

CITY OF VANCOUVER BRITISH COLUMBIA



BUILDING BY-LAW NO. 14343

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

MAY 20, 2025

BY-LAW NO. 14343

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

THE COUNCIL OF THE CITY OF VANCOUVER, in public meeting, enacts as follows:

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 to this By-law as Schedule 1.

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- 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. 12511 as amended from time to time, except that the provisions of By-law No. 12511, with respect to matters other than administration, continue to apply as if unrepealed in respect of permits applied for under By-law No. 12511 before September 15, 2025 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 15th day of September, 2025.

ENACTED by Council this 20th day of May, 2025

Signed _____ "Ken Sim"
Mayor

Signed _____ "Katrina Leckovic"
City Clerk

SCHEDULE 1

BOOK I (GENERAL)
AND
BOOK II (PLUMBING SYSTEMS)

Vancouver Building By-law 2025

**Book I: General
(Volume 1)**

Preface

The 2025 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 2024 British Columbia Building Code, which in turn is substantially based on the model National Building Code of Canada 2020 and the model National Plumbing Code of Canada 2020. This model of adoption of national model codes helps promote consistency among building codes.

This Building By-law replaces the 2019 Building By-law and also contains certain transition provisions which apply to permits issued under the 2019 Building By-law. The Building By-law is regularly updated and users should ensure that the By-law is current.

Codes Development

National Codes

The CCBFC, an independent committee established by the National Research Council of Canada (NRC), is responsible for the content of the National Model Codes. The CCBFC is made up of volunteers from across the country and from all facets of the Codes-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 staff within the Construction Research Centre at the NRC provide technical and administrative support to the CCBFC and its standing committees, and coordinate the provision of evidence-based research to inform Codes development. The NRC publishes the National Model Codes and periodic revisions to the Codes to address pressing issues, and like the Codes themselves, such periodic revisions do not have legal effect until adopted into law by the City of Vancouver.

British Columbia Building Code

In British Columbia, the 2024 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

The Building By-law sets out technical provisions for the design and construction of new buildings. It also applies to the alteration, change of use and demolition of existing buildings.

The Building By-law establishes requirements to address the following five objectives:

- (a) safety
- (b) health
- (c) accessibility
- (d) fire and structural protection of buildings
- (e) environment

The design of a technically sound building depends upon many factors beyond compliance with building regulations. Such factors include the availability of knowledgeable practitioners who have received appropriate education, training and experience and who are familiar with the principles of good building practice and experience using reference manuals and technical guides.

Additional Information

Numbering System

A consistent numbering system has been used throughout the National Model Codes. The first number indicates the Part of the Code; 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

Use of the term “Reserved”

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 (UTV) 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 2024 British Columbia Building and Plumbing Codes. Where the provisions of Vancouver have required the deletion of the 2024 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 2024 British Columbia Building and Plumbing Codes text.

Revision Indication

From time to time, the provisions of the Building By-law may be amended. Where this occurs, updated text is marked by a sidebar with text in brackets indicating the Revision. In some cases, text that was originally included as part of the Building By-law is amended and would result in substantial renumbering of associated portions of the Building By-law.

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 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 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. Moreover, the connecting words “and” and “or” must be read in the context of the Sentence. In particular, the use of the word “and” as a connecting word does not necessarily mean that all Clauses (or Subclauses) are applicable for compliance with the Sentence.

Units

All values in the NBC are given in metric units. Some of the metric values in the Code have been converted and rounded from imperial values. A conversion table of imperial equivalents for the most common units used in building design and construction is located at the end of the Code.

Complementary Publications

The following publications are referenced in the NBC 2020 or facilitate the application of its requirements:

National Energy Code of Canada for Buildings 2020 National
Farm Building Code of Canada 1995 National Fire Code of
Canada 2020

National Plumbing Code of Canada 2020

Illustrated User's Guide – NBC 2020: Part 9 of Division B, Housing and Small Buildings Structural
Commentaries (User's Guide – NBC 2020: Part 4 of Division B)

Supplement to the NBC 2020: Intent Statements

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Building, Inspections, and By-law Services
Development Building and Licensing
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Vancouver, BC V5Y 1V4
Email: CBO@vancouver.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 network of accredited organizations concerned with standards development, certification, testing and inspection 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 accredits standards development organizations, certification bodies, testing and calibration laboratories, and inspection bodies, among others.

The SCC is a non-profit federal Crown corporation responsible for the coordination of voluntary standardization in Canada. It also coordinates Canadian participation in voluntary international standardization activities.

Canadian Standards

Many of the standards referenced in the NBC are published by standards development organizations accredited in Canada. As part of the accreditation requirements, these organizations adhere to the principle of consensus, which 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 standards development organizations also have formal procedures for the balloting and second-level review of standards prepared under their oversight.

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

- Air-Conditioning, Heating and Refrigeration Institute (AHRI)
- ASTM International
- Bureau de normalisation du Québec (BNQ)
- Canadian General Standards Board (CGSB)
- CSA Group
- International Association of Plumbing and Mechanical Officials (IAPMO)
- ULC Standards
- Underwriters' Laboratories Inc. (UL)

Tables 1.3.1.2. and D-1.1.2. of Division B list the standards referenced in the NBC. Standards proposed to be referenced in the NBC are reviewed to ensure that 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 the NBC – withdrawals, amendments, new editions, etc. This information is passed on to the CCBFC, its standing committees, the provinces and territories, and interested stakeholders, 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 experience of committee members, provincial or territorial staff, NRC staff, and consulted stakeholders to identify changes in the standards that might create problems in the Code.

Non-Canadian Standards

A number of subject areas for which the standards development organizations accredited in Canada have not developed standards are covered in the NBC. 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 standards development organizations accredited in Canada; nevertheless, the standards have been reviewed by the relevant standing committees and found to be acceptable.

Conformity Assessment

The NBC establishes minimum measures, which are set out within its own text or within referenced standards. However, the NBC does not set out who is responsible for assessing conformity to the measures or how those with this responsibility might carry it out. This responsibility is usually established by the governing legislation of the adopting provinces and territories. Provincial or territorial authorities should be consulted to determine who is responsible for conformity assessment within their jurisdiction.

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

Those persons responsible for ensuring that materials, appliances, systems and equipment meet the requirements of this Code have several means available to assist them, ranging 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 SCC accredits testing and calibration laboratories that are capable of reliably testing products to specified standards. The test results produced by these organizations can be used in the certification, evaluation and qualification of products for compliance with Code provisions. The SCC's website (www.scc.ca) lists accredited testing and calibration laboratories, along with their scope of accreditation.

Certification

Certification is the confirmation by an independent organization that a product, process, service or system meets a requirement. Certification may entail physical examination, testing as specified in appropriate standards, an initial plant inspection, and/or 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, service 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 an accredited certification body and specifically designed to measure the performance of that product.

Certification bodies publish lists of certified products and companies. The SCC's website (www.scc.ca) lists accredited certification bodies, along with their scope of accreditation. Several organizations, including the Canadian Construction Materials Centre (CCMC) at the NRC, offer product certification services.

Evaluation

An evaluation is a written opinion by an independent professional organization that a product will perform its intended function. An evaluation is often done to determine the ability of an innovative product, for which no standards exist, to satisfy the intent of a Code requirement. Follow-up plant inspections are not normally part of the evaluation process. While the development of such an evaluation is useful to establish a basis for

acceptance, this 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

Qualification 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 product manufacturing and/or testing facilities for compliance with the Building By-law and relevant standards.

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BOOK I (GENERAL) - DIVISION A

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*, and
- o) the *alteration*, renovation 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 m² in *building area* that do not create a hazard,

f) with the permission of the *Chief Building Official*, 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*, and

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 m²,

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) Deleted.

6) Temporary *buildings* and *existing buildings* that are occupied on a temporary basis shall conform to the requirements of this *By-law*.

1.1.1.2. Application to Existing Buildings

1) Where a *building* is altered, renovated or repaired, or there is a change in *major occupancy*, the *building* shall also upgrade in accordance with Part 11 of Division B. (See Note A-1.1.1.2.(1).)

2) Alternative compliance measures to assist in the renovation or conversion of *existing buildings* in Sections 11.2. though 11.4. 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.

1.1.2. Internal References to this By-law

1.1.2.1. Book I (General) and Book II (Plumbing Systems) 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 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 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, including Figures A-1.4.1.2.(1)-C, D and E,
- b) A-1.4.1.2.(1) Flood construction level requirements of Division A,
- c) A-Table 9.23.3.5.-B of Division B, and
- d) A-9.23.13. of Division B, including Table A-9.23.13.

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) and Sentence 3.3.1.3.(1) of Division C, 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 *Vancouver 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 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.

1.2.2.3. 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.

1.2.3. Installation of Plumbing Systems

1.2.3.1. Personnel Performing Plumbing Work

- 1)** Personnel performing the installation, *alteration*, renewal or repair of a *plumbing system* shall
- a) possess a Canadian tradesperson's qualification certification as a plumber,
 - b) be an indentured apprentice supervised by a journeyperson who meets the criteria set out in Clause (a), or
 - c) be the registered *owner* and occupant or intended occupant of the single detached 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 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 m² 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 m² 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, 12, and 13

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 m², and used for *major occupancies* classified as

- a) reserved,
- b) Group C, *residential occupancies* (see Note A-9.1.1.1.(1) of Division B),
- c) Group D, *business and personal services occupancies*,
- d) Group E, *mercantile occupancies*, or
- e) Group F, Divisions 2 and 3, *medium- and low-hazard industrial occupancies*.

2) Part 11 applies to the *alteration*, renovation, repair, *addition* or change of *major occupancy* of an existing *building* and as defined in Subsection 11.1.4. 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 Subsection 11.1.4. of Division B.

4) Part 13 applies to the design and *construction* of temporary *buildings*, and the occupancy of existing *buildings* on a temporary basis.

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 (3) and (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) and (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 superimposed portions of the *building area* above 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) and (3) may terminate at the floor assembly immediately above a *basement*

a) provided the *basement* conforms to Article 3.2.1.2. of Division B-, and

b) where any of the separated portions exceed 4 *storeys* in *building height* and measures to prevent the movement of contaminated air are provided in accordance with Article 3.2.6.3. 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 2 to 9 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*.

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 with some *accessible* features and which accommodates the future modification to provide more *accessible* features.

Addition means an *alteration* to any *building* which will increase the total aggregate area of *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 that 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:

- with its primary *dwelling unit* constitute a single real estate entity,
- is smaller than the principal *dwelling unit*, and
- is located in: - a *building* of only *residential occupancy*, or - that portion of a *building* which is *row housing* and is completely separated from all other parts of the *building* by a continuous vertical *fire separation* that has a fire-resistance rating of no less than 1 h.

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 or using electricity to carry out a process supporting *building* services, 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.

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 Bylaw.

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

Assembly occupancy (Group A) 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 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 Book II, Division A, Figure A-1.4.1.2.(1)-F in Note A-1.4.1.2.(1).)

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 (Group D) 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.

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*.

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 (Group B, Division 3) means the *occupancy* or use of a *building* or part thereof, other than a home-type *care occupancy*, 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*.

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, "Standard Method of 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* or *encapsulated mass timber 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.

Commissioning means a process by which a *building's* operating systems are verified to meet the basis of design as stated in the design documents submitted for *building permit*.

Commissioning Provider means an individual identified by an *owner* to lead the planning and implementation of the *commissioning* process as defined in ASHRAE Standard 202, or CSA Z320 and CSA Z5000.

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 or Contractor means a person who contracts with an *owner* or their 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.

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.

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

Dangerous goods means products, materials or substances that are

- (a) regulated by TC SOR/2001-286, "Transportation of Dangerous Goods Regulations (TDGR)" (see Table 3.2.7.1. of Division B of the NFC), 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 NFC).

(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 Bylaw 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 Regulations pursuant to the Professional Governance 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 (Group B, Division 1) 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.

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).)

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

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.

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.

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.

Encapsulated mass timber construction means that type of *construction* in which a degree of fire safety is attained by the use of encapsulated mass timber elements with an *encapsulation rating* and minimum dimensions for structural members and other *building* assemblies.

Encapsulation rating means the time in minutes that a material or assembly of materials will delay the ignition and combustion of encapsulated mass timber elements when it is exposed to fire under specified conditions of test and performance criteria, or as otherwise prescribed by this By-law.

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 contains an agricultural occupancy. (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 their 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 Sentence 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).)

Firestop 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 that 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 D323, "Standard Test Method for 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 Bylaw, 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.

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

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.

Greenhouse agricultural occupancy (Group G, Division 3) means an agricultural occupancy where plants are grown in a *building* or part thereof that is primarily constructed of roofs and walls designed to transmit natural light.

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.

Heat loss calculation means a calculation according to the methodology of CSA F280-12, "*Determining the required capacity of residential space heating and cooling appliances*".

Heat pump means equipment that transfers heat from one location to another using a refrigeration cycle. When used for space heating, this equipment may function to provide both heating and cooling.

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

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.

Home-type care occupancy (Group B, Division 4) means the *occupancy* or use of a *building* consisting of a single detached housekeeping unit where care is provided to residents and may include the living space of the caregiver and their family. (See Note A-1.4.1.2.(1).)

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 (Group F) 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.

Journey person 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.

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.

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.

Liveboard 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 carbon energy system means a professionally operated and maintained district-scale or on-site system that supplies heat energy, primarily derived from highly efficient and renewable sources, in order to provide space heating and conditioned ventilation air for buildings, and may also provide domestic hot water and cooling service.

Low-hazard industrial occupancy (Group F, Division 3) means an *industrial occupancy* in which the *combustible* content is not more than 50 kg/m² or 1 200 MJ/m² of *floor area*.

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.

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).)

Mechanical system means a heating or cooling system and includes all components, controls, wiring and any piping associated with the system.

Medium-hazard industrial occupancy (Group F, Division 2) means an *industrial occupancy* in which the *combustible* content is more than 50 kg/m² or 1 200 MJ/m² of *floor area* and not classified as a high-hazard industrial occupancy.

Mercantile occupancy (Group E) 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*.

Municipal Heat Pump Certification means a certification issued to a person who has completed the Municipal Heat Pump Certification training.

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, "Standard Method of 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.

Offset means the piping that connects the ends of 2 pipes that are parallel. (See Book II, Division A, Figure A-1.4.1.2.(1)-K in Note A-1.4.1.2.(1).)

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.

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.

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 journeyman plumber or a person who employs a journeyman 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 the *Chief Building Official* has determined is necessary for the provision of essential services to the general public in the event of a disaster and includes buildings meeting these criteria but not limited to

- hospitals, emergency treatment facilities and blood banks,
- telephone exchanges,
- power generating stations and electrical substations,
- control centres for natural gas distribution,
- control centres for air, land and marine transportation,
- water treatment facilities,
- water storage facilities,
- water and sewage pumping stations,
- sewage treatment facilities,
- buildings having critical national defence functions, and
- buildings of the following types, unless exempted from this designation by the *Chief Building Official*:
 - 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*.

Ramp means a path of travel having a slope steeper than 1 in 20.

Recommissioning means to commission a building using the documentation created during the previous commissioning process.

Registered professional means

- a person who is registered as an Architect with the Architectural Institute of British Columbia under the Professional Governance Act, or
- a person who is registered as a professional engineer or professional licensee engineering with the Association of Professional Engineers and Geoscientists of the Province of British Columbia under the Professional Governance Act.

Registered professional of record means a *registered professional* retained to undertake design work and *field review* 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*.

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

Residential occupancy (Group C) 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.

Recommissioning means to commission a *building* using the documentation created during the previous commissioning process.

Retro-commissioning means to commission an *existing building* when *commissioning* has never been carried out or documentation does not exist.

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.

Roof drain means a fitting or device that is installed in the roof to permit *storm water* to discharge into a *leader*.

Row housing means a *building* or portion of a *building* of *residential occupancy* where no *dwelling unit* is located above another principal *dwelling unit* or its *ancillary residential 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*.

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.

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 Bylaw 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 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 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 drainage system means a *drainage system* that conveys *storm water*.

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 Bylaw, 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).)

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.

Tapered tread means a tread with non-parallel edges that increases or decreases its run uniformly over its width.

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 (Group B, Division 2) 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 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. (See Note A-1.4.1.2.(1).)

Vegetated roof assembly ("green roof") means a vegetated roof system (a functional arrangement of interacting components, inclusive of vegetation) that is combined with a roof assembly, is intended to both grow and flourish, and may be installed on a roof to control the rate of rainwater discharged through a storm drainage system. (See Note A-1.4.1.1.)

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 Code 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

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

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 Vancouver 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 certification of prefabricated buildings, modules, and panels" 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. Most of the individual standards in the series contain requirements regarding many issues also covered in this By-law. Some of these Z240 MH Series provisions are performance requirements with no quantitative criteria, some simply reference the applicable Building By-law requirements, while others contain requirements that differ from those in the Building By-law. One of the individual standards in the Z240 MH Series deals 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. Therefore, labeling that indicates that a factory-constructed house complies with the Z240 MH Series standards can NOT be taken as an indication that the house necessarily complies with the building code in effect for the location where the house will be sited.

The Building By-law does reference CSA Z240.10.1, "Site preparation, foundation, and installation of buildings," 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-1.1.1.2.(1) **Application to Existing Buildings.** This By-law is most often applied to existing or relocated buildings when an owner wishes to renovate 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 Chief Building Official 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 re-constructed, 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 Code By-law requires considerable judgment on the part of both the designer and the Chief Building Official.

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 “Structural Commentaries (User’s Guide – NBC 2020: 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 accessed ordered through the 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 a separate electronic document entitled “Supplement to the NBC 2020: Intent Statements,” which is available on the NRC’s website. 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: ~~OS1~~, 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: ~~OP1~~, 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 ~~Code~~ 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) 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.

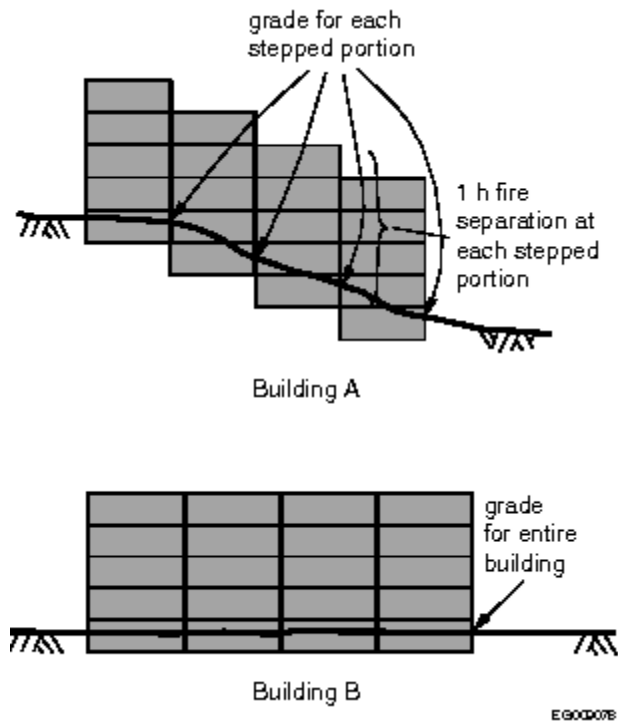


Figure A-1.3.3.4.(2)-A
Application of the definition of grade

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.

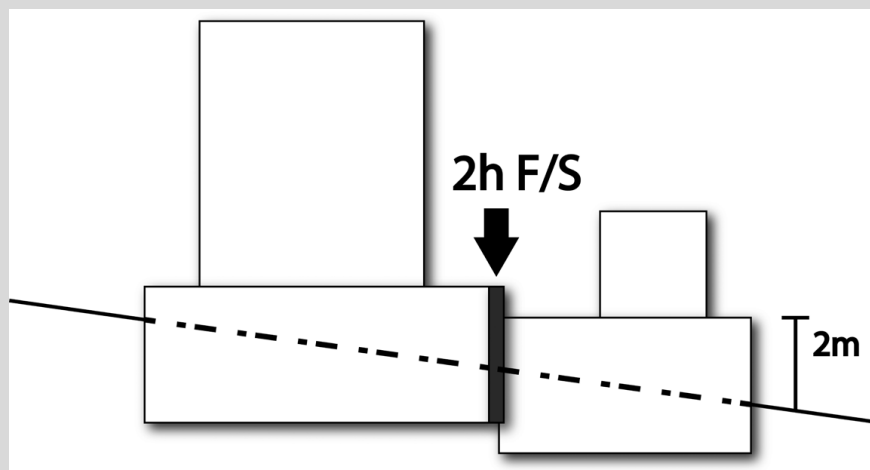


Figure A-1.3.3.4.(2)-B
Application of the definition of grade for physically separate components

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.

