixture Units	21	1¼

Notes to Table A-2.6.3.1.(2)-H:
(1) Based on 1.5 m/s and adjusted static pressure at building entry of 540 kPa.

Table A-2.6.3.1.(2)-I
Sizing of Cold Water System Using Figure A-2.6.3.1.(2)-A and Table A-2.6.3.1.(2)-F[(1)]

Pipe Letter	Cold Water, fixture units	Pipe Size, inches
A	11	⅝
B	21	1
C	21	1
D	29.8	1
E	20	1
F	49.8	1¼
G	20	1
H	69.8	1½
I	20	1
J	89.8	1½
K	20	1
L	109.8	2
M	60	1½
N	169.8	2
O	20	1
P	189.8	2
Q	21	1
R	210.8	2
Total Fixture Units	210.8	2

Notes to Table A-2.6.3.1.(2)-I:
(1) Based on 2.4 m/s velocity and adjusted static pressure at water service entry of 540 kPa.

A-2.6.3.2.(4) Sizing for Flush Valves. Distribution piping and water mains serving flush valves may be sized using the values assigned in Tables 2.6.3.2.-B and 2.6.3.2.-C, beginning with the most remote flush valve on each section of distribution piping served by the water main.

A-2.6.3.4.(5) Sizing of Water Systems. Sentence 2.6.3.4.(5) and Table 2.6.3.4. present a simplified method of water system sizing, which is permitted in buildings containing one or two dwelling units or row houses with separate water services.

Simplified Method

This sizing method may be used in the buildings noted, where:

a) the total developed length from the property line to the most remote fixture is not more than 90 m, and

b) the static pressure available at the water service entry to the building is not less than 200 kPa.

Where either the developed length is exceeded or the minimum static pressure required is not known, a detailed engineering design method must be used to size the water service piping. The design must ensure a minimum static pressure of 200 kPa is available at the water service entry to the building.

Information required when using this method:

a) The total number of fixture units (FU) as determined by using the sum of the total fixture unit values given in Tables 2.6.3.2.-A, 2.6.3.2.-B, 2.6.3.2.-C and 2.6.3.2.-D.

b) Where the water service also serves a fire sprinkler system, irrigation system, or any other system, these demands must be added to the water service sizing.

Pipe Sizing Procedures

Step 1: Water Service Pipe

a) Obtain the total fixture units required for the installation using the sum of the total values given in Tables 2.6.3.2.-A, 2.6.3.2.-B, 2.6.3.2.-C and 2.6.3.2.-D and consider all other demands on the water supply.

b) Determine the water service pipe size using the water velocity column in Table 2.6.3.4. that is consistent with the pipe material chosen for the installation.

Step 2: Hot Water Piping

a) Start with the most remote fixture requiring a supply of hot water and work back toward the service water heater, adding in the fixture unit loads as they occur.

b) Determine the fixture units using the sum of the total fixture unit values given in Tables 2.6.3.2.-A, 2.6.3.2.-B, 2.6.3.2.-C and 2.6.3.2.-D.

c) Size the hot water system using the water velocity column in Table 2.6.3.4. that is consistent with the manufacturer's recommendations for the pipe and fittings chosen when serving a hot water system.

Step 3: Cold Water Piping

a) Start with the most remote fixture requiring a supply of cold water and work back toward the water service entry, adding in the fixture unit loads as they occur.

b) Obtain the fixture units using the sum of the total fixture unit values given in Tables 2.6.3.2.-A, 2.6.3.2.-B, 2.6.3.2.-C and 2.6.3.2.-D.

c) Size the cold water system using the water velocity column in Table 2.6.3.4. that is consistent with the manufacturer's recommendations for the pipe chosen when serving a cold water system.

d) Where the service water heater distribution pipe occurs, add in the fixture unit demand of the fixtures served with only hot water and those that have not yet been added in as served to the cold water side of the fixtures requiring both a hot and cold water supply.

e) Continue sizing the cold water main between the service water heater distribution pipe and the water service entry by adding all fixtures served with only a cold water supply as they occur.

f) Complete by sizing all cold water distribution piping served by the main between the water heater distribution pipe and the water service entry.

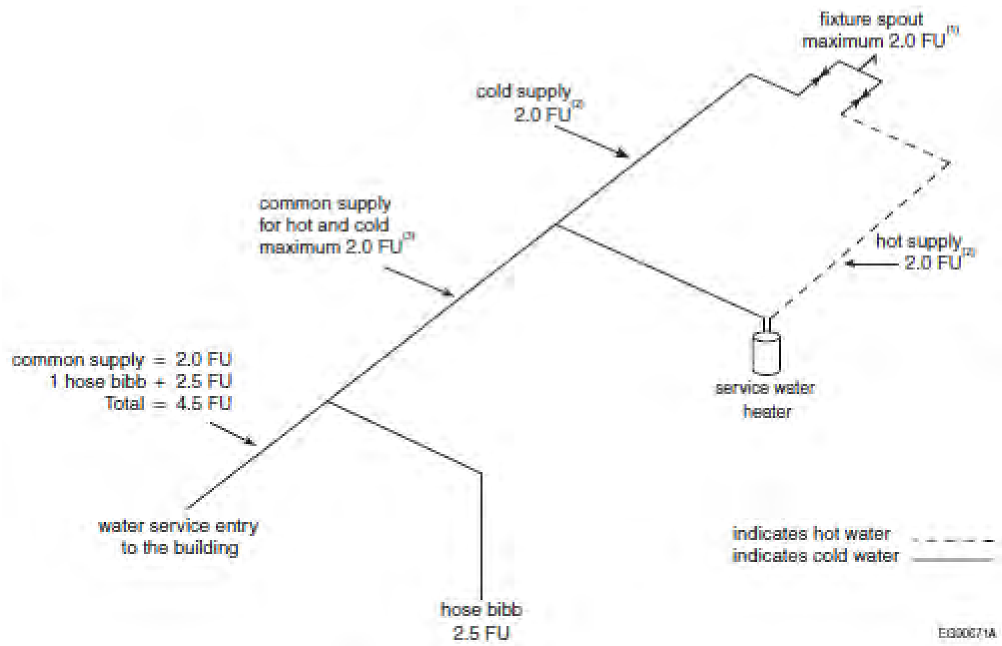


Figure A-2.6.3.4.(5)-A
Determining the hydraulic needs of a fixture

Notes to Figure A-2.6.3.4.(5)-A:
(1) The fixture spout delivers a maximum of 2.0 fixture units.
(2) This would apply if only the hot side or the cold side were fully opened.
(3) The common pipe that serves both the hot and cold sides of the faucet also delivers a maximum of 2.0 fixture units even if both the hot and cold valves at the faucet are fully opened at the same time.

Table A-2.6.3.4.(5)-A
Fixture Units Summary Using Figure A-2.6.3.4.(5)-B and Tables 2.6.3.2.-A, -B, -C and -D

Fixtures	Number of Fixtures	100% Fixture Unit Values	Total Demand (Quantity x Fixture Unit Values)
Bathtub	2	1.4	2.8
Clothes washer	2	1.4	2.8
Dishwasher	2	1.4	2.8
Hose bibb	1	2.5	2.5
Lavatory, 8.3 LPM or less	3	0.7	2.1
Shower, 9.5 LPM or less	1	1.4	1.4
Sink, 8.3 LPM or less	2	1.4	2.8
W.C., 6 LPF or less	3	2.2	6.6
Other			
Total Fixture Units			23.8

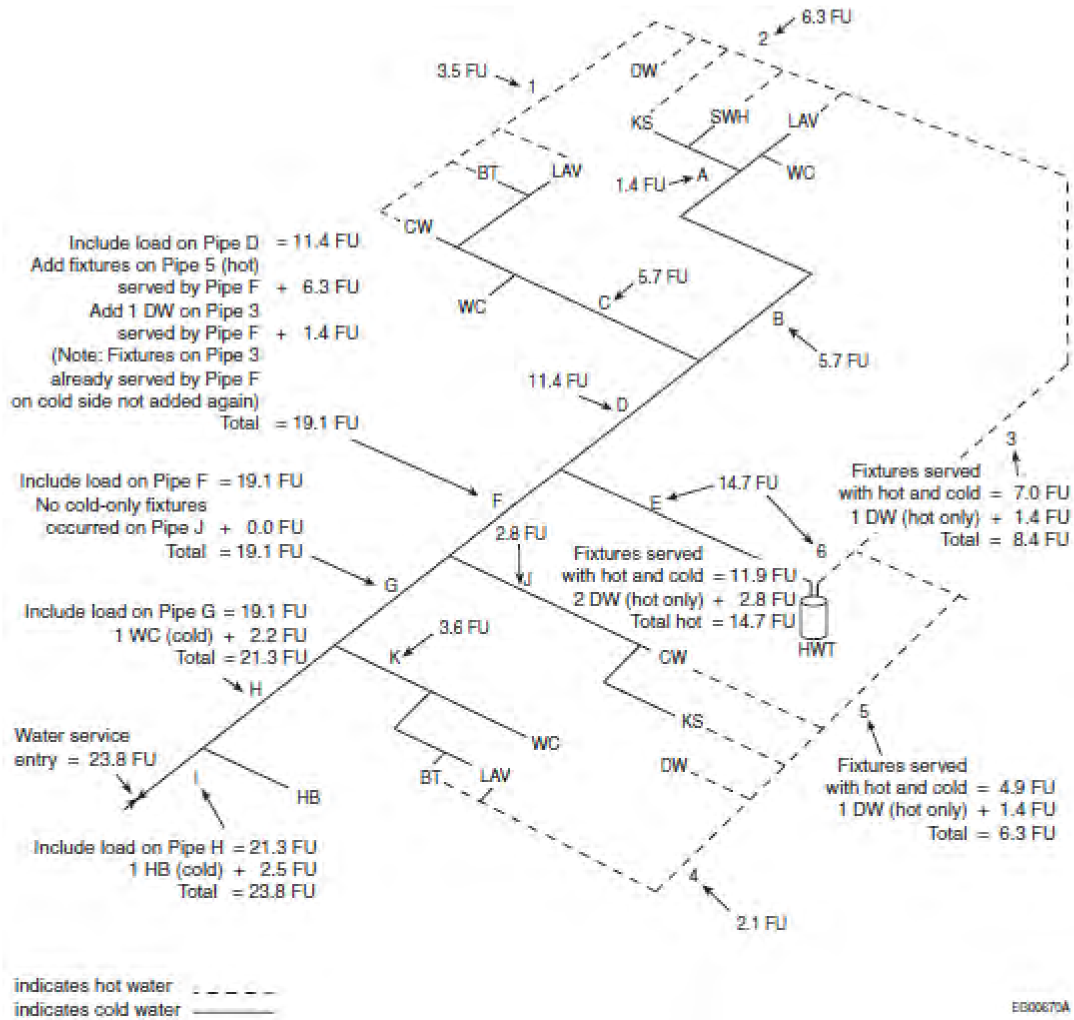


Figure A-2.6.3.4.(5)-B
Example of water pipe sizing for buildings containing one or two dwelling units or row houses with separate water services

Table A-2.6.3.4.(5)-B
Sizing of Water Service Pipe Using Figure A-2.6.3.4.(5)-B and Table 2.6.3.4.

Fixture Units		Water Velocity, m/s		
		3.0	2.4	1.5
		Pipe Size, inches		
Total fixture units	23.8	–	–	–
Fire sprinkler system	n/a	–	–	–
Irrigation system	n/a	–	–	–
Other	n/a	–	–	–

Total demand on water service	23.8	1	1	1¼

Table A-2.6.3.4.(5)-C
Sizing of Hot Water System Using Figure A-2.6.3.4.(5)-B and Table 2.6.3.4.

Pipe Number	Hot Water Fixture Units	Water Velocity, m/s		
		3.0	2.4	1.5
		Pipe Size, inches		
1	3.5	½	½	½
2	6.3	½	½	¾
3	8.4	¾	¾	¾
4	2.1	½	½	½
5	6.3	½	½	¾
6	14.7	¾	¾	1
Total Fixture Units	14.7			

Table A-2.6.3.4.(5)-D
Sizing of Cold Water System Using Figure A-2.6.3.4.(5)-B and Table 2.6.3.4.

Pipe Letter	Cold Water Fixture Units	Water Velocity, m/s		
		3.0	2.4	1.5
		Pipe Size, inches		
A	2.8	½	½	½
B	5.7	½	½	¾
C	5.7	½	½	¾
D	11.4	¾	¾	1
E	14.7	¾	¾	1
F	19.1	¾	1	1¼
G	19.1	¾	1	1¼
H	21.3	1	1	1¼
I	23.8	1	1	1¼
J	2.8	½	½	½
K	3.6	½	½	½

Total Fixture Units	23.8			

A-2.7.3.2.(1) Outlets from Non-Potable Water Systems. The location of outlets from non-potable water systems where they can be discharged into a sink or lavatory, a fixture into which an outlet from a potable water system is discharged, or a fixture that is used for the preparation, handling or dispensing of food, drink or products that are intended for human consumption, may have proven acceptable on the basis of past performance in some localities, and its acceptance under this Code may be warranted.

Subclause 2.7.3.2.(1)(b) would permit non-potable water to be used to supply water closets or urinals provided the fixtures are not also connected to potable water.

A-2.7.6.7, 2.7.6.8. and 2.7.6.9. Non-*potable* Water System Design

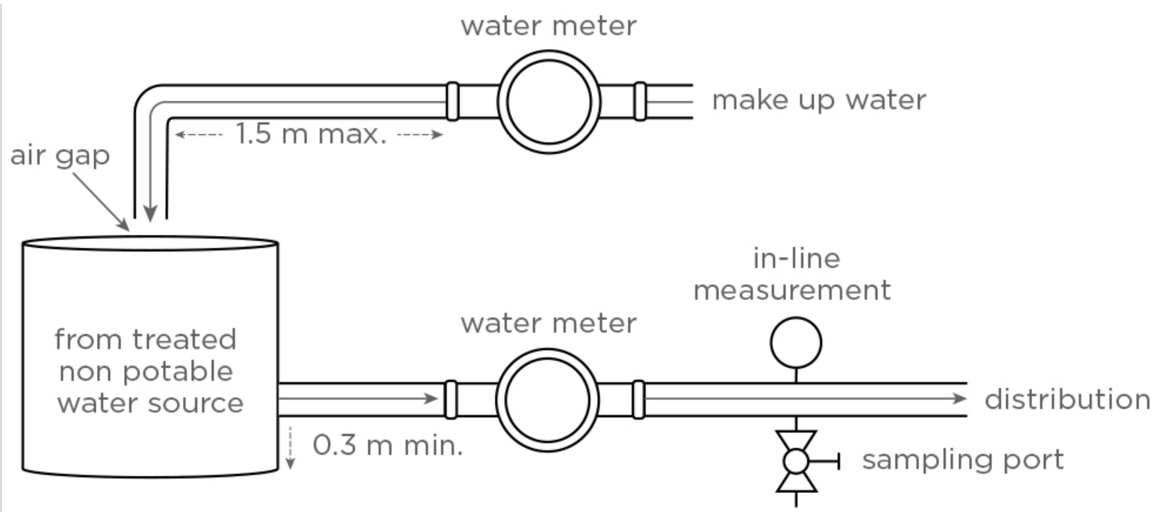


Figure A-2.7.6.7., 2.7.6.8. and 2.7.6.9.
Schematic Example for a Non-*potable* Water System

Division C
Administrative Provisions

Part 1
General

Section 1.1. Application

1.1.1. Application

1.1.1.1. Application

1) This Part applies to all *plumbing systems* covered in this By-law. (See Article 1.1.1.1. of Division A.)

Section 1.2. Terms and Abbreviations

1.2.1. Definitions of Words and Phrases

1.2.1.1. Non-defined Terms

1) Words and phrases used in Division C that are not included in the list of definitions in Article 1.4.1.2. of Division A shall have the meanings that are commonly assigned to them in the context in which they are used, taking into account the specialized use of terms by the various trades and professions to which the terminology applies.

2) Where objectives and functional statements are referred to in Division C, they shall be the objectives and functional statements described in Parts 2 and 3 of Division A.

3) Where acceptable solutions are referred to in Division C, they shall be the provisions stated in Part 2 of Division B.

4) Where alternative solutions are referred to in Division C, they shall be the alternative solutions mentioned in Clause 1.2.1.1.(1)(b) of Division A.

1.2.1.2. Defined Terms

1) The words and terms in italics in Division C shall have the meanings assigned to them in Article 1.4.1.2. of Division A.

1.2.2. Symbols and Other Abbreviations

1.2.2.1. Symbols and Other Abbreviations

1) The symbols and other abbreviations in Division C shall have the meanings assigned to them in Article 1.4.2.1. of Division A.

Section 1.3. Interpretation, Intent and Prohibitions

1.3.1. General Interpretation

1.3.1.1. Interpretation

1) This By-law shall, despite any other provision herein, be interpreted in accordance with this Section.

2) The Schedules attached to this Part 1 form part of this By-law.

1.3.2. General Intent

1.3.2.1. Intent

1) This By-Law sets standards in the general public interest. It is enacted and retained on the understanding and specifically expressed condition that it creates no duty whatsoever on the *City*, the *Chief Building Official* or any employee of the *City* to enforce its provisions, and on the further condition that a failure to administer or enforce its provisions, or the incomplete or inadequate administration or enforcement of its provisions, shall not give rise to a cause of action in favour of any person whatsoever. The issuance of any *permit*, including an *occupancy permit*, is not a representation, warranty or statement that this By-Law or any other enactment has been complied with, and the issuance thereof in error shall not give rise to a cause of action. Accordingly, words in this By-law defining the responsibilities and authority of the *Chief Building Official* shall be construed as internal administrative directions which do not create a duty.

1.3.2.2. Reliance on Registered and Certified Professionals

1) The *City* and the *Chief Building Official* do not have the resources to deal with matters which fall within the expertise of *registered professionals* and the *City* and the *Chief Building Official* rely on letters of assurance, documents sealed with professional seals, and related documents received from *registered professionals*, and on *field reviews* carried out by or under the supervision of *registered professionals*, as evidence that the design and *construction* of *buildings* complies with the provisions of this By-law, including alternate solutions, and substantially complies with any other applicable enactments.

2) The *City* and the *Chief Building Official* do not have the resources to deal with matters which fall within the expertise of *certified professionals* and the *City* and the *Chief Building Official* rely on letters of assurance, documents stamped with professional stamps, and related documents received from *certified professionals*, on site reviews carried out by *certified professionals*, and on field reviews monitored by *certified professionals* as evidence that the design and *construction* of *buildings* complies with the provisions of this By-law, including alternate solutions and substantially complies with any other applicable enactments.

1.3.2.3. No Representation or Warranty

1) No person shall rely on a *permit* issued by the *Chief Building Official* or an inspection carried out by the *Chief Building Official* as establishing compliance with this By-Law or any other enactment or assume or conclude that this By-Law has been administered or enforced according to its terms.

2) All persons shall make such independent investigations as they deem necessary to determine whether a *building* complies with this By-law or any other enactment.

1.3.3. General Prohibitions

1.3.3.1. Contravention

1) No person shall fail to comply with an order or notice issued by the *Chief Building Official*.

1.3.3.2. No Work Without Permit

1) No person shall work or authorize or allow work to proceed on a *project* for which a *permit* is required unless a valid *permit* exists for the work to be done.

1.3.3.3. Deviation Needs Prior Approval

1) No person shall deviate from the plans and supporting documents forming part of the *permit*, without having first paid all necessary fees and obtained all necessary *permits* and approvals from the *Chief Building Official*.

1.3.3.4. No Occupancy Without Permission

1) No person shall occupy a *building* or authorize or allow the *occupancy* of a *building* without having first obtained the permission of the *Chief Building Official*.

1.3.3.5. Unsafe Conditions

(See Note A-1.3.3.5.)

1) No person who is an *owner* or who is involved in the *construction*, relocation or *occupancy* of a *building* shall cause, allow or maintain any *unsafe condition*.