Ancillary Residential Unit

An ancillary residential unit is a self-contained dwelling unit that together with a larger principal dwelling unit forms a single real-estate entity. Ancillary residential units are typically created within an existing single dwelling building (house) either constructed as an addition or an alteration to an existing house or incorporated during the construction of a new house. An ancillary residential unit may have more than one storey and may be on the same level as the principal dwelling unit or be above or below it.

In a building with more than one ancillary residential unit, the principal dwelling unit along with its associated ancillary residential unit, must be either be vertically separated from all other portions of a the building that is of residential occupancy by a vertical fire separation that extends continuously through all crawlspaces, storeys and attic spaces of the vertically separate portions of a building or provided with enhanced fire protection (see Article 9.37.2.24.) Neither the ancillary residential unit nor any other dwelling unit subordinate to a principal dwelling unit can be strata-titled or otherwise subdivided from the remainder of the principal dwelling unit under provincial legislation. This means that the principal dwelling unit and all subordinate dwelling units are registered under the same title.

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 E413, “Classification for Rating Sound Insulation,” roughly describe the noise reduction 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.

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 ~~The NBC nomenclature uses~~ introduces a descriptive approach to classifying dangerous goods, which is similar to the one used 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** 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)
TDGR, WHMIS and Building By-law Class Descriptors for Dangerous Goods

TDGR		WHMIS	Building By-law
Class	Descriptor		
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 WHMIS	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 classified 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 classified 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

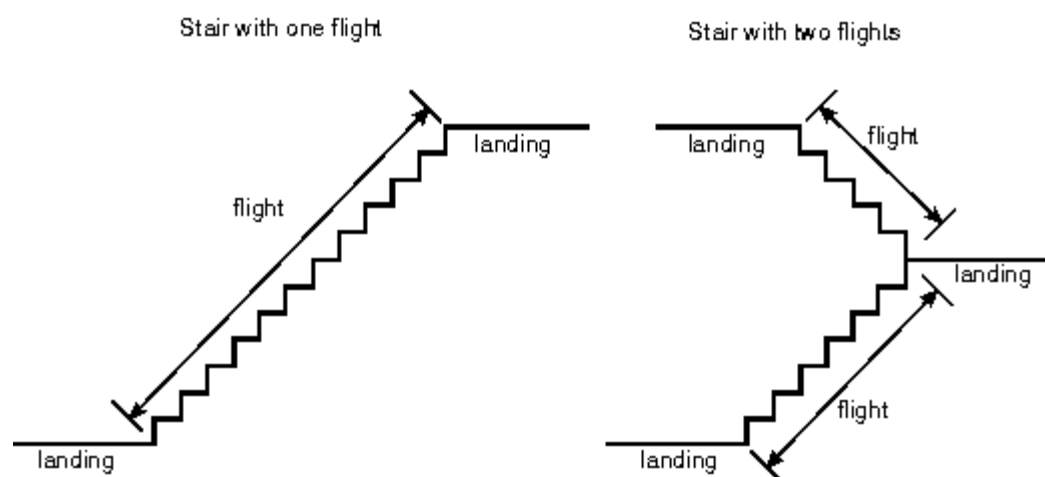


Figure A-1.4.1.2.(1)-A
Flight

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 to 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. Such is the case in the following examples: an example that is stored at a volunteer's residence or a police station that is housed in a small shopping mall or residential complex.

Some municipalities have emergency management plans that specify which buildings are to be used for the provision of essential services after a disaster. Municipalities normally coordinate their requirements with provincial or territorial emergency management protocols, which may or may not be mandatory. If in doubt about whether a building should be designated as a post-disaster building, designers should consult with the Chief Building Official.

The inclusion of control centres for natural gas distribution as examples of post-disaster buildings is intended to ensure that, following a disaster, control is maintained over large fuel distribution networks that supply a commodity essential to the health and safety of a significant proportion of the Canadian population. In contrast, the localized failure of a single fuel supply point does not jeopardize the entire fuel distribution system.

Buildings with rooftop telecommunication or cellular network equipment need not be designated as post-disaster buildings.

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 ($L \times T$) 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.

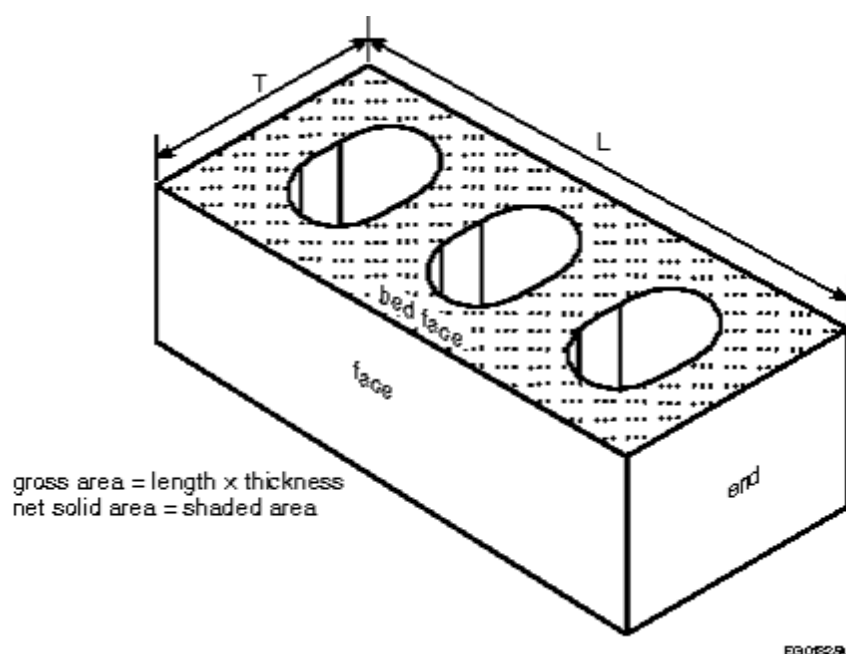


Figure A-1.4.1.2.(1)-B
Net solid area of masonry unit

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

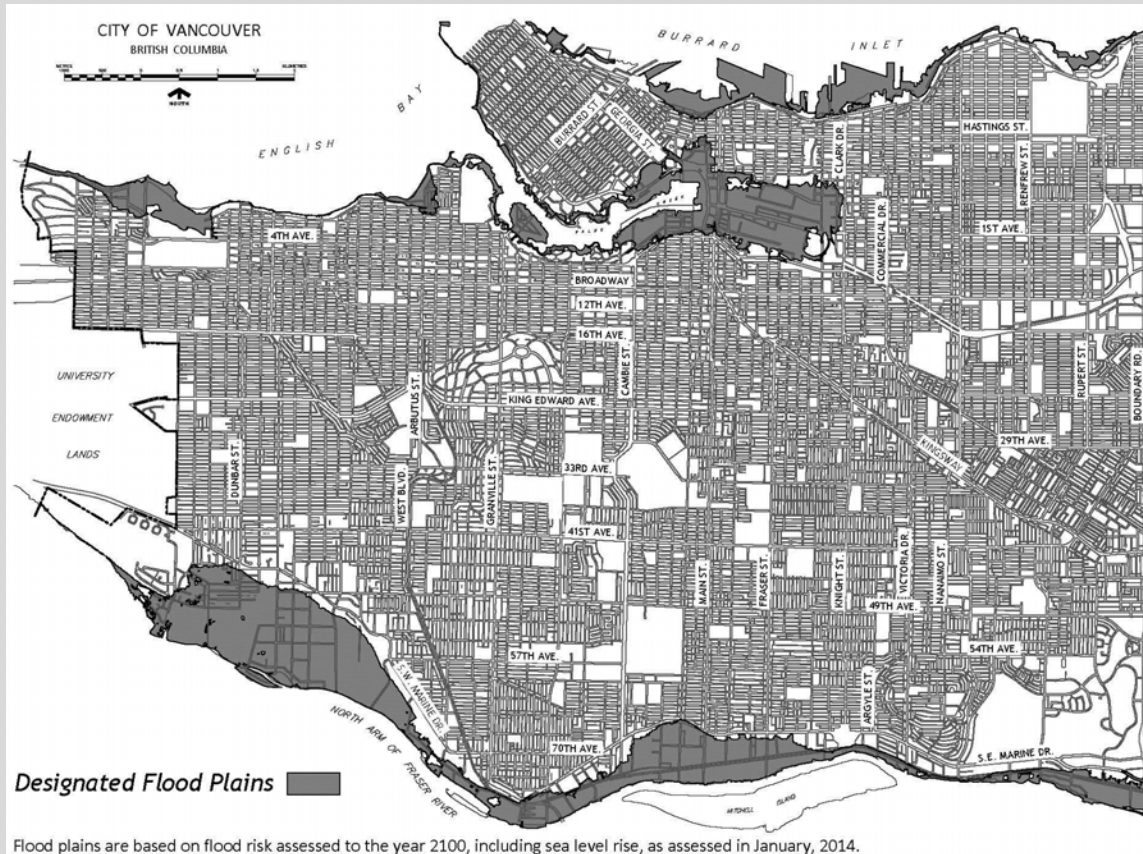


Figure A-1.4.1.2.(1)-C

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

Diagram A2: Burrard Inlet, English Bay, False Creek and Fraser River Flood Plain Wave Effect Zone

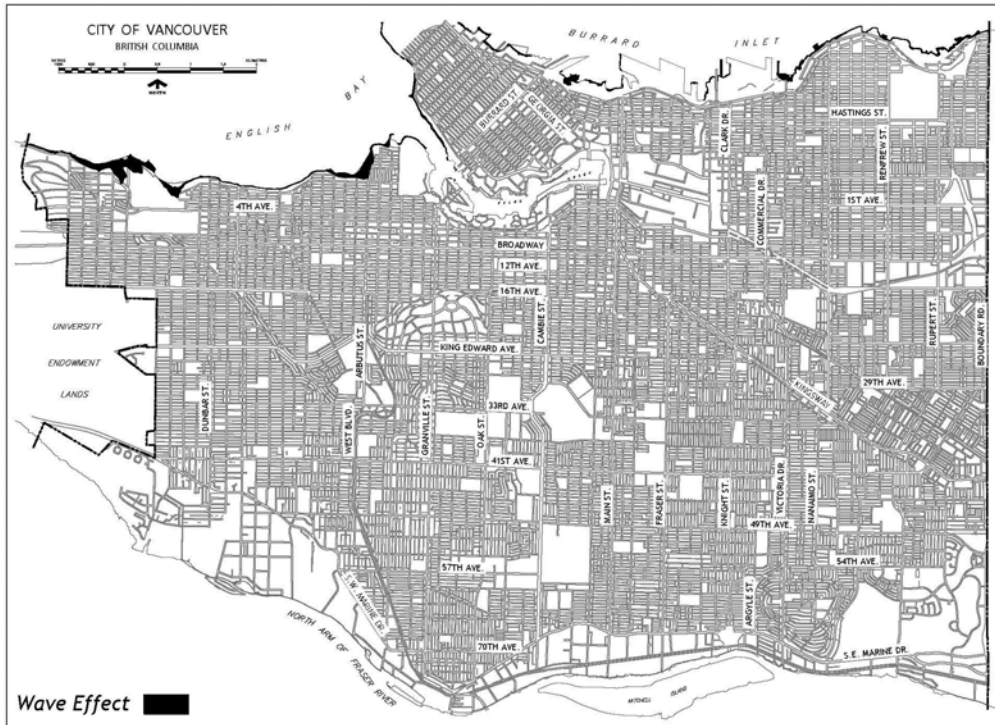


Figure A-

1.4.1.2.(1)-D

Diagram A2: Burrard Inlet, English Bay, False Creek and Fraser River Flood Plain Wave Effect Zone

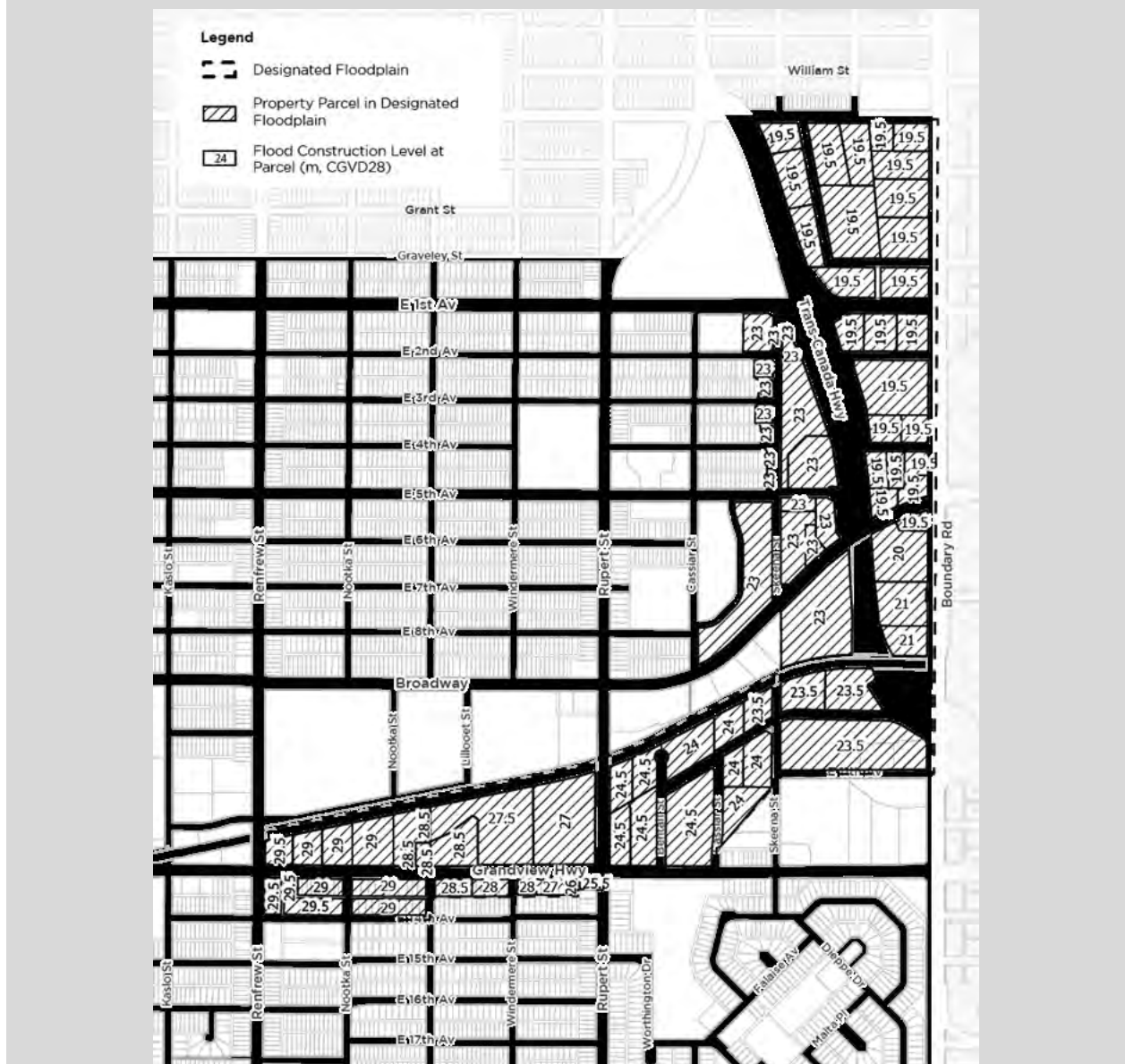


Figure A-1.4.1.2.(1)-E

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 except for *existing buildings*. (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 *buildings* and publicly accessible spaces. (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) detached houses, semi-detached houses, houses with *ancillary residential units*, duplexes, triplexes, townhouses, *row housing* and boarding houses,

b) *buildings* of Group F, Division 1 major occupancy, and

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

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 m², and
- c) *buildings* containing a mix of the *residential* and *non-residential occupancies* described in Clauses (a) and (b).

(See Note A-2.1.1.2.(6).) (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 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 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

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 Code 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 Code 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

OE2 Greenhouse Gases

An objective of this By-law is to limit the probability that, as a result of design and construction of the *building*, including the *building's* systems, and the energy consumed in the operation of those systems, the production of greenhouse gases will be excessive. The risks of excessive greenhouse gas emissions addressed in this By-law are those caused by-

OE2.1 – excessive emissions as a result of the design and construction of the *building*, including the *building's* systems, and the energy consumed in the operation of those systems

OE2.2 – excessive greenhouse gas emissions associated with building materials and construction processes throughout the lifecycle of a *building*, except emissions from building energy use. These include emissions from extraction, manufacture, transportation, construction, replacement, refurbishment, demolition, removal, and other processes.

Notes to Part 2

Objectives

A-2.1.1.2.(6) **Application of Environment Objective.** Objective OE, Environment (including its sub-objectives), is attributed to the requirements in Section 9.36. of Division B, which address energy efficiency for small residential buildings and certain small non-residential and mixed-use buildings (see Article 9.36.1.3. of Division B). The objectives, functional statements and energy efficiency requirements for larger Part 9 residential buildings as well as for non-residential buildings whose combined total floor area exceeds 300 m² and some mixed-use buildings are addressed in the National Energy Code for Buildings.

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 Code Documents — but not all objectives are pertinent to all Codes.

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.

Fire Safety

In the definition of Objective OS1, Fire Safety, the term “person” refers to any individual in or adjacent to the building, including the occupants, the public, and emergency responders including firefighters when performing their duties.

Certain technical requirements in the **By-law** are intended to address the safety of emergency responders, including firefighters, when performing their duties.

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) Functional Statement F56 applies only to *dwelling units*.
- 3) Functional Statements F73 and F74 do not apply to
 - a) detached houses, semi-detached houses, houses with *ancillary residential units*, duplexes, triplexes, townhouses, *row housing* and boarding houses,
 - b) buildings of Group F, Division 1 major occupancy, and
 - c) buildings that are not intended to be occupied on a daily or full-time basis, including automatic telephone exchanges, pumphouses and substations.
- 4) Functional Statement F75 applies only to *adaptable dwelling units*.

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 circulation 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.

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.

F101 To limit excessive emission of greenhouse gases into the environment.

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 Code Documents—the British Columbia Building Code Book I: General, British Columbia Building Code Book II: Plumbing Systems, and the British Columbia Fire Code—but not all functional statements are pertinent to all Codes.

BOOK I (GENERAL) - DIVISION B

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 2.5., 3.10., 4.5., 5.10., 6.10., 7.2., 8.3., 9.38, and 10.5. (See Note A-1.1.2.1.(1).)

1.1.3. Climatic and Seismic Data

1.1.3.1. Climatic and Seismic Values

1) Except as provided in Sentences (2) and (4) and 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*.

2) Where they have not been established by the *Chief Building Official*, the climatic values required for the design of *buildings* shall be in conformance with Sentence (3) and the values listed in Appendix C. (See Note A-1.1.3.1.(2).)

3) 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.(3).)

4) Where they have not been established by the *Chief Building Official*, the seismic values required for the design of *buildings* under Part 4 and Part 9 shall be in conformance with Appendix C. (See Note A-1.1.3.1.(4).)

5) The outside summer design temperatures determined from Appendix C shall be those listed for the July 2.5% dry values.

1.1.3.2. Depth of Frost Penetration

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

1.1.4. Fire Safety Plan

1.1.4.1. Fire Safety Plan

1) Where a fire safety plan is required, it shall conform to Section 2.8. of Division B of 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, and 12.

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 April 15, 2025.

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⁾⁽²⁾
Forming Part of Sentence 1.3.1.2.(1)

Issuing Agency	Document Number ⁽³⁾	Title of Document	Code Reference
AAMA	501-05	Methods of Test for Exterior Walls	A-5.9.3.
AAMA	501.1-05	Standard Test Method for 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 Storefront Systems Subjected to Seismic and Wind-Induced Inter-Story Drifts	A-5.9.3.
AAMA	501.5-07	Test Method for 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.(14) and (15) 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	6.2.1.1.(1) 6.3.2.14.(2) A-6.3.1.5.
ACI	355.2-19	Qualification of Post-Installed Mechanical Anchors in Concrete (ACI 355.2-19) and Commentary	4.1.8.18.(7)
ACI	355.4M-19	Qualification of Post-Installed Adhesive Anchors in Concrete (ACI 355.4M-19) and Commentary	4.1.8.18.(7)
AISI	S201-12	North American Standard for Cold-Formed Steel Framing - Product Data 2012 Edition	9.24.1.2.(1)
ANSI	A135.6-2012	Engineered Wood Siding	Table 5.9.1.1. 9.27.9.1.(1)
ANSI	A208.1-2009	Particleboard	9.23.15.2.(3) 9.29.9.1.(1) 9.30.2.2.(1)
ANSI/APA	PRG 320-2018	Standard for Performance-Rated Cross-Laminated Timber	3.1.18.3.(3)
ANSI/ASHRAE	52.2-2017	Method of Testing General Ventilation Air-Cleaning Devices	6.3.2.14.(1)
ANSI/ASHRAE	55-2010	Thermal Environment Conditions for Human Occupancy	6.6.2.1.(1)
ANSI/ASHRAE	188-2018	Legionellosis: Risk Management for Building Water Systems	A-6.2.1.1.
ANSI/CSA	ANSI Z21.10.3-2017/CSA 4.3-2017	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 Z83.8-2016/CSA 2.6-2016	Gas unit heaters, gas packaged heaters, gas utility heaters and gas-fired duct furnaces	10.2.2.14.(1)
APA	ANSI/APA PRG 320-2018	Standard for Performance-Rated Cross-Laminated Timber	3.1.6.3.(3)
ASCE	ASCE/SEI (7-10)	Minimum Design Loads for Buildings and Other Structures	A-4.1.8.18.(14) and (15) A-9.4.2.1. and 9.4.2.2.

ASCE	ASCE/SEI (8-02)	Specification for the 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	4.1.7.14.(1)
ASHRAE	1997	ASHRAE Handbook – Fundamentals	A-9.32.3.11.
ASHRAE	2011	ASHRAE Handbook – HVAC Applications	A-2.4.2.1.(1)
ASHRAE	Guideline 12-2023	Minimizing the Risk of Legionellosis Associated with Building Water Systems	6.2.1.1.(1) 6.3.2.15.(9) 6.3.2.16.(1)
ASHRAE	ANSI/ASHRAE 62-2001 (except addendum n)	Ventilation for Acceptable Indoor Air Quality (except Addendum n)	A-9.25.5.2.
ASHRAE	ANSI/ASHRAE 62.1-2016	Ventilation for Acceptable Indoor Air Quality	6.3.1.1.(2) 6.3.1.1.(3) 6.3.2.2.(1)
ASHRAE	ANSI/ASHRAE/IES 90.1-2019	Energy Standard for Buildings Except Low-Rise Residential Buildings	10.2.2.1.(1) A-10.2.2.2.
ASHRAE	ANSI/ASHRAE 188-2015	Legionellosis: Risk Management for Building Water Systems	A-6.2.1.1.
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)
ASME/CSA	ASME A17.1-2016/CSA B44-16	Safety Code for Elevators and Escalators	3.2.6.7.(2) 3.5.2.1.(1) 3.5.2.1.(2) 3.5.2.1.(3) 3.5.4.1.(2) 3.5.4.2.(1) 3.8.3.7.(1) A-3.5.2.1.(1) Table 4.1.5.11. Table 4.1.8.18.
ASSE/ IAPMO/ANSI	12080-2020	Professional Qualifications Standard for Legionella Water Safety and Management Personnel	A-1.6.9.4.(1) of Division C
ASTM	A123/A123M-17	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products	Table 5.9.1.1. Table 9.20.16.1.
ASTM	A153/A153M-16a	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware	Table 5.9.1.1. Table 9.20.16.1. 9.23.2.4.(2)
ASTM	A252-10	Standard Specification for Welded and Seamless Steel Pipe Piles	4.2.3.8.(1)
ASTM	A283/A283M-18	Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates	4.2.3.8.(1)
ASTM	A390-06	Standard Specification for Zinc-Coated (Galvanized) Steel Poultry Fence Fabric (Hexagonal and Straight Line)	Table 9.10.3.1.-B

ASTM	A653/A653M-18	Standard Specification for 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) 9.23.2.4.(1)
ASTM	A792/A792M-10	Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process	9.3.3.2.(1)
ASTM	A1008/A1008M-18	Standard Specification for 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	A1011/A1011M-18a	Standard Specification for 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	C4-04	Standard Specification for Clay Drain Tile and Perforated Clay Drain Tile	Table 5.9.1.1. 9.14.3.1.(1)
ASTM	C27-98	Standard Classification of Fireclay and High-Alumina Refractory Brick	9.21.3.4.(1)
ASTM	C73-17	Standard Specification for Calcium Silicate Brick (Sand-Lime Brick)	Table 5.9.1.1. 9.20.2.1.(1)
ASTM	C126-13	Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units	Table 5.9.1.1. 9.20.2.1.(1)
ASTM	C212-17	Standard Specification for Structural Clay Facing Tile	Table 5.9.1.1. 9.20.2.1.(1)
ASTM	C260/C260M-10a	Standard Specification for Air-Entraining Admixtures for Concrete	9.3.1.8.(1)
ASTM	C411-19	Standard Specification for 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	C412M-15	Standard Specification for Concrete Drain Tile	Table 5.9.1.1. 9.14.3.1.(1)
ASTM	C444M-17	Standard Specification for Perforated Concrete Pipe	Table 5.9.1.1. 9.14.3.1.(1)
ASTM	C494/C494M-17	Standard Specification for Chemical Admixtures for Concrete	9.3.1.8.(1)
ASTM	C516-08e1	Standard Specification for Vermiculite Loose Fill Thermal Insulation	A-9.25.2.4.(5)
ASTM	C553-13	Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications	Table 5.9.1.1.
ASTM	C612-14	Standard Specification for Mineral Fiber Block and Board Thermal Insulation	Table 5.9.1.1.
ASTM	C700-18	Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated	Table 5.9.1.1. 9.14.3.1.(1)

ASTM	C726-17	Standard Specification for Mineral Wool Roof Insulation Board	Table 5.9.1.1. 9.25.2.2.(1)
ASTM	C754-18	Standard Specification for 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	C834-17	Standard Specification for Latex Sealants	Table 5.9.1.1. 9.27.4.2.(2)
ASTM	C840-18b	Standard Specification for Application and Finishing of Gypsum Board	3.1.6.6.(2) Table 5.9.1.1. 9.29.5.1.(3) A-9.29.5.1.(3)
ASTM	C920-18	Standard Specification for Elastomeric Joint Sealants	Table 5.9.1.1. 9.27.4.2.(2)
ASTM	C954-18	Standard Specification for 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	C991-16	Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings	Table 5.9.1.1.
ASTM	C1002-07	Standard Specification for 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	C1055-03	Standard Guide for Heated System Surface Conditions that Produce Contact Burn Injuries	A-6.5.1.1.(3)
ASTM	C1177/C1177M-17	Standard Specification for 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-9.27.14.2.(2)(a)
ASTM	C1178/C1178M-18	Standard Specification for 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	C1184-18e1	Standard Specification for Structural Silicone Sealants	Table 5.9.1.1. 9.27.4.2.(2)
ASTM	C1193-16	Standard Specification for Use of Joint Sealants	A-Table 5.9.1.1. A-9.27.4.2.(1)
ASTM	C1280-13	Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing	Table 5.9.1.1.
ASTM	C1299-03	Standard Guide for Use in Selection of Liquid-Applied Sealants	A-9.27.4.2.(1)
ASTM	C1311-14	Standard Specification for Solvent Release Sealants	Table 5.9.1.1. 9.27.4.2.(2)

ASTM	C1330-18	Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants	Table 5.9.1.1. 9.27.4.2.(3)
ASTM	C1363-11	Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus	A-5.9.4.1.(1)
ASTM	C1396/C1396M-17	Standard Specification for Gypsum Board	3.1.5.14.(6) 3.1.5.15.(4) 3.1.6.6.(2) 3.1.6.15.(1) Table 5.9.1.1. Table 9.23.17.2.-A 9.29.5.2.(1) Table 9.29.5.3.
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ASTM	D323-15a	Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method)	1.4.1.2.(1) ⁽⁴⁾
ASTM	D1037-12	Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials	A-9.23.15.2.(4)
ASTM	D1143/D1143M-07	Standard Test Methods for Deep Foundations Under Static Axial Compressive Load	A-4.2.7.2.(2)
ASTM	D1227/D1227M-13	Standard Specification for 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	D1761-12	Standard Test Methods for Mechanical Fasteners in Wood and Wood-Based Materials	A-9.27.5.4.(2)
ASTM	D2178/D2178M-13a	Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing	Table 5.9.1.1.
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ASTM	D3019/D3019M-17	Standard Specification for Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, and Fibered	Table 5.9.1.1. 9.13.3.2.(2) Table 9.26.2.1.-B
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ASTM	D4477-16	Standard Specification for Rigid (Unplasticized) Poly(Vinyl Chloride) (PVC) Soffit	9.27.12.1.(3)

ASTM	D4479/D4479M-07e1	Standard Specification for 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	D4637/D4637M-15	Standard Specification for EPDM Sheet Used In Single-Ply Roof Membrane	Table 5.9.1.1. 9.13.3.2.(2) Table 9.26.2.1.-B
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ASTM	D7254-17	Standard Specification for Polypropylene (PP) Siding	9.27.13.1.(1)
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ASTM	D8052/D8052M-17	Standard Test Method for Quantification of Air Leakage in Low-Sloped Membrane Roof Assemblies	A-5.4.1.2.(1)
ASTM	E90-09	Standard Test Method for 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	E96/E96M-16	Standard Test Methods for Water Vapor Transmission of Materials	5.5.1.2.(3) 9.13.2.2.(2) 9.25.4.2.(1) 9.25.4.2.(2) 9.25.5.1.(1) 9.30.1.2.(1)
ASTM	E283-04	Standard Test Method for 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	E330/E330M-14	Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference	A-5.9.3.2.(1)
ASTM	E331-00	Standard Test Method for 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	E336-11	Standard Test Method for 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	E413-16	Classification for Rating Sound Insulation	A-1.4.1.2.(1) ^(d) 5.8.1.2.(1) 5.8.1.2.(2)

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ASTM	E492-09e1	Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine	A-9.11.
ASTM	E547-00	Standard Test Method for 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)
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ASTM	E736/E736M-17	Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members	Table 9.10.3.1.-B
ASTM	E779-10	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization	10.2.3.5.(1)
ASTM	E783-02	Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors	A-5.4.1.2.(2) A-5.9.2.3.(1) A-5.9.3.4.(2)
ASTM	E1007-19	Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures	A-9.11.
ASTM	E1105-15	Standard Test Method for 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	E1186-17	Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems	A-5.4.1.2.(2)
ASTM	E1300-16	Standard Practice for Determining Load Resistance of Glass in Buildings	4.3.6.1.(1) 9.6.1.3.(1)
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ASTM	E3158-18	Standard Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building	10.2.2.21.(1) 10.2.3.5.(1)
ASTM	F476-14	Standard Test Methods for Security of Swinging Door Assemblies	9.7.5.2.(2) A-9.7.5.2.(2)
ASTM	F842-01 or 04	Standard Test Methods for Measuring the Forced Entry Resistance of Sliding Door Assemblies, Excluding Glazing Impact	9.7.5.1.(3)
ASTM	F1667-18a	Standard Specification for Driven Fasteners: Nails, Spikes, and Staples	9.23.3.1.(1) 9.26.2.3.(1) 9.29.5.6.(1)
ASTM	F2090-17	Standard Specification for Window Fall Prevention Devices With Emergency Escape (Egress) Release Mechanisms	A-9.8.8.1.(4)
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BC	2023	British Columbia Fire Code	1.1.1.1.(1) ⁽⁴⁾ A-1.1.1.2.(1) ⁽⁴⁾ 1.1.4.1.(1) 1.4.1.2.(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)
BC	2023	Book II (Plumbing Systems) of the British Columbia Building Code	1.1.2.1.(1) ⁽⁴⁾ 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.(8) 6.3.2.15.(10) 6.3.2.16.(6) 7.1.2.1.(1) 7.1.2.1.(2) 7.1.2.1.(3) 7.1.2.1.(4) 9.31.6.2.(1) Appendix C
BC	R.S.B.C. 1996 c.293	Mines Act	1.4.1.2.(1) ⁽⁴⁾
BC	R.S.B.C. 2018 c.47	Professional Governance Act	1.4.1.2.(1) ⁽⁴⁾
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BC	S.B.C. 2007 c.42	Climate Change Accountability Act	9.37.1.2.(2) 10.3.1.2.(1)
BNQ	BNQ 3624-115/2016	Polyethylene (PE) Pipe and Fittings for Soil and Foundation Drainage	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 38732	National Farm Building Code of Canada 1995	1.1.1.1.(3) ⁽⁴⁾ 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 56190	National Building Code of Canada 2015	A-4.1.8.4.(3) Appendix C
CCBFC	NRCC-CONST-56436E	National Plumbing Code of Canada 2020	7.1.2.1.(1)

CCBFC	NRCC-CONST-56438E	National Energy Code of Canada for Buildings 2020	A-3.2.1.1.(1) ⁽⁴⁾ A-5.4.1. A-2.2.8.1.(1) ⁽⁵⁾ 10.2.2.1.(1) 10.2.2.2.(2) 10.2.2.2.(3) 10.2.2.2.(4) Table 10.2.3.3.-A Table 10.2.3.3.-B 10.2.3.4.(1) 10.2.3.4.(4) A-10.2.2.2. A-10.2.3.3.(2) A-10.2.3.4.
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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. 9.29.7.1.(1) 9.30.2.2.(1)
CGSB	CAN/CGSB-12.1-2017	Safety Glazing	3.3.1.20.(3) 3.3.2.17.(1) 3.3.2.17.(2) 3.4.6.15.(1) 3.4.6.15.(3) 3.7.2.4.(1)

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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-12.9-M91	Spandrel glass	Table 5.9.1.1. 9.6.1.2.(1)
CGSB	CAN/CGSB-12.10-M76	Glass, Light and Heat Reflecting	9.6.1.2.(1)
CGSB	CAN/CGSB-12.11-M90	Wired Safety Glass	3.3.1.20.(3) 3.4.6.15.(1) 3.4.6.15.(3) 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
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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	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.
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)
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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.(4)
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.(3) A-9.27.11.1.(2) and (3)
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CISC/ICCA	2018	Crane-Supporting Steel Structures: Design Guide (Third Edition)	A-4.1.3.2.(2)
CMHC	1988	Air Permeance of Building Materials	Table A-9.25.5.1.(1)
CMHC	1993	Testing of Fresh Air Mixing Devices	A-9.32.3.4.
CoV	Version 1.0	City of Vancouver Addendum to the National Whole-Building Life Cycle Assessment Practitioner's Guide	10.4.1.2.(1)
CoV	Version 3.0	City of Vancouver Energy Modeling Guidelines	10.2.3.4.(1) 10.2.3.4.(3) 10.2.3.4.(4) 10.3.1.1.(2) A-10.2.3.4.
CoV	2024	City of Vancouver Energy Modelling Guidelines for 1 to 3 Storey Residential Buildings	10.2.2.4.
CoV		Zoning and Development By-law ⁽⁹⁾	A-9.14.5.3.(2)
CRCA	Technical Bulletin 35 (1988)	Ballast For Protected Membrane Roofing	A-5.2.2.2.(4)

CRCA	Technical Bulletin 40 (1993)	Design of Loose-Laid Gravel Stone Ballasted Roofs	A-5.2.2.2.(4)
CSA	6.19-01	Residential carbon monoxide alarming devices	6.9.3.1.(2) 9.32.3.9.(2) 9.32.3.9.(3)
CSA	A23.1:19	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)
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CSA	A23.4-16	Precast concrete – Materials and construction	A-4.3.3.1.(1)
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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.(5) 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
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CSA	CAN/CSA-A123.16:04	Asphalt-coated glass-base sheets	Table 5.9.1.1. Table 9.26.2.1.-B
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CSA	CAN/CSA-A324-M88	Clay Flue Liners	9.21.3.3.(1)
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CSA	AAMA/WDMA/CSA 101/I.S.2/A440-17	North American Fenestration Standard/Specification for windows, doors, and skylights	5.9.2.2.(1) A-5.3.1.2. A-5.9.2.3.(1) A-5.9.3.1.(1) 9.7.4.3.(1) 9.7.4.3.(2) 9.7.5.1.(1) 9.7.5.3.(1) A-9.7.4.2.(1)
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CSA	CAN/CSA-C22.2 No. 262-04	Optical Fiber Cable and Communication Cable Raceway Systems	3.1.5.23.(1)
CSA	CAN/CSA-C260-M90	Rating the Performance of Residential Mechanical Ventilating Equipment	9.32.3.10.(1) 9.32.3.10.(2) Table 9.32.3.10.-B
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CSA	CAN/CSA-C448 Series-13	Design and installation of earth energy systems	9.33.5.2.(1)
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CSA	S16:19	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	CAN/CSA-S37-18	Antennas, towers, and antenna-supporting structures	4.1.6.15.(1) 4.1.7.11.(1)
CSA	S136-16	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	S157-17/S157.1-17	Strength design in aluminum/Commentary on CSA S157-17, Strength design in aluminum	4.3.5.1.(1)
CSA	S269.1-16	Falsework and formwork	4.1.1.3.(4) A-9.15.1.1.(1)(c) and 9.20.1.1.(1)(b)
CSA	S269.2-16	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	Design of masonry structures	Table 4.1.8.9. 4.3.2.1.(1) A-5.1.4.1.(6)(b) and (c)
CSA	S367-12	Air-, cable-, and frame-supported membrane structures	4.4.1.1.(1)
CSA	S406-16	Specification of permanent wood foundations for housing and small buildings	9.15.2.4.(1) 9.16.5.1.(1) A-9.15.2.4.(1)
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CSA	S478:19	Durability in buildings	A-5.1.4.2.
CSA	S832:14	Seismic risk reduction of operational and functional components (OFCs) of buildings	A-Table 4.1.8.18.
CSA	Z32-15	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-16	Manufactured homes	1.1.1.1.(2) ⁽⁴⁾ A-1.1.1.1.(2) ⁽⁴⁾
CSA	Z240.2.1-16	Structural requirements for manufactured homes	A-1.1.1.1.(2) ⁽⁴⁾ 9.12.2.2.(6) 9.15.1.3.(1)
CSA	Z240.10.1:19	Site preparation, foundation, and installation of buildings	A-1.1.1.1.(2) ⁽⁴⁾ 9.15.1.3.(1) 9.23.6.3.(1)
CSA	CAN/CSA-Z317.2-15	Special requirements for heating, ventilation, and air-conditioning (HVAC) systems in health care facilities	6.2.1.1.(1) 6.3.2.15.(6)
CSA	CAN/CSA-Z662-15	Oil and gas pipeline systems	3.2.3.22.(1)

CSA	Z7396.1-17	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)
CSSBI	23M-2016	Standard for Residential Steel Cladding	9.27.11.1.(1) A-9.27.11.1.(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.
ECC	2013	EIFS Practice Manual	A-5.9.4.1.(1) A-9.27.14.1.(1)
EGBC	Version 1.1	Professional Practice Guidelines – Retaining Wall Design	A-9.14.5.3.(2)
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.(14) and (15)
FEMA	P-750-2009	NEHRP Recommended Seismic Provisions for New Buildings and Other Structures	A-4.1.8.18.(14) and (15)
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.(10)
FPI	Project 43-10C-024 (1988)	Deflection Serviceability Criteria for Residential Floors	A-9.23.4.2.(2)
HC	2004	Fungal Contamination in Public Buildings: Health Effects and Investigation Methods	A-5.5.1.1.
HC	2007	Radon: A Guide for Canadian Homeowners	A-5.4.1.1. A-6.2.1.1. A-9.13.4.3.
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.
HC	H46-2/90-156E	Exposure Guidelines for Residential Indoor Air Quality	A-6.3.1.5. A-9.25.5.2.
HC	R.S.C. 1985, c. H-3	Hazardous Products Act	A-1.4.1.2.(1) ⁽⁶⁾ A-9.25.2.2.(2)