1.3.3.6. Work on Public Property

(See Note A-1.3.3.6.)

1) No person shall excavate or undertake work on public property, or erect or place any *construction* or work or store any materials thereon without approval having first been obtained in writing from the *Chief Building Official* over such public property.

1.3.3.7. Changes in Ground Elevation and Limiting Distance

(Refer to Book I (General) of this By-law.)

1.3.3.8. Compliance with By-law and Other Enactments

1) No person shall work, or authorize or allow work to proceed, or undertake any *building*, *construction*, work or *occupancy* which is in contravention of this By-law or any other enactment.

1.3.3.9. False Information

1) No person shall submit false or incorrect information to the *Chief Building Official*.

1.3.3.10. Tampering with a Posted Notice or Order

1) No person, except for the *Chief Building Official*, shall reverse, alter, deface, cover, remove or in any way tamper with any notice or order which has been posted on or affixed to a *building* pursuant to this By-law.

Section 1.4. Obligations of the Owner and Contractor

1.4.1. Obligations of the Owner

1.4.1.1. Right of Entry of Chief Building Official

1) The *owner* shall allow the *Chief Building Official* to enter any *building* or premises at any reasonable time for the purpose of administering and enforcing this By-law.

1.4.1.2. Permit Required

1) The *owner* shall obtain all *permits* or approvals prior to commencing the work to which they relate.

1.4.1.3. Compliance with Permit

1) The *owner* shall comply with all conditions of a *permit* or a staged *permit*.

1.4.1.4. Posting a Permit

1) The *owner* shall ensure that the *permit* authorizing the work, or a true copy of the *permit*, is posted conspicuously on the site or is affixed to the exterior of the *building* during the entire *project*.

1.4.1.5. Compliance with By-law and other enactments

1) The *owner* shall comply with this By-law and all other applicable enactments.

2) The *owner* shall ensure that all work, *construction*, or *occupancy* is carried out in accordance with this By-law and all other applicable enactments.

3) The *owner* shall ensure that the *occupancy* of a *building* or part of a *building* complies with the *occupancy permit*.

4) The issuance of a *permit*, the acceptance of plans and supporting documents submitted for a *permit*, or the making of inspections by the *Chief Building Official* shall not relieve the *owner* of a *building* from the full responsibility for carrying out the work or having the work carried out in accordance with this By-law and all other applicable enactments.

5) The *owner* shall ensure that all underground storage tanks on the subject property that are intended for the storage of heating oil but have not been used for over 2 years are removed and any associated contamination is remediated to the applicable standards as prescribed in the Contaminated Sites Regulation. All work must be completed in accordance with the requirements of the Vancouver Fire By-law.

1.4.1.6. Compliance with Stop Work Order

1) The *owner* shall not carry out work or *construction* or suffer, permit or allow work or *construction* to be carried out in contravention of a stop work order issued by the *Chief Building Official*.

1.4.1.7. Compliance with Development Permit Plans

1) The *owner* shall ensure that the plans and supporting documents submitted for a *permit* conform substantially with the approved Development Permit plans and supporting documents, except that where differences exist, the *owner* shall make application for a “Development Permit Amendment” as required by the Zoning and Development By-law.

1.4.1.8. Owner’s Undertaking

1) The *owner* shall submit a completed *Owner’s* Undertaking letter to the *Chief Building Official* in support of and prior to the issuance of a *permit*, in the applicable form set out in Schedules E-1 and E-2 at the end of this Part.

1.4.1.9. Letters of Assurance

1) When required by this By-law, the *owner* shall provide to the *Chief Building Official* any applicable letters of assurance in the forms set out in Schedules A, B, C-A and C-B at the end of Part 2 of Division C of Books I and II of this By-law or in the forms set out in Schedules D and C-D at the end of Part 5 of Division B of Book I (General) of this By-law.

1.4.1.10. Project Directory

(See Note A-1.4.1.10.)

1) The *owner* shall, prior to commencing work, give notice in writing to the *Chief Building Official*, of the name, address, electronic mail address and telephone number of the *owner*, the *constructor* or other person in charge of the work, the *designer* reviewing the work, and any inspection or testing agency engaged to monitor the work.

2) During the course of the *construction*, the *owner* shall give immediate notice in writing to the *Chief Building Official*, of any change in employment of persons listed in the notice given pursuant to Sentence (1).

1.4.1.11. Other Notices

1) The *owner* shall give such other notices to the *Chief Building Official* as may be required by the *Chief Building Official*, by this By-law, or by another enactment.

1.4.1.12. Construction Safety

1) Where a *Construction Safety Plan* is required by Section 8.2 of Division B of Book I (General) of this By-law, the *owner* shall:

a) prior to commencing work, ensure that the *Construction Safety Plan* has been submitted to the *Chief Building Official*, and

b) during *construction*, ensure that the *Construction Safety Plan* is posted at all times and is amended from time to time in accordance with the requirements of this By-law.

2) Where a *building* is required by Subsection 2.2.7. of Division C of Book I (General) of this By-law to be professionally designed and reviewed, the *owner* shall, prior to commencing work, ensure that the *contractor* provides a full-time *construction safety officer* at the worksite.

1.4.1.13. Plans Required on Site

1) The *owner* shall ensure that the plans and specifications on which the issuance of the *permit* was based are available at the worksite for inspection during working hours by the *Chief Building Official*.

1.4.1.14. Site Cleared of Debris

1) The *owner* shall ensure that upon completion of *demolition* procedures, all debris and fill is cleared and the site levelled or graded, to the satisfaction of the *Chief Building Official*.

1.4.1.15. Tests to Establish Compliance

(See Note A-1.4.1.15.)

1) Where required by the *Chief Building Official* the *owner* shall make or have made, at the *owner's* expense, tests or inspections, as necessary to establish compliance with this By-law and shall promptly provide a copy of all such tests or inspection reports to the *Chief Building Official*.

1.4.1.16. Up-to-Date Survey

1) The *owner* shall provide to the *Chief Building Official* a survey, which has been certified by a registered land surveyor no more than 30 days before the date of delivery of the survey to the *Chief Building Official*

a) in the case of an *existing building* and site, if required by the *Chief Building Official* to substantiate the *building* location and size, above, at and below ground level, relative to the site,

b) in the case of an *existing building* and site, if required by the *Chief Building Official* to establish the relationship of the *building* to neighbouring grades, and

c) in the case of all new *buildings*, upon completion of foundations and footings and before any further *construction*, and the survey must include the elevation of a bench mark on the front of the foundation wall, to substantiate its size, location, and elevation relative to the site and to neighbouring grades.

1.4.1.17. Covering Work Prior to Inspection, Site Review or Field Review

1) The *owner* shall not cover work prior to inspection, site review or *field review*.

1.4.1.18. Request for Inspection

1) The *owner* shall give at least 24 hours notice to the *Chief Building Official* when requesting an inspection of work that is required or ordered to be inspected.

1.4.1.19. Uncovering Work

1) The *owner* shall uncover any work that has been covered without inspection, when required to do so by the *Chief Building Official*. (See Note A-1.4.1.19.(1).).

2) An *owner* who is required to uncover work by the *Chief Building Official* shall uncover and replace such work at the *owner's* expense.

1.4.1.20. Reinspection

1) If the *Chief Building Official* discovers faulty or incomplete work or faulty materials during an inspection, the *owner* shall apply for a reinspection.

2) Every applicant for a reinspection of a *project* shall pay the applicable reinspection fees set out in the Fee Schedule, prior to the reinspection.

1.4.1.21. Report of Building, Demolition or Excavation Failure

1) When a *building*, *demolition* or excavation failure occurs which causes or has the potential to cause injury or loss
of life, the *owner* shall

a) immediately report the failure to the *Chief Building Official*,
b) submit a report, if required to do so by the *Chief Building Official*, in accordance with Article 1.5.3.1., and
c) carry out any repairs or remedial work required by the *Chief Building Official*.

1.4.1.22. Removing Unsafe Conditions

1) When a *building* or part thereof is in an *unsafe condition*, the *owner* shall forthwith take all necessary action to put the *building* in a safe condition.

1.4.1.23. Damage to City Property

1) The *owner* is responsible for the cost of repair of any damage to *City* property or works located thereon that occurs as a result of undertaking work for which a *permit* or a *street* use *permit* was required.

1.4.1.24. Requirements Regarding Street Addresses

(Refer to Book I (General) of this Bylaw.)

1.4.1.25. Requirements regarding Professional Design and Review

1) In addition to the obligations listed in this section, the *owner* of a *building* to which the provisions of Part 2 of Division C of Book I (General) of this By-law apply, shall also comply with the *owner's* obligations in that Part.

1.4.2. Obligations of the Contractor

1.4.2.1. Construction Safety

1) The *contractor* shall ensure that all requirements of this By-law relating to *construction* safety are complied with, and shall ensure that every sub-*contractor* of the *project* has retained a *trades safety coordinator* as required by Sentence (2).
2) Every sub-*contractor* shall retain a qualified *trades safety coordinator* whose responsibilities shall include appropriate training of all persons working for the sub-*contractor* at the worksite in safe *construction* and installation practice.
3) The *trades safety coordinator* shall provide certification respecting training to the *Chief Building Official* upon request.

1.4.2.2. Work on Public Property

1) The *contractor* shall ensure that no excavation or other work is undertaken on public property, and that no *building* is erected or materials stored thereon, without first having obtained approval in writing from the appropriate government authority.

1.4.2.3. Compliance with By-law and Other Enactments

1) The *contractor* shall ensure that all work, *building*, *construction*, or *occupancy* is carried out in accordance with this By-law and with all other applicable enactments.

1.4.2.4. Right of Entry of Chief Building Official

1) The *contractor* shall allow the *Chief Building Official* to enter any *building* or premises at any reasonable time for the purpose of administering and enforcing this By-law.

1.4.2.5. Compliance with Stop Work Order

1) The *contractor* shall not carry out work or *construction*, or suffer, permit or allow work or *construction* to be carried out, in contravention of a stop work order issued by the *Chief Building Official*.

Section 1.5. Authority of the Chief Building Official

1.5.1. Administration

1.5.1.1. Administrator

1) The *Chief Building Official* is authorized to administer this By-law.

1.5.1.2. Filing Documents

1) The *Chief Building Official* is authorized to keep copies of applications received, *permits* and orders issued, inspections and tests made and papers and documents connected with the administration of this By-law, for such time as is required by law.

2) Despite the provisions of Sentence (1), the *Chief Building Official* is authorized to keep copies of applications received, *permits* and orders issued, inspections and tests made and papers and documents connected with the administration of this By-law, for such time as is necessary, in the opinion of the *Chief Building Official*, to support the administration of this By-law.

1.5.1.3. Inspection of Records

1) The *Chief Building Official* is authorized to provide plans and documents filed pursuant to the provisions of this By-law for inspection, subject to the provisions of the Freedom of Information and Protection of Privacy Act.

1.5.1.4. Fees for Inspection of Records

1) The *Chief Building Official* shall charge a fee as set out in the Fee Schedule, payable in advance, for the inspection of records referred to in Article 1.5.1.3.

2) No refund shall be issued for any fees or portion of fees, resulting from any outstanding costs incurred by the *City* for the inspection of records pursuant to Article
1.5.1.4.

1.5.2. Authorities

1.5.2.1. Power of Entry

(See Note A-1.5.2.1.)

1) The *Chief Building Official*, and any person authorized to act on behalf of the *Chief Building Official*, may enter any *building* or premises at any reasonable time for the purpose of administering or enforcing this By-law, or immediately if there is reason to believe an *unsafe condition* exists.

1.5.2.2. Review of Value of Work

1) The *Chief Building Official* may review the value of the proposed work in an application for a *permit* and may substitute a different value, in accordance with Articles 1.6.2.3. and 1.6.2.4., for the purpose of determining applicable *permit* fees.

1.5.2.3. Construction Safety

1) The *Chief Building Official* may review a *Construction Safety Plan* and may require that the *Construction Safety Plan* be changed or amended.

1.5.2.4. Permit Issuance

1) The *Chief Building Official* shall issue a *permit* when the applicable requirements of this By-law have been met.

1.5.2.5. Permit Refusal

1) The *Chief Building Official* may refuse to issue a *permit*

a) if plans or supporting documents are incomplete or do not comply with the provisions of this By-law,

b) if plans or supporting documents contain false or incorrect information, or

c) for any *building*, *construction*, work or *occupancy* that would not be permitted by this By-law or by another enactment.

2) The *Chief Building Official* shall provide reasons for the refusal to issue a *permit*, on the request of an applicant or *owner*.

1.5.2.6. Permit with Incomplete Application

(See Note A-1.5.2.6.)

1) The *Chief Building Official* may issue a *permit* for a *building* based on an incomplete application if the incomplete information is of a secondary nature and is unavailable at the time of *permit* issuance.

2) If the *Chief Building Official* issues a *permit* pursuant to Sentence (1) the *Chief Building Official* may impose conditions requiring submission of further information by a specified date.

3) The *Chief Building Official* may suspend or revoke a *permit* issued pursuant to Sentence (1), if the holder of the *permit* fails to comply with the conditions imposed by the *Chief Building Official*.

1.5.2.7. Conditions on Permits

1) The *Chief Building Official* may impose conditions on *permits* including, but not limited to, conditions regarding

a) notifications and notices,

b) safety,

c) health,

d) design requirements,

e) *construction* requirements,

f) timing of *construction*,

g) deadlines for completion of *construction*,

h) reviews and inspections,

i) responsibilities of the *owner*, *constructor*, *registered professional* and *certified professional*,

j) compliance with this By-law and other enactments,

k) use and *occupancy*, and

l) temporary *buildings* and *occupancies*.

1.5.2.8. Permits for Existing Buildings

1) The *Chief Building Official* may issue a *permit* for an *existing building* in accordance with the provisions of Part 11 of Division B of Book I (General) of this By-law and may impose conditions on the *permit*.

2) The *Chief Building Official* may permit an alternative solution to the alternative *acceptable* solutions provided in this By-law for the conversion of an *existing building* if

a) the *owner* demonstrates, to the satisfaction of the *Chief Building Official*, that the level of upgrade required presents an extraordinary hardship for the *owner*, and

b) the *owner* proposes an alternative solution which achieves the objectives of the alternative *acceptable* solutions prescribed by this By-law, to the satisfaction of the *Chief Building Official*.

1.5.2.9. Combustible Construction for Minor Repairs in Existing Buildings

(Refer to Book I (General) of this Bylaw.)

1.5.2.10. Permits for Plumbing and Sprinkler Systems

1) The *Chief Building Official* may issue a *permit* for a plumbing system or *sprinkler system* in accordance with the provisions of Subsection 1.6.3.

1.5.2.11. Permits in Designated Flood Plain

1) If a *building* is located on a *designated flood plain* the *Chief Building Official* may

a) require plans and supporting documents to demonstrate that the elevation or design of the *buildings* incorporates *flood construction level requirements* intended to reduce the risk of flood damage,

b) require that a covenant acknowledging the risk of flood damage be registered against the land, and

c) withhold issuance of a *permit* until the requirements of the *Chief Building Official* have been satisfied.

2) The *Chief Building Official* may increase the *flood construction level requirements* or the setback requirements as provided in Article 2.2.9.5.

3) The *Chief Building Official* may relax the *flood construction level requirements* or the setback requirements in this By-law as provided in Article 2.2.9.6.

1.5.2.12. Permit for Staged Construction

(See Note A-1.5.2.12.)

1) Where a *permit* for staged *construction* is applied for pursuant to Subsection 1.6.5., the *Chief Building Official* may authorize the excavation or *construction* of a portion of a *building*, and may impose conditions to ensure compliance with this By-law, before all the plans and supporting documents for the *building* have been accepted, at the risk of the *owner*.

2) The *Chief Building Official* may suspend or revoke a *permit* issued pursuant to Subsection 1.6.5. if the holder of the *permit* fails to comply with the conditions imposed by the *Chief Building Official*.

1.5.2.13. Minor Revisions to Permit

1) The *Chief Building Official* may accept an application for minor revisions to an existing *permit* if the proposed revisions do not add or delete additional *storeys* or *major occupancy* classifications to or from the *project*.

1.5.2.14. Requirement for New Permit

1) The *Chief Building Official* may require that an applicant for revisions to an existing *permit* apply for a new *permit*,
if the proposed revisions would add or delete *floor area*, *storeys*, *dwelling units* or *major occupancy* classifications to or from the *project*.

1.5.2.15. Permit Suspension

1) The *Chief Building Official* may suspend a *permit* by issuing an order to stop work.

1.5.2.16. Permit Revocation

1) The *Chief Building Official* may revoke a *permit* if

a) there is a contravention of any condition under which the *permit* was issued,

b) the *permit* was issued in error, or

c) the *permit* was issued on the basis of false or incorrect information.

1.5.2.17. Permit Extension

1) The *Chief Building Official* may extend a *permit* in accordance with Subsection 1.6.7. of this Part.

1.5.2.18. Designation of Street Addresses

1) The *Chief Building Official* may, at any time, number, renumber or assign a series of numbers or *suite* numbers to any *building*, or part thereof.
2) Upon the issuance of a *building permit*, the *Chief Building Official* shall designate the *street* address or series of *suite* numbers required for the *building*, or any portion of the *building*.
3) Upon registration of a parcel of land in the Land Title Office, the *Chief Building Official* shall designate the *street* address or series of numbers required for the parcel.

1.5.2.19. Renumbering of Street Addresses

1) Where an *owner* has requested a renumbering and has paid the applicable fees set out in the Fee Schedule, the *Chief Building Official* may renumber any *building* or *suite* within a *building*, or parcel of land.

1.5.2.20. Proof of Compliance

1) The *Chief Building Official* may direct that tests of materials, equipment, devices, *construction* methods, structural assemblies or foundations be made, or sufficient evidence or proof be submitted, at the expense of the *owner*, where such evidence or proof is necessary, in the opinion of the *Chief Building Official*, to determine whether the material, equipment, device, *construction*, structural assembly or foundation condition complies with this By-law.

1.5.2.21. Occupancy Permit for Building at Variance with By-law

1) The *Chief Building Official* may issue an *occupancy permit* for a *building* which varies in a minor respect from the requirements of this By-law if, in the opinion of the *Chief Building Official*, such variation will not substantially interfere with the objectives of this By-law.

1.5.2.22. Occupancy Permit Prior to Completion

1) The *Chief Building Official* may issue an *occupancy permit* to allow the *occupancy* of a *building* or a part thereof for the approved use, prior to commencement or completion of the *construction* or *demolition* work.
2) The *Chief Building Official* may impose conditions on an *occupancy permit* issued in accordance with Sentence (1).

1.5.3. Authorities Regarding Unsafe and Unsanitary Conditions

1.5.3.1. Report of Failure

1) Where any *building*, *construction* or excavation failure occurs which causes or has the potential to cause injury or loss of life, the *Chief Building Official* may require the *owner* to submit a report which includes

a) the name and address of the *owner*,
b) the address or location of the *building*, *demolition* or excavation,
c) the name and address of the constructor,
d) the nature of the failure,
e) the cause of the failure,
f) a remedial plan to correct the failure, and
g) a plan to prevent future failure.

1.5.3.2. Hazardous Material

1) The *Chief Building Official* may require that any person supervising or doing work to install or remove *building* materials provide evidence of their training, certification or qualifications, if the installation or removal of *building* materials may create an *unsafe condition* or affect the structural safety or fire protection of a *building*.

1.5.3.3. Order to Remove Unsafe Condition

1) When any *building*, *construction* or excavation or part thereof is in an *unsafe condition*, the *Chief Building Official* may issue a written order to the *owner*, certifying the existence of an *unsafe condition* and requiring correction of any *unsafe condition* found on a *building* site, within a specified time.

1.5.3.4. Order to Repair Plumbing Systems

1) The *Chief Building Official*, if of the opinion that the *plumbing system*, or any part of it, in any *building* is defective, unsanitary or inadequate, may notify the *owner* or occupant thereof of such condition and may order that such *plumbing system*, or part thereof, be placed in a proper, safe and sanitary condition.