HC	WHMIS 1988	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)
HPVA	ANSI/HPVA HP-1-2009	American National Standard for Hardwood and Decorative Plywood	Table 5.9.1.1. 9.27.8.1.(1) 9.30.2.2.(1)
HRAI	2017 Edition	HRAI Digest	6.2.1.1.(1) 9.32.2.3.(4) 9.32.3.2.(1) 9.33.4.1.(1)
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	9.32.3.10.(1)
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	3864-1:2011	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	7010:2011	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	Ergonomics – Danger signals for public and work areas – Auditory danger signals	A-3.2.4.22.(1)(b)
ISO	8201:1987	Acoustics – Audible emergency evacuation signal	3.2.4.18.(2) A-3.2.4.18.(2)
ISO	10848-1:2006	Acoustics – Laboratory measurement of the flanking transmission of airborne and impact sound between adjoining rooms – Part 1: Frame document	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	13-2019 ⁽⁶⁾	Standard for the Installation of Sprinkler Systems	3.1.9.1.(4) 3.2.4.8.(2) 3.2.4.15.(1) 3.2.5.12.(1) 3.2.5.12.(9) 3.2.8.2.(5) 3.2.8.3.(2) 3.3.2.14.(3) A-3.1.11.5.(3) and (4) A-3.2.4.9.(3)(f) A-3.2.5.12.(1) A-3.2.5.12.(6) A-3.2.5.13.(1) A-3.2.8.2.(3) 9.10.9.9.(4)
NFPA	13D-2016	Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes	3.2.4.1.(2) 3.2.5.12.(3) 3.2.7.9.(4) A-3.2.5.12.(2) A-3.2.5.12.(6) A-3.2.5.13.(1) 9.10.2.2.(2) 9.10.18.2.(3)
NFPA	13R-2019 ⁽⁷⁾	Standard for the 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-3.2.5.13.(1)
NFPA	14-2013	Standard for the Installation of Standpipe and Hose Systems	3.2.5.9.(1) 3.2.5.10.(1)
NFPA	20-2016	Standard for the 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	30-2018	Flammable and Combustible Liquids Code	A-6.9.1.2.(1)
NFPA	30A-2018	Code for Motor Fuel Dispensing Facilities and Repair Garages	A-6.9.1.2.(1)
NFPA	32-2016	Standard for Drycleaning Facilities	A-6.9.1.2.(1)
NFPA	33-2018	Standard for Spray Application Using Flammable or Combustible Materials	A-6.9.1.2.(1)
NFPA	34-2018	Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids	A-6.9.1.2.(1)
NFPA	35-2016	Standard for Manufacture of Organic Coatings	A-6.9.1.2.(1)
NFPA	36-2017	Standard for Solvent Extraction Plants	A-6.9.1.2.(1)
NFPA	40-2019	Standard for the Storage and Handling of Cellulose Nitrate Film	A-6.9.1.2.(1)
NFPA	51-2018	Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes	A-6.9.1.2.(1)
NFPA	51A-2012	Standard for Acetylene Cylinder Charging Plants	A-6.9.1.2.(1)

NFPA	55-2020	Compressed Gases and Cryogenic Fluids Code	A-6.9.1.2.(1)
NFPA	61-2017	Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities	A-6.9.1.2.(1)
NFPA	68-2013	Standard on 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	Standard on Explosion Prevention Systems	A-3.6.2.7.(5) A-6.9.1.2.(1)
NFPA	72-2019	National Fire Alarm and Signaling Code	A-3.2.4.22.(1)(b)
NFPA	80-2013	Standard for 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) 9.10.9.9.(5) 9.10.13.1.(1)
NFPA	80A-2012	Recommended Practice for Protection of Buildings from Exterior Fire Exposures	A-3
NFPA	82-2014	Standard on Incinerators and Waste and Linen Handling Systems and Equipment	6.2.2.1.(1) 9.10.10.5.(2)
NFPA	85-2019	Boiler and Combustion Systems Hazards Code	A-6.9.1.2.(1)
NFPA	86-2019	Standard for Ovens and Furnaces	A-6.9.1.2.(1)
NFPA	88A-2019	Standard for Parking Structures	A-6.9.1.2.(1)
NFPA	91-2015	Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids	6.3.4.3.(1) A-6.9.1.2.(1)
NFPA	96-2014	Standard for 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. 6.3.1.6.(1) A-6.9.1.2.(1) A-9.10.1.4.(1)
NFPA	101-2018	Life Safety Code	3.3.2.1.(2) 3.3.2.1.(3) A-3.3.2.1.(2)
NFPA	105-2013	Standard for Smoke Door Assemblies and Other Opening Protectives	3.1.8.5.(3) 3.1.8.5.(7)
NFPA	204-2018	Standard for Smoke and Heat Venting	A-6.9.1.2.(1)
NFPA	211-2019	Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances	6.3.3.2.(2) 6.3.3.3.(1)
NFPA	303-2016	Fire Protection Standard for Marinas and Boatyards	A-6.9.1.2.(1)

NFPA	307-2016	Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves	A-6.9.1.2.(1)
NFPA	409-2016	Standard on Aircraft Hangars	A-6.9.1.2.(1)
NFPA	415-2016	Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways	A-6.9.1.2.(1)
NFPA	484-2019	Standard for Combustible Metals	A-6.9.1.2.(1)
NFPA	654-2017	Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids	A-6.9.1.2.(1)
NFPA	655-2017	Standard for Prevention of Sulfur Fires and Explosions	A-6.9.1.2.(1)
NFPA	664-2017	Standard for the 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	Standard for the 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)
NLGA	2017	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-1-2017	Fingerjoined Structural Lumber	Table 9.10.3.1.-A A-9.23.10.4.(1)
NLGA	SPS-3-2017	Fingerjoined "Vertical Stud Use Only" Lumber	Table 9.10.3.1.-A A-9.23.10.4.(1)
NRC	1988	Performance and acceptability of wood floors – Forintek studies	A-9.23.4.2.(2)
NRC	2005	A Guide for the Wind Design of Mechanically Attached Flexible Membrane Roofs	A-5.2.2.2.(4)
NRC	2024	National Whole-Building Life Cycle Assessment Practitioner's Guide	10.4.1.2.(1)
NRC	17808-2005	Performance Guidelines for Basement Envelope Systems and Materials: Final Research Report	A-9.25.5.1.
NRC	BPN 54-85	The difference between a vapour barrier and an air barrier	A-9.25.1.1.(2)
NRC	CBD 222	Airtight houses and carbon monoxide poisoning	A-9.33.1.1.(2)

NRC	CBD 230	Applying building codes to existing buildings	A-1.1.1.1.(1) ⁽⁴⁾
NRC	CBD 231	Moisture problems in houses	A-9.25.3.1.(1)
NRC	CRBCPI-Y2-R19	Guideline on Design for Durability of Building Envelopes	A-5.1.4.2. A-5.4.1.1.(3)
NRC	NRCC 49677-2007	Best Practice Guide on Fire Stops and Fire Blocks and their Impact on Sound Transmission	A-9.11.
NRC	RR-331-2017	Guide to Calculating Airborne Sound Transmission in Buildings	A-5.8.1.4. A-5.8.1.4.(4)(b)
NRCA	3rd Edition, 2017	The NRCA 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)
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.
RCABC	2023	Roofing Practices Manual	A-1.4.1.1.(1) A-5.6.1.2.(2) A-5.6.2.2.(5)
SMACNA	ANSI/SMACNA 006-2006	HVAC Duct Construction Standards – Metal and Flexible	9.33.6.5.(2)
SPRI	ANSI/SPRI RP-4 2022	Wind Design Standard for Ballasted Single-ply Roofing Systems	A-5.2.2.2.(4)
SPRI	ANSI/SPRI VF-1 2023	External Fire Design Standard for Vegetative Roofs	3.1.14.4.(1)
SPRI	ANSI/ SPRI VR-1-2018	Procedure for Investigating Resistance to Root or Rhizome Penetration on Vegetative Roofs	5.6.1.2.(2) Table 5.9.1.1.
SPRI	ANSI/SPRI WD-1-2020	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/2001-286	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	2019	Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses	9.23.14.11.(1)
TWC	1993	Details of Air Barrier Systems for Houses	Table A-9.25.5.1.(1)
UL	ANSI/CAN/UL/ULC 300-2019	Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment	6.9.1.3.(1)

UL	ANSI/UL 1784-2015	Standard for Air Leakage Tests of Door Assemblies and Other Opening Protectives	3.1.8.4.(4)
UL	ANSI/CAN/UL 2524 - 2019	Standard For Safety In-building 2-Way Emergency Radio Communication Enhancement Systems	3.2.5.20.(4) A-3.2.5.20.
UL	2034-2008	Standard for Single and Multiple Station Carbon Monoxide Alarms	6.9.3.1.(6) 9.32.4.2.(8)
ULC	CAN/ULC-S101-14	Standard Method of 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) A-3.1.5.14.(5)(d) 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 5.9.1.1. Table 9.23.17.2.-A 9.29.5.2.(1)
ULC	CAN/ULC-S102.2:2018	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) 9.27.12.1.(4) 9.27.13.1.(2)
ULC	CAN/ULC-S102.3:2018	Standard Method of Fire Test of Light Diffusers and Lenses	3.1.13.4.(1)
ULC	CAN/ULC-S102.4:2017	Standard Method of 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-S104-15	Standard Method for Fire Tests of Door Assemblies	3.1.8.4.(1) 3.2.6.5.(3)
ULC	CAN/ULC-S105:2016	Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104	9.10.13.6.(1)
ULC	CAN/ULC-S106-15	Standard Method for Fire Tests of Window and Glass Block Assemblies	3.1.8.4.(1)
ULC	CAN/ULC-S107:2019	Standard Methods of Fire Tests of Roof Coverings	3.1.15.1.(1)
ULC	CAN/ULC-S109-14	Standard Method for Flame Tests of Flame-Resistant Fabrics and Films	3.1.16.1.(1) 3.1.18.5.(1) 3.6.5.2.(2) 3.6.5.3.(1) 9.33.6.3.(1)
ULC	CAN/ULC-S110-13	Standard Methods of 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	Standard Method of Fire Tests for Air Filter Units	6.3.2.13.(1) 9.33.6.14.(1)
ULC	CAN/ULC-S112-10	Standard Method of Fire Test of Fire Damper Assemblies	3.1.8.4.(1) A-3.2.6.6.(1)
ULC	CAN/ULC-S112.1-10	Standard for 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	Standard Method of Fire Test of Ceiling Firestop Flap Assemblies	3.6.4.3.(2) 9.10.13.14.(1)
ULC	CAN/ULC-S113:2016	Standard Specification for 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-S114:2018	Standard Method of Test for Determination of Non-Combustibility in Building Materials	1.4.1.2.(1) ⁽⁴⁾
ULC	CAN/ULC-S115-11	Standard Method of Fire Tests of Firestop Systems	3.1.5.19.(3) 3.1.8.3.(3) 3.1.9.1.(1) 3.1.9.1.(2) 3.1.9.1.(3) 3.1.9.1.(6) 3.1.9.1.(7) 3.1.9.3.(1) 3.1.9.3.(2) 3.1.9.3.(4) 3.1.9.4.(4) 3.1.9.4.(7) A-3.1.8.3.(2) A-3.1.11.7.(7) 9.10.9.2.(3) 9.10.9.6.(1) 9.10.9.6.(2) 9.10.9.8.(1) 9.10.9.8.(6)
ULC	CAN/ULC-S124-06	Standard Method of 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-S126-14	Standard Method of Test for Fire Spread Under Roof-Deck Assemblies	3.1.14.1.(1) 3.1.14.2.(1)
ULC	CAN/ULC-S134-13	Standard Method of 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	Standard 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	Standard Method of 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-S139:2017	Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables	3.2.6.5.(6) 3.2.7.10.(2) 3.2.7.10.(3)
ULC	CAN/ULC-S143-14	Standard Method of Fire Tests for Non-Metallic Electrical and Optical Fibre Cable Raceway Systems	3.1.5.23.(1)
ULC	CAN/ULC-S144-12	Standard Method of Fire Resistance Test – Grease Duct Assemblies	3.6.3.5.(2) A-3.6.3.5.
ULC	CAN/ULC-S146-19	Standard Method of Test for the Evaluation of Encapsulation Materials and Assemblies of Materials for the Protection of Structural Timber Elements	3.1.6.5.(1)
ULC	ULC-S332-93	Standard for Burglary Resisting Glazing Material	A-9.7.5.2.(1)
ULC	ULC-S505-74	Standard for Fusible Links for Fire Protection Services	3.1.8.10.(2)
ULC	CAN/ULC-S524:2019	Standard for Installation of Fire Alarm Systems	3.1.8.11.(3) 3.1.8.14.(3) 3.2.4.5.(1) 3.2.4.19.(5) 3.2.4.20.(7) 3.2.4.20.(8) 3.2.4.20.(10) 3.2.4.20.(15) A-3.2.4.7.(4) A-3.2.4.18.(9) and (10) A-3.2.4.19.(1)(g) A-3.2.4.20.(10) 9.10.19.4.(3) 9.10.19.6.(2)
ULC	CAN/ULC-S526-2016	Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories	3.2.4.19.(5) 3.2.4.19.(6) A-3.2.4.19.(3)
ULC	CAN/ULC-S531:2019	Standard for Smoke Alarms	3.2.4.20.(2) 3.3.2.18.(4) 9.10.19.1.(1)
ULC	CAN/ULC-S537:2019	Standard for Verification of Fire Alarm Systems	3.2.4.5.(2)
ULC	CAN/ULC-S540-13	Standard for Residential Fire and Life Safety Warning Systems: Installation, Inspection, Testing and Maintenance	3.2.4.21.(1) 9.10.2.2.(3) 9.10.2.2.(4) 9.10.19.8.(1)
ULC	CAN/ULC-S553-14	Standard for the Installation of Smoke Alarms	3.2.4.20.(13) 9.10.19.3.(2)
ULC	CAN/ULC-S561-13	Standard for Installation and Services for Fire Signal Receiving Centres and Systems	3.2.4.7.(4) A-3.2.4.7.(4)
ULC	CAN/ULC-S572:2017	Standard for Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems	3.4.5.1.(3) 3.4.5.1.(4) A-3.4.5.1.(4) 9.9.11.3.(3) 9.9.11.3.(4)

ULC	CAN/ULC-S610:2018	Standard for Factory-Built Fireplace Systems	9.22.8.1.(1)
ULC	ULC-S628-93	Standard for Fireplace Inserts	9.22.10.1.(1)
ULC	CAN/ULC-S629:2016	Standard for 650°C Factory-Built Chimneys	9.33.10.2.(1)
ULC	CAN/ULC-S639-M87	Standard for Steel Liner Assemblies for Solid-Fuel Burning Masonry Fireplaces	9.22.2.3.(1)
ULC	CAN/ULC-S701.1:2017	Standard for Thermal Insulation, Polystyrene Boards	Table 5.9.1.1. Table 9.23.17.2.-A 9.25.2.2.(1)
ULC	CAN/ULC-S702.1-14	Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification	3.1.6.3.(4) Table 5.9.1.1. A-5.9.1.1.(1) 9.10.9.8.(3) 9.10.3.1.(3) Table 9.23.17.2.-A 9.25.2.2.(1)
ULC	CAN/ULC-S703-09	Standard for Cellulose Fibre Insulation (CFI) for Buildings	Table 5.9.1.1. 9.10.3.1.(3) 9.25.2.2.(1)
ULC	CAN/ULC-S704.1:2017	Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced	Table 5.9.1.1. Table 9.23.17.2.-A 9.25.2.2.(1)
ULC	CAN/ULC-S705.1-18	Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Material Specification	Table 5.9.1.1. 9.25.2.2.(1)
ULC	CAN/ULC-S705.2-05	Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Application	Table 5.9.1.1. 9.25.2.5.(1)
ULC	CAN/ULC-S706.1:2016	Standard for 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-S710.1:2019	Standard for Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification	Table 5.9.1.1.
ULC	CAN/ULC-S711.1:2019	Standard for Bead-Applied Two Component Polyurethane Air Sealant Foam, Part 1: Material Specification	Table 5.9.1.1.
ULC	CAN/ULC-S716.1-12	Standard for Exterior Insulation and Finish Systems (EIFS) - Materials and Systems	5.9.4.1.(1) A-5.9.4.1.(1) 9.27.14.1.(1) 9.27.14.2.(1) A-9.27.14.2.(2)(a)
ULC	CAN/ULC-S716.2-12	Standard for Exterior Insulation and Finish Systems (EIFS) - Installation of EIFS Components and Water Resistive Barrier	A-5.9.4.1.(1) 9.27.14.3.(1)

ULC	CAN/ULC-S716.3-12	Standard for Exterior Insulation and Finish System (EIFS) - Design Application	A-5.9.4.1.(1) 9.27.14.3.(1)
ULC	CAN/ULC-S717.1:2017	Standard for Flat Wall Insulating Concrete Form (ICF) Units – Material Properties	Table 5.9.1.1. 9.15.4.1.(1)
ULC	CAN/ULC-S741-08	Standard for Air Barrier Materials – Specification	5.4.1.2.(2)
ULC	CAN/ULC-S742-11	Standard for Air Barrier Assemblies – Specification	5.4.1.2.(1) 5.4.1.2.(2) A-5.4.1.1.(3) A-5.4.1.2.(1) A-5.4.1.2.(2) A-5.4.1.2.(4)
ULC	CAN/ULC-S1001-11	Standard for 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-02	Combustible Piping for Sprinkler Systems	3.2.5.13.(2) 3.2.5.13.(5)
ULC	ULC/ORD-C1254.6-95	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 Envelope	10.2.3.5.(1)
WCLIB	No. 17 (2004)	Grading Rules for West Coast Lumber	A-Table 9.3.2.1.
WWPA	2017	Western Lumber Grading Rules 2017	A-Table 9.3.2.1.

Notes to Table 1.3.1.2.:

(1) While every effort was made to ensure the accuracy of the information in this Table, the **City** is not responsible for the accuracy, timeliness or reliability of the content presented therein. For all purposes of interpreting and applying the referenced standards, **By-law** users should refer to the most recent official versions of the referenced editions.

(2) See Table D-1.1.2. of Appendix D for the list of standards referenced therein.

(3) Some documents may have been reaffirmed or reapproved. Check with the applicable issuing agency for up-to-date information.

(4) By-law reference is in Division A.

(5) By-law reference is in Division C.

(6) Subsection 9.3.15, Sprinkler-Protected Glazing, does not apply in the context of Division B.

(7) Subsection 6.5.3, Sprinkler-Protected Glazing, does not apply in the context of Division B.

(8) 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.

AAMA Fenestration and Glazing Industry Alliance (formerly American Architectural Manufacturers Association) (www.fgiaonline.org)

ACGIH American Conference of Governmental Industrial Hygienists (www.acgih.org)

ACI American Concrete Institute (www.concrete.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)

APA The Engineered Wood Association (www.apawood.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 ASTM International (www.astm.org)

BNQ Bureau de normalisation du Québec (www.bnq.qc.ca/en)

CAN National Standard of Canada designation (www.scc.ca) (The number or name following the CAN designation represents the agency under whose auspices the standard is issued.)

CAN3 designates CSA

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.chchydro.com)

CISC Canadian Institute of Steel Construction (www.cisc-icca.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)

CSSBI Canadian Sheet Steel Building Institute (www.cssbi.ca)

CWC Canadian Wood Council (www.cwc.ca)

DOE U.S. Department of Energy (www.energy.gov)

EC Environment and Climate Change Canada (www.ec.gc.ca)

ECC EIFS Council of Canada (www.eifscouncil.org)

EGBC Engineers & Geoscientists British Columbia (www.egbc.ca)

EPA Environmental Protection Agency (U.S.) (www.epa.gov)

FEMA Federal Emergency Management Agency (U.S.) (www.fema.gov)

FLL German Landscape Research, Development and Construction Society (shop.fll.de/en)

FPI FPIInnovations – 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 Decorative Hardwoods Association (formerly Hardwood Plywood & Veneer Association) (www.decorativehardwoods.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 2020
NCMA National Concrete Masonry Association (www.ncma.org)
NECB National Energy Code of Canada for Buildings 2020
NEMA National Electrical Manufacturers Association (www.nema.org)
NFC National Fire Code of Canada 2020
NFPA National Fire Protection Association (www.nfpa.org)
NFRC National Fenestration Rating Council (www.nfrc.org)
NLGA National Lumber Grades Authority (www.nlga.org)
NPC National Plumbing Code of Canada 2020
NRC National Research Council of Canada (nrc.canada.ca)
NRCA National Roofing Contractors Association (www.nrca.net)
NRCan Natural Resources Canada (www.nrcan.gc.ca)
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)
RCABC Roofing Contractors Association of British Columbia (www.rcabc.org)
SEI Structural Engineering Institute
(www.asce.org/structural-engineering/structural-engineering)
SMACNA Sheet Metal and Air Conditioning Contractors' National Association (www.smacna.org)
SPRI Single Ply Roofing Industry (www.spri.org)
TC Transport Canada (tc.canada.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 Pacific Lumber Inspection Bureau (formerly West Coast Lumber Inspection Bureau) (www.plib.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.(2) Climatic Values. Climatic values for municipalities not listed in Appendix C can be obtained at www.climate.weather.gc.ca or by e-mail from the Engineering Climate Services Unit of Environment and Climate Change Canada at scg-ecs@ec.gc.ca.

A-1.1.3.1.(3) Winter Design Temperatures. The 2.5% values referred to in Sentence 1.1.3.1.(3) 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.

A-1.1.3.1.(4) Seismic Values. Figure A-1.1.3.1.(4) illustrates how to determine the seismic hazard values to be used in the application of the Part 4 and Part 9 seismic provisions.