2) The *Chief Building Official*, if of the opinion that the *plumbing system*, or any part of it, in any *building* may has become dangerous or defective on account of the settlement of the *building* or through abuse, accident or for any other cause whatsoever, may order the *owner* or occupant thereof to have a *plumbing contractor* conduct a smoke test on the waste and *vent pipes* of the *building* to ascertain whether any dangerous or defective condition exists.

1.5.3.5. Corrective Measures

1) If the *Chief Building Official* has issued an order in accordance with Article 1.5.3.3. or 1.5.3.4. and an *owner* has failed to comply with that order, the *Chief Building Official* may

a) authorize *demolition*, removal, posting of security guards or fire wardens, or enclosure of a *building*, *construction*, excavation or part thereof, at the expense of the *owner*,

b) recover such expense in the manner set out in Article 1.5.3.6., and

c) take such other measures as may be necessary to protect the public.

1.5.3.6. Immediate Measures

1) When immediate measures must be taken to avoid an imminent danger or risk of accident, the *Chief Building Official* may take such action as is appropriate, without prior notice and at the expense of the *owner*.

2) Where immediate security measures must be taken to limit the risk of damage, vandalism, theft, loss, or the creation of *unsafe conditions*, the *Chief Building Official* may board-up or otherwise secure a *building* against unauthorized entry without prior notice and at the expense of the *owner*.

1.5.3.7. Recovery of City Costs

1) The cost of the measures described in Articles 1.5.3.5. and 1.5.3.6. shall be recoverable from the *owner*

a) in any Court of competent jurisdiction, or

b) by entry of such cost in the real property roll with respect to the property and by collection in the same manner as the taxes shown in the real property roll.

1.5.4. Notices and Orders

1.5.4.1. Notices or Orders

1) The *Chief Building Official* may issue in writing such notices or orders as may be necessary to inform the *owner* of a contravention of this By-law, in the manner set out in this By-law.

1.5.4.2. Scope of Orders

1) The *Chief Building Official* may order

a) a person to comply with the provisions of this By-law within a specified time,

b) a person to allow the *Chief Building Official* to enter any *building* or premises at any reasonable time for the purpose of administering and enforcing this By-law,

c) work to stop on a *building* or any part thereof, if such work is proceeding in contravention of a provision of this By-law or another enactment, or if there is deemed to be an *unsafe condition*,

d) the removal of an unauthorized encroachment on public property,

e) the removal of any *building* or part thereof constructed in contravention of a provision of this By-law,
f) the cessation of any *occupancy* in contravention of a provision of this By-law,
g) the cessation of any *occupancy* if an *unsafe condition* exists,
h) the correction of an *unsafe condition*,
i) the correction of an unsanitary condition,
j) a person to provide a written assessment of a specified condition by a *registered professional* if there is deemed to be an *unsafe condition, and*
k) a person to secure a building against unauthorized entry.

1.5.4.3. Contents of Notice

1) A notice shall state the nature of any contravention and specify the date or the phase of *construction* by which remedial measures must be completed.

1.5.4.4. Delivery of Notice

1) A notice may be posted on a *building*, and may be delivered by regular mail or by hand to the person listed as the *owner* in the records of the Assessment Authority of British Columbia or to a representative of the *owner*.

1.5.4.5. Contents of Order

1) An order shall specify any contraventions of this By-law or any *unsafe condition* or unsanitary condition and may require *demolition*, removal, or compliance with this By-law, by a specified phase of *construction*, or within a specified time after the date of mailing or posting the order.
2) Despite Sentence (1), an order to stop work, board up or cease *occupancy* shall state the nature of the contravention or *unsafe condition*, and may order the immediate suspension of *construction* or of *occupancy* and the rectification of the contravention or *unsafe condition*.

1.5.4.6. Delivery of Order

1) The *Chief Building Official* may deliver an order
a) by mailing the order by registered mail or by regular mail to the *owner* at the *owner's* address as it appears on a Tax Certificate or a State of Title Certificate, and posting the order on the premises which is the subject of the order,
b) by sending the order by electronic mail to the electronic mail address of the *owner* or a representative of the *owner*, or
c) by delivery of the order by hand to the *owner* or a representative of the *owner*.
2) When a building is at imminent or unreasonable risk of collapse which could pose a danger to building occupants or the public, the Chief Building Official may post an order to cease occupancy on the premises which is the subject of the order, which shall be deemed to comply with the requirements of Sentence (1).
3) Delivery of an order in accordance with the provisions of Sentences (1) or (2) shall be deemed to be good and sufficient service of the order.

Section 1.6. Permits, Applications and Fees

1.6.1. Permits

1.6.1.1. When a Permit is Required

1) A *permit* is required before any work regulated by this By-Law is undertaken.

1.6.1.2. Construction without a Permit

1) If *construction* for which a *permit* is required has been commenced before a *permit* has been issued, the *owner* shall

a) make application for any necessary *permits* in accordance with Subsection 1.6.2. of this By-law, and

b) pay to the *City*, a minimum of $500 or double the fee set out in the Fee Schedule to a maximum of $20,000, whichever is the lesser amount.

2) If *construction* for which a *permit* is required has been commenced before a *permit* has been issued, the *owner* shall, if ordered to do so by the *Chief Building Official*,

a) provide proof that the *construction* complies with this By-law and any other applicable enactments,

b) carry out tests and investigations by independent agencies, at the cost of the *owner*, to determine whether or not the *construction* complies with this By-law,

c) carry out tests and investigations by independent agencies, at the cost of the *owner*, to determine appropriate remedial measures to ensure that the *construction* complies with this By-law,

d) provide to the *Chief Building Official*, at the cost of the *owner*, the results of any tests and investigations ordered by the *Chief Building Official*, and

e) provide documentation to the satisfaction of the *Chief Building Official* to establish that all remedial measures to ensure the *construction* complies with this By-law have been completed.

1.6.1.3. Additional Permits

1) In addition to a *permit* required by Article 1.6.1.1., other *permits* and supporting documents necessary for specific *building* components, services and uses, may be required by the *Chief Building Official*.

1.6.2. Application for Permit

1.6.2.1. Owner Requirement

1) To obtain a *permit*, the *owner* shall file an application in writing in the form prescribed by the *Chief Building Official*.

1.6.2.2. Application Requirements

(See Note A-1.6.2.2.)

1) Except as otherwise provided in this By-law, every application shall

a) describe the work, *building*, *construction* or and *occupancies* for which the *permit* is required,

b) provide a legal description and address for the land on which the work is to be done,

c) include plans and other supporting documents which conform with Section 2.2. of Division C,

d) state the value of the proposed work calculated in accordance with Article 1.6.2.3.,

e) include the requisite *permit* fee, in accordance with the Fee Schedule at the end of this Part,

f) include the appropriate *owner's* undertaking letter in the applicable form set out in Schedule E-1 or E-2 at the end of this Part,

g) include any other plans or supporting documents required by the *Chief Building Official* to establish that the work, *building*, *construction* and *occupancy* complies with this By-law or any other enactment, and

h) list the names, addresses, electronic mail addresses and telephone numbers of all *owners*, designers and constructors.

1.6.2.3. Valuation for Permit

1) The value of the proposed work stated on the application for the *permit* shall reflect the total current monetary worth of all proposed materials, *construction* and work related to the *building*.

2) In addition to Sentence (1), the value of the proposed work shall include the total current monetary worth of all labour and all fees and costs incurred for design, investigative testing, consulting services, *construction*, *construction* management, *contractor's* profit and overhead, sales taxes, and *construction* insurance related to the *building*.

3) The total current monetary worth referred to in Sentences (1) and (2) shall include the market value of all labour, including unpaid labour provided by an *owner* or volunteer, and the market value of all materials, including donated, recycled or used materials.

4) The total current monetary worth referred to in Sentences (1) and (2) shall include all components of the *building*, notwithstanding the fact that some components of the *building* may be subject to other *permits* and fees.

1.6.2.4. Review of Valuation by *Chief Building Official*

1) The *Chief Building Official* may review the value of the proposed work stated in an application, using the Marshall Valuation Method, and may substitute a different value for the proposed work.

1.6.2.5. Fee Schedule

1) *Permit* fees shall be calculated in accordance with the Fee Schedule at the end of this Part and the fees for *construction* without a *permit* are as outlined in Article 1.6.1.2.

1.6.2.6. No Refund

1) Except as permitted in Article 1.6.2.7. or Article 1.6.4.5., no *permit* fees or part thereof shall be refunded if

a) *construction* authorized by a *permit* has commenced,

b) the *permit* has expired pursuant to Article 1.6.7.1., or

c) the application has lapsed as outlined in Article 1.6.2.8.

1.6.2.7. Partial Refund and Set-off

1) If *construction* authorized by *permit* has not commenced and the *Chief Building Official* approves, the Director of Finance may refund a portion of the fees related to the *permit*, after deduction of any outstanding costs incurred by the *City* in processing the application for the *permit* and in carrying out any work pursuant to Article 1.5.3.4. or Article 1.5.3.5.

1.6.2.8. Lapse of Application

1) Subject to the provisions of Article 1.6.2.9., an *owner* shall comply with all the necessary requirements to complete an application for a *permit* within 6 months after the date of receipt of the application by the *Chief Building Official*.

2) If an *owner* fails to comply with the requirements of Sentence (1), the application for a *permit* shall lapse.

3) An application for a *permit* which has lapsed is expired and shall not be renewed except in accordance with Article 1.6.2.9.

1.6.2.9. Renewal of Lapsed Application

1) The *Chief Building Official* may renew a lapsed application for a *permit* if the *Chief Building Official* determines that

a) no more than 3 months have passed since the date the application lapsed, and

b) the failure to complete the requirements of the original application for a *permit* was reasonable in the circumstances.

2) Despite the provisions of Sentence (1), the *Chief Building Official* shall not renew a lapsed application for a *permit* more than once.

3) An application for a *permit* which has been renewed pursuant to Sentence (1) must comply with any amendments to this By-law made since the date of receipt of the original application by the *Chief Building Official*.

1.6.3. Additional Requirements for Plumbing and Sprinkler Permits

1.6.3.1. Application Requirements

1) The *Chief Building Official* may issue a *permit* for a *plumbing system* or *sprinkler system* if the applicant is authorized to obtain such a *permit* in accordance with the provisions of this Section.

1.6.3.2. Permit for Plumbing System

1) The *Chief Building Official* shall only issue a *permit* to construct, extend, alter, renew or repair a *plumbing system* to a licensed plumbing *contractor*.

1.6.3.3. Permit for Sprinkler System

1) The *Chief Building Official* shall only issue a *permit* to construct, extend, alter, renew or repair a *sprinkler system* to a licensed *sprinkler contractor*.

1.6.3.4. Permit for Plumbing System to Licensed Contractor

1) Despite the provisions of Article 1.6.3.2., the *Chief Building Official* may issue a *permit* to a licensed *contractor*

a) to install *sewers*, *sumps*, *catch basins*, and water lines outside of a *building*, or

b) to install *backflow* devices or other similar protection devices inside a *building*.

1.6.3.5. Permit for Plumbing System to Owner

1) Despite the provisions of Article 1.6.3.2., the *Chief Building Official* may issue a *permit* to the *owner* of a residential *building* with not more than one principal *dwelling unit* to do plumbing work in that *building* if the *owner* is the occupier of the *building*.

1.6.3.6. No Permit for Minor Repairs to Plumbing System

1) Despite the provisions of Article 1.6.3.1., no *permit* is required to repair or replace a valve, faucet, fixture, *fixture outlet pipe* or *service water heater*, to clear a stoppage, or to repair a leak, if there is no change to any other piping.

1.6.3.7. Requirement for Inspection

1) No person shall use a *plumbing system* or *sprinkler system* until it has been inspected by the *Chief Building Official*.

1.6.4. Applications by Certified Professionals

1.6.4.1. Applications for Permits by Certified Professionals

1) A *Certified Professional* may apply for a *permit* on behalf of an *owner*.

1.6.4.2. Requirements for Permit

1) A *Certified Professional* who applies for a *permit* on behalf of an *owner* must comply with the requirements of Section 1.6 of this By-law.

1.6.4.3. Application Review For Permit

1) The *Chief Building Official* may issue a *permit* based upon a modified review of the drawings and other supporting documents submitted with the application for a *permit* by a *Certified Professional*.

1.6.4.4. Site Review For Permit

1) A *Certified Professional* shall carry out detailed site reviews and shall be responsible for monitoring and follow-up necessary to support the *construction* authorized by the *permit* and to support the *construction* of the entire *building*.

1.6.4.5. Refund of Permit Fees

1) Except as otherwise determined in this Article, the *Chief Building Official* may refund a portion of the fees for a *permit* issued to a *Certified Professional* for the administrative costs assumed by the applicant that would have otherwise been incurred by the *Chief Building Official.*
2) An application for a refund of *permit* fees pursuant to Sentence (1) must be submitted to the Chief Building Official in writing, within 90 days following the issuance of a final *occupancy permit*.
3) Calculation of the administrative costs pursuant to Sentence (1) shall be determined from
a) the prevailing fee rate(s) at the time of application for the refund, and
b) as applicable and determined in
i) the Schedule of Fees at the end of this Part, or
ii) the Schedule of Fees in the "Zoning and Development Fee By-law" currently in force and effect.
4) No refund for *permit* fees or part thereof identified pursuant to Sentence (1) shall be issued for
a) *alterations* to *existing buildings*, or
b) the failure to make an application pursuant to the requirements of Sentence (2).

1.6.5. Applications for Staged Construction by Certified Professionals

1.6.5.1. Requirements for Staged Construction
1) The *Chief Building Official* may issue a *permit* to construct a *building* in stages if
a) the applicant for the staged *construction* is a *Certified Professional*,
b) the *Certified Professional* also applies for permission to construct the entire *building*,
c) the *Certified Professional* submits complete plans and all supporting documents for each portion of the work for which a *permit* for staged *construction* is sought, and
d) the *Certified Professional* submits all documents required pursuant to the Certification of Professionals By-law.

1.6.5.2. Owner's Risk
1) The issuance of a staged *permit* creates no obligation on the *Chief Building Official* to issue any other staged *permits* or to issue a *permit* to construct the entire *building*.
2) An *owner* who commences *construction* of a *building* in accordance with a staged *permit* does so at the *owner's* risk.

1.6.5.3. Owner's Responsibility
1) An *owner* who fails to complete the work authorized by a *permit* for staged *construction* or who fails to comply with the conditions of a *permit* for staged *construction* shall restore the site to a safe condition, to the satisfaction of the *Chief Building Official*.

1.6.5.4. Application Review for Permit for Staged Construction
1) Where a *Certified Professional* complies with all application requirements for a *permit* for staged *construction*, the *Chief Building Official* may issue a *permit* for staged *construction* based upon a modified review of the drawings and other supporting documents submitted for the *permit* for staged *construction*.

1.6.5.5. Site Review of Staged Construction
1) Where a *permit* for staged *construction* is issued, the *Certified Professional* shall carry out detailed site reviews and shall be responsible for monitoring and follow-up necessary to support the *construction* authorized by the *permit* for staged *construction* and to support the *construction* of the entire *building*.

1.6.6. Revisions

1.6.6.1. Revisions to Applications
1) All applications for revisions to the original application shall comply with Article 1.6.2.2.

2) When revisions to the original application result in an increase in the value of the proposed work, the *Chief Building Official* shall review the valuation and recalculate the *permit* fee in accordance with this By-law.
3) When application documents are either incomplete or changed to the extent that an additional plan review is necessary, an additional revision fee shall be charged in accordance with the Fee Schedule at the end of this Part.

1.6.6.2. Minor Revisions to Permits
1) All applications for minor revisions to the original *permit* shall comply with Article 1.6.2.2. to the extent required by the *Chief Building Official*.
2) When applications for minor revisions to the original *permit* result in an increase in the value of the proposed work, the *Chief Building Official* shall review the valuation and recalculate the *permit* fee in accordance with this By-law.
3) An additional revision fee shall be charged for applications for minor revisions to the original *permit* in accordance with the Fee Schedule at the end of this Part.

1.6.7. Permit Expiry and Extension

1.6.7.1. Permit Expiry
1) Except as provided in this Subsection, a *permit* shall expire and the rights of the *owner* under the *permit* shall terminate if in the opinion of the *Chief Building Official*
a) the work authorized by the *permit* is not commenced within 6 months from the date of issue of the *permit*,
b) the work although commenced is not continuously and actively carried out thereafter, or
c) the work has been substantially discontinued for a period of 6 months. (See Note A-1.6.7.1.(1).)
2) Except as provided in this Subsection 1.6.7., a *permit* for a temporary *building* or *occupancy* shall expire and the rights of the *owner* under the *permit* shall terminate on the expiry date noted on the *permit*.

1.6.7.2. Application to *Chief Building Official* for Extension
1) An *owner* who wishes to seek an extension of a *permit* shall make application to the *Chief Building Official* prior to the expiry of the *permit*.
2) An *owner* who wishes to seek an extension of a *permit* shall submit the application in writing accompanied by the requisite extension fee.

1.6.7.3. Extension of Permit by *Chief Building Official*
1) If the *Chief Building Official* is of the opinion that substantial completion of the work has been prevented because of exceptional circumstances, the *Chief Building Official* may extend the *permit* twice only, provided that, in the meantime, no applicable amendments have been made to this By-law.
2) If the *Chief Building Official* is of the opinion that a *building* or *occupancy* is temporary, the *Chief Building Official* may extend the *permit* for a temporary *building* or *occupancy* twice only, provided that, in the meantime, no applicable amendments have been made to this By-law.

1.6.7.4. Application to Council for Extension
1) An *owner* who has been granted an extension of a *permit* by the *Chief Building Official* may make application to Council for a further extension prior to the expiry of the *permit*.
2) An *owner* who wishes to seek an extension of a *permit* from Council shall submit an application in writing to the *Chief Building Official* accompanied by the requisite extension fee.
3) The *Chief Building Official* shall forward to Council any application submitted in accordance with this section, together with information and advice to assist Council in considering the application.

1.6.7.5. Extension of Permit by Council

1) Council may extend a *permit* for such further period or periods it deems appropriate.
2) If Council grants an extension of a *permit*, the *Chief Building Official* shall endorse the further extension or extensions on the *permit*.

1.6.8. Permits for Temporary Buildings, Including Tents and Air-Supported Structures

1.6.8.1. Definition of "Temporary"

1) In this Subsection, "temporary" means for a time period not exceeding twelve consecutive months.

1.6.8.2. Compliance with By-law

1) Except as otherwise provided in this Subsection or in Section 11.6, Division B, Book 1, no person shall erect a temporary *building*, including a tent or *air-supported structure*, which does not comply with this By-law.

1.6.8.3. Permit Required

1) No person shall erect, or use or occupy a temporary *building*, including a tent or *air-supported structure* without a *permit*.

1.6.8.4. Compliance with Permit Conditions

1) No person shall erect, or use or occupy a temporary *building*, including a tent or *air-supported structure*, in contravention of the conditions of a *permit*.

1.6.8.5. Application Requirements

1) The application for a *permit* for a temporary *building*, including a tent or *air-supported structure*, shall be accompanied by

a) plans showing the location of the temporary *building*, tent or *air-supported structure* on the site, all other *existing buildings* on the same property and all other *buildings* on adjacent property located within at least 10 feet of the property line of the site,
b) *construction* details of the *building*, tent or *air-supported structure*, and
c) a statement by the *owner* indicating the intended use and intended duration of such use.

2) The application for a temporary *occupancy permit* for a tent or *air-supported structure* shall be accompanied by documentation sufficient to establish that the tent or *air-supported structure* complies with Subsection 3.1.6. of Division B of Book I (General) of this By-law.

1.6.8.6. Time Limited Permits for Temporary Buildings

1) The *Chief Building Official* may issue a *permit* authorizing the *construction*, use or *occupancy* of a temporary *building*, including a tent or *air-supported structure*, and may attach conditions to such *permit*, including conditions allowing for selective compliance with the provisions of this By-law, if the *Chief Building Official* determines that the *construction*, use or *occupancy* will exist for a short time, and the circumstances do not warrant complete compliance with this By-law.

1.6.8.7. Permit End Date

1) A *permit* for a temporary *building*, including a tent or *air-supported structure*, shall state the date after which the *permit* is no longer valid.

1.6.8.8. Permit Extension

1) A *permit* for a temporary *building*, including a tent or *air-supported structure*, may only be extended if an extension is granted by the *Chief Building Official* prior to the expiry of the *permit*.
2) An *owner* who wishes to seek an extension of a *permit* for a temporary *building* from the *Chief Building Official* shall submit an application in writing to the *Chief Building Official* accompanied by the requisite extension fee.

3) If the *Chief Building Official* is of the opinion that the temporary *building* complies with the life safety requirements of this By-law, the *Chief Building Official* may extend the *permit* once only, and the *Chief Building Official* may require documentation from *registered professionals* to verify that the requirements of this By-law are being met.

1.6.9. Operating Permits

1.6.9.1. Operating Permit Required

1) No person shall install or retain existing equipment or systems for which an *operating permit* is required under this By-law, without an *operating permit*.

1.6.9.2. Compliance with Permit Conditions

1) No person shall install or retain existing equipment or systems for which an *operating permit* is required under this By-law, in contravention of the conditions of an *operating permit*.

1.6.9.3. Application Requirements

1) To obtain an *operating permit*, the *owner* shall file an application in writing in the form prescribed by the *Chief Building Official*.

2) The application for an *operating permit* shall be accompanied by the *operating permit* fees and any documentation required by the *Chief Building Official* to verify that the requirements of this By-law are being met.

1.6.9.4. Permit Expiry

1) An *operating permit* shall expire and the rights of the *owner* under the *operating permit* shall terminate on the expiry date noted on the *operating permit*.

1.6.9.5. Operating Permit Fees

1) *Operating permit* fees are as set out in the Schedule of Fees at the end of this Part.

Section 1.7. Permission to Occupy Buildings

1.7.1. General

1.7.1.1. Occupancy Permit Required

1) Except as otherwise provided in this By-law, no person shall occupy or allow the *occupancy* of any *building* or part thereof unless the *owner* has obtained an *occupancy permit* from the *Chief Building Official*.

2) No person shall occupy any *building* for a purpose other than the *occupancy* stipulated in an *occupancy permit* issued by the *Chief Building Official*.

1.7.1.2. Occupancy Permit

(See Note A-1.7.1.2.)

1) Every *owner* shall obtain an *occupancy permit* from the *Chief Building Official* prior to any

a) *occupancy* of a *building* or part thereof after *construction* or *alteration* of that *building*,

b) change in the *major occupancy* of any *building* or part thereof, or

c) change in the permitted *occupancy* within the same Division of the *major occupancy* Group, where the occupant load or the fire load has increased.

1.7.1.3. Exemptions from Occupancy Permit

1) Despite the requirements of Articles 1.7.1.1. and 1.7.1.2., an *occupancy permit* is not required for

a) residential *building* with not more than two principal *dwelling units*, or

b) a change in the permitted *occupancy* within the same *major occupancy* classification provided the *occupant load* is not increased and no *construction* has taken place.

1.7.1.4. Posting of Lawful Use

1) In any *building* not requiring an *occupancy permit*, the *Chief Building Official* may post a notice which describes the uses to which the *building* may be lawfully put.

1.7.2. Occupancy Permit Process

1.7.2.1. Owner's Obligation

1) An *owner* who wishes to obtain an *occupancy permit* shall file an application in the form required by the *Chief Building Official*.

1.7.2.2. Requirements for Occupancy Permit Application

1) The *permit* application requirements described in Article 1.6.2.2. do not apply to an application for an *occupancy permit* if the application includes

a) a letter from the *owner* declaring that the work complies with the By-law, the necessary *permits*, including *operating permits*, have been obtained and the *building* conforms with the accepted plans, in any case where a professional is not required by Subsection 2.2.7., Division C, Book I,
b) the appropriate letters of assurance in any case where a professional *field review* is required by Subsection 2.2.7. of Division C of Book I (General) of this By-law,
c) the anticipated date of completion,
d) the classification of the *building*,
e) the number of *storeys* in the *building*,
f) the gross *floor area* of each *storey*,
g) the allowable *live loads* for each *floor area*, and
h) an annual permit as required by the Electrical By-law.

1.7.2.3. Scheduling of Construction, Fire and Life Safety Systems Inspection

1) Prior to the issuance of an *occupancy permit*, the *owner* of a *building* shall call for and coordinate a final inspection of *construction*, fire and life safety systems in the *building*.

1.7.2.4. Requirements prior to Construction, Fire and Life Safety Systems Inspection

1) At least 24 hours prior to the final inspection for an *occupancy permit*, every *owner* shall submit to the *Chief Building Official*

a) proof of compliance with the By-law for all materials, equipment and methods of *construction*,
b) letters of assurance in the applicable forms attached as Schedules C-A and C-B, at the end of Part 2 of Division C,
c) a *contractor's* material and test certificate, certifying that the *sprinkler systems* have been flushed, inspected and tested,
d) a certificate of verification and a manufacturer's inspection report for the fire alarm system,
e) a fire safety plan and record of installed fire safety systems, conforming to the Fire By-law, and
f) a letter from a fire protection consultant verifying that the special devices or methods forming part of the alternative solution achieves the alternative solution.

1.7.2.5. Requirements during Construction, Fire and Life Safety Systems Inspection

1) During the final inspection of *construction*, fire and life safety systems in the *building*, the *owner* of the *building* shall make available

a) a copy of the fire safety plan,
b) a copy of the record of installed fire safety systems, and

c) a preventive maintenance and testing schedule and a maintenance log book for the life and fire safety systems.

1.7.2.6. Notice of Change Prior to Occupancy

1) Every *owner* shall give notice in writing to the *Chief Building Official* of any change to the *owner's* address or any change in the *ownership* of the *building* which occurs

a) prior to the issuance of an *occupancy permit*, or

b) prior to the *occupancy* of the *building*.

1.7.3. Partial Occupancy Permit for Building Under Construction

1.7.3.1. Partial Occupancy Permit

1) The *Chief Building Official* may issue a partial *occupancy permit* for part of a *building* which is under *construction* if, in the opinion of *Chief Building Official*, such partial *occupancy* would not jeopardize life or property.

2) The *Chief Building Official* may impose conditions on a partial *occupancy permit*.

3) The *Chief Building Official* may revoke a partial *occupancy permit* if the *permit* holder fails to comply with the conditions imposed by the *Chief Building Official*.

4) The *Chief Building Official* may revoke a partial *occupancy permit* if the *owner* fails to comply with any *permit* relating to the *building*.

1.7.3.2. Owner's Obligation regarding Unsafe Conditions

1) The *owner* of a *building* for which a partial *occupancy permit* has been issued shall ensure that there are no *unsafe conditions* in the *building*.

1.7.4. Temporary Occupancy Permit

1.7.4.1. Temporary Occupancy Permit

1) The *Chief Building Official* may issue a temporary *occupancy permit* for a temporary use within an *existing building*, or for the limited use of a *building* approved according to Subsection 1.6.8. or as otherwise provided in this By-law.

1.7.5. Re-Occupancy Permit

1.7.5.1. Re-occupancy Permit

1) Every *owner* shall obtain a re-*occupancy permit* from the *Chief Building Official* prior to any *occupancy* of a *building* or part thereof in respect of which the *Chief Building Official* has issued an order to cease *occupancy* due to an *unsafe condition*.

Section 1.8. Street Regulations

1.8.1. Encroachments

1.8.1.1. Encroachment Defined

1) In this Section an encroachment means a *building*, or a *building* appurtenance or fixture, including an existing areaway, a new or existing ornamental projection, awning, canopy, mechanical apparatus, or emergency *exit* apparatus, projecting in a *street*, whether above, at or below ground level.

1.8.1.2. Measurement of Encroachment

1) An encroachment shall be measured at right angles from a theoretical vertical plane located at the property line, to the outermost point of the encroachment in the *street*.

1.8.1.3. No Encroachment without Permission

1) No encroachment shall project into a *street*, unless permission has first been granted by the *City*.

1.8.1.4. Maintenance and Repair of Encroachment

1) Encroachments shall be repaired and maintained to the satisfaction of the *City Engineer* and the *Chief Building Official*.

1.8.1.5. Prohibited Encroachments

1) An encroachment shall not obstruct or interfere with

a) public utility poles or equipment,
b) firefighting equipment or fire rescue operations,
c) *street* trees or lamp standards, or
d) *street* furniture.

1.8.1.6. Compliance with Encroachment By-law

1) The *Chief Building Official* shall not issue a *permit* to construct an encroachment unless the encroachment complies with this By-law and with the Encroachment By-law.

1.8.2. Existing Encroachments

1.8.2.1. Existing Encroachments

1) An existing encroachment which complies with the Encroachment By-law and does not conform with this By-law may be continued if the encroachment is not altered.

1.8.2.2. Damage to Existing Encroachment

1) Subject to the provisions in Sentence (2), an existing encroachment which is damaged may be repaired.
2) Despite the provisions of Sentence (1) if the cost of the repair to an existing encroachment is more than 50 per cent of the current replacement cost of the damaged encroachment, the repair shall constitute a new encroachment and shall comply with the provisions of this By-law and the Encroachment By-law.

1.8.2.3. Alteration to Existing Encroachment

1) Except for signs permitted by the Sign By-law, any enlargement or *alteration* of an existing encroachment shall constitute a new encroachment and shall comply with the provisions of this By-law and the Encroachment By-law.

1.8.2.4. Signs

(Refer to Book I (General) of this Bylaw.)

1.8.2.5. Door Swings

(Refer to Book I (General) of this Bylaw.)

1.8.3. New Encroachments

1.8.3.1. Application

1) This Section applies to

a) new encroachments, and
b) *alterations* to existing encroachments which do not comply with the provisions of Subsection 1.8.2.

1.8.3.2. Dimensions and Clearances
1) Unless otherwise provided in this By-law, all new encroachments shall comply with the applicable *construction*, clearance and dimension requirements in Subsections 1.8.5. to 1.8.10.

1.8.3.3. Design and Construction of New Encroachments
1) A new encroachment shall be designed and constructed so that, in the event of its removal from the *building*,
the *building* will comply with the provisions of this By-law.

1.8.3.4. Compliance with By-laws
1) A new encroachment shall comply with the provisions of this By-law and the Encroachment By-law.

1.8.3.5. Encroachments in Narrow Streets
1) Unless otherwise permitted by this Section, new encroachments or encroachments which do not comply with the provisions of Subsection 1.8.2. are not permitted in a *street* which is 10 m or less in width.

1.8.4. Repair or Removal of Encroachment

1.8.4.1. Removal or Repair by Owner
1) The *owner* of a *building* which encroaches in a *street* shall repair, alter or remove the encroachment if so ordered
a) by the *Chief Building Official*, in accordance with this By-law, or
b) by the *City Engineer*, in accordance with the Encroachment By-law.

1.8.4.2. Repair of Building after Removal of Encroachment
1) Upon removal of an encroachment from a *building*, the *owner* shall promptly repair the *building* and shall ensure that the *building* complies with this By-law.

1.8.4.3. Repair of Building at Owner's Expense
1) If the *Chief Building Official* has issued an order in accordance with Article 1.8.4.1. and an *owner* has failed to
comply with that order, the *Chief Building Official* may
a) authorize *demolition* or removal of an encroachment, posting of security guards or fire wardens, or enclosure of such encroachment, *building*, *construction*, excavation or part thereof, at the expense of the *owner*,
b) recover such expense in the manner set out in this By-law, and
c) take such other measures as may be necessary to protect the public.

1.8.5. Areaways
(Refer to Book I (General) of this Bylaw.)

1.8.6. Ornamental Projections and Existing Windows
(Refer to Book I (General) of this Bylaw.)

1.8.7. Awnings
(Refer to Book I (General) of this Bylaw.)

1.8.8. Canopies
(Refer to Book I (General) of this Bylaw.)

1.8.9. Solar Shading Device

(Refer to Book I (General) of this Bylaw.)

1.8.10. Mechanical Apparatus

1.8.10.1. Clearances

1) Exterior hose connections for fire-fighting equipment, ventilation intakes and outlets, *chimneys* and air conditioning units shall not encroach in a street unless permitted by the *City Engineer*.

2) Fire alarm bells and fire gongs may encroach up to 300 mm in a *street*, except that such encroachments shall be located no less than 2.6 m above the *street* surface or established *building* grade.

1.8.11. Emergency Exits

(Refer to Book I (General) of this Bylaw.)

Section 1.9. Temporary Occupancy of a Street for Construction Purposes

1.9.1. General Requirements

1.9.1.1. Permit Required Prior to Occupancy of Street

1) No person shall occupy a *street* or the air space above a *street* in connection with, or incidental to the *construction* or maintenance of any *building*, without first obtaining a *street* use *permit* from the *City Engineer*.

1.9.1.2. Permit Required Prior to Excavation in Street

1) No person shall excavate or backfill any part of a *street* without first obtaining a *street* use *permit* from the *City Engineer*.

1.9.1.3. Liability Disclaimer

1) An application for a *street* use *permit* shall contain an undertaking by the *owner* to save harmless the *City* against all claims, liabilities, judgments, costs and expenses in consequence of, or in any way incidental to the granting of such *permit*, in a form satisfactory to the Director of Legal Services.

1.9.2. Overhead Construction

1.9.2.1. Permit Required for Overhead Construction

1) No person shall cause a swing scaffold or *construction* hoisting device to occupy the air space above a *street* without first obtaining a *street* use *permit* from the *City Engineer*.

1.9.2.2. Prevention of Public Entry

1) The *street* under a swing scaffold or *construction* hoisting device shall be fenced, roped off or otherwise protected against public entry to the satisfaction of the *City Engineer*.

1.9.3. Public Safety

1.9.3.1. Construction Site Protection of the Public Required

1) No person shall construct, alter or repair any *building* unless fencing, boarding, barricades or covered walkways as required by Part 8 of Division B of Book I (General) of this By-law have first been erected on or adjacent to the *street*, to the satisfaction of the *Chief Building Official*.

2) The *Chief Building Official* may modify the requirements of Sentence (1) if satisfied that the location of the *construction* is sufficiently protected or remote from areas frequented by the public.

1.9.3.2. Permit Required for Fencing, Boarding, Barricades or Covered Walkways

1) No person shall erect fencing, boarding, barricades or covered walkways on a *street*, without first obtaining a *street* use *permit* from the *City Engineer*.

Section 1.10. Addressing Buildings and Parcels of Land

(Refer to Book I (General) of this Bylaw.)

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

Building Permit No. ______________

SCHEDULE E-1

Forming Part of Subsection 1.4.1. Div. C of the Building By-law

OWNER'S UNDERTAKING

Notes:

i) This letter must be submitted after completion of the project but before the *occupancy permit* is issued *or* a final inspection is made, by the *Chief Building Official*.

ii) This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C.

iii) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

Re: ____
Name of Project (Print)

____
Address of Property (Print)

In consideration of the *City* accepting and processing an application for a *building permit* for the *project* identified above, and as required by the Building By-law, the following representations, warranties and indemnities are given to the *City* by the *owner*.

1. ***[If an individual is the owner]***

   ( ) I am the *owner* of the above property.

   or

   [If a corporation is the owner]

   ( ) ______________________________ is the *owner* of the above property.
   (Name of Corporation)

2. The *owner* will comply with and cause those employed for this project to comply with all applicable by-laws of the *City* and other statutes and regulations in force in the *City* relating to the development, work, undertaking or permission in respect of which this letter is submitted.

3. The *owner* fully understands the requirements herein, and acknowledges responsibility for carrying out the work, or gives assurance that the work will be carried out, in accordance with all by-laws governing the *construction* of the *building*. The *owner* understands and acknowledges that the issuance of any permit, including an *occupancy permit*, or the inspection or approval or passage of work by the *City*, is not a representation or warranty that any by□law has been complied with and the *owner* remains responsible at all times for compliance. The *owner* has read and understands Article 1.3.2.1. and Article 1.4.1.5. of Division C Book I and Book II of the Building By-law, which are set out below.

4. The owner hereby agrees to indemnify and save harmless the City and its employees from all claims, liability, judgments, costs and expenses of every kind including negligence which may result from the failure to comply fully with all by-laws, statutes and regulations relating to any work or undertaking in respect of which this letter is submitted.

5. Where the words "work" or "undertaking" are used herein, the owner understands this to include all trade work, including but not limited to: electrical, plumbing, mechanical, gas and other works necessary to complete the contemplated construction.

6. I am authorized to give these representations, warranties, assurances and indemnities to the City.

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

Schedule E– 1 *Continued*

Building Permit No: ____________

[Where the owner is an individual]

Signed, sealed and delivered in the presence of:

Owner's Signature

Witness Signature

Owner's Name (Print)

Witness's Name (Print)

Date

Date

Phone No. and Email address

Witness's address

[Where the owner is a corporation]

Signed, sealed and delivered in the presence of:

Name of Corporation

Witness Signature

Per: Authorized Signatory

Witness's Name (Print)

Name (Print)

Witness's address

Date

Date

Phone No. and Email address

Referenced Articles *below*

Building By-law, Division C, Article 1.3.2.1 Intent

1) This By-Law sets standards in the general public interest. It is enacted and retained on the understanding and specifically expressed condition that it creates no duty whatsoever on the City, the Chief Building Official or any employee of the City to enforce its provisions, and on the further condition that a failure to administer or enforce its provisions, or the incomplete or inadequate administration or enforcement of its provisions, shall not give rise to a cause of action in favour of any person whatsoever. The issuance of any permit, including an occupancy permit, is not a representation, warranty or statement that this By-Law or any other enactment has been complied with, and the issuance thereof in error shall not give rise to a cause of action. Accordingly, words in this By-law defining the responsibilities and authority of the Chief Building Official shall be construed as internal administrative directions which do not create a duty.

Building By-law, Division C, Article 1.4.1.5. Compliance with By-law and other enactments

1) The *owner* shall comply with this By-law and all other applicable enactments.

2) The *owner* shall ensure that all work, *construction*, or *occupancy* is carried out in accordance with this By-law and all other applicable enactments.

3) The *owner* shall ensure that the *occupancy* of a *building* or part of a *building* complies with the *occupancy permit*.

4) The issuance of a *permit*, the acceptance of plans and supporting documents submitted for a *permit*, or the making of inspections by the *Chief Building Official* shall not relieve the *owner* of a *building* from the full responsibility for carrying out the work or having the work carried out in accordance with this By-law and all other applicable enactments.

5) The *owner* shall ensure that all underground storage tanks on the subject property that are intended for the storage of heating oil but have not been used for over 2 years are removed and any associated contamination is remediated to the applicable standards as prescribed in the Contaminated Sites Regulation. All work must be completed in accordance with the requirements of the Vancouver Fire By-law.

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE E-2

Forming Part of Subsection 1.4.1, Div. C of the Building Bylaw

Building Permit No. ______

Project Address ______

OWNER'S AND TENANTS UNDERTAKING

[to be used when a tenant is carrying out the project]

To: The *Chief Building Official*

Re: ______________________________
Name of Project (Print)

____
Address of Property (Print)

In consideration of the *City* accepting and processing an application for a *building permit* for the *project* identified above, and as required by the Building By-law, the following representations, warranties and indemnities are given to the *City* by the *owner* and by the tenant.

1. ***[If an individual is the owner]***

   ( ) I am the *owner* of the above property.

   or

   [If a corporation is the owner]

   ( ) ______________________ is the *owner* of the above property.
   (Name of Corporation)

   [If an individual is the tenant]

   ( ) I am the *owner* of the above property.

   or

   [If a corporation is the tenant]

   ( ) ______________________ is the *owner* of the above property.
   (Name of Corporation)

2. The *owner* and the tenant will comply with and cause those employed for this project to comply with all applicable by-laws of the *City* and other statutes and regulations in force in the *City* relating to the development, work, undertaking or permission in respect of which this letter is submitted.