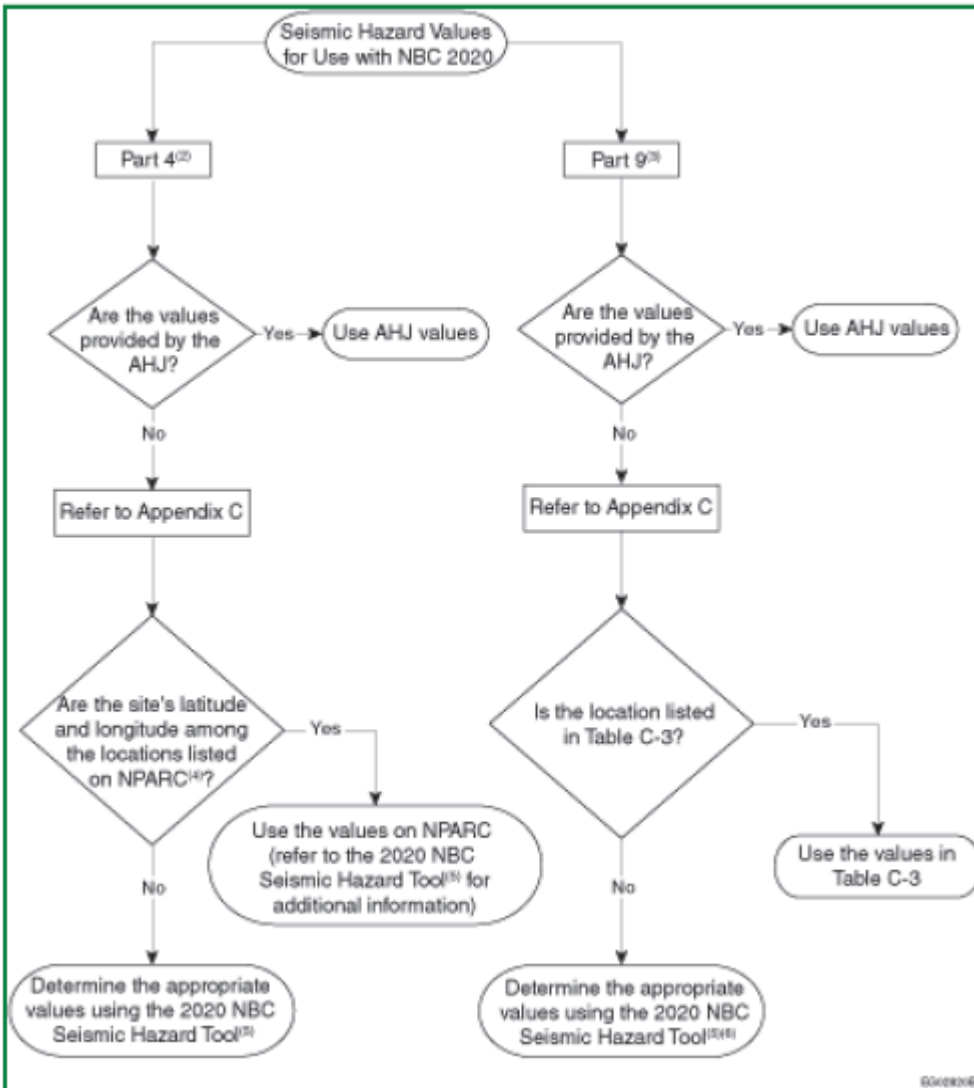


Figure A-1.1.3.1.(4)
Determining seismic hazard values for use in Part 4 and Part 9

Notes to Figure A-1.1.3.1.(4):

(1) The abbreviations used in the figure have the following meanings:

AHJ = authority having jurisdiction

NPARC = NRC Publications Archive

(2) See also the section entitled "Seismic Hazard for Part 4" in Appendix C.

(3) See also the section entitled "Seismic Hazard for Part 9" in Appendix C.

(4) The seismic hazard values available on NPARC at <https://doi.org/10.4224/nqzr-dz38> were generated from the 2020 National Building Code of Canada Seismic Hazard Tool. This subset of values on NPARC is provided as a static, archival record for Code users.

(5) The 2020 National Building Code of Canada Seismic Hazard Tool is available at <https://doi.org/10.23687/b1bd3cf0-0672-47f4-8bfa-290ae75fde9b>.

(6) Refer to the procedure set out in the section entitled "Seismic Hazard for Part 9" in Appendix C.

PART 2 – Reserved

Part 3

Fire Protection, Occupant Safety and Accessibility

(See Note A-3.)

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 3.1.2.5., and 3.1.2.7., 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 <i>Major Occupancies</i>
A	1	<i>Assembly occupancies</i> intended for the production and viewing of the performing arts
A	2	<i>Assembly occupancies</i> not elsewhere classified in Group A
A	3	<i>Assembly occupancies</i> of the arena type
A	4	<i>Assembly occupancies</i> in which occupants are gathered in the open air
B	1	<i>Detention occupancies</i>

B	2	<i>Treatment occupancies</i>
B	3	<i>Care occupancies</i>
C	—	<i>Residential occupancies</i>
D	—	<i>Business and personal services occupancies</i>
E	—	<i>Mercantile occupancies</i>
F	1	<i>High-hazard industrial occupancies</i>
F	2	<i>Medium-hazard industrial occupancies</i>
F	3	<i>Low-hazard industrial occupancies</i>

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 m² 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. 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*.

3.1.2.7. Group A, Division 2, Low Occupant Load

(See Note A-3.1.2.7.)

1) A *suite* of Group A, Division 2 *assembly occupancy*, except a *child or infant daycare 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.

3.1.2.8. Daycare Facilities for Children

(See Note A-3.1.2.8.)

1) A daycare facility for children shall be classified as a Group A, Division 2 *assembly occupancy* or Group C *residential occupancy* as determined in accordance with Table 3.1.2.8., and provided with the fire and life safety provisions corresponding to that major occupancy, except as permitted by Sentence (2).

Table 3.1.2.8.
Fire Safety Requirements for Daycare Facilities for Children
Forming part of Sentence 3.1.2.8.

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	<i>Building</i>	Required	Required	2 h	Required
	3–8	C	<i>Suite Only</i>	Required	Required	2 h	Required
		C ⁽¹⁾	<i>Suite Only</i>	Not Required	Required	No	Required
≥ 30	> 8	A2	<i>Building</i>	Required	Required	1 h	Required
	3–8	C	<i>Suite Only</i>	Required	Required	1 h	Required
		⁽¹⁾	Not Required	Not Required	Required	No	Required

Notes to Table 3.1.2.8.:

⁽¹⁾ Applies to residential *buildings* with no more than 2 principal *dwelling units* or *row housing*

⁽²⁾ Smoke detection shall include *smoke detectors* throughout normally occupied *floor areas* within the *suite* where the *building* is provided with a fire alarm system, and smoke alarms where required by Article 3.2.4.20.

2) The *fire-resistance rating* of a *fire separation* to separate the daycare facilities for children from the remainder of the *building* required by Table 3.1.2.8. need not exceed the *fire-resistance rating* of the floor assembly required by Subsection 3.2.2.

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 two *dwelling units* are contained together with a Group E *major occupancy*, the *fire-resistance rating* of the *fire separation* between the two *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⁾ 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⁾ See Sentence 3.1.3.2.(1).

⁽³⁾ Where the building or part thereof is constructed in accordance with 3.2.2.51., 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 or part thereof is constructed in accordance with 3.2.2.60., 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 permitted 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*.

3.1.3.3. 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.E 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. 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 m²,

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 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 *fire separation* in Clause (d) 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, and

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.

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 Sentence (2) and 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).)

(See also Sentence 3.6.4.3.(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.

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) Except as provided in Sentence (2), cladding on an exterior wall assembly of a *building* or part of a *building* conforming to Article 3.2.2.51. or 3.2.2.60. shall consist of

- a) *noncombustible* cladding, or

- b) except as provided in Sentence (4), 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) For *buildings* described in Sentence (1), *combustible* cladding representing up to 10% of the cladding on the face of an exterior wall facing a *street* or access route shall be permitted, provided all portions of the *combustible* cladding are located not more than 15 m from a *street* or access route conforming to Article 3.2.5.6., measured horizontally from the face of the *building*.

3) 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 D2898, "Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing."

4) Exterior wall assemblies constructed in accordance with Section D-6 of Appendix D are deemed to comply with Clause (1)(b).

- 5) Cladding described in this Article must also comply with the requirements of Article 3.2.3.7.

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, "Standard 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/m²,

- a) its average total heat release is not more than 3 MJ/m²,

- b) its average total smoke extinction area is not more than 1.0 m², 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) *firestops* 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 intended for the attachment of window elements within exterior wall assemblies,

h) wood blocking within wall assemblies intended for the attachment of handrails, fixtures, and similar items mounted on the surface of the wall, and

i) 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 that are not more than 610 mm high are permitted on a *building* required to be of *noncombustible construction*, provided the facings and any roof membranes covering the facings are protected by sheet metal.

3.1.5.4. Combustible Windows, 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 m²,

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 m²,

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 they are vertically non-contiguous between storeys.

3.1.5.5. Combustible Cladding on Exterior Walls

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) except as provided in Sentence (4), when tested in accordance with CAN/ULC-S134, "Standard Method of 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/m² 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 D2898, "Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing."

4) Exterior wall assemblies constructed in accordance with Section D-6 of Appendix D are deemed to comply with Clause (1)(b).

3.1.5.6. Combustible Components in Exterior Walls

1) *Combustible* components, other than those permitted by Article 3.1.5.5. and Sentence 3.1.5.7.(2), 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) except as provided in Sentence (2), satisfies the criteria 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)).

2) Exterior wall assemblies constructed in accordance with Section D-6 of Appendix D are deemed to comply with Subclause (1)(b)(i).

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, “Standard Method of 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, “Standard Method of 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, "Standard Method of 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 spaces 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 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 *buildings* 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, "Standard Method of 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 C1177/C1177M, "Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing,"
 - ii) ASTM C1178/C1178M, "Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel,"
 - iii) ASTM C1396/C1396M, "Standard Specification for Gypsum Board,"
 - iv) ASTM C1658/C1658M, "Standard Specification for 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, "Standard Method of 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), (4) and 3.1.5.7.(1), 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, "Standard Method of 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, "Standard Method of 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 C1177/C1177M, "Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing,"
 - ii) ASTM C1178/C1178M, "Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel,"
 - iii) ASTM C1396/C1396M, "Standard Specification for 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, "Standard Method of 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 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 *firestop* 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, "Standard Method of 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* when complying with Article 3.1.9.2., 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, "Standard Method of 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 D2898, “Standard Practice for 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.”

3.1.5.25. Di-electric Liquid Filled Equipment

1) Where noncombustible surfaces are required by the “Electrical Safety Regulations” or its referenced standards, to prevent the exposure of combustible construction from di-electric liquid filled equipment, exterior wall assemblies and roof surfaces within the stipulated area shall

a) have no opening, or part thereof, within 6 m that are in direct line of sight to the equipment unless the opening is provided with

- i) a solid noncombustible barrier between the equipment and unprotected opening,
- ii) wired glass or fire-resistant glazing in steel, metal clad, or fire-rated frames, or
- iii) a fire-rated closures tested to CAN/ULC-S104,

b) where on or within a sphere 3 m of the equipment, and in the horizontal plane projected to the ground below, exterior walls and roofs shall be constructed with the following

- i) noncombustible materials tested to CAN/ULC-S114,
- ii) cladding consisting of concrete or masonry not less than 25 mm thick, sheet steel not less than 1.6 mm thick, or non-combustible materials tested to CAN/ULC-S101 “*Fire Endurance Tests of Building Construction and Materials*” and complying with the conditions of acceptance in Sentence 3.2.3.8.(2), or

iii) non-combustible roofing materials, and

c) except as otherwise required by Clause (b), where on or within 6 m of the equipment, and in the horizontal plane projected to the ground below, exterior walls and roofs shall be protected with

- i) continuous noncombustible cladding, flashing or roofing materials meeting the acceptance criteria of CAN/ULC-S114
- ii) Concrete roof tiles with no gaps wider than 3 mm,
- iii) Concrete pavers with no concealed space over 25 mm,
- iv) Class A roofing material tested in conformance CAN/ULC-S107,

v) Windows with noncombustible frames or frames complying with 3.1.5.4.(5), or

vi) minor combustible components as necessary for the attachment of the roofing and cladding to the *building* structure.

3.1.6. Encapsulated Mass Timber Construction

(See Note A-3.1.6.)

3.1.6.1. Scope

1) *Encapsulated mass timber construction* permitted in this Part shall conform to this Subsection.

3.1.6.2. Materials Permitted

1) Except as otherwise provided in this Part and Sentence 6.4.3.1.(1), materials used in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* shall conform to Subsection 3.1.5.

3.1.6.3. Structural Mass Timber Elements

(See Note A-3.1.6.3.)

1) Except as otherwise provided in this Subsection and Articles 3.2.2.16. and 3.2.3.19., a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* is permitted to include structural mass timber elements, including beams, columns, arches, and wall, floor and roof assemblies, provided they comply with Sentences (2) and (3).

2) Structural mass timber elements referred to in Sentence (1) shall

- a) except as provided in Sentence (4), be arranged in heavy solid masses containing no concealed spaces,
- b) have essentially smooth flat surfaces with no thin sections or sharp projections, and
- c) except as provided in Sentence 3.1.6.17.(1), conform to the minimum dimensions stated in Table 3.1.6.3.

3) Adhesives used in structural mass timber elements referred to in Sentence (1) 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."

4) Concealed spaces are permitted within structural mass timber elements referred to in Sentence (2) and need not conform to Sentence 3.1.6.4.(1), provided the concealed spaces are

- a) *sprinklered* and divided into compartments by *fire blocks* in conformance with Subsection 3.1.11.,
- b) completely filled with rock or slag fibre insulation conforming to CAN/ULC-S702.1, "Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification," and having a density not less than 32 kg/m³,
- c) if horizontal, lined with not less than a single layer of 12.7 mm thick Type X gypsum board or *noncombustible* material providing an *encapsulation rating* of not less than 25 min, or
- d) if vertical, lined with not less than a single layer of 12.7 mm thick Type X gypsum board or *noncombustible* material providing an *encapsulation rating* of not less than 25 min and vertically divided into compartments by *fire blocks* in conformance with Subsection 3.1.11.

Table 3.1.6.3.

Minimum Dimensions of Structural Mass Timber Elements in Encapsulated Mass Timber Construction
Forming Part of Sentences 3.1.6.3.(2), 3.1.6.8.(1) and 3.1.6.17.(1)

Structural Wood Elements	Minimum Thickness, mm	Minimum Width × Depth, mm × mm
Walls that are <i>fire separations</i> or exterior walls (1-sided fire exposure)	96	—
Walls that require a <i>fire-resistance rating</i> , but are not <i>fire separations</i> (2-sided fire exposure)	192	—
Floors ⁽¹⁾ and roofs (1-sided fire exposure)	96	—

Beams, columns and arches (2- or 3-sided fire exposure)	—	192 × 192
Beams, columns and arches (4-sided fire exposure)	—	224 × 224

Notes to Table 3.1.6.3.:

⁽¹⁾ The minimum dimensions for floor assemblies are also applicable to mezzanines and exterior balconies.

3.1.6.4. Encapsulation of Mass Timber Elements

(See also Note A-3.1.6.3.)

1) Except as provided in Sentences (3) to (9), 3.1.6.3.(4), 3.1.6.16.(2) and 3.1.6.17.(2), and Articles 3.1.6.7. and 3.1.6.12., the exposed surfaces of structural mass timber elements conforming to Article 3.1.6.3. shall be protected from adjacent spaces in the *building*, including adjacent concealed spaces within wall, floor and roof assemblies, by a material or assembly of materials conforming to Sentence (2) that provides an *encapsulation rating* that

a) is not less than 50 minutes in a *building* or part of a *building* constructed in conformance with Article 3.2.2.48. or 3.2.2.57., or

b) conforms to the minimum values stated in Table 3.2.2.93. for the applicable *major occupancy* and *building height*.

(See Note A-3.1.6.4.(1).)

2) Except as provided in Sentence 3.1.6.11.(1), the material or assembly of materials referred to in Sentence (1) shall consist of

- a) gypsum board,
- b) gypsum concrete,
- c) *noncombustible* materials,
- d) materials that conform to Sentences 3.1.5.1.(2) to (4), or
- e) any combination of the materials listed in Clauses (a) to (d).

3) Except as provided in Sentence (5) and (7), the exposed surfaces of mass timber beams, columns and arches within a *suite* or *fire compartment* in a *building* or part of a *building* constructed in conformance with Article 3.2.2.48. or 3.2.2.57. or permitted by Article 3.2.2.93. to have a 50 min *encapsulation rating*, other than a *residential suite*, need not be protected in accordance with Sentence (1), provided

a) their aggregate exposed surface area does not exceed 35% of the total wall area of the perimeter of the *suite* or *fire compartment* in which they are located, and

b) the *flame-spread rating* on any exposed surface is not more than 150.

(See Note A-3.1.6.4.(3) to (8).)

4) Except as provided in Sentences (5) to (7), the exposed surfaces of mass timber walls within a *suite* in a *building* or part of a *building* constructed in conformance with Article 3.2.2.48. or 3.2.2.57. or permitted by Article 3.2.2.93. to have a 50 min *encapsulation rating*, other than a *residential suite*, need not be protected in accordance with Sentence (1), provided

- a) each portion of an exposed surface of a mass timber wall faces
 - i) faces the same direction, or
 - ii) is separated from any other exposing mass timber wall by a horizontal distance of not less than 4.5 m , and
- b) the *flame-spread rating* on any exposed surface is not more than 150.

(See Notes A-3.1.6.4.(4) and A-3.1.6.4.(3) to (8).)

5) Except as provided in Sentence (7), the aggregate exposed surface area of mass timber elements within a *suite* permitted in Sentences (3) and (4) shall not exceed 35% of the total wall area of the perimeter of the *suite*. (See Note A-3.1.6.4.(3) to (8).)

6) Except as provided in Sentence (7), the exposed surfaces of mass timber ceilings within a *suite* or *fire compartment*, other than an *exit*, *public corridor* or a *residential suite*, in a *building* or part of a *building* constructed in conformance with Article 3.2.2.48. or 3.2.2.57. or permitted by Article 3.2.2.93. to have a 50 min *encapsulation rating*, need not be protected in accordance with Sentence (1), provided their aggregate surface area does not exceed

a) 10% of the total ceiling area of the *suite* or *fire compartment*, where the *flame-spread rating* on any exposed surface is not more than 150, or

b) 25% of the total ceiling area of the *suite* or *fire compartment*, where the *flame-spread rating* on any exposed surface of a mass timber wall or ceiling is not more than 75.

(See Note A-3.1.6.4.(3) to (8).)

7) The exposed surfaces of mass timber ceilings within a *suite* in a *building* or part of a *building* constructed in conformance with Article 3.2.2.48. or 3.2.2.57. or permitted by Article 3.2.2.93. to have a 50 min *encapsulation rating*, other than a *residential suite*, need not be protected in accordance with Sentence (1) or (6), provided

a) the aggregate surface area of any exposed mass timber beams, columns and arches does not exceed 20% of the total wall area of the perimeter of the *suite* in which they are located,

b) all surfaces of mass timber walls are

i) protected in accordance with Sentence (1), or

ii) mass timber walls that are not otherwise permitted to be exposed in accordance with Sentence (5) are protected by a material or assembly of materials conforming to Sentence (2) that provides an *encapsulation rating* of not less than 80 min, and

c) the *flame spread rating* on any exposed surface of a mass timber wall or ceiling is not more than 75. (See Note A-3.1.6.4.(3) to (8).)

8) Structural mass timber elements in a *building* or part of a *building* permitted by Article 3.2.2.93. to have a 0 min *encapsulation rating* need not be protected in accordance with Sentence (1), other than *residential suites*, provided

a) mass timber walls and ceilings within *vertical service spaces*, *public corridors*, and *exits* are protected on the interior side with a material or assembly of materials conforming to Sentence (2) that provides an *encapsulation rating* of not less than 25 min, and

b) concealed spaces are protected in conformance with Sentence 3.1.6.3.(4).

(See Note A-3.1.6.4.(3) to (8).)

9) In a *building* or part of a *building* required by Clause 3.1.6.4.(1)(b) to have a minimum *encapsulation rating* of 70 min, the upper surface of a mass timber floor or roof assembly is permitted to be encapsulated by a material or assembly of materials conforming to Sentence 3.1.6.4.(2) that provides an *encapsulation rating* of 50 min.

3.1.6.5. Determination of Encapsulation Ratings

1) Except as provided in Article 3.1.6.6., the rating of a material or assembly of materials that is required to have an *encapsulation rating* shall be determined on the basis of the results of tests conducted in conformance with CAN/ULC-S146, "Standard Method of Test for the Evaluation of Encapsulation Materials and Assemblies of Materials for the Protection of Structural Timber Elements."

3.1.6.6. Encapsulation Materials

(See Note A-3.1.6.6.)

1) Gypsum-concrete topping and concrete not less than 38 mm thick are deemed to have an *encapsulation rating* of 50 min when installed on the upper side of a mass timber floor or roof assembly.

2) One layer of Type X gypsum board conforming to ASTM C 1396/C 1396M, "Standard Specification for Gypsum Board," or CAN/CSA-A82.27-M, "Gypsum Board," not less than 12.7 mm thick, is deemed to have an *encapsulation rating* of 25 min when installed on a mass timber element in accordance with Sentence (6).

3) Two layers of Type X gypsum board conforming to ASTM C1396/C1396M, "Standard Specification for Gypsum Board," or CAN/CSA-A82.27-M, "Gypsum Board," each not less than 12.7 mm thick are deemed to have an *encapsulation rating* of 50 min when installed on a mass timber element in accordance with Sentence (6).

4) Two layers of Type X gypsum board conforming to ASTM C 1396/C 1396M, "Standard Specification for Gypsum Board," or CAN/CSA-A82.27-M, "Gypsum Board," each not less than 15.9 mm thick, are deemed to have an *encapsulation rating* of 70 min when installed on a mass timber element in accordance with Sentence (6).

5) Three layers of Type X gypsum board conforming to ASTM C1396/C1396M, "Standard Specification for Gypsum Board," or CAN/CSA-A82.27-M, "Gypsum Board," each not less than 12.7 mm thick, are deemed to have an *encapsulation rating* of 80 min when installed on a mass timber element in accordance with Sentence (6).

6) The gypsum board described in Sentences (2) to (5) shall be

a) fastened with a minimum of two rows of screws in each layer

i) directly to the mass timber element with screws of sufficient length to penetrate not less than 20 mm into the mass timber element that are spaced not more than 400 mm o.c. and 20 mm to 38 mm from the boards' edges, or

ii) to wood furring or resilient metal or steel furring channels not more than 25 mm thick spaced not more than 400 mm o.c. on the mass timber element,

b) for multiple layer systems, installed with the joints in each layer staggered from those in the adjacent layer, and

c) installed in conformance with ASTM C840, "Standard Specification for Application and Finishing of Gypsum Board," except that, for multiple layer systems, their joints need not be taped and finished.

(See Note A-3.1.6.6.(6).)

3.1.6.7. Combustible Roofing Materials

1) Wood roof sheathing and roof sheathing supports that do not conform to Articles 3.1.6.3. and 3.1.6.4. are permitted in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided they are installed

a) above a concrete deck in accordance with Sentence 3.1.5.3.(2), or

b) above a deck of *encapsulated mass timber construction*, where

i) said deck is permitted to be encapsulated between the roof sheathing supports by a material or assembly of materials conforming to Sentence 3.1.6.4.(2) that provides an *encapsulation rating* of not less than 50 min,

ii) the height of the roof space is not more than 1 m,

iii) the roof space is divided into compartments by *fire blocks* in conformance with Article 3.1.11.5.,

iv) openings through the deck other than for *noncombustible* roof drains and plumbing piping are protected by shafts constructed as *fire separations* having a *fire-resistance rating* not less than 1 h that extend from the deck to not less than 150 mm above the adjacent sheathing, and

v) except as permitted by Subclause (b)(iv), the roof space does not contain any *building services*.

2) *Combustible* cant strips, roof curbs, nailing strips and similar components used in the installation of roofing are permitted on a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*.

3) Wood nailer facings to parapets that are not more than 610 mm high are permitted on a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided the facings and any roof membranes covering the facings are protected by sheet metal.

3.1.6.8. Combustible Window Sashes and Frames

1) *Combustible* window sashes and frames are permitted in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided

a) each window in an exterior wall face is an individual unit separated from every other opening in the wall by *noncombustible* wall construction or mass timber wall construction conforming to the dimensions stated in Table 3.1.6.3.,

b) windows in exterior walls in contiguous *storeys* are separated by not less than 1 m of *noncombustible* wall construction or mass timber wall construction conforming to the dimensions stated in Table 3.1.6.3., 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.

3.1.6.9. Exterior Cladding

1) Except as provided in Sentences (2), (3), (4), (6) and (9), cladding on an exterior wall assembly of a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* shall be

a) *noncombustible*,

b) a material or combination of materials that satisfy the criteria of Sentence 3.1.5.1.(2),

c) except as provided in Sentence (7), a wall assembly that satisfies the criteria of Clause 3.1.5.5.(1)(b), or

d) a combination of the cladding described in Clauses (a) to (c). (See Note A-3.1.6.9.(1), (2), (4) and (6).)

2) Except as provided in Sentences (3), (4), (6) and (8), cladding on an exterior wall assembly of a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* that is not more than 12 *storeys* in *building height* is permitted to consist of

a) *combustible* cladding that

i) is not contiguous over more than 4 *storeys*,

ii) represents not more than 10% of the cladding on each exterior wall of each *storey*,

iii) is not more than 1.2 m in width,

iv) has a *flame-spread rating* not more than 75 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction,

v) is separated from other portions of *combustible* cladding on adjacent *storeys* by a horizontal distance of not less than 2.4 m, and

vi) is separated from other portions of *combustible* cladding by a horizontal distance of not less than 1.2 m,

b) *combustible* cladding that

i) is not contiguous across adjacent *storeys*,

ii) represents not more than 10% of the cladding on each exterior wall of each *storey*,

iii) has a *flame-spread rating* not more than 75 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, and

iv) is separated from other portions of *combustible* cladding on adjacent *storeys* by a horizontal distance of not less than 2.4 m,

c) *combustible* cladding representing up to 100% of the cladding on exterior walls of the first *storey*, provided all portions of the cladding can be directly accessed and are located not more than 15 m from a *street* or access route conforming to Article 3.2.5.6., measured horizontally from the face of the *building*,

or

d) a combination of *noncombustible* cladding and the cladding described in Clauses (a) to (c).

(See Note A-3.1.6.9.(1), (2), (4) and (6).)

3) The permitted area of *combustible* cladding in Clause (2)(a) or (b) shall not exceed 5% of the cladding on each exterior wall of each *storey* where 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*. (See Note A-3.2.3.1.(8).)

4) Except as provided in Sentences (6) and (8), cladding on an exterior wall assembly of a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* that is not more than 6 *storeys* in *building height* is permitted to consist of

a) *combustible* cladding that

i) represents not more than 10% of the cladding on each exterior wall of each *storey*, and

ii) has a *flame-spread rating* not more than 75 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, or

b) a combination of the cladding described in Clause (a) and the cladding described in Sentence (1) and Clause (2)(c).

(See Note A-3.1.6.9.(1), (2), (4) and (6).)

5) Where *combustible* cladding conforming to Clause (2)(a), (b) or (4)(a) on an exterior wall of a *fire compartment* is exposed to *combustible* cladding conforming to Clause (2)(a), (b) or (4)(a) on an exterior wall of the same *fire compartment* or of another *fire compartment*, and the planes of the two walls are parallel or at an angle less than 135° measured from the exterior of the *building*, the different portions of *combustible* cladding shall

a) be separated by a horizontal distance of not less than 3 m, and

b) not be contiguous over more than 2 *storeys*.

6) Except as provided in Sentence (8), cladding on an exterior wall assembly of a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* and not more than 4 *storeys* in *building height* is permitted to consist of *combustible* material with a *flame-spread rating* not more than 75 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction. (See Note A-3.1.6.9.(1), (2), (4) and (6).)

7) An exterior wall assembly constructed in conformance with Section D-6 of Appendix D is deemed to satisfy the criteria of Clause (1)(c).

8) Except as provided in Article 3.2.3.10., where the *limiting distance* in Table 3.2.3.1.-D or 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.

9) A wall assembly conforming to Clause (1)(c) 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 D2898, "Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing."

3.1.6.10. Combustible Components in Exterior Walls

1) Except as provided in Sentence (2), *combustible* components, other than those permitted by Article 3.1.6.9., are permitted to be used in an exterior wall assembly of a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided the wall assembly meets the requirements of Clause 3.1.6.9.(2)(d).

2) An exterior wall assembly constructed in conformance with Section D-6 of Appendix D is deemed to satisfy the criteria of Sentence (1).

3) Non-loadbearing wood elements permitted in Article 3.1.5.6. need not conform to Article 3.1.6.3. in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*.

3.1.6.11. Nailing Elements

1) Wood nailing elements are permitted to be used for the attachment of a material or assembly of materials used to provide an *encapsulation rating* in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided the concealed space created by the wood nailing elements is not more than 25 mm deep.

2) Except as permitted by Sentence 3.1.6.16.(2) and Article 3.1.6.6., wood nailing elements are permitted to be used for the attachment of interior finishes in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided the concealed space created by the wood nailing elements is not more than 50 mm deep and

- a) exposed surfaces in the concealed space have a *flame-spread rating* not more than 25, or
- b) the concealed space is filled with *noncombustible* insulation.

3.1.6.12. Combustible Flooring Elements

1) Wood members that are more than 50 mm but not more than 300 mm high are permitted to be used for the construction of a raised platform in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, and they need not conform to Articles 3.1.6.3. and 3.1.6.4., provided

a) the concealed spaces created by the wood members are divided into compartments by *fire blocks* in conformance with Sentence 3.1.11.3.(4), and

b) the wood members are

- i) applied directly to or set into a *noncombustible* floor slab, or
- ii) applied directly to a mass timber floor assembly that conforms to the requirements of Article 3.1.6.3.

2) The upper surface of the mass timber floor assembly referred to in Subclause (1)(b)(ii) is permitted to be encapsulated only between the wood members by a material or assembly of materials conforming to Sentences 3.1.6.4.(1) and (2).

3) The floor system for the raised platform referred to in Sentence (1) is permitted to include a *combustible* subfloor and *combustible* finished flooring.

3.1.6.13. Combustible Stairs

1) Wood stairs and landings conforming to the requirements for floor assemblies in Article 3.1.6.3. and Sentences 3.1.6.4.(1) and (2) are permitted in an exit stairwell in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*.

2) Wood stairs in a *suite* in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* need not conform to Articles 3.1.6.3. and 3.1.6.4.

3.1.6.14. Combustible Interior Finishes

1) Except as provided 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* or part of a *building* permitted to be of *encapsulated mass timber construction*.

2) Except as provided in Sentences 3.1.6.4.(3), (4), (7) and (8), *combustible* interior wall finishes, other than foamed plastics, that are not more than 25 mm thick are permitted in a *building* or part of a *building* permitted to be of *encapsulated mass timber 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 Sentences (4) and 3.1.6.4.(3), (6), (7) and (8), *combustible* interior ceiling finishes, other than foamed plastics, that are not more than 25 mm thick are permitted in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided they have 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, 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. (See Note A-3.1.11.3.(3).)

4) *Combustible* interior ceiling finishes made of *fire-retardant-treated wood* are permitted in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided they are not more than 25 mm thick or are exposed *fire-retardant-treated wood* battens.

3.1.6.15. Combustible Elements in Partitions

1) Solid lumber *partitions* not less than 38 mm thick and *partitions* containing wood framing that do not conform to Article 3.1.6.3. are permitted in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided the *partitions* are

a) protected on each face with not less than

i) a single layer of 12.7 mm thick Type X gypsum board, with all joints either backed or taped and filled, conforming to ASTM C1396/C1396M, "Standard Specification for Gypsum Board," or CAN/CSA A82.27-M, "Gypsum Board,"

ii) a single layer of 19 mm thick *fire-retardant-treated wood*, on solid lumber *partitions*, or

iii) a single layer of 19 mm thick *fire-retardant-treated wood*, on *partitions* containing wood framing, where the wood stud cavities are filled with *noncombustible* insulation, and

b) not installed as enclosures for *exits* or *vertical service spaces*.

3.1.6.16. Exposed Construction Materials and Components in Concealed Spaces

1) Except as provided in Sentence (2) and Article 3.1.11.7., and except as otherwise provided in this Subsection, only construction materials and components permitted in *noncombustible construction* shall be permitted to have exposed surfaces in concealed spaces within floor, roof, and wall assemblies in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*.

2) Exposed surfaces are permitted in a concealed space created by the attachment of a material or assembly of materials conforming to Sentence 3.1.6.4.(1), provided the concealed space is not more than 25 mm deep.

3.1.6.17. Penetration by Outlet Boxes

1) The minimum dimensions stated in Table 3.1.6.3. need not apply at cutouts in vertical or horizontal structural mass timber elements where outlet boxes are installed in accordance with Article 3.1.9.3. (See also Note A-3.1.9.2.(1).)

2) The exposed surfaces of the cutouts described in Sentence (1) need not be protected in accordance with Sentence 3.1.6.4.(1).

3) Outlet boxes on opposite sides of a structural mass timber element having a *fire-resistance rating* shall be separated by a distance of not less than 600 mm.

3.1.7. Fire-Resistance Ratings

3.1.7.1. Determination of Ratings

1) Except as permitted by Sentence (2) to (4), 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, "Standard Method of 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 3.2.2.93. 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 as provided in Sentence (4) and except for *noncombustible* roof assemblies required by Clauses 3.2.2.51.(2)(c) and 3.2.2.60.(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*.

4) Except for portions of a *building* constructed in accordance with Article 3.2.2.7. that are required to be of *noncombustible construction*, assemblies of *noncombustible construction* in *buildings* or portions of *buildings* permitted to be of *encapsulated mass timber construction* are permitted to be supported by *encapsulated mass timber 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 in conformance with Article 3.1.8.3., 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) Except as provided in Sentence (5), the continuity of a *fire separation* having a *fire-resistance rating* that abuts another *fire separation*, a floor, a ceiling, or a roof shall be maintained by a *firestop* conforming to Sentence (3). (See Note A-3.1.8.3.(2).)

3) The *firestop* required in Sentence (2) shall have an FT rating not less than the *fire-resistance rating* of the abutting *fire separation* when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems."

4) Except as provided in Sentence (5), joints located in a horizontal plane between a floor and an exterior wall shall be sealed by a *firestop* that, when subjected to the fire test method in ASTM E2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-storey Test Apparatus," has an F rating not less than the *fire-resistance rating* of the horizontal *fire separation*.

5) Joints between ceilings and walls, between floors and walls, and between walls at corners need not comply with Sentences (2) and (4) where such joints consist of gypsum board that is attached to framing members and arranged so as to restrict the passage of flame and smoke through the joints. (See Note A-3.1.8.3.(5).)

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, "Standard Method for Fire Tests of Door Assemblies,"
- b) CAN/ULC-S106, "Standard Method for Fire Tests of Window and Glass Block Assemblies," or
- c) CAN/ULC-S112, "Standard Method of 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, "Standard for 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, "Standard for Air Leakage Tests of Door Assemblies and Other Opening Protectives."

Table 3.1.8.4.
Fire-Protection Rating of Closures
Forming Part of Sentence 3.1.8.4.(2)

<i>Fire-Resistance Rating of Fire Separation</i>	<i>Minimum Fire-Protection Rating of Closure</i>
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, "Standard for 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, "Standard for 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 11.3.8.1.(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, "Standard for 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 m², 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 m², 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 11.3.8.1.(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 6.3.1.6.),
- 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 m² 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 6.3.1.6.),
- 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 11.3.8.1.(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 m² 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, "Standard for Fusible Links for Fire Protection Services," 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, "Standard for 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, "Standard for 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, "Standard for 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 11.3.8.1.(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. Fire Protective Glazing 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 fire protective glazing, wired glass assemblies or glass blocks installed in conformance with NFPA 80, "Standard for Fire Doors and Other Opening Protectives." (See also Article 3.3.2.17.)

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.

4) Fire protective glazing permitted by Sentence (1), shall include glazing meeting a fire-protection rating when tested in accordance CAN/ULC-S104, and shall be installed in an appropriate fire-resistive frame.

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 <i>Fire-Protection Rating of Door</i>	Maximum Temperature Rise on Opaque Portion of Unexposed Side of Door, °C	Maximum Aggregate Area of Wired Glass or Safety Glazing in a Door, m ²	Maximum Aggregate Area of Glass Block, Wired Glass or Safety Glazing Panels Not in a Door, m ²
Between a dead-end corridor and an adjacent <i>occupancy</i> where the corridor provides the only <i>access to exit</i> and is required to have a <i>fire-resistance rating</i>	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	45 min	250 after 30 min	0.0645	0
	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, Glass Block and Safety Glazing

1) Except as permitted by Article 3.1.8.19., the maximum aggregate area of wired glass or safety glazing 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 aggregate area of glass block, wired glass or safety glazing 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, glass block or safety glazing 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. Firestops

1) Except as provided in Sentences (2) to (7) and Article 3.1.9.3., 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 firestop that, when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," has an F rating not less than the required fire-resistance rating of the fire separation, or

b) cast in place, where the item penetrating the fire separation is steel, ferrous, copper, concrete or masonry (see Note A-3.1.9.1.(1)(b)).

(See also Article 3.1.9.4. for requirements regarding penetrations by combustible drain, waste and vent piping.)

2) Except as permitted in Sentence (6), 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 firestop that, when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," has an FT rating not less than the fire-resistance rating for the fire separation.

3) Except as permitted in Sentences (6) and (7), penetrations of a *fire separation* in conformance with Sentence 3.6.4.2.(2) shall be sealed by a *firestop* that, when subjected to the fire test method in CAN/ULC-S115, "Standard Method of 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 *firestop* 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, "Standard for the Installation of Sprinkler Systems."

5) Unless specifically designed with a *firestop*, *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 *firestop* requirements of Sentences (1) to (3), provided the *fire damper* is installed in conformance with NFPA 80, "Standard for Fire Doors and Other Opening Protectives."

6) Service equipment penetrations through a horizontal *fire separation* having a *fire-resistance rating* as described in Sentences (2) and (3) that are contained within the cavity of a wall above and below the horizontal *fire separation* are permitted to be sealed at the penetration by a *firestop* that, when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," has an F rating not less than the *fire-resistance rating* for the *fire separation*.

7) Service equipment penetrations through a horizontal *fire separation* having a *fire-resistance rating* as described in Sentence (3) are permitted to be sealed at the penetration by a *firestop* that, when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," has an F rating not less than the *fire-resistance rating* for the *fire separation*, provided the penetration

a) is contained within the concealed space of a floor or ceiling assembly having a *fire-resistance rating*,

b) is located above a ceiling membrane that is a horizontal *fire separation*, or

c) is contained within a *horizontal service space* conforming to Subsection 3.6.4. that is directly above or below the floor.

3.1.9.2. Service Equipment Penetrations

1) Ducts, electrical outlet boxes, pipes, totally enclosed raceways, optical fibre cables, electrical wires and cables, and other similar service equipment are permitted to penetrate a *fire separation* or a membrane forming part of an assembly required to have a *fire-resistance rating*, provided they are protected at the penetration with a *firestop* conforming to Sentence 3.1.9.1.(1). (See Note A-3.1.9.2.(1).)

2) *Combustible* totally enclosed raceways that are embedded in a concrete floor slab are permitted in an assembly required to have a *fire-resistance rating*, provided the concrete cover between the raceway and the bottom of the slab is not less than 50 mm.

3.1.9.3. Penetration by Outlet Boxes

(See Note A-3.1.9.3.) (See also Note A-3.1.9.2.(1).)

1) Except as provided in Sentence (3), 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 *firestop* 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, "Standard Method of Fire Tests of Firestop Systems."

2) *Combustible* 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 *firestop* that, when subjected to the fire test method in CAN/ULC-S115, "Standard Method of 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 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 conform to Sentence (1), provided

a) they do not exceed

- i) 0.016 m² in area, and
- ii) an aggregate area of 0.065 m² in any 9.3 m² of surface area, and
- b) the annular space between the membrane and the *noncombustible* electrical outlet boxes does not exceed 3 mm.
- 4) 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,
 - b) a *fire block* conforming to Article 3.1.11.7., or
 - c) a *firestop* installed on each outlet box 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, "Standard Method of Fire Tests of Firestop Systems."

3.1.9.4. 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*, provided the piping is protected at the penetration with a *firestop* in conformance with Clause (4)(a) or (b).
- 3) Except as permitted by Sentences (4), (5), (7) and (8), *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) except as provided in Clause (b), the piping is sealed at the penetration by a *firestop* 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, "Standard Method of Fire Tests of Firestop Systems,"
 - b) in *buildings* more than 3 *storeys* in *building height*, the piping is sealed at the penetration by a *firestop* 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, "Standard Method of 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, and
 - c) 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).
- 7) Except as provided in Sentence (8), penetrations of a *fire separation* that incorporate transitions between *combustible* and *noncombustible* drain, waste and vent piping shall be sealed by a *firestop* 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, "Standard Method of 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.
- 8) Transitions between vertical *noncombustible* drain, waste and vent piping and *combustible* branches for drain, waste and vent piping are permitted on either side of a *fire separation*, provided they are not located in a *vertical service space*. (See Note A-3.1.9.4.(8).)