3. The *owner* and the tenant fully understands the requirements herein, and acknowledges responsibility for carrying out the work, or gives assurance that the work will be carried out, in accordance with all by-laws governing the *construction* of the *building*. The *owner* understands and acknowledges that the issuance of any permit, including an *occupancy permit*, or the inspection or approval or passage of work by the *City*, is not a representation or warranty that any by□law has been complied with and the *owner* remains responsible at all times for compliance. The *owner* has read and understands Article 1.3.2.1. and Article 1.4.1.5. of Division C Book I and Book II of the Building By-law, which are set out below.

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

Schedule E– 2 *Continued*

Building Permit No.

Project Address

4. The owner and the tenant hereby agree to indemnify and save harmless the City and its employees from all claims, liability, judgments, costs and expenses of every kind including negligence which may result from the failure to comply fully with all by?laws, statutes and regulations relating to any work or undertaking in respect of which this letter is submitted.

5. Where the words "work" or "undertaking" are used herein, the owner and the tenant understand this to include all trade work, including but not limited to: electrical, plumbing, mechanical, gas and other works necessary to complete the contemplated construction.

6. The owner and the tenant are authorized to give these representations, warranties, assurances and indemnities to the City.

Owner's signature

[Where the owner is an individual]

Signed, sealed and delivered in the presence of:

Owner's Signature	Witness Signature
Owner's Name (Print)	Witness's Name (Print)
Date	Date
Phone No. and Email address	Witness's address

[Where the owner is a corporation]

Signed, sealed and delivered in the presence of:

Name of Corporation	Witness Signature
Per: Authorized Signatory	Witness's Name (Print)
Name (Print)	Witness's address
Date	Date
Phone No. and Email address	

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

Schedule E– 2 *Continued*

Building Permit No

Project Address

Tenant's Signature

[Where the owner is an individual]

Signed, sealed and delivered in the presence of:

Owner's Signature

Witness Signature

Owner's Name (Print)

Witness's Name (Print)

Date

Date

Phone No. and Email address

Witness's address

[Where the owner is a corporation]

Signed, sealed and delivered in the presence of:

Name of Corporation

Witness Signature

Per: Authorized Signatory

Witness's Name (Print)

Name (Print)

Witness's address

Date

Date

Referenced Articles *below*

Building By-law, Division C, Article 1.3.2.1 Intent

1) This By-Law sets standards in the general public interest. It is enacted and retained on the understanding and specifically expressed condition that it creates no duty whatsoever on the City, the Chief Building Official or any employee of the City to enforce its provisions, and on the further condition that a failure to administer or enforce its provisions, or the incomplete or inadequate administration or enforcement of its provisions, shall not give rise to a cause of action in favour of any person whatsoever. The issuance of any permit, including an occupancy permit, is not a representation, warranty or statement that this By-Law or any other enactment has been complied with, and the issuance thereof in error shall not give rise to a cause of action. Accordingly, words in this By-law defining the responsibilities and authority of the Chief Building Official shall be construed as internal administrative directions which do not create a duty.

Building By-law, Division C, Article 1.4.1.5. Compliance with By-law and other enactments

1) The *owner* shall comply with this By-law and all other applicable enactments.

2) The *owner* shall ensure that all work, *construction*, or *occupancy* is carried out in accordance with this By-law and all other applicable enactments.

3) The *owner* shall ensure that the *occupancy* of a *building* or part of a *building* complies with the *occupancy permit*.

4) The issuance of a *permit*, the acceptance of plans and supporting documents submitted for a *permit*, or the making of inspections by the *Chief Building Official* shall not relieve the *owner* of a *building* from the full responsibility for carrying out the work or having the work carried out in accordance with this By-law and all other applicable enactments.

5) The *owner* shall ensure that all underground storage tanks on the subject property that are intended for the storage of heating oil but have not been used for over 2 years are removed and any associated contamination is remediated to the applicable standards as prescribed in the Contaminated Sites Regulation. All work must be completed in accordance with the requirements of the Vancouver Fire By-law.

Schedule of Fees

PART A – BUILDING

1. The fees hereinafter specified shall be paid to the City with respect to and upon the application for the issue of a PERMIT as follows:

(a) Except as provided for in Clause (b) for the CONSTRUCTION of any BUILDING, or part thereof:
When the estimated cost of the work, being the valuation referred to in Article 1.6.2.3. of Book I, Division C
and Book II, Division C of this By-law, does not exceed $5,000 or for the first $5,000 of the estimated cost of the work **$158.00**
For each $1,000, or part thereof, by which the estimated cost of the work exceeds $5,000 but does not exceed $50,000.......... **$10.10**
For each $1,000, or part thereof, by which the estimated cost of the work exceeds $50,000.... **$5.10**

(b) For the installation, CONSTRUCTION, re- construction, ALTERATION or repair of, or ADDITION to:
(i) any CHIMNEY, FIREPLACE, INCINERATOR, VENTILATING SYSTEM, AIR- CONDITIONING SYSTEM, or HEATING SYSTEM, the fee shall be in accordance with Clause (a), except that a fee shall not be charged when the cost of such work is less than $500
(ii) any PHOTOVOLTAIC PANELS, and related roof ALTERATION or repair..................... **$100.00**

(c) For a permit for temporary OCCUPANCY of a part of a STREET, or of the AIR SPACE immediately ABOVE a part of a STREET, in accordance with Section 1.9. of Book I, Division C and Book II, Division C
of this By-law, the daily fee shall be for each 10 m^2 or part thereof, of STREET or of AIR SPACE part thereof, of STREET or of AIR SPACE immediately above such STREET to be occupied **$3.20**
Subject to a minimum fee of **$110.00**
Flat fee for each portable toilet. **$110.00**

(d) For an OCCUPANCY PERMIT not required by this By-law but requested............................ **$228.00**

(e) For the demolition of a BUILDING, not including a ONE-FAMILY DWELLING, which has at any time since November 1, 1986 provided RESIDENTIAL OCCUPANCY, subject to Section 3:
For each DWELLING UNIT.......... **$1,150.00**
For each sleeping room in a multiple conversion dwelling, hotel or other BUILDING, which is or has been a principal dwelling or residence of a person, family or household **$1,150.00**

(f) For the demolition of a ONE-FAMILY DWELLING, which has at any time since November 1, 1986 provided RESIDENTIAL OCCUPANCY, subject to Section 3.. **$1,150.00**

(g) For the repair of building walls pursuant to requirements of Book I, Division B, Part 5 for any residential building .... **Nil**

2. The fees hereinafter specified shall be paid to the City as follows:

(a) For a required permit inspection for compliance with this By-Law which cannot be carried out during normal working hours and where there is a request to carry out the inspection after hours, the fee to be based on the time actually spent in making such inspection, at a minimum inspection time of four (4) hours, including traveling time:
For each hour or part thereof.......... **$311.00**

(b) For a plan review where an applicant requests in writing that the review be carried out during overtime:
For each hour or part thereof **$311.00**

(c) For each special inspection of a BUILDING or structure to determine compliance with this By-law, and in respect of which no specific fee is otherwise prescribed, the fee to be based on the time actually spent in making the inspection:
For each hour or part thereof **$206.00**

(d) For each REINSPECTION made necessary due to faulty work or materials or incomplete work requested to be inspected **$206.00**

(e) For each inspection of a drainage tile system:
For a one- or two-family residence **$212.00**
For all other drain tile inspections:
When the estimated cost of the CONSTRUCTION of the BUILDING, being the valuation referred to in Article 1.6.2.3. of Book I, Division C and Book II, Division C does not exceed $500,000 .... **$414.00**
When the estimated cost of the work exceeds $500,000 but does not exceed $1,000,000 ..... **$827.00**
When the estimated cost of the work exceeds $1,000,000 .... **$1,034.00**

(f) For the special search of records pertaining to a BUILDING to advise on the status of outstanding orders and other matters concerning the BUILDING:
For a residential *building* containing not more than 2 principal *dwelling units* **$265.00**
For all other BUILDINGS **$532.00**

(g) To access plans (electronic or on microfilm) or documents for viewing or copying **$45.10**

(h) For each microfilm image or electronic file copied **$12.40**

(i) For a request to renumber a BUILDING **$984.00**

(j) For the extension of a BUILDING PERMIT where requested in writing by an applicant pursuant to Article 1.6.7.1. of Book I, Division C and Book II, Division C .... **50 %** of the original BUILDING PERMIT fee to a maximum of **$380.00**

(k) For the extension of a building permit by Council where requested in writing by an applicant pursuant to Article 1.6.7.4. of Book I, Division C and Book II, Division C **$2,490.00**

(l) For an evaluation of plans, specifications, building materials, procedures or design methods for the purpose of revisions to an application or a permit in accordance with Article 1.5.2.13. and Section 1.6.6. of Book I, Division C and Book II, Division C
where the PERMIT relates to a ONE-FAMILY DWELLING or a SECONDARY SUITE **$206.00**
plus for each hour, or part thereof, exceeding one hour **$206.00**
where the PERMIT relates to any other BUILDING **$623.00**
plus for each hour, or part thereof, exceeding one hour **$311.00**

(m) For each RE-OCCUPANCY PERMIT after rectification of an UNSAFE CONDITION and related By-law violations **$379.00**

(n) For review of plans, specifications, building materials, procedures or design methods for the purpose of acceptance of an alternative solution for new construction under Article 2.3.2.1. of Book 1, Division C for each application **$871.00**

(o) For an evaluation of plans, specifications, building materials, procedures or design methods for the purpose of acceptance of existing conditions with mitigating features, for each application ... **$498.00**

(p) For review by the alternative solution review panel **$2,790.00**

(q) For the evaluation of a resubmission or revised submission made under Clauses (n) or (o) of this Section 2........ **$311.00**

3. Upon written application of the payor and on the advice of the Acting General Manager of Community Services, the Director of Finance shall refund to the payor, or a designate of the payor, the fees paid pursuant to Clauses (e) and (f) of Section 1:

(a) for all demolished dwelling units in a building that will be replaced by a social housing or co-operative development that has received a Project Commitment Letter from the British Columbia Housing Management Commission or the Canada Mortgage and Housing Corporation; and

(b) for each demolished dwelling unit that has been replaced by a dwelling unit occupied by rental tenants and not created pursuant to the Strata Property Act.

PART B - PLUMBING

Every applicant for a Plumbing PERMIT shall, at the time of application, pay to the City the fees set out hereunder:

1. INSTALLATIONS

For the Installation of:

One, two or three FIXTURES	**$206.00**
Each additional FIXTURE	**$64.70**

Note: For the purpose of this schedule the following shall also be considered as FIXTURES:

- Every "Y" intended for future connection;
- Every ROOF DRAIN, swimming pool, dishwasher, and interceptor;
- Every vacuum breaker in a lawn sprinkler system; and
- Every back-flow preventer

Alteration of Plumbing (no FIXTURES involved):

For each 30 m of piping or part thereof	**$302.00**
For each 30 m of piping or part thereof, exceeding the first 30 m	**$84.00**
Connection of the City water supply to any hydraulic equipment	**$114.00**

2. INSPECTIONS OF FIRELINE SYSTEMS:

Hydrant & Sprinkler System:

First two inspections for each 30 m of water supply pipe or part thereof	**$302.00**
Each additional inspection for each 30 m of water supply pipe or part thereof	**$124.00**

Sprinklers:

First head, one- or two-family dwelling	**$344.00**
First head, all other buildings	**$731.00**
First head, renovations to existing sprinkler systems	**$213.00**
Each additional head, all buildings (no limit on number)	**$3.80**

Firelines:

Hose Cabinets	**$39.80**
Hose Outlets	**$39.80**
Wet & Dry Standpipes	**$39.80**
Standpipes	**$39.80**
Dual Check Valve In-flow Through Devices	**$39.80**
Backflow Preventer	**$206.00**

Wet & Dry Line Outlets:

Each connection	**$39.80**
NOTE: A Siamese connection shall be considered as two dry line outlets.	
Each Fire Pump	**$321.00**
Each Fire Hydrant	**$99.00**

3. REINSPECTIONS

For each REINSPECTION made necessary due to faulty work or materials or incomplete work requested to be inspected **$206.00**

4. SPECIAL INSPECTIONS

Each inspection to establish fitness of any existing fixture for each hour or part thereof **$206.00**

An inspection outside normal working hours and at a minimum inspection time of four (4) hours, including traveling time, for each hour or part thereof **$311.00**

5. BUILDING SEWER INSPECTIONS

First two inspections for each 30 m of BUILDING SEWER or part thereof **$302.00**

Each additional inspection for each 30 m of BUILDING SEWER or part thereof **$124.00**

PART C – OPERATING PERMITS

Every applicant for an OPERATING PERMIT shall, at the time of application, pay to the City the fee set out hereunder:

For each OPERATING PERMIT $00.00

Notes to Part 1
Administrative Provisions

This Appendix is included for explanatory purposes only and does not form Part of the requirements except as defined in Division A Sentence 1.1.3.1.(1). The numbers that introduce each Appendix Note correspond to the applicable requirements in this Division.

A-1.3.3.5. Unsafe Conditions Although words such as alteration, occupancy, building and unsafe conditions are defined in Article 1.4.1.2. of Division A, such words as removal and relocation contained here and in the definitions are adequately defined in dictionaries and need not be defined herein.

A-1.3.3.6. Work on Public Property The appropriate government authority may be federal, provincial or city, depending on the nature of the public property.

A-1.3.3.7. Changes in Ground Elevation and Limiting Distance If a new or existing building is built as close to a boundary line as the regulations permit, moving the property boundary could result in contravention of the By-law in regards to spatial separations. In those circumstances, this Subsection would not apply.

A-1.4.1.10. Project Directory This Subsection requires the owner to inform the Chief Building Official of changes in responsibilities of certain employees. It is not intended to limit the owner's right to change the constructor, engineer, architect or inspection or testing agency, but rather to let the building official know of any such change so that construction will not be held up because of any misunderstanding as to who is responsible. See Letters of Assurance at the end of Part 2 of Division C.

A-1.4.1.15. Tests to Establish Compliance Where a manufacturer, fabricator or erector is required to conform to specified requirements, such as those referenced by Articles 4.3.1.2. and 4.3.3.1. of Division B, Book I, it is intended that proof of such compliance be filed with the Chief Building Official. See Letters of Assurance at the end of Part 2 of Division C.

A-1.4.1.19.(1) Uncovering Work The requirement to uncover and replace work will normally apply only if Article 1.4.1.17. has not been complied with, that is, if work requiring inspection has been covered prematurely. Complete uncovering may not be necessary. Here, again, the judgment of the designated official is required to determine if partial uncovering, test holes or similar actions will be sufficient to indicate compliance, the purpose being to promote compliance not to penalize the constructor.

A-1.6.2.2. Application Requirements In addition to the information required by this provision, further information is required by Subsection 2.3.4. of Division C, Structural and Foundation Drawings and Calculations, and Subsection 2.3.5. of Division C, Heating, Ventilating, Air-Conditioning and Energy Utilization Drawings and Specifications.

A-1.6.7.1.(1) Permit Expiry The owner must provide documentation to establish that the work has not been substantially discontinued for 6 months.

A-1.7.1.2. Occupancy Permit An occupancy permit is required for a temporary occupancy.

Part 2
Administrative Provisions

Section 2.1. Application

2.1.1. Application

2.1.1.1. Application

1) This Part applies to all *plumbing systems* covered in this By-law. (See Article 1.1.1.1. of Division A.)

Section 2.2. Administration

2.2.1. Administration

2.2.1.1. Conformance with Administrative Requirements

1) This By-law is made pursuant to Section 306 of the Vancouver Charter.

2.2.2. Information Required for Proposed Work

2.2.2.1. General Information Required

1) Sufficient information shall be provided to show that the proposed work will conform to this By-law and whether or not it may affect adjacent property.

2) Plans shall be drawn to scale and shall indicate

a) the nature and extent of the work or proposed *occupancy* in sufficient detail to establish that, when completed, the work and the proposed *occupancy* will conform to this By-law,
b) the applicable edition of the By-law,
c) whether the *building* is designed under Part 3 or Part 9,
d) the *major occupancy* classifications of the *building*,
e) the *building area* and *building height*,
f)the number of *streets* the *building* faces,
g) the *accessible* entrances, work areas and washrooms, and
h) the *accessible* facilities particular to the *occupancies*.

3) When proposed work is changed during construction, information on the changes shall comply with the requirements of this Section for proposed work.

2.2.2.2. Site Plans

1) Site plans shall be referenced to an up-to-date survey and, when required to prove compliance with this Code, a copy of the survey shall be provided.

2) Site plans shall show

a) by dimensions from property lines, the location of the proposed *building*,
b)the similarly dimensioned location of every adjacent existing *building* on the property,
c)existing and finished ground levels to an established datum at or adjacent to the site,
d)the access routes for firefighting, and
e)the *accessible* paths of travel to the *building* from
  i) the sidewalk, roadway or *street*, and
  ii) if provided, exterior parking stalls for *persons with disabilities* and exterior passenger-loading zones, and
f) the exterior entrances and key plan for each *storey* indicating the location and number of *suites*.

2.2.2.3. Information Required on Building Plans for Addressing Purposes
(Refer to Book I (General) of this Bylaw.)

2.2.3. Fire Protection and Plumbing Components

2.2.3.1. Information Required for Fire Protection Components
1) Information shall be submitted to show the major components of fire protection including
a) the division of the *building* by *firewalls*,
b) the *building area*,
c) the degree of *fire separation* of *storeys*, shafts and special rooms or areas, including the location and rating of *closures* in *fire separations*,
d) the source of information for *fire-resistance ratings* of elements of construction (to be indicated on large-scale sections),
e) the location of *exits*, and
f) fire detection, suppression and alarm systems.

2.2.3.2. Plans of Sprinkler Systems
1) Before a sprinkler system is installed or altered, plans showing full details of the proposed sprinkler system and essential details of the *building* in which it is to be installed shall be drawn to an indicated scale.

2.2.3.3. Information Required on Plumbing Drawings and Related Documents
1) If the *Chief Building Official* requires an application for a permit in respect of *plumbing systems*, plumbing drawings and related documents submitted with the application shall show
a) the location and *size* of every *building drain* and of every *trap* and *cleanout* fitting that is on a *building drain*,
b) the *size* and location of every *soil-or-waste pipe*, *trap* and *vent pipe*, and
c) a layout of the *potable water distribution system*, including pipe *sizes* and valves.

2.2.4. Structural and Foundation Drawings and Calculations
(Refer to Book I (General) of this Bylaw.)

2.2.5. Drawings and Specifications for Environmental Separators and Other Assemblies Exposed to the Exterior
(Refer to Book I (General) of this Bylaw.)

2.2.6. Heating, Ventilating and Air-conditioning Drawings and Specifications
(Refer to Book I (General) of this Bylaw.)

2.2.7. Professional Design and Review
(See Note A-2.2.7.)

2.2.7.1. Application
1) The requirements of this Subsection apply to
a) *buildings* within the scope of Part 3 of Division B,
b) *buildings* within the scope of Part 9 of Division B that are designed with common egress systems for the occupants and require the use of *firewalls* according to Article 1.3.3.4. of Division A, and
c) the following, in respect of *buildings* within the scope of Part 9 of Division B other than *buildings* described in Clause (b),
i) structural components that are not within the scope of Part 9 of Division B (See Note A-2.2.7.1.(1)(c)(i).),

ii) geotechnical conditions at *building* sites that are not within the scope of Part 9 of Division B,
iii) sprinkler systems designed to NFPA 13, “Installation of Sprinkler Systems”, NFPA 13R, “Installation of Sprinkler Systems in Low-Rise Residential Occupancies”, or NFPA 13D, “Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes”, and
iv) standpipe and hose systems designed to NFPA 14, “Installation of Standpipe and Hose Systems”,

d) a *building* that is designed according to Article 1.3.3.5. of Division A of Book I (General) of this By-law,
e) a *building* that is within the scope of Part 5 of Division B of Book I (General) of this By-law,
f) *additions* which are subject to Part 11 of Division B of Book I (General) of this By-law, and
g) a change of *major occupancy* which is subject to Part 11 of Division B of Book I (General) of this By-law.

2.2.7.2. Responsibilities

1) Before the construction of or the *alteration* to a *building*, the owner shall

a) retain a *coordinating registered professional* to coordinate all design work and *field reviews* of the *registered professionals of record* required for the project in order to ascertain that (See Note A-2.2.7.2.(1)(a).)

i) the design will substantially comply with the Building By-law and other applicable *City* By-laws, and
ii) the construction of the project will substantially comply with the Building By-law and other applicable enactments respecting safety, not including the construction safety aspects, and

b) if a *building* permit is required, deliver to the *Chief Building Official* letters in the forms set out in Schedules A and B, and (See the end of Division C and Note A-2.2.7.2.(1)(a) and (b).)
c) provide reasonable and timely written notice of any work or excavation that would directly or indirectly affect private property adjacent to the excavation site, to the *owner* of the affected property, and deliver a copy of the notice to the *Chief Building Official*. (See Note A-2.2.7.2.(1)(c).)

2) If an occupancy permit or final inspection from an *Chief Building Official* is required and before an owner occupies or receives permission to occupy the *building*, the owner or *coordinating registered professional* shall deliver to that authority letters in the forms set out in Schedules C-A and C-B (See the end of Division C and Note A-2.2.7.2.(2).)

2.2.7.3. Registered Professional Responsibilities

(See Note A-2.2.7.3.)

1) A *registered professional of record* who signs a letter, the form of which is set out in a Schedule to this Subsection, and an owner who signs or has an agent sign a letter the form of which is set out in a Schedule to this Subsection, shall comply with this Subsection, Part 1, and the provisions of the letter that apply to the person signing.

2) A *registered professional of record* or *coordinating registered professional* who is responsible for a *field review* shall keep a record of the *field review* and of any corrective action taken as a result of the *field review* and shall submit monthly summary reports to the Chief Building Official.

3) A *registered professional of record* who is retained to undertake design work and *field reviews* and who is required to provide letters pursuant to Clause 2.2.7.2.(1)(b) shall

a) place his or her professional seal or stamp on the plans submitted by him or her in support of the application for a *building* permit, after ascertaining that they substantially comply with the Building By-law and other applicable enactments respecting safety,

b) provide to the *Chief Building Official* a letter in the form of Schedule C-B (See the end of Division
c) after ascertaining that the components of the project for which the *registered professional of record* is responsible are constructed so as to substantially comply, in all material respects, with

i) the plans and supporting documents prepared by the *registered professional of record*, and
ii) the requirements of the Building By-law and other applicable enactments respecting safety, not including construction safety aspects.

2.2.7.4. Termination

1) An owner must not terminate the appointment of a *coordinating registered professional* or *registered professional of record* unless

a) the owner immediately replaces the *coordinating registered professional* or *registered professional of record*, or
b) the owner has complied with Clause (1)(b) and Sentence (2) of Article 2.2.7.2. by delivering letters in the forms set out in Schedule A, B, C-A and C-B, as applicable, to the *Chief Building Official*.

2) In respect of a project to which this Subsection applies,

a) if the *coordinating registered professional* ceases to be retained at any time before the completion of the project, both the owner and the *coordinating registered professional* shall notify the *Chief Building Official*, and
b) if a *registered professional of record* ceases to be retained at any time before the completion of the project, both the *coordinating registered professional* and the *registered professional of record* shall notify the *Chief Building Official*.

3) Notification under Sentences (1) and (2) shall be made,

a) if possible, before the *coordinating registered professional* or *registered professional of record*, as the case may be, ceases to be retained, or
b) if advance notice is not possible, as soon as possible.

2.2.7.5. Reserved.

2.2.8. Deleted.

2.2.9. Buildings on Designated Flood Plains

2.2.9.1. Exemptions from Flood Construction Level Requirements

1) *Flood construction level requirements* do not apply to:

a) *alteration* of an *existing building*, not including reconstruction as defined in this By-law. (See A-11.2.1.2. of Div C),
b) *alteration* of an *existing building* to increase the *building area* by less than 25 per cent of the total *building area* existing as of July 29, 1999, if

i) the number of *dwelling units* is not increased,
ii) there is no further encroachment into setbacks required by this By-law, and
iii) there is no further reduction in the *flood construction level*,

c) enclosed parking areas, including bicycle and residential storage areas, in a multiple dwelling, if there is

i) an unobstructed non-mechanized means of pedestrian ingress and egress to the areas, above the *flood construction level*, and
ii) a sign posted at all entry points warning of the risk of flood damage,

d) *buildings* and portions of *buildings* used as a carport or garage,
e) non-residential accessory *buildings*, and
f) loading facilities used for water oriented industry.

2.2.9.2. Design Considerations on Designated Flood Plains

1) For *buildings* constructed on *designated flood plains*, the *building* designer shall comply with by-law requirements regarding *construction* materials and service equipment installations below *flood construction level requirements*, to the satisfaction of the *Chief Building Official*. (See Article 1.5.2.11. of Division C.)

2.2.9.3. Construction Considerations on Designated Flood Plains

1) For *buildings* constructed on *designated flood plains*, *construction* of the *buildings* to *flood construction level requirements* shall be achieved, to the satisfaction of the *Chief Building Official*, by

a) the structural elevation of the floor system of the *building*
b) the use of adequately compacted fill, or
c) a combination of structural elevation and compacted fill.

2) No person shall install furnaces, electrical switchgear, electrical panels, fire protection systems or other fixed *building* services susceptible to flood damage, below the *flood construction level*, unless such services are protected from flood damage and accessible for servicing during a flood, to the satisfaction of the *Chief Building Official*.

3) No person shall store hazardous or toxic substances below the *flood construction level*.

4) All piping, wiring and conduit penetrations shall be water stopped and sealed to prevent water seepage into the *building*.

2.2.9.4. Setback Requirements on Designated Flood Plains

1) Subject to the provisions of this By-law, no *building*, structural support or fill shall be constructed or located within

a) 30 m of the *natural boundary* of the Fraser River,
b) 15 m of the *natural boundary* of Burrard Inlet, English Bay or False Creek,
c) 5 m of the *natural boundary* of Still Creek,
d) 7.5 m of any structure erected for flood protection or seepage control, or
e) in the case of a *building*, structural support, or fill located on a bluff in a *designated flood plain*, where the toe of the bluff is subject to erosion or is closer than 15 m from the *natural boundary*, a setback measuring 3.0 times the height of the bluff as measured from the toe to the crest of the bluff.

2.2.9.5. Increase of Flood Construction Level and Setback Requirements on Designated Flood Plains

1) The *Chief Building Official* may increase the *flood construction level requirements* or the setback requirements in this By-law if, in the opinion of the *Chief Building Official*, a higher *flood construction level* or a greater setback is necessary as the result of a site-specific geological or hydrological feature.

2.2.9.6. Relaxation of Flood Construction Level and Setback Requirements on Designated Flood Plains

1) The *Chief Building Official* may relax the *flood construction level requirements* in this By-law in accordance with Article 1.5.2.11., if

a) the *owner* demonstrates to the satisfaction of the *Chief Building Official*, that, due to existing site characteristics and the location of existing infrastructure, it is impractical to meet the *flood construction level requirements*,
b) the *owner* demonstrates to the satisfaction of the *Chief Building Official*, the proposed *construction* methods are designed to mitigate flood damage, and
c) the *owner* provides a report, to the satisfaction of the *Chief Building Official*, stamped by a professional engineer, certifying that the habitable space in the *building* will be safe during a flood if a lower *flood construction level* is applied.

2) The *Chief Building Official* may relax the setback requirements in this By-law in accordance with Article 1.5.2.11., if

a) the *owner* demonstrates to the satisfaction of the *Chief Building Official*, that, due to existing site characteristics and the location of existing infrastructure, it is impractical to meet the setback requirements,
b) if considered necessary by the *Chief Building Official*, the *owner* agrees to construct erosion protection works to mitigate flood damage and erosion, and
c) the *owner* provides a report, to the satisfaction of the *Chief Building Official*, stamped by a professional engineer, certifying that the habitable space in the *building* will be safe during a flood if a reduced setback requirement is applied.

Section 2.3. Alternative Solutions

2.3.1. Alternative Solutions

(See Note A-2.3.1.)

2.3.1.1. Application

1) For the purposes of Clause 1.2.1.1.(1)(b) of Division A, on written request by the owner of a *building* or an authorized agent of that owner, the *Chief Building Official* shall accept a measure as an alternate solution to an acceptable solution for the building if satisfied that
a) the measure will achieve at least the level of performance required by Clause 1.2.1.1.(1)(b) of Division A, and
b) the acceptable solution does not expressly require conformance to a provincial enactment other than the Building By-law.

2.3.1.2. Documentation

1) The *Chief Building Official* may require a person requesting the use of an alternative solution to provide documentation to demonstrate that the proposed alternative solution will achieve at least the level of performance required by Clause 1.2.1.1.(1)(b) of Division A.
2) The documentation referred to in Sentence (1) shall include
a) a Code analysis outlining the analytical methods and rationales used to determine that a proposed alternative solution will achieve at least the level of performance required by Clause 1.2.1.1.(1)(b) of Division A, and
b) information concerning any special maintenance or operational requirements, including any *building* component commissioning requirements, that are necessary for the alternative solution to achieve compliance with the By-law after the *building* is constructed.
3) The Code analysis referred to in Clause (2)(a) shall identify the applicable objectives, functional statements and acceptable solutions, and any assumptions, limiting or restricting factors, testing procedures, engineering studies or performance parameters that will support a Code compliance assessment.
4) The Code analysis referred to in Clause (2)(a) shall include information about the qualifications, experience and background of the person or persons taking responsibility for the design.
5) The information provided under Sentence (3) shall be in sufficient detail to convey the design intent and to support the validity, accuracy, relevance and precision of the Code analysis.
6) Where more than one person is responsible for the design of a *building* or facility that includes a proposed alternative solution, the person requesting the use of the alternative solution shall identify a single person to co-ordinate the preparation of the design, Code analysis and documentation referred to in this Article.

2.3.1.3 Alternative Solution Expiry

1) The Chief Building Official may rescind a request or application made pursuant to the requirements of this Subsection if in the opinion of the *Chief Building Official*

a) there has been no substantial progress or activity by the owner of a *building* or an authorized agent of that owner to demonstrate that the level of performance specified by Clause 1.2.1.1.(1)(b) of Division A will be achieved,
b) the work to install measures describe in the alternative solution although commenced is not continuously and actively carried out thereafter, or
c) the work to install measures describe in the alternative solution has been substantially discontinued for a period of 6 months.

2.3.2. Additional Requirements for Fire and Life Safety Alternative Solutions

2.3.2.1. Design Criteria

1) Alternative solutions, as described in Article 2.3.1.2., shall be based upon an *acceptable* report sealed by an *acceptable registered professional* and provided to the *Chief Building Official*, which shall include
a) a thorough description of the *building*,
b) an analysis of the *building* that identifies all deviations from the requirements of this By-law,
c) the life safety principles considered in developing the proposed alternative solutions and their rationale, based upon NRC fire research reports and other approved agencies where applicable,
d) a proposal for alternative solutions,
e) an evaluation of the proposed alternative solutions based upon generally recognized studies,
f) evidence of reliable performance of the proposed alternative solutions,
g) a method of monitoring the design of the proposed alternative solutions, and
h) a commitment to perform field review of the proposed alternative solutions.

2) The report described in Sentence (1) shall be sufficiently detailed to permit evaluation of the proposed alternative solutions.

3) Upon acceptable of a proposed alternative solution by the *Chief Building Official*, the *registered professional* who has placed their seal on the report shall
a) submit a letter to the *Chief Building Official*, assuring that the alternative solution, as installed, will perform as represented in the report, and
b) at the request of the *Chief Building Official*, submit an acceptable field commissioning and testing report.

2.3.3. Alternative Solution Review Panel

2.3.3.1. Request for Review by Alternative Solution Review Panel

1) An applicant may apply to the *Chief Building Official* to request the appointment of an alternative review panel to review an alternative solution application.

2) An applicant who requests the appointment of an alternative review panel must pay the fees set out in the Fee Schedule.

3) At the request of the applicant, the *Chief Building Official* may appoint an alternative solution review panel of up to three experts to review the alternative solution application, to hear from the applicant and *City* staff and to advise the applicant and the *Chief Building Official* regarding the proposed solution.

4) A decision of an alternative solution review panel is not binding on the *Chief Building Official*.

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE A

Building Permit No. ______________

Forming Part of Sentence 2.2.7.3.(1), Div. C of the Building By-law

CONFIRMATION OF COMMITMENT BY OWNER AND COORDINATING REGISTERED PROFESSIONAL

Notes:

i) This letter must be submitted before issuance of a building permit.
ii) This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C.
iii) In this letter the words in italics have the same meaning as in the Building By-law.

Re: Design and *Field Review* of *Construction* by a *Coordinating Registered Professional*

To: The *Chief Building Official*

Re: ______________________________________
Name of Project (Print)

____
Address of Project (Print)

____

The undersigned has retained ______________________________ as a *coordinating registered professional* to coordinate the design work and *field reviews* of the *registered professionals of record* required[1] for this project. The *coordinating registered professional* shall coordinate the design work and *field reviews* of the *registered professionals of record* required for the project in order to ascertain that the design will substantially comply with the Building By-law and other applicable enactments respecting safety and that the construction of the project will substantially comply with the Building By-law and other applicable enactments respecting safety, not including the construction safety aspects.

"*field reviews*" are defined in the Building By-law to mean those reviews of the work

(a) at a project site of a development to which a *building* permit relates, and

(b) where applicable, at fabrication locations where *building* components are fabricated for use at the project site

that a *registered professional* in his or her professional discretion considers necessary to ascertain whether the work substantially complies in all material respects with the plans and supporting documents prepared by the *registered professional of record* for which the *building* permit is issued.

The *owner* and the *coordinating registered professional* have read Subsection 2.2.7, Division C of the Building By-law. The *owner* and the *coordinating registered professional* each acknowledge their responsibility to notify the *Chief Building Official* of the date the *coordinating registered professional* ceases to be retained by the *owner* before the date the *coordinating registered professional* ceases to be retained or, if that is not possible, then as soon as possible. The *coordinating registered professional* acknowledges the responsibility to notify the *Chief Building Official* of the date a *registered professional of record* ceases to be retained before the date the *registered professional of record* ceases to be retained or, if that is not possible, then as soon as possible.

[1] It is the responsibility of the *coordinating registered professional* to ascertain which *registered professionals* are required, and to initial each Schedule B prior to submission to the *Chief Building Official*.

1 of 2

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE A - continued

Building Permit No. ____________

____
Project Address

The *owner* and the *coordinating registered professional* understand that where the *coordinating registered professional* or a *registered professional of record* ceases to be retained at any time during *construction*, work on the above project will cease until such time as

(a) a new *coordinating registered professional* or *registered professional of record*, as the case may be, is retained, and

(b) a new letter in the form set out in Schedule A or in the forms set out in Schedules B, as the case may be, is filed with the *Chief Building Official*.

The undersigned *coordinating registered professional* certifies that he or she is a *registered professional* as defined in the Building By-law, and agrees to coordinate the design work and *field reviews* of the *registered professionals of record* required for the project as outlined in the attached Schedules B including coordination and integration of functional testing of fire protection and life safety systems. (See A-2.2.7.3 in Appendix A.)

Coordinating Registered Professional

____
Coordinating Registered Professional's Name (Print)

____
Address (Print)

____

____
Phone No. and Email address

Owner

____
Owner's Name (Print)

____
Address (Print)

____

____
Name of Agent or Signing Officer if applicable (Print)

____
Date

____
Owner's or *Owner's* appointed agent's Signature
(If *owner* is a corporation the signature of a signing officer must be given here. If the signature is that of the agent, a copy of the document that appoints the agent must be attached.)

(If the *Coordinating Registered Professional* is a member of a firm, complete the following.)

I am a member of the firm ____________

and I sign this letter on behalf of the firm (Print name of firm)

This letter must be signed by the *owner* or the *owner's* appointed agent and by the *coordinating registered professional*. An agent's letter of appointment must be attached. If the *owner* is a corporation, the letter must be signed by a signing officer of the corporation and the signing officer must set forth his or her position in the corporation.

The Building By-law defines a *registered professional* to mean
(a) a person who is registered or licensed to practise as an architect under the Architects Act, or
(b) a person who is registered or licensed to practise as a professional engineer under the Engineers and Geoscientists Act.

2 of 2

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE B

Forming Part of Sentence 2.2.7. Div. C of the Building By-law

Building Permit No. ______________

ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW

Notes:

i) This letter must be submitted prior to the commencement of *construction* activities of the components identified below. A separate letter must be submitted by each *registered professional of record*.

ii) This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C.

iii) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

Re: ____
Name of Project (Print)

____
Address of Project (Print)

____

The undersigned hereby gives assurance that the design of the
(Initial those of the items listed below that apply to this registered professional of record. All the disciplines will not necessarily be employed on every project.)

___________ **ARCHITECTURAL**
___________ **STRUCTURAL**
___________ **MECHANICAL**
___________ **PLUMBING**
___________ **FIRE SUPPRESSION SYSTEMS**
___________ **ELECTRICAL**
___________ **GEOTECHNICAL — temporary**
___________ **GEOTECHNICAL — permanent**

components of the plans and supporting documents prepared by this *registered professional* in support of the application for the *building permit* as outlined below substantially comply with the Building By-law and other applicable enactments respecting safety except for *construction* safety aspects.

The undersigned hereby undertakes to be responsible for *field reviews* of the above referenced components during *construction* as indicated on the "SUMMARY OF DESIGN AND FIELD REVIEW REQUIREMENTS" below.

____
CRP's initials

1 of 4

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE B - continued

Building Permit No. ______________

______________ Project Address

______________ Discipline

The undersigned also undertakes to notify the *Chief Building Official* in writing as soon as possible if the undersigned's contract for *field review* is terminated at any time during *construction*.

I certify that I am a *registered professional* as defined in the Building By-law.

Coordinating Registered Professional

____
Coordinating Registered Professional's Name (Print)

____
Address (Print)

____

____
Phone No. and Email address

(If the *Coordinating Registered Professional* is a member of a firm, complete the following.)

I am a member of the firm ______________
and I sign this letter on behalf of the firm (Print name of firm)

Note: This letter must be signed by the *owner* or the *owner's* appointed agent and by the *coordinating registered professional*. An agent's letter of appointment must be attached. If the *owner* is a corporation, the letter must be signed by a signing officer of the corporation and the signing officer must set forth his or her position in the corporation.

The Building By-law defines a *registered professional* to mean

(a) a person who is registered or licensed to practise as an architect under the Architects Act, or
(b) a person who is registered or licensed to practise as a professional engineer under the Engineers and Geoscientists Act.

____
CRP's Initials

2 of 4

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE B - continued

Building Permit No. ______________

____
Project Address

____
Discipline

SUMMARY OF DESIGN AND FIELD REVIEW REQUIREMENTS

(Initial applicable discipline below and cross out and initial only those items not applicable to the project.)