3.1.9.5. Openings through a Membrane Ceiling

1) A membrane ceiling forming part of an assembly assigned a *fire-resistance rating* on the basis of Appendix D 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.

3.1.9.6. 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.
- 2) The aggregate width of openings in a *firewall* within a *storey* 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 Concealed Vertical 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 a wood-framed building
 - 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 is filled with insulation,
- b) the exposed construction materials and any insulation within the wall space are *noncombustible*,
- c) the exposed materials within the 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 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 m².
- 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 m².
- 3) In a *building* or part of a *building* permitted to be of *encapsulated mass timber 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 m². (See Note A-3.1.11.3.(3).)
- 4) In a *building* or part of a *building* permitted to be of *encapsulated mass timber 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 3.1.6.12.(1) so that the maximum area of a concealed space is not more than 10 m².

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 m² 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 m² 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 (5), in *buildings* or parts thereof conforming to Article 3.2.2.51. or 3.2.2.60., 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 m² 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 m² 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) and (4).)

4) Except for crawl spaces conforming to Sentence 3.1.11.6.(1) and except as provided in Sentence (5), in *buildings* or parts thereof conforming to Article 3.2.2.48., 3.2.2.57., or 3.2.2.93., horizontal concealed spaces within a floor assembly or roof assembly of *encapsulated mass timber construction* shall be separated by construction conforming to Article 3.1.11.7. into compartments that are

a) not more than 600 m² 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 m² 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) and (4).)

5) *Fire blocks* conforming to Sentences (3) and (4) 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 m² in area with no dimension more than 30 m.

3.1.11.7. Fire Block Materials

1) Except as permitted by Sentences (2) to (5) and (8), *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, "Standard Method of 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* or part of a *building* permitted to be of *encapsulated mass timber construction*, wood nailing elements referred to in Article 3.1.6.11. need not be tested in conformance with Sentence (1).

5) In a *building* permitted to be of *combustible construction*, in a *combustible* roof system permitted by Sentences 3.1.5.3.(2) and 3.1.6.7.(1), and in a raised platform permitted by Sentences 3.1.5.10.(2) and 3.1.6.12.(1), *fire blocks* are permitted to be

a) solid lumber or a structural composite lumber product conforming to ASTM D5456, "Standard Specification for 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 D5456, "Standard Specification for 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.

6) Openings through materials referred to in Sentences (1) to (5) shall be protected to maintain the integrity of the construction.

7) Where materials referred to in Sentences (1) to (5) are penetrated by construction elements or by service equipment, a *firestop* shall be used to seal the penetration. (See Note A-3.1.11.7.(7).)

8) 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/m³,
- 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.(8).)

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, "Standard Method of 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

523 Richards St.

Occupancy, Location or Element	Maximum <i>Flame-Spread Rating</i> for Walls and Ceilings	
	<i>Sprinklered</i>	<i>Not Sprinklered</i>
Group A, Division 1 <i>occupancies</i> , including doors, skylights, glazing and light diffusers and lenses	150	75
Group B <i>occupancies</i>	150	75
<i>Exits</i> ⁽¹⁾	25	25
Lobbies described in Sentence 3.4.4.2.(2)	25	25
Covered vehicular passageways, except for roof assemblies of <i>heavy timber construction</i> in the passageways	25	25
<i>Vertical service spaces</i>	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, "Standard Method of 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, "Standard Method of 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 m² 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 m² 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 <i>Flame-Spread Rating</i>			Maximum Smoke Developed Classification		
	Wall Surface	Ceiling Surface ⁽¹⁾	Floor Surface	Wall Surface	Ceiling Surface ⁽¹⁾	Floor Surface
<i>Exit</i> stairways, vestibules to <i>exit</i> stairs and lobbies described in Sentence 3.4.4.2.(2)	25	25	25	50	50	50
Corridors not within <i>suites</i>	(2)	(2)	300	100	50	500
Elevator cars	75	75	300	450	450	450
Elevator vestibules	25	25	300	100	100	300
<i>Service spaces</i> and <i>service rooms</i>	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.

3.1.13.12. Encapsulated Mass Timber Construction

1) In a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*,

a) the *flame-spread ratings* required by Subsection 3.1.6. shall apply in addition to the requirements in this Subsection, and

b) the *flame-spread ratings* for *exits* required by 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, structural mass timber elements conforming to Sentence 3.1.6.4.(3), *heavy timber construction*, and *fire-retardant-treated wood*.

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, "Standard Method of 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, "Standard Method of 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), 3.2.2.62.(2), 3.2.2.68.(2), 3.2.2.78.(2) and 3.2.2.85.(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. Vegetated Roof Assemblies

1) A *vegetated roof assembly* is permitted in *combustible* and *noncombustible construction* if

a) the *vegetated roof assembly* is designed and constructed in conformance with ANSI/SPRI VF-1 "External Fire Design Standard for Vegetative Roofs",

b) the *vegetated roof assembly* conforms to the requirements in Part 5, and

c) except for *buildings* to which Part 9 applies as described in Sentence 1.3.3.3.(1) of Division A, the roof covering conforms with Subsection 3.1.15.

3.1.15. Roof Covering

(See Note A-1.4.1.1. of Division A concerning roof terminology)

3.1.15.1. Roof Covering Classification

1) A roof covering classification shall be determined in conformance with CAN/ULC-S107, "Standard Methods of Fire Tests of Roof Coverings."

3.1.15.2. Roof Coverings

1) Except as provided in Sentences (2) to (4), 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 m² 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 (5), roof coverings on *buildings* conforming to Article 3.2.2.51. or 3.2.2.60. 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) Except as provided in Sentence (5), roof coverings in *buildings* or parts of *buildings* permitted to be of *encapsulated mass timber construction* 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.

5) Where *buildings* or parts thereof conforming to Article 3.2.2.48., 3.2.2.51., 3.2.2.57., 3.2.2.60., or 3.2.2.93., include non-contiguous roof assemblies at different elevations, the roof coverings referred to in Sentences (3) and (4) 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, "Standard Method for 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.

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.

Table 3.1.17.1.
Occupant Load
Forming Part of Article 3.1.17.1.

Type of Use of <i>Floor Area</i> or Part Thereof	Area per person, m ²
Assembly uses space with fixed seats	(1)
space with non-fixed seats	0.75
<i>stages</i> 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
Library stack areas (without reading areas)	9.3
Exercise rooms without equipment	1.40 ⁽⁴⁾
Exercise rooms with equipment	4.60 ⁽⁴⁾
<i>Care, treatment</i> or detention uses <i>suites</i>	(2)
<i>care, treatment</i> and sleeping room areas	10.00
detention quarters	11.60
Residential uses <i>dwelling units</i>	(2)
dormitories	4.60
Business and personal services uses personal services shops	4.60
offices	9.30
Mercantile uses <i>basements</i> and <i>first storeys</i>	3.70
second <i>storeys</i> having a principal entrance from a pedestrian thoroughfare or a parking area	3.70
other <i>storeys</i>	5.60
Industrial uses	4.60

manufacturing or process rooms	
<i>storage garages</i>	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
<i>public corridors</i> intended for <i>occupancies</i> 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.

3.1.18. Tents and Air-Supported Structures

(See Note A-3.1.18.)

3.1.18.1. Means of Egress

- 1) Tents and *air-supported structures* shall conform to Sections 3.3. and 3.4.

3.1.18.2. 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.

3.1.18.3. Clearance to Other Structures

- 1) Except as permitted by Sentences (2) to (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 m² 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.

5) For the purposes of compliance with Sentence (1) to (3), Clusters of tents of up to 60 m² in aggregate floor area may be considered as a single tent for the purposes of establishing clearance to other structures.

3.1.18.4. 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.

3.1.18.5. 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, "Standard Method for Flame Tests of Flame-Resistant Fabrics and Films."

3.1.18.6. 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.

3.1.18.7. 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.

Section 3.2. Building Fire Safety

3.2.1. General

3.2.1.1. Exceptions in Determining Building Height

- 1) A rooftop enclosure shall not be considered as a *storey* in calculating the *building height* if it is provided for
- a) elevator machinery,
 - b) a *service room*,
 - c) a stairway used for no purpose other than for access or egress,
 - d) an elevator lobby used for no purpose other than for access or egress, or
 - e) a combination thereof.
- 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) the aggregate area of *mezzanines* that are not superimposed does not exceed 40% of the open area of the room in which they are located (see Note A-3.2.1.1.(3)(a)), 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.
- 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*.
- 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 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. (See Note A-3.2.1.1.(3)(a).)

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 3.3.1.25., and Sentences 3.2.4.18.(11), 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 *encapsulated mass timber 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* or *encapsulated mass timber 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), 3.2.2.50.(3), 3.2.2.51.(3), 3.2.2.52.(3), 3.2.2.53.(3), 3.2.2.54.(3), 3.2.2.55.(3), or 3.2.2.93., 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 3.2.2.93. 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 m² 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 3.2.2.93.

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 complying with Subsection 3.1.18.

2) The fire-resistance rating required in Sentence (1) is permitted to be 1.5 h for a storage garage.

3) encapsulated mass timber construction 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 3.2.2.51.(5) or 3.2.2.60.(4), the building shall

a) be sprinklered, and

b) be divided into at least two horizontal fire compartments on each storey containing a major occupancy other than Group C or Group D where each fire compartment is

i) served by at least one exit stair, and

ii) constructed with fire separations with a fire-resistance rating not less than the floor assembly above.

(See Note A-3.2.1.7.(4))

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 3.2.2.93. 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 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 3.2.2.48.(4), 3.2.2.51.(5), 3.2.2.57.(3), 3.2.2.60.(4), and 3.2.2.93.(5) to (7), 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*.
- 2) In a *building* or part of a *building* constructed in conformance with Article 3.2.2.48., 3.2.2.57., or 3.2.2.93. containing more than one *major occupancy*, the most restrictive encapsulation requirements of Article 3.1.6.4. and Table 3.2.2.93. for any *major occupancy* contained within a storey shall apply to the encapsulation required on the interior of a *public corridor* or *exit* within that storey.

3.2.2.7. Superimposed Major Occupancies

1) Except as provided in Article 3.2.2.8. and Sentences 3.2.2.18.(2), 3.2.2.48.(4), 3.2.2.51.(5), 3.2.2.57.(3), 3.2.2.60.(4), and 3.2.2.9.3.(5) to (7), 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.)

3) In a *building* or part of a *building* constructed in conformance with Article 3.2.2.48., 3.2.2.57., or 3.2.2.93., if one *major occupancy* is located above another *major occupancy*,

a) the most restrictive encapsulation requirements of Article 3.1.6.4. and Table 3.2.2.93. for any *major occupancy* contained within the *building* shall apply to the encapsulation required on the interior of *vertical service spaces* and *exit stairs*, and

b) the encapsulation requirements of Article 3.1.6.4. and Table 3.2.2.93. for a mass timber floor assembly between the *major occupancies* shall be determined on the basis of the requirements for

i) the upper *major occupancy* for the encapsulation of the upper surface of the mass timber floor assembly, and

ii) the lower *major occupancy* for the encapsulation of the underside of the mass timber floor assembly.

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) Reserved.

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) Except as provided in Sentence (2), an exterior balcony shall be constructed in accordance with the type of construction required by Articles 3.2.2.20. to 3.2.2.93., as applicable to the *occupancy* classification of the *building*.

2) The floor assembly of an exterior balcony in a *building* or part of a *building* conforming to Article 3.2.2.48., 3.2.2.57., or 3.2.2.93. shall

- a) be of *noncombustible construction*, or
- b) be constructed in accordance with Article 3.1.6.3., but need not comply with Sentence 3.1.6.4.(1).

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 3.2.2.93. 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 3.2.2.93. for floor assemblies, and not the *fire-resistance rating* for roof assemblies.

3.2.2.14. Rooftop Enclosures

1) A rooftop enclosure for elevator machinery, an elevator lobby, or for a *service room* shall be constructed in accordance with the type of construction required by Articles 3.2.2.20. to 3.2.2.93.

2) A rooftop 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 rooftop enclosure for a stairway shall be constructed in accordance with the type of construction required by Articles 3.2.2.20. to 3.2.2.93.

4) A rooftop enclosure for a stairway or an elevator lobby serving an *occupancy* on a roof that serves only one *dwelling unit* 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:

- 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.

(See Note A-3.2.2.15.(2).)

3) Deleted.

3.2.2.16. Heavy Timber Roof Permitted

1) Unless otherwise permitted by Articles 3.2.2.20. to 3.2.2.93., 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. Roof Assemblies and Mezzanines in Gymnasiums, Swimming Pools, Arenas and Rinks

1) The requirements for a roof assembly to have a *fire-resistance rating* stated in Articles 3.2.2.25., 3.2.2.30. and 3.2.2.32. are permitted to be waived for gymnasiums, swimming pools, arenas, and rinks, provided

a) the roof carries no loads other than normal roof loads, including permanent access walks, and ventilating, sound and lighting equipment, and

b) except as provided in Sentence (3), no part of the roof assembly is less than 6 m above the main floor or balcony.

(See Note A-3.2.2.17.(1).)

2) The requirements for a *mezzanine* to have a *fire-resistance rating* stated in Articles 3.2.2.25., 3.2.2.30. and 3.2.2.32. are permitted to be waived for gymnasiums, swimming pools, arenas, and rinks, provided

a) the *mezzanine* is not required to be considered as a *storey* as per Sentences 3.2.1.1.(3) to (5),

b) the *mezzanine* is used only for ventilating, sound and lighting equipment, and

c) except as provided in Sentence (3), no part of the *mezzanine* is less than 6 m above the main floor or balcony.

3) The restrictions concerning minimum distance stated in Clauses (1)(b) and (2)(c) shall not apply to

a) an inclined and stepped floor ascending from the main floor that 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 permitted 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., 3.2.2.49., 3.2.2.51., 3.2.2.52., 3.2.2.55., 3.2.2.56., 3.2.2.57., 3.2.2.59., 3.2.2.60., 3.2.2.61., 3.2.2.63., 3.2.2.65., 3.2.2.66., 3.2.2.67., 3.2.2.69., 3.2.2.71., 3.2.2.72., 3.2.2.73., 3.2.2.74., 3.2.2.76., 3.2.2.77., 3.2.2.79., 3.2.2.81., 3.2.2.82., 3.2.2.84., 3.2.2.86., 3.2.2.88., 3.2.2.90., and 3.2.2.93.

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 3.2.2.93. 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 3.2.2.93. 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 3.2.2.93. 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 m² 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 m² 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. and 3.2.2.93. 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) except as permitted by Article 3.2.2.17., *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

c) except as permitted by Article 3.2.2.17., 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*.

3.2.2.26. 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 m² if 1 storey in *building height*, or

ii) 2 400 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* 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 m² if 1 storey in *building height* with no basement,
 - ii) 1 200 m² if 1 storey in *building height*, or
 - iii) 600 m² 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 m² if facing one *street*,
 - ii) 500 m² if facing 2 *streets*, or
 - iii) 600 m² 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)

	Maximum Area, m ²

No. of Storeys	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) except as permitted by Article 3.2.2.17., *mezzanines* shall have a *fire-resistance rating* not less than 1 h,
- c) except as permitted by Article 3.2.2.17., 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) except as permitted by Article 3.2.2.17., *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

b) except as permitted by Article 3.2.2.17., 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 m² if facing one *street*,
- ii) 1 500 m² if facing 2 *streets*, or
- iii) 1 800 m² 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 m² 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 m².

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 m² if facing one *street*,
 - ii) 1 250 m² if facing 2 *streets*, or
 - iii) 1 500 m² 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 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.

3.2.2.37. 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 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.

3.2.2.38. 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 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.

3.2.2.40. 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. and 3.2.2.93., 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 m² if 1 *storey* in *building height*,
 - ii) 2 700 m² if 2 *storeys* in *building height*, or
 - iii) 1 800 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* 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 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.

3.2.2.46. 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 m².

3.2.2.47. Group C, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.48. to 3.2.2.55. and 3.2.2.93., 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 12 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 12 *storeys* in *building height*,
- c) it has a height not more than 50 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 6 000 m².

2) Except as provided in Article 3.2.2.16., the *building* referred to in Sentence (1) is permitted to be of *encapsulated mass timber 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 2 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*, 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) 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* is located below the fourth *storey*,
- b) the Group E *major occupancy* is located below the third *storey*, and
- c) the *storage garage* is located below the fifth *storey* (see also Article 4.4.2.1.).

(See Note A-3.2.2.48.(4), 3.2.2.57.(3) and 3.2.2.93.(5) to (7).) (See also Article 3.2.1.7)

3.2.2.49. 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 m² if 3 storeys in building height,
- iii) not more than 9 000 m² if 4 storeys in building height,
- iv) not more than 7 200 m² if 5 storeys in building height, or
- v) not more than 6 000 m² 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*.

3.2.2.50. 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 3.2.2.50.

Table 3.2.2.50.
Maximum Building Area, Group C, up to 3 Storeys
Forming Part of Sentence 3.2.2.50.(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*.

3.2.2.51. 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, excluding any floor level within a rooftop enclosure that is not considered as a *storey* in calculating *building height* in accordance with Sentence 3.2.1.1.(1), and
 - d) it has a *building area* not more than
 - i) 9 000 m² if 1 *storey* in *building height*,
 - ii) 4 500 m² if 2 *storeys* in *building height*,
 - iii) 3 000 m² if 3 *storeys* in *building height*,
 - iv) 2 250 m² if 4 *storeys* in *building height*,
 - v) 1 800 m² if 5 *storeys* in *building height*, or
 - vi) 1 500 m² 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 thereof 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* are located below the third *storey*, and
 - b) the *storage garage* is located below the fourth *storey* (see also Article 4.4.2.1.).

(See Note A-3.2.2.51.(5) and 3.2.2.60.(4).) (See also Article 3.2.1.7.)

3.2.2.52. 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.

3.2.2.53. 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 3.2.2.53.

Table 3.2.2.53.

Maximum Building Area, Group C, up to 3 Storeys, Increased Area
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	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.

3.2.2.54. 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 3.2.2.54.

Table 3.2.2.54.
Maximum Building Area, Group C, up to 3 Storeys
Forming Part of Sentence 3.2.2.54.(1)

No. of Storeys	Maximum Area, m ²		
	Facing 1 <i>Street</i>	Facing 2 <i>Streets</i>	Facing 3 <i>Streets</i>
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.

3.2.2.55. 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 m² if 1 *storey* in *building height*,
 - ii) 2 700 m² if 2 *storeys* in *building height*, or

iii) 1 800 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) 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.

3.2.2.56. Group D, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.57. to 3.2.2.65. and 3.2.2.93., 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.

3.2.2.57. Group D, up to 12 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 12 storeys in building height,

c) it has a height not more than 50 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 7 200 m².

2) Except as provided in Article 3.2.2.16., the building referred to in Sentence (1) is permitted to be of *encapsulated mass 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 2 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) 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* is located below the fourth *storey*,
- b) the Group E *major occupancy* and Group F, Division 2 or 3 *major occupancy* are located below the third *storey*, and
- c) the *storage garage* is located below the fifth *storey* (see also Article 4.4.2.1.).

(See Note A-3.2.2.48.(4), 3.2.2.57.(3). and 3.2.2.93.(5) to (7)) (See also Article 3.2.1.7)

3.2.2.58. 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 3.2.2.58.

Table 3.2.2.58.

**Maximum Building Area, Group D, up to 6 Storeys
Forming Part of Sentence 3.2.2.58.(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	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.

3.2.2.59. 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 m² if 3 storeys in *building height*,
- iii) not more than 10 800 m² if 4 storeys in *building height*,
- iv) not more than 8 640 m² if 5 storeys in *building height*, or
- v) not more than 7 200 m² 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.

3.2.2.60. 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, excluding any floor level within a rooftop enclosure that is not considered as a *storey* in calculating *building height* in accordance with Sentence 3.2.1.1.(1), and

d) it has a *building area* not more than

- i) 18 000 m² if 1 storey in *building height*,
- ii) 9 000 m² if 2 storeys in *building height*,
- iii) 6 000 m² if 3 storeys in *building height*,
- iv) 4 500 m² if 4 storeys in *building height*,
- v) 3 600 m² if 5 storeys in *building height*, or
- vi) 3 000 m² 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 thereof 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*, Group E *major occupancy*, and Group F, Division 2 or 3 *major occupancy* are located below the third *storey*, and

b) the *storage garage* is located below the fourth *storey* (see also Article 4.4.2.1.).

(See Note A-3.2.2.51.(5) and 3.2.2.60.(4).)

3.2.2.61. 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 m².

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.

3.2.2.62. 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 3.2.2.62.

Table 3.2.2.62.