_______ **ARCHITECTURAL**

1.1 Fire resisting assemblies
1.2 *Fire separations* and their continuity
1.3 *Closures*, including tightness and operation
1.4 Egress systems, including *access to exit* within *suites* and *floor areas*
1.5 Performance and physical safety features (guardrails, handrails, etc.)
1.6 Structural capacity of architectural components, including anchorage and seismic restraint
1.7 Sound control
1.8 Landscaping, screening and site grading
1.9 Provisions for firefighting access
1.10 *Access* requirements for *persons with disabilities*
1.11 Elevating devices
1.12 Functional testing of architecturally related fire emergency systems and devices
1.13 Development Permit and conditions therein
1.14 Interior signage, including acceptable materials, dimensions and locations
1.15 Review of all applicable shop drawings
1.16 Interior and exterior finishes
1.17 Dampproofing and/or waterproofing of walls and slabs below *grade*
1.18 Roofing and flashings
1.19 Wall cladding systems
1.20 Condensation control and cavity ventilation
1.21 Exterior glazing
1.22 Integration of building envelope components
1.23 Environmental separation requirements (Part 5)
1.24 Building envelope, Part 10 requirements (ASHRAE, NECB, ZEBP, etc)

_______ **STRUCTURAL**

2.1 Structural capacity of structural components of the *building*, including anchorage and seismic restraint
2.2 Structural aspects of *deep foundations*
2.3 Review of all applicable shop drawings
2.4 Structural aspects of unbonded post-tensioned concrete design and construction

_______ **MECHANICAL**

3.1 HVAC systems and devices, including high *building* requirements where applicable
3.2 *Fire dampers* at required *fire separations*
3.3 Continuity of *fire separations* at HVAC penetrations
3.4 Functional testing of mechanically related fire emergency systems and devices
3.5 Maintenance manuals for mechanical systems
3.6 Structural capacity of mechanical components, including anchorage and seismic restraint
3.7 Review of all applicable shop drawings
3.8 Mechanical systems, Part 10 requirements (ASHRAE, NECB, ZEBP, etc)

____
CRP's Initial

2 of 2

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE C-A

Forming Part of Sentence 2.2.7.2.(1), Div. C of the Building By-law

Building Permit No. ______________

ASSURANCE OF COORDINATION OF PROFESSIONAL FIELD REVIEW

Notes:

i) This letter must be submitted after completion of the project but before the *occupancy permit* is issued *or* a final inspection is made, by the *Chief Building Official*.
ii) This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C.
iii) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

____
Name of Jurisdiction (Print)

Re: ______________________________
Name of Project (Print)

____
Address of Project (Print)

(The *coordinating registered professional* shall complete the following:)

____
Name (Print)

____
Address (Print)

____
Phone No. and Email address (Print)

I hereby give assurance that

a) I have fulfilled my obligations for coordination of *field reviews* of the *registered professionals of record* required for the project as outlined in Subsection 2.2.7, Division C of the Building By-law and in the previously submitted Schedule A, "CONFIRMATION OF COMMITMENT BY OWNER AND BY COORDINATING REGISTERED PROFESSIONAL,"
b) I have coordinated the functional testing of the fire protection and life safety systems to ascertain that they substantially comply in all material respects with
   i) the applicable requirements of the Building By-law and other applicable enactments respecting safety, not including construction safety aspects, and
   ii) the plans and supporting documents submitted in support of the application for the *building* permit,
c) I am a *registered professional* as defined in the Building By-law.

(If the *registered professional* is a member of a firm, complete the following.)

I am a member of the firm ______________________________
and I sign this letter on behalf of the firm. (Print name of firm)

Note: The above letter must be signed by a *coordinating registered professional*, who is also a *registered professional*. The Building By-law defines a *registered professional* to mean

a) a person who is registered or licensed to practise as an architect under the Architects Act, or
b) a person who is registered or licensed to practise as a professional engineer under the Engineers and Geoscientists Act.

1 of 1

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE C-B

Building Permit No. ____________

Forming Part of Sentence 2.2.7.2, Division C of the Building By-law

ASSURANCE OF PROFESSIONAL FIELD REVIEW AND COMPLIANCE

Notes:

i) This letter must be submitted after completion of the project but prior to final inspection by the *Chief Building Official*. A separate letter must be submitted by each *registered professional of record*.

ii) This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C.

iii) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

____
Name of Jurisdiction (Print)

Re: ______________________________
Name of Project (Print)

____
Address of Project (Print)

(The *coordinating registered professional* shall complete the following:)

____
Name (Print)

____
Address (Print)

____
Phone No. and Email address (Print)

I hereby give assurance that

a) I have fulfilled my obligations for coordination of *field reviews* as outlined in Subsection 2.2.7, Division C of the Building By-law and in the previously submitted Schedule B, "ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW, and

b) I have coordinated the functional testing of the fire protection and life safety systems to ascertain that they substantially comply in all material respects with

   i) the applicable requirements of the Building By-law and other applicable enactments respecting safety, not including construction safety aspects, and

   ii) the plans and supporting documents submitted in support of the application for the *building* permit,

c) I am a *registered professional* as defined in the Building By-law.

(If the *registered professional* is a member of a firm, complete the following.)

I am a member of the firm ______________________________
and I sign this letter on behalf of the firm. (Print name of firm)

Note: The above letter must be signed by a *registered professional of record*, who is a *registered professional*. The Building By-law defines a *registered professional* to mean

a) a person who is registered or licensed to practise as an architect under the Architects Act, or

b) a person who is registered or licensed to practise as a professional engineer under the Engineers and Geoscientists Act.

1 of 1

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE C-D

Building Permit No. ______________

Forming Part of Section 5.1, Division B of the Building By-law

COMPLETION OF BUILDING ENVELOPE PROFESSIONAL REVIEW

Notes:

i) This letter must be submitted after the completion of the project at final inspection.

ii) This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C.

iii) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

RE: ____

Address of Project (Print)

The undersigned *Building Envelope Professional* has been retained with respect to the above referenced *project*, and gives a commitment of responsibility for *Building Envelope Professional* design review and enhanced *field review* for components and assemblies as required **in Article 5.1.2.2. in Part 5 of Division B**, of the Building By-law, and as the *Building Envelope Professional* in their professional discretion considers to be necessary, for the *project* designed by,

____

Name of *registered professional* signing for 'Architectural' items of Schedule B letters (Print)

who is providing the *Chief Building Official* with Schedule B 'ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW' letter covering 'Architectural' items. The undersigned will sign and provide copies of all reports to the *registered professional* responsible for 'Architectural' items, and copies of these reports shall also be available on site, for review by the City of Vancouver District Building Inspector. The undersigned undertakes to notify the *Chief Building Official* in writing as soon as practical if their contract is terminated at any time.

____

Name (Print)

____

Address (Print)

____

City Postal Code

____

Telephone (Print) Email

(If the *Building Envelope Professional* is a member of a firm, complete the following.)

I am a member of the firm; ______________________ and I sign this letter on behalf of the firm.

(Print Name of Firm)

NOTE: The above letter must be signed by a *Building Envelope Professional*. The Building By-Law defines a *Building Envelope Professional* to mean a person who is a member of the Architectural Institute of British Columbia or the Association of Professional Engineers and Geoscientists of British Columbia.

____

CRP's Initials

1 of 1

BUILDING BY-LAW 2019 – CITY OF VANCOUVER

SCHEDULE D

Building Permit No. ______________

Forming Part of Sentence 2.2.7.2.(1), Div. C of the Building By-law

COMMITMENT FOR BUILDING ENVELOPE PROFESSIONAL REVIEW

Notes:

i) This letter must be submitted before issuance of a building permit.
ii) This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C.
iii) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

RE: ____

Address of Project (Print)

The undersigned *Building Envelope Professional* has been retained with respect to the above referenced *project*, and gives a commitment of responsibility for *Building Envelope Professional* design review and enhanced *field review* for components and assemblies as required **in Article 5.1.2.2. in Part 5 of Division B**, of the Building By-law, and as the *Building Envelope Professional* in their professional discretion considers to be necessary, for the *project* designed by,

____

Name of *registered professional* signing for 'Architectural' items of Schedule B letters (Print)

who is providing the *Chief Building Official* with Schedule B 'ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW' letter covering 'Architectural' items. The undersigned will sign and provide copies of all reports to the *registered professional* responsible for 'Architectural' items, and copies of these reports shall also be available on site, for review by the City of Vancouver District Building Inspector. The undersigned undertakes to notify the *Chief Building Official* in writing as soon as practical if their contract is terminated at any time.

____
Name (Print)

____
Address (Print)

____
City Postal Code

____
Telephone (Print) Email

(If the *Building Envelope Professional* is a member of a firm, complete the following.)

I am a member of the firm: ______________________________ and I sign this letter on behalf of the firm.
(Print Name of Firm)

NOTE: The above letter must be signed by a *Building Envelope Professional*. The Building By-Law defines a *Building Envelope Professional* to mean a person who is a member of the Architectural Institute of British Columbia or the Association of Professional Engineers and Geoscientists of British Columbia.

____
CRP's initials

1 of 1

Notes to Part 2
Administrative Provisions

A-2.2.1.2.(1) Structural Design. Part 4 of Division B is written on the assumption that structural design will be carried out by a registered professional who is qualified to perform such design. Sentence 2.2.1.2.(1) is not intended to imply that a registered professional may not also be required in the application of requirements in other Parts of the Building By-law.

A-2.2.6.2.(1) Information Required on Drawings and Specifications. Examples of information that should be shown on architectural drawings and drawings for heating, ventilating and air-conditioning systems are:

(a) the name, type and location of the building,
(b) the name of the owner,
(c) the name of the architect,
(d) the name of the engineer or designer,
(e) the north point,
(f) the dimensions and height of all rooms,
(g) the intended use of all rooms,
(h) the details or description of the wall, roof, ceiling and floor construction, including insulation,
(i) the details or description of the windows and outside doors, including the size, weatherstripping, storm sashes, sills and storm doors,
(j) the size and continuity of all pipes, ducts, shafts, flues and fire dampers,
(k) the location, size, capacity and type of all principal units of equipment,
(l) the size, shape and height of all chimneys and gas vents,
(m) the size and location of all combustion air and ventilation openings, and
(n) the location and fire-resistance rating of required fire separations.

A-2.2.7. Professional Design and Review. This Subsection provides for the use of what are generally called Letters of Assurance. The letters themselves, known as Schedules A, B, C-A and C-B and located at the end of Division C, are intended to put on paper the responsibilities of the owner and the various registered professionals in a construction project. The Letters of Assurance do not impose any additional responsibilities on the registered professionals nor are they intended to alter the roles and responsibilities of the authorities having jurisdiction.

The Schedules have been very carefully scrutinized by the City of Vancouver, Province of British Columbia, Union of BC Municipalities, Building Officials' Association of British Columbia, Architectural Institute of British Columbia, Engineers & Geoscientists British Columbia and their respective legal counsel. The precise wording in the letters is extremely critical and must not be modified. Any notations on these Schedules which are absolutely necessary to suit a particular project must be clearly and legibly marked in ink on the copies.

It is typical that the registered professional responsible for the design is also responsible for the field review. There are instances where this is not the case and having a different registered professional doing the field reviews is unavoidable. Schedule C-B requires that the registered professional who provides the field review provide assurance that the building as finally constructed is in substantial conformance with the By-law. In the event that another registered professional is to provide field review, the field reviewer takes on the responsibility to confirm that the construction substantially complies with the plans and supporting documents that were submitted for the building permit. The responsibility for code compliance of the design remains with the original registered professional who undertook the design. In this event, the Schedule C-B must be modified by the field reviewer by crossing out and initialing Clause (b)(i) and providing the effective transition date.

Note that Schedules A, B, C-A & C-B, as required by Subsection 2.2.7., must be signed, sealed and submitted to the *Chief Building Official*, as applicable for each specific project. Conditional or qualified Schedules are not typically acceptable. Any fire and life safety issue relative to the Schedule B disciplines is to be remedied before the Schedules C-A / C-B are released, not accommodated by conditions or qualifications placed on the Schedule or by any attached document. See the Guide to Letters of Assurance, available from the Building and Safety Standards Branch Web site, for more details.

A-2.2.7.1.(1)(c)(i) Structural Components. The reference to “structural components of buildings that fall within the scope of Part 4” includes the situation where a building is classified under Part 9 due to its size and occupancy but also contains some structural components (such as beams supporting concentrated loads) which must be designed under Part 4. In this situation only Schedules B and C-B for the structural components are required. Schedule A and Schedules B, C-A and C-B relating to non-structural components are not required.

A-2.2.7.2.(1)(a) Coordinating Registered Professional. The coordinating registered professional is responsible to ascertain that all Code related aspects which are relevant to the project are clearly identified by each of the registered professionals in the collection of Schedules B. If a registered professional of record has crossed out any item on their Schedule B, the coordinating registered professional must confirm this item is not applicable to the project or resolve the issue with the registered professional of record.

A-2.2.7.2.(1)(b) Schedule B. The purpose of Schedule B is to clearly identify the appropriate registered professional of record who has the overall responsibility in each discipline for compliance with the various By-law related aspects of the project. Detailed design of certain building components may be undertaken by other registered professionals. The registered professional of record is responsible for monitoring the design work and field review of the other registered professionals within their discipline for components listed in Schedule B. In the event that the other registered professionals provide design and field review, the registered professional of record must be satisfied that such design and field reviews have been performed and is responsible for Schedule C-B.

A-2.2.7.2.(1)(c) Shoring Works in Street or Lane Where shoring works are proposed to be left in the street and/or lane permanently, an application for the proposal should be made by the owner to the City Engineer. Where the City Engineer is satisfied as to the safety and advisability of the proposal, the City Engineer may approve the basis on which the shoring works may be allowed to remain.

A-2.2.7.2.(2) Schedule C-A. Schedule C-A provides confirmation that the coordinating registered professional has completed the obligation to coordinate the various registered professionals engaged in the project. It also confirms that the testing of the interrelated fire and life safety systems, such as fire alarms and sprinklers, has been completed and the systems function as intended.

A-2.2.7.3. Demonstration of the Coordinated Fire and Life Safety Systems. The design drawings and supporting documents must clearly indicate all essential details of the Coordinated Fire and Life Safety Systems prior to the construction of or the alteration to a building. Demonstration of the proper, integrated operation of the Fire and Life Safety Systems must be conducted prior to occupancy.

Note that Schedules A, B, C-A & C-B, as required by Subsection 2.2.7., must be signed and sealed and submitted to the *Chief Building Official*, as appropriate for each specific project.

The following is an example of the steps required to coordinate the installation and testing of fire and life safety systems in buildings.

1.0. General

Referencing Schedule B:

- Item No. 1.14 "Functional Testing of Architecturally Related Fire Emergency Systems and Devices,"
- Item No. 3.4 "Functional Testing of Mechanically Related Fire Emergency Systems and Devices,"
- Item No. 4.5 "Functional Testing of Plumbing Related Fire Emergency Systems and Devices,"
- Item No. 5.14 "Functional Testing of Fire Suppression Systems and Devices," and
- Item No. 6.3 "Functional Testing of Electrical Related Fire Emergency Systems and Devices."

The Coordinating Registered Professional (CRP) and Registered Professionals of Record (RPRs) must demonstrate that the Fire and Life Safety Systems' design has been coordinated prior to the issuance of the Building Permit. That is, the CRP/RPRs must accumulate and submit the necessary documentation, such as:

- complete drawings,
- schedules,
- schematic diagrams,
- a fire alarm system sequencing description showing coordination between mechanical and electrical fire protection and life safety systems,
- mechanical fire protection and life safety schematic riser diagrams,
- an electrical fire alarm riser diagram,
- a motor data list coordinated with fire alarm system sequencing, and
- other documentation, as appropriate,

to demonstrate that the interface of the Fire and Life Safety Systems has been designed and coordinated so that when built correctly they will function as an integrated system. Further, it is intended that when the construction of the Fire & Life Safety Systems is indicated by the Contractor to be complete, the RPRs/CRP witness the demonstration of the testing of the Fire and Life Safety Systems to confirm compliance that the as-built systems function as intended by the design.

The required list of items will depend on the simplicity or complexity of the Project. The following is a comprehensive list of items for Fire and Life Safety Systems for a complex project, which must be coordinated in order to demonstrate compliance:

Notes: *It is the responsibility of the Coordinating Registered Professional (CRP) and Registered Professionals of Record (RPRs) to determine the best method of "How To" demonstrate to the Chief Building Official (CBO) that the Fire and Life Safety Systems have been coordinated for each project. That is, the method(s) used (i.e., charts, drawings, matrices, tables, etc.) for demonstration purposes should be project-specific and relate only to that project.*

It is not the intent of this Appendix material to dictate or produce "checklists" or other prescriptive methods for demonstrating compliance since this is best left to the professional discretion of the appropriate CRP/RPRs.

2.0. Design Phase — Building Permit Application Stage & Final Construction Phase — Occupancy Permit Application Stage

2.1. Fire Protection and Life Safety Systems

2.1.1. Automatic Sprinkler Systems

- design requirements to appropriate Standard

2.1.2. Standpipe Systems

- design requirements to appropriate Standard
- Class I/Class II
- locations
- coverage

• F.D. connections

2.1.3. Fire Pump Systems

• design requirements to appropriate Standard

2.1.4. Fire Alarm Systems

• one/two stage system(s)
• no. of systems
• design requirements to appropriate Standard
• sequence of operation
• F.A. system zoning
• location of F.A. system devices
• annunciator panel (location and design criteria)
• annunciator panel shop drawings (detail design)
• sprinkler zone/waterflow device
• smoke detectors
• smoke alarms
• manual pull stations
• signals to Fire Department via an acceptable central monitoring station
• activation of ancillary devices

2.1.6. Emergency Telephone System

• each exit stair

2.1.7. Emergency Power

• design requirements to appropriate Standard
• supervisory provisions for fire alarm
• emergency electrical load
• emergency generator

2.1.8. Emergency Lighting

• exits
• access to exits
• public corridors
• other floor areas

2.1.9. Exit Signs

2.2. Additional Requirements for High Buildings

2.2.1. Interface Condition between Highrise and Lowrise Components (Measure 'N' Vestibules)

2.2.2. Smoke Control — Measure A

• design requirements to appropriate Standard
• venting above-grade stairs
• separation of above-grade and below-grade stairs
• venting below-grade stairs
• pressurization of below-grade stairs at bottom
• above-grade elevator shaft serving below-grade protected with a "protected" vestibule
• additional controls at CACF (annunciator panel shop drawings)

2.2.3. Smoke Venting

2.2.4. Fire Fighters' Elevators
- fire fighting controls
- emergency recall

2.2.5. Protection of Emergency Electrical Conductors
- highrise elevator
- emergency generator(s)
- fire pump(s)
- smoke control systems
- smoke venting systems
- fire alarm and emergency voice communication systems

2.2.6. Emergency Voice Communications
- integrated with F.A. system
- audible to appropriate Standard
- zoning of speakers

3.0. Roles and Responsibilities for the Demonstration of the Coordinated Fire and Life Safety Systems

3.1. Roles and Responsibilities for the Design, Commissioning and Functional Testing of Fire and Life Safety Systems

3.1.1. Design Phase
RPRs will clearly indicate on their drawings and supporting documents the details of the fire and life safety systems for each applicable item of Section 2 for their particular discipline. RPRs will also coordinate the design of the components in their system with the designs of other RPRs on the project. RPRs are to indicate what functional testing, system verification, etc., must be performed by the Contractor or subtrades and establish the documentation to be provided.
The CRP will develop the project-specific test protocol and procedures in consultation with the RPRs. The CRP will act as the facilitator for the coordination of the design of the fire and life safety systems among the various RPRs.

3.1.2. Construction Phase
The Contractor will coordinate the activities of the subtrade contractors for the installation of the fire and life safety systems in accordance with the contract documents.
RPRs will provide field reviews to ascertain that the construction of the fire and life safety systems substantially complies with their design.
RPRs will review shop drawings of the fire and life safety systems to determine that they accurately reflect their design intent. They will also coordinate their reviews with those of the other RPRs on the project.
The CRP will coordinate the shop drawing reviews and field reviews by the RPs with the objective that the entire fire and life safety system will correctly operate as an integrated system.

3.1.3. Occupancy Phase
The Contractor will coordinate the subtrade contractors for the commissioning and functional testing of the fire and life safety systems. The Contractor will also collect all of the required Occupancy Permit submission documents from the various subtrade contractors and forward them to the CRP.

The CRP will take the lead role in coordinating the activities of the RPRs required for the commissioning and functional testing of the fire and life safety systems. The CRP will distribute the test protocol and test procedures, as developed in the Design Stage, to the various parties involved in the process.
RPRs will ascertain that the appropriate commissioning and functional testing of the fire and life safety systems of the components in their disciplines have been satisfactorily completed by the subtrade contractors. They will also determine that the appropriate Occupancy Permit submission documents have been submitted and filled in correctly.
The CRP will be responsible for collecting all of the required Occupancy Permit submission documents, reviewing them for completeness and accuracy, and forwarding them to the CBO in a complete package at least 24 hours prior to the Coordinated Final CBO Review.

3.2. Sample Summary of Roles and Responsibilities for Demonstration of the Coordinated Fire and Life Safety Systems

The following is a sample summary (only) of the roles and responsibilities for a typical highrise building with underground parking. The precise roles and responsibilities for each project will vary depending on the complexity. The CRP will ascertain that the appropriate roles and responsibilities for each project are fulfilled by the RPRs.

3.2.1. Coordinating Registered Professional

Design Phase

- Determine the appropriate RPRs required for the project and make arrangements with the owner for their services.
- Clarify the roles and responsibilities of the various RPRs.
- Coordinate the design of the fire and life safety systems by the RPRs.
- Coordinate and develop the test protocol and procedures for functional testing of the fire and life safety systems.
- Coordinate the submission of the design drawings and supporting documents for the Building Permit application.

Construction Phase

- Coordinate and monitor the field reviews of the RPRs.
- Coordinate and monitor the review of shop drawings by the RPRs.
- Facilitate the information flow among the RPRs and Contractor.

Occupancy Phase

- In conjunction with the RPRs, finalize the project-specific test protocol and procedures for the fire and life safety systems, and review the requirements with the Contractor, subtrades and RPRs.
- Finalize the list of project-specific occupancy permit submission documents and the schedule for submissions and confirm completeness with CBO.
- Organize the "Coordinated Final Consultant Review" at least one week prior to "Coordinated CBO Final Review."
- Take a lead role in coordinating the functional testing of the fire and life safety systems during the "Coordinated Final Consultant Review."
- Coordinate the RPRs' review of Occupancy Permit submission documents for completeness and accuracy.
- Coordinate Certification of Equivalencies, if applicable.
- Collect all of the required Occupancy Permit submission documents and submit them in a complete package to the CBO.
- Organize the "Coordinated CBO Final Review."
- Record any deficiencies identified at the "Coordinated CBO Final Review" and monitor RPRs' field review of the corrective actions by the subtrades.
- Assist in finalizing the list of outstanding requirements which need to be met for the issuance of the Occupancy Permit.
- Follow-up on minor deficiencies post-Occupancy.

3.2.2. Architectural Design Phase

- Establish the conceptual design for the fire and life safety systems in consultation with RPRs.
- Determine equivalency reports required and coordinate the implementation on the drawings and supporting documents.
- Clearly indicate on drawings and supporting documents:
  - Major occupancies and code classifications.
  - Fire separations and fire-resistance ratings.
- Closures:
  - Fire-protection rating
  - Temperature rise requirements
  - Amount of glazing
- Hardware for closures
  - Panic hardware
  - Hold-open devices
  - Electromagnetic locks
- Egress systems.
- Provisions for fire fighting access.
- Interior and exterior finishes.
- Elevating devices c/w integrated controls to the fire alarm panel.
- Signage coordinated with fire alarm system and annunciation.

Construction Phase

- Provide field reviews of architectural components.
- Review shop drawings for architectural components and coordinate requirements with other RPRs.
- Review shop drawings for other disciplines which may influence architectural components.

Occupancy Phase

- Ascertain that the architectural components substantially conform to the architectural drawings and supporting documents.
- Perform an active role in witnessing the functional testing of the architectural components of the fire and life safety systems.
- Coordinate the signage with the fire alarm annunciator and the fire safety plans.
- Review the architecturally-related Occupancy Permit submission documents provided by the Contractor and subtrades for completeness and accuracy.
- Prepare and forward to the CRP the architectural Schedule C-B and other assurance letters required for the Occupancy Permit.

3.2.3. Mechanical/Plumbing Design Phase

- Coordinate mechanical/plumbing clearances and functional requirements with other RPRs.
- Clearly indicate on drawings and supporting documents:
  - Details of the mechanical/plumbing components of the fire and life safety systems.
  - Schematic diagram of the smoke venting system showing all fans, ducts, motorized dampers, fusible link dampers and backdraft dampers.
  - Location and fire-protection ratings of fusible link fire dampers and fire stop flaps.
  - Location and fire-protection ratings of motorized fire dampers.
  - Location and fire-resistance ratings of fire-rated duct enclosures.
  - Fire stop systems for mechanical/plumbing penetrations of fire separations.
  - Kitchen exhaust system/suppression system.
- Mechanical fans/motorized dampers sequence of operations:
  - Describe operation under normal mode

- Describe operation under fire alarm mode
- Indicate fire alarm initiation devices that activate change of operation

Construction Phase

- Provide field reviews of mechanical/plumbing components.
- Review shop drawings for mechanical/plumbing components and coordinate requirements with other RPRs.
- Review shop drawings for other disciplines which may influence mechanical/plumbing components.

Occupancy Phase

- Ascertain that the mechanical/plumbing components substantially conform to the mechanical/plumbing drawings and supporting documents.
- Perform an active role in witnessing the functional testing of the mechanical/ plumbing components of the fire and life safety systems.
- Review the mechanical/plumbing related occupancy permit submission documents provided by the Contractor and subtrades for completeness and accuracy.
- Prepare and forward to the CRP the mechanical/plumbing Schedule C-B and other assurance letters and documentation required for the Occupancy Permit.

3.2.4. Fire Suppression

The design of sprinkler systems can be accomplished by at least two possible scenarios:

Scenario 1

- The engineer of record undertakes the complete detailed design prior to the building permit application.
- The engineer of record submits Schedule B with the BP application.
- The engineer of record provides field reviews during construction and submits a Schedule C-B prior to Occupancy Permit.

Scenario 2 (where *acceptable* to the *Chief Building Official*)

- The engineer of record provides a detailed performance specification for the sprinkler design, as well as sufficient drawings to demonstrate/assure layout feasibility and interface with other components.
- The engineer of record submits Schedule B with the BP application for overall coordination of the sprinkler design. Schedule B can be annotated "For Performance Specification Only."
- The performance specifications may include a requirement that a separate sprinkler design engineer be responsible for detailed sprinkler design, preparation of sprinkler shop drawings and hydraulic calculations, letter of assurance Schedule B, (for field review during construction), and Schedule C-B (for Detailed Design) prior to Occupancy Permit.
- The engineer of record reviews the detailed sprinkler design and shop drawings to ascertain that they substantially comply with the performance specifications.
- The engineer of record provides a Schedule C-B prior to Occupancy Permit to confirm overall coordination of the sprinkler design and installation. Schedule C-B can be annotated "For Performance Specification Only." The engineer of record is entitled to rely upon the professional seal of the sprinkler design engineer for the detailed design and field review of the sprinkler system.

For purposes of this example, Scenario 2 Roles and Responsibilities are outlined below:

Design Phase by Engineer of Record

- Coordinate fire suppression spatial and functional requirements with other RPRs/CRP.
- Clearly indicate on the drawings and performance specification:
    - Fundamental design parameters for the fire suppression system to appropriate Standard.
    - Location of fire department siamese hose connections.
    - Location and size of standpipes and hose connections.
    - Details of special sprinkler protection as per equivalent reports.

- Fire stop systems for pipe penetrations of fire separations.
- Zoning of the sprinkler system to be coordinated with the electrical engineer for the fire alarm annunciation and clearly identified in the performance specifications.

Construction Phase by Sprinkler Design Engineer

- Prepare, sign and seal shop drawings and hydraulic calculations, clearly indicating:
    - Details of the fire suppression components of the fire and life safety systems.
    - Schematic riser diagram of sprinkler and standpipe systems c/w all devices that will be connected to the fire alarm system (flow switches, tamper switches, pressure switches, freeze monitoring, heat trace monitoring).
    - Location of fire department siamese hose connections.
    - Location and size of standpipes and hose connections.
    - Details of special sprinkler protection as per equivalent reports.
    - Zoning of the sprinkler system to be coordinated with the electrical engineer for the fire alarm annunciation and clearly identified on the sprinkler shop drawings.
    - Coordinate fire suppression location and functional requirements with engineer of record/CRP.
- Provide field reviews of fire suppression components.

Construction Phase by Engineer of Record

- Review shop drawings and hydraulic calculations for fire suppression components to determine substantial conformance to the performance specifications.
- Provide field reviews of fire suppression components to determine substantial conformance to the performance specifications.
- Monitor the field reviews by the Sprinkler Design Engineer to determine substantial conformance with the performance specifications.
- Review shop drawings for other disciplines which may influence fire suppression components.

Occupancy Phase by the Engineer of Record

- Ascertain that the fire suppression components substantially conform to the performance specifications.
- Perform an active role in witnessing the functional testing of the fire suppression components of the fire and life safety systems.
- Review the fire suppression-related Occupancy Permit submission documents by the Contractor and subtrades for completeness and accuracy.
- Collect the Schedule C-B from the Sprinkler Design Engineer, review for accuracy and completeness and forward to the CRP.
- Collect other Occupancy Permit documents from the subtrade contractor (e.g., Contractor's Material and Test Certificates), review for completeness and forward to the CRP.
- Prepare and forward to the CRP the fire suppression Schedule C-B for overall coordination of the fire suppression system.

Occupancy Phase by the Sprinkler Design Engineer

- Ascertain that the fire suppression components substantially conform to the sprinkler shop drawings and supporting documents.
- Perform an active role in witnessing the functional testing of the fire suppression components of the fire and life safety systems.
- Review the fire suppression-related Occupancy Permit submission documents by the Contractor and subtrades for completeness and accuracy.
- Prepare and forward to the Engineer of Record the fire suppression Schedule C-B and other assurance letters and documentation required for the Occupancy Permit.

3.2.5. Electrical

Design Phase

- Coordinate with the CRP and RPRs the test protocol and procedures for functional testing of the fire and life safety systems.
- Details of the electrical components of the fire and life safety systems.
- Clearly indicate on drawings and supporting documents:
    - Fire Alarm System
        - Location of fire alarm annunciator panel and central alarm control facility
        - Location of fire alarm initiating devices (smoke detectors, heat detectors, manual pull stations)
        - Fire alarm riser diagram c/w ancillary device connections
        - Audibility of fire alarm signal throughout floor area
        - Zoning of fire alarm initiation devices and audible signal appliances
        - Monitoring of fire alarm
        - Routing and method of protection of emergency conductors
        - Wiring methods for equipment
        - Testing/verification requirements and the documentation to be submitted to the RPR
    - Sprinkler System
        - Coordinate design with sprinkler design engineer
        - Sprinkler system alarm initiation and monitoring to be indicated on the fire alarm riser diagram (flow, tamper, pressure, etc.)
        - Detailed diagrams for freeze protection systems (heat trace monitoring, low temperature monitoring, etc.)
    - Fire Pump Systems
        - Riser diagram to indicate monitoring of the fire pump (pump running, power failure, phase reversal, wiring details for device connections)
        - Routing and method for protection of fire pump feeders from fire and power source, so that a fire from one source will not interrupt power from the other source
        - Electrical requirements to appropriate Standard and documents to be submitted to RPR (overcurrent protection details, location of controller and transfer switches, voltage drop, etc.)
    - Kitchen Exhaust/Fire Suppression System
    - Emergency Generator
        - Generator load calculations
        - Details and wiring diagram for monitoring through the fire alarm system
        - Details for testing to appropriate Standard and documents to be submitted to RPR
    - Smoke Venting Systems
        - Coordinate design with the mechanical engineer
        - Fire alarm riser diagram to indicate smoke venting fans and motorized dampers and HVAC/exhaust fan shutdown
        - Detailed wiring diagrams for fan shut-offs, exhaust fan operation, pressurization fan operation, damper operation (opening, closing, throttling)
        - Sequence of operation of smoke venting system in a narrative form
        - Describe operation under normal mode
        - Describe operation under fire alarm mode
        - Indicate fire alarm initiating devices that activate changes of operation/sequence
        - Routing methods for protection of emergency conductors
    - Electromagnetic Locks and Hold-Open Devices
        - Coordinate design with the architect
        - Sequence of operation in both normal and fire alarm mode
        - Wiring diagrams for connection of devices

- Locations of devices on the floor plans
- Elevators
  - Sequence of operation in a narrative form
  - Wiring diagram details
  - Routing and method of protection of emergency conductors
    - Fire stop systems for electrical penetrations of fire separations
    - Coordinate electrical equipment location and functional requirements with other RPRs/CRP.

Construction Phase

- Provide field reviews of electrical components.
- Review shop drawings for electrical components and coordinate requirements with other RPRs.
- Review shop drawings for other disciplines which may influence electrical components.

Occupancy Phase

- Ascertain that the electrical components substantially conform to the electrical drawings and supporting documents.
- Perform an active role in witnessing the functional testing of the electrical components of the fire and life safety systems.
- Review the electrical-related Occupancy Permit submission documents provided by the Contractor and subtrades for completeness and accuracy.
- Prepare and forward to the CRP the electrical Schedule C-B and other assurance letters and documents required for the Occupancy Permit.

4.0. Sample Occupancy Demonstration/Witnessing Flowchart

DEVELOP TESTING PROTOCOL/PROCEDURE (Design Stage)
CRP/RPRs develop Testing Demonstration/Witness Protocol
— Issue to Authorities Having Jurisdiction & Contractor
||
V
DOCUMENTATION SUBMISSION
Contractor/Subtrades submit/deliver all appropriate documentation to CRP/RPRs, including:
— The original Contractor's Materials and Test Certificate for the sprinkler system
— Fire Pump Flow Test Certificate(s)
— Back Flow Prevention Certificate(s)
— Emergency generator commissioning and verification reports
— The original Certificate of Verification for the fire alarm system
— Appendix "A" to the fire alarm verification report
— ULC Certificate for Protective Signaling Service
— Other documentation, as appropriate
||
V
CONTRACTOR DEMONSTRATION — CONSTRUCTION COMPLETE
Contractor & Subtrades
(Mechanical, Electrical, Elevator, Sprinkler, Fire Alarm, etc.) as appropriate
||
V
COORDINATED FINAL CONSULTANT REVIEW DEMONSTRATION/WITNESSING CRP/RPRs

(Architect, Mechanical Engineer, Electrical Engineer, Sprinkler Engineer, Equivalency Consultant, etc.) as appropriate
||
\/
OCCUPANCY SUBMISSION DOCUMENTS
CRP to collect all submission documents, including Schedule Cs from RPRs, and submit to CBO in a complete package
||
\/
COORDINATED FINAL CBO REVIEW DEMONSTRATION/WITNESSING
Contractor, Subtrades, CRP/RPRs demonstrate to CBO
(Building, Fire, Mechanical, Electrical and Sprinkler)
||
\/
OP ISSUED

A-2.2.8.1.(1) Deleted.

A-2.2.8.3.(2)(c)(i) Deleted.

A-2.3.1. Alternative Solutions. Beyond the purposes of demonstrating compliance and acquiring a building permit, there are other important reasons for requiring that the proponent of an alternative solution submit project documentation (i.e. a compliance report) to the *Chief Building Official* and for the *Chief Building Official* to retain that documentation for a substantial period following the construction of a building:

- Alternative solutions made possible by objective-based codes may have special maintenance requirements, which would be described in the documentation.
- Documentation helps consultants perform code compliance assessments of existing buildings before they are sold and informs current owners or prospective buyers of existing buildings of any limitations pertaining to their future use or development.
- Documentation provides design professionals with the basic information necessary to design changes to an existing building.
- An alternative solution could be invalidated by a proposed alteration to a building. Designers and regulators must therefore know the details of the particular alternative solutions that were integral to the original design. Complete documentation should provide insight as to why one alternative solution was chosen over another.
- Documentation is the “paper trail” of the alternative solution negotiated between the designer and the regulator and should demonstrate that a rational process led to the acceptance of the alternative solution as an equivalency.
- It is possible that over time a particular alternative solution may be shown to be inadequate. It would be advantageous for a jurisdiction to know which buildings included that alternative solution as part of their design: documentation will facilitate this type of analysis.
- Project documentation provides important information to a forensic team that is called to investigate an accident or why a design failed to provide the level of performance expected.

This subject is discussed in further detail in “Recommended Documentation Requirements for Projects Using Alternative Solutions in the Context of Objective-Based Codes,” which was prepared for the CCBFC Task Group on Implementation of Objective-Based Codes and is available on NRC’s Web site.

Part 3
Appeals, Offences and Penalties and Transition Provisions

Section 3.1. Appeals

3.1.1. BUILDING BOARD OF APPEAL

3.1.1.1. Appeal Within 30 Days

1) Any person dissatisfied with a decision of the *Chief Building Official* relating to matters described in Article 3.1.1.2. may appeal the decision to the *Building* Board of Appeal who shall have such powers relating to this By-law as are set out in this By-law and in the *Building* Board of Appeal By-law.

3.1.1.2. Limits of Appeal

1) An appeal lies to the *Building* Board of Appeal from any decision of the *Chief Building Official* regarding

a) the interpretation of this By-law,
b) the use of new *construction* methods or materials,
c) upgrading *existing buildings* or
d) permitting alternative proposals.

3.1.1.3. Filing of Appeal

1) An application for an appeal shall be filed with the Secretary of the Board, in writing, within 30 days of the decision which gives rise to the appeal.

2) An application for an appeal shall include

a) the address of the *building* to which the decision relates,
b) the applicable provisions of the By-law, and
c) sufficient detail to describe the factual and technical basis for the appeal.

Section 3.2. Offences and Penalties

3.2.1. VIOLATION OF BY-LAW

3.2.1.1. Offences

1) Every person who

a) violates any of the provisions of this By-law,
b) suffers or permits any act or thing to be done in contravention or in violation of any of the provisions of this By-law,
c) neglects to do or refrains from doing anything required to be done by any of the provisions of this By-law,
d) does any act which violates any of the provisions of this By-law, or
e) fails to comply with an order or notice given under this By-law,

is guilty of an offence against this By-law and liable to the penalties hereby imposed.

3.2.2. FINES AND PENALTIES

3.2.2.1. Minimum Fine

1) Every person who commits an offence against this By-law is liable to a fine of no less than $250 and not more than $10,000 for each offence.

3.2.2.2. Continuing Offence

1) Every person who commits an offence of a continuing nature against this By-law is liable to a fine of not less than $250 and no more than $10,000 for each day such offence is continued.

3.2.2.3. Unsafe Condition

1) Despite the minimum fine referred to in Article 3.2.2.1., every person who permits *occupancy* to occur while an *unsafe condition* exists in or about a *building* or the premises is liable to a fine of no less than $500 and not more than $10,000 for each offence.

3.2.2.4. Failure to Comply with an Order

1) Despite the minimum fine referred to in Article 3.2.2.1., every person who fails to comply with an order or notice issued by the *Chief Building Official* is liable to a fine of no less than $500 and not more than $10,000 for each offence.

3.2.2.5. Work Without a Permit

1) Despite the minimum fine referred to in Article 3.2.2.1., every person who works without *permit* is liable to a fine of no less than $500 and not more than $10,000 for each offence.

3.2.2.6. Failure to Permit Entry

1) Despite the minimum fine referred to in Article 3.2.2.1., every person who fails to allow the *Chief Building Official* entry to a *building* or premises is liable to a fine of not less than $500 and not more than $10,000 for each offence.

Section 3.3. Transition Provisions

3.3.1. GENERAL

3.3.1.1. Validity of Permits Issued under Previous By-law

1) Subject to the provisions of Articles 1.5.2.4. and 3.3.1.2., *buildings* for which *permits* were obtained under By-law No. 10908 may be constructed in accordance with the provisions of that By-law.

3.3.1.2. Grace Period

1) Where an *owner* has applied for a *permit* prior to June 03, 2019, a *building* may be constructed in accordance with By-law No. 10908 if, in the opinion of the *Chief Building Official*, the *owner* has commenced the work authorized by the *permit* within 6 months of the date of issuance of the *permit* and the *owner* has continued work to completion without interruption other than work stoppages which are standard in the *building* industry.