**Maximum Building Area, Group D, up to 3 Storeys
Forming Part of Sentence 3.2.2.62.(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 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 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 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*.

3.2.2.64. 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 3.2.2.64.

Table 3.2.2.64.

Maximum Building Area, Group D, up to 2 Storeys

Forming Part of Sentence 3.2.2.64.(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	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*.

3.2.2.65. 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 m² if 1 *storey* in *building height*, or
- ii) 2 400 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* 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*.

3.2.2.66. Group E, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.67. to 3.2.2.71. and 3.2.2.93., 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.*

3.2.2.67. 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 m².

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.

3.2.2.68. 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 3.2.2.68.

Table 3.2.2.68.

Maximum Building Area, Group E, up to 3 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	1 500	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.*

3.2.2.69. 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 m² if 1 *storey* in *building height*,
 - ii) 3 600 m² if 2 *storeys* in *building height*, or
 - iii) 2 400 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* 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*.

3.2.2.70. 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 3.2.2.70.

Table 3.2.2.70.

**Maximum Building Area, Group E, up to 2 Storeys
Forming Part of Sentence 3.2.2.70.(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.*

3.2.2.71. 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 m² if 1 *storey* in *building height*, or

ii) 1 800 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, 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 4 Storeys, Sprinklered

1) Except as permitted by Articles 3.2.2.73. to 3.2.2.75., 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 m² if 1 *storey* in *building height*,

ii) 4 500 m² if 2 *storeys* in *building height*,

iii) 3 000 m² if 3 *storeys* in *building height*, or

iv) 2 250 m² 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.*

3.2.2.73. 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

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) 3 600 m² if 1 storey in building height,

ii) 1 800 m² if 2 storeys in building height, or

iii) 1 200 m² 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.

3.2.2.74. 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 m² if 1 storey in building height, or

ii) 1 200 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* 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*.

3.2.2.75. 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 m².

3.2.2.76. Group F, Division 2, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.77. to 3.2.2.81. and 3.2.2.93., 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.

3.2.2.77. 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 m² if 1 *storey* in *building height*,
 - ii) 9 000 m² if 2 *storeys* in *building height*,
 - iii) 6 000 m² if 3 *storeys* in *building height*, or
 - iv) 4 500 m² 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.

3.2.2.78. 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 3.2.2.78.

Table 3.2.2.78.
Maximum Building Area, Group F, Division 2, up to 3 Storeys
Forming Part of Sentence 3.2.2.78.(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*.

3.2.2.79. 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*.

3.2.2.80. 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 3.2.2.80.

Table 3.2.2.80.
Maximum Building Area, Group F, Division 2, up to 2 Storeys
Forming Part of Sentence 3.2.2.80.(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* 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*.

3.2.2.81. 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 m² if 1 storey in *building height*, or

ii) 1 800 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* 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*.

3.2.2.82. Group F, Division 3, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.83. to 3.2.2.93., 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.

3.2.2.83. 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 3.2.2.83.

Table 3.2.2.83.

Maximum Building Area, Group F, Division 3, up to 6 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	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.

3.2.2.84. 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 m² if 2 storeys in *building height*,
 - iii) not more than 14 400 m² if 3 storeys in *building height*,
 - iv) not more than 10 800 m² if 4 storeys in *building height*,
 - v) not more than 8 640 m² if 5 storeys in *building height*, or
 - vi) not more than 7 200 m² 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.

3.2.2.85. 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 3.2.2.85.

Table 3.2.2.85.

Maximum Building Area, Group F, Division 3, up to 4 Storeys
Forming Part of Sentence 3.2.2.85.(1)

No. of Storeys	Maximum Area, m ²		
	Facing 1 <i>Street</i>	Facing 2 <i>Streets</i>	Facing 3 <i>Streets</i>
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 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 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 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 m² if 1 *storey* in *building height*,
 - ii) 7 200 m² if 2 *storeys* in *building height*,
 - iii) 4 800 m² if 3 *storeys* in *building height*, or
 - iv) 3 600 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* 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*.

3.2.2.87. 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 3.2.2.87.

Table 3.2.2.87.

Maximum Building Area, Group F, Division 3, up to 2 Storeys

Forming Part of Sentence 3.2.2.87.(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*.

3.2.2.88. 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 m² if 1 *storey* in *building height*, or
 - ii) 2 400 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* 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*.

3.2.2.89. 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 m² if facing one *street*,
 - ii) 7 000 m² if facing 2 *streets*, or
 - iii) 8 400 m² if facing 3 *streets*.

3.2.2.90. 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 m².

3.2.2.91. 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*.

3.2.2.92. 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 m² in *building area*, and
- d) designed so that every portion of each *floor area* is within 60 m of an exterior wall opening.

3.2.2.93. Encapsulated Mass Timber Construction, Various Occupancies, Heights and Areas, Sprinklered

1) A *building* that is classified as Group A, Division 2, Group B, Division 3, Group C, Group D, Group E, or Group F, Division 2 or 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*,
- b) it has a *building height* not exceeding the number of storeys shown in Table 3.2.2.93. for the applicable *major occupancy* and minimum *encapsulation rating*,
- c) it has a maximum height that conforms to the value shown in Table 3.2.2.93. for the applicable *major occupancy* and minimum *encapsulation rating* that is 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*, Proposed Technical Code Content: Harmonized Variations for Mass Timber

d) it has a maximum *building area* that conforms to the value shown in Table 3.2.2.93. for the applicable *major occupancy*, and

e) except as provided in Sentences 3.1.6.3.(4) and 3.1.6.7.(1) and Article 3.1.6.4, the *encapsulation rating* conforms to the value shown in Table 3.2.2.93. for the applicable *major occupancy* and maximum *building height*.

(See Note A-3.2.2.93.(1) and Table 3.2.2.93. See also Articles 3.2.2.48 and 3.2.2

Table 3.2.2.93.
EMTC Requirements⁽¹⁾
Forming part of Sentence 3.2.2.93.(1)

OCCUPANCY	MAX. BUILDING HEIGHT, STOREYS	MAX. HEIGHT, m	MAX. BUILDING AREA, m2	MINIMUM ENCAPSULATION RATING, min
A-2	18	76	7200	70
	12	51		50
	6	26		0
B-3	10	42	8000	70
	6	26		50
	4	17		0
C	18	76	6000	70
	8	34		0
D	18	76	7200	70
	9	38		0
E	12	51	6000	70
	8	34		50
	6	26		0
F-2	10	42	4500	70
	7	30		50
	5	21		0
F-3	12	51	7200	70
	8	34		50
	5	21		0

Notes to Table 3.2.2.93.

(1) See Sentences (5) to (7) and Articles 3.2.2.4. to 3.2.2.8. for information pertaining to multiple *major occupancies*.

2) Except as provided in Article 3.2.2.16., the *building* referred to in Sentence (1) is permitted to be of *encapsulated mass timber 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 2 hours,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 hour, 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* classified as a Group C *major occupancy* 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*, 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) In *buildings* referred to in Sentence (1) where the roof assembly of an *exit stairway* or *vertical service space* used as an elevator hoistway has a height greater than 55 m measured from *grade* to the highest point of the roof assembly, the enclosure for the stairway or hoistway shall be of *encapsulated mass timber construction* or constructed of concrete.

5) Group E *major occupancies* and *storage garages* located in a *building* or part of a *building* classified as a Group A, Division 2, Group C, or Group D *major occupancy* within the scope of this Article are permitted to be constructed in accordance with this Article and the corresponding Group A, Division 2, Group C, or Group D *major occupancy* requirements contained in Table 3.2.2.93., provided

- a) the Group E *major occupancy* is located below the third *storey*, and
- b) the *storage garage* is located below the fifth *storey* (see also Article 4.4.2.1.).

(See Note A-3.2.2.48.(4), 3.2.2.57.(3) and 3.2.2.93.(5) to (7).)

6) Group A, Division 2 *major occupancies* located in a *building* or part of a *building* classified as a Group C or Group D *major occupancy* within the scope of this Article are permitted to be constructed in accordance with this Article and the corresponding Group C or Group D *major occupancy* requirements contained in Table 3.2.2.93., provided they are located below the fourth *storey*. (See Note A-3.2.2.48.(4), 3.2.2.57.(3) and 3.2.2.93.(5) to (7).)

7) Group F, Division 2 and 3 *major occupancies* located in a *building* or part of a *building* classified as a Group D *major occupancy* within the scope of this Article are permitted to be constructed in accordance with this Article and the corresponding Group D *major occupancy* requirements contained in Table 3.2.2.93., provided they are located below the third *storey*. (See Note A-3.2.2.48.(4), 3.2.2.57.(3) and 3.2.2.93.(5) to (7).)

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 3.1.18.3.)

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 openings* 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

$$\text{Area} = 0.24(2 \times \text{LD} - 1.2)^2$$

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)

<i>Limiting Distance</i> , m	Maximum Area of Individual <i>Unprotected Openings</i> , 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) ^(a)	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:

⁽¹⁾ 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, 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	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 than 3 : 1	0	4	5	7	11	16	32	53	79	100																				
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 10 : 1	0	4	4	4	5	6	8	10	13	15	18	21	23	26	30	33	36	44	53	62	90	100										
	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:

⁽¹⁾ 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 Sentence 3.1.6.9.(5) and Article 3.2.3.1.

<i>Exposing Building Face</i>	<i>Area of Unprotected Opening for Groups A, B, C, D and F, Division 3 Occupancies, %</i>											
Max. Area, m ²	<i>Limiting Distance, m</i>											
	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 Sentence 3.1.6.9.(5) and Article 3.2.3.1.

<i>Exposing Building Face</i>	<i>Area of Unprotected Opening for Groups E and F, Division 1 and 2 Occupancies, %</i>																	
Max. Area, m ²	<i>Limiting Distance, m</i>																	
	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 two *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 *public way*. (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 *public way*, 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 3.1.6.9.(5) and 3.2.3.7.(1) to (4)

<i>Occupancy Classification of Building or Fire Compartment</i>	<i>Maximum Area of Unprotected Openings Permitted, % of Exposing Building Face Area</i>	<i>Minimum Required Fire-Resistance Rating</i>	<i>Type of Construction Required</i>	<i>Type of Cladding Required</i>
Group A, B, C, D, or Group F, Division 3	0 to 10	1 h	<i>Noncombustible</i>	<i>Noncombustible</i>
	> 10 to 25	1 h	<i>Combustible, Encapsulated mass timber, or Noncombustible</i>	<i>Noncombustible</i>
	> 25 to 50	45 min	<i>Combustible, Encapsulated mass timber, or Noncombustible</i>	<i>Noncombustible</i>
	> 50 to < 100	45 min	<i>Combustible, Encapsulated mass timber, or Noncombustible</i>	<i>Combustible or Noncombustible⁽¹⁾⁽²⁾</i>
Group E, or Group F, Division 1 or 2	0 to 10	2 h	<i>Noncombustible</i>	<i>Noncombustible</i>
	> 10 to 25	2 h	<i>Combustible, Encapsulated mass timber, or Noncombustible</i>	<i>Noncombustible</i>
	> 25 to 50	1 h	<i>Combustible, Encapsulated mass timber, or Noncombustible</i>	<i>Noncombustible</i>
	> 50 to < 100	1 h	<i>Combustible, Encapsulated mass timber, or Noncombustible</i>	<i>Combustible or Noncombustible⁽²⁾</i>

Notes to Table 3.2.3.7.:

(1) The cladding on Group C buildings conforming to Article 3.2.2.51. and on Group D buildings conforming to Article 3.2.2.60. shall be noncombustible or consist of a wall that satisfies the requirements of Article 3.1.4.8.

(2) The cladding on *buildings* or parts thereof conforming to Articles 3.2.2.48., 3.2.2.57. or 3.2.2.93. shall conform to Article 3.1.6.9. or be noncombustible.

3) Except as provided in Articles 3.1.4.8. and 3.1.6.9., 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. or 3.1.5.6.

4) Except as provided in Articles 3.1.4.8. and 3.1.6.9., 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 D2898, "Standard Practice for 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 (see Note A-3.2.3.7.(4)(d)(iv)), or

e) the exterior wall assembly complies with Article 3.1.5.5. or 3.1.5.6.

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, "Standard Method of 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 m² 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 3.2.2.93., 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 3.2.2.91. 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 a *building* that is not *sprinklered* 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 Article D-2.3.15. of 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* or *ramp*, or *confined path of travel*, or

b) less than 5 m above the *exit stair* or *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) to (3) shall consist of

- a) glass block conforming to the requirements of Article 3.1.8.16.,
- b) a wired glass assembly conforming to Article D-2.3.15. of 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) the water curtain is located and not more than 3.6 m vertically above the floor immediately below and within 300 mm of a smooth horizontal 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, the water curtain shall 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, and
 - 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
- 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.(5), 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

$$D_o = 2D - \left(\frac{\theta}{90} \times D \right)$$

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, $\theta = 0^\circ$).

(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.(5), 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 (4), a *walkway* connected to a *building* required to be of *noncombustible construction* shall also be of *noncombustible construction*.

3) Except as provided in Sentence (4), a *walkway* connected to a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* shall be of *noncombustible construction* or *encapsulated mass timber construction*.

4) A *walkway* connected to a *building* required to be of *noncombustible construction* or to a *building* or part of a *building* permitted to be of *encapsulated mass timber 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.

5) 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.

6) 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 CAN/CSA-Z662, "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) and (3), 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, "Standard for the 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), (6) and 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) A fire alarm system is not required in a *residential occupancy* that is not *sprinklered*, where
- a) not more than 4 *suites* share a common *means of egress*, or
 - b) each *suite* has direct access to an exterior *exit* facility leading to ground level.

6) A fire alarm system is not required in a *storage garage* conforming to Article 3.2.2.92. 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 coded 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, "Standard for Installation of Fire Alarm Systems."

2) Fire alarm systems shall be verified in conformance with CAN/ULC-S537, "Standard for 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.(8) 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) to (3), shall be provided in conformance with CAN/ULC-S561, "Standard for 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 Sentence (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 m²,

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, "Standard for the 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, "Standard for 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 visible 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 m², 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 a *building* of *residential occupancy* containing *row housing* or in residential blocks where the egress of the *dwelling units* conforms to Sentence 3.3.4.4.(3) or Clause 9.9.9.1.(1)(b) and the *building* is no more than 4 *storeys* above the adjacent ground or *storage garage*, 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, and
 - d) a strobe light located outside the principal entrance of each *dwelling unit* and connected to an internal *smoke alarm* within the *dwelling unit*.
- 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 3.2.4.8.(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 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, "Standard for the Installation of Stationary Pumps for Fire Protection."
- 5) Heat-tracing cables installed on standpipe risers and sprinkler lines shall be electrically supervised by the fire alarm system for loss of power.
- 6) Indication of a supervisory signal in accordance with Sentences (3) and (5) shall be transmitted to the fire department in conformance with Sentence 3.2.4.7.(4).

7) Except as permitted by Sentence (8), 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.

8) 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.

9) A trouble signal indicating the nature of the trouble in accordance with Sentence (3) and (7) 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.

(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. 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, "Standard for the 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 Sentence (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 throughout any *occupancy* on a roof, and

b) *alert signals* are clearly audible in continuously staffed locations, and where there are no continuously staffed locations, throughout the *floor area* and throughout any *occupancy* on a roof.

(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) Audible signal devices in sleeping rooms in a *building of residential or care occupancy* shall emit a low frequency signal. (See Note A-3.2.4.18.(6).)

7) 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 and not less than 65 dBA when any intervening doors between the device and the rest of the *floor area* are closed.

8) Except as permitted by Sentence (12), 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.(8).)

9) 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 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.(9).)

10) In a *building* or part thereof classified as a *residential* or *care occupancy*,

a) separate circuits shall be provided for audible signal devices on each *floor area*, and

b) audible signal devices within *dwelling units* or *suites* of *residential* or *care occupancy* shall be wired on separate signal circuits from those not within *dwelling units* or *suites* of *residential* or *care occupancy*.

(See Note A-3.2.4.18.(9) and (10).)

11) 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.

12) Audible signal devices within *dwelling units* that are wired on separate signal circuits in accordance with Clause (10)(b) need not include a means for manual signal silencing as required by Sentence (8), 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 systems referred to in Articles 3.2.4.22. and 3.2.4.23. have 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.(8).)

13) If a 2-stage fire alarm system has been installed with an automatic signal silence as described in Sentence (12), 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.(8).)

14) An audible signal device forming part of a fire alarm system provided so as to sound alarm signals that are clearly audible throughout any *occupancy* on a roof or balcony, shall be located

a) in the vicinity of an exterior door providing access to a private residential roof deck or balcony with a depth greater than 3m, or

b) on exterior public roofs or balconies.

(See Note A-3.2.4.18.(14).)

3.2.4.19. Visible Signals

1) Where a fire alarm system is installed, visible signal devices shall be provided in addition to *alarm signal* devices

a) in *buildings* or portions thereof intended for use primarily by persons who 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,
- 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,
- e) in *public corridors* serving a Group B, C, D or E *major occupancy*,
- f) in corridors used by the public serving a Group A *major occupancy*,
- g) in not less than 10% of the *suites of residential occupancy* in a hotel or motel (see Note A-3.2.4.19.(1)(g)), and
- h) in washrooms, except those located within
 - i) *suites of residential occupancy*,
 - ii) *suites of care occupancy*, or
 - iii) patients' sleeping rooms.

2) Visible signal devices are permitted to be installed in lieu of audible signal devices in the compartments referred to in Article 3.3.3.6.

3) 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.(3).)

4) Visible signal devices shall be installed in the rooms and spaces required by Article 3.2.4.20. and Section 3.8. and shall

- a) conform to Sentence (5) where a fire alarm system is provided,
- b) conform to Sentence (6) where a fire alarm system is not provided,
- c) 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,
- d) produce between 1 and 3 flashes per second, with the flashes synchronized when more than one strobe light is visible from a single location, and

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 and any hallway serving the living area.

5) The visible signal devices required by Sentence (4) shall

a) consist of strobe lights conforming to CAN/ULC-S526, "Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories," that are designed to operate as part of the fire alarm system, and

b) be located in conformance with the installation requirements for visible signal devices in CAN/ULC-S524, "Standard for Installation of Fire Alarm Systems."

6) Where a fire alarm system is not provided, the visible signal devices required by Sentence (4) shall

a) consist of strobe lights conforming to CAN/ULC-S526, "Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories,"

b) be connected to, and activated by,

- i) the *smoke alarms* required by Article 3.2.4.20. and 9.10.19.1., or
- ii) the *smoke detectors* permitted by Articles 3.2.4.20., 3.2.4.21. or 9.10.19.8., and

- c) be located not less than 2 100 mm above the floor on a wall or ceiling in a location that will maximize effectiveness.
- 7) Each *adaptable dwelling unit* shall be provided with special outlet boxes and cover plates that
 - a) are designed, located and wired specifically to allow strobe lights to operate in conformance with
 - i) Sentence (5) where a fire alarm system is provided, or
 - ii) Sentence (6) where a fire alarm system is not provided,
 - b) are permanently identified as "FIRE – Strobe Light Connection Only,"
 - c) are installed in the locations described in Clause (4)(e), and
 - d) for the purposes of providing power to the strobe lights that may be connected to the outlet boxes, are assumed that the total special outlets for at least 20 percent of the *adaptable 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 (10), *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) In hotels and motels with a fire alarm system, *smoke alarms* installed in rooms required to have a visible signal device connected to the fire alarm system as specified in Clause 3.2.4.19.(1)(g) shall have a visible signal component installed in accordance with CAN/ULC-S524, "Standard for Installation of Fire Alarm Systems."
- 8) In hotels and motels without a fire alarm system, *smoke alarms* installed in sleeping rooms of not less than 10% of the *suites of residential occupancy* shall have a visible signal component installed in accordance with CAN/ULC-S524, "Standard for Installation of Fire Alarm Systems." (See also Note A-3.2.4.19.(1)(g).)
- 9) Except as permitted in Sentence (10), *smoke alarms* referred in Sentence (2) shall
 - a) be installed with permanent connections to an electrical circuit (see Note A-3.2.4.20.(9)(a)),
 - b) have no disconnect switch between the overcurrent device and the *smoke alarm*, and
 - c) except for the visible signal component required in Sentences (7) and (8), 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.
- 10) *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 with a sound pressure level between 75 dBA and 110 dBA within the individual *suites* (see also Note A-3.2.4.18.(4)),

b) except as permitted in Sentence (11), are installed in conformance with CAN/ULC-S524, "Standard for Installation of Fire Alarm Systems," and

c) form part of the fire alarm system.

(See Note A-3.2.4.20.(10).)

11) *Smoke detectors* permitted to be installed in lieu of *smoke alarms* as stated in Sentence (10) are permitted to sound localized alarms within individual *suites*, and need not sound an alarm throughout the rest of the *building*.

12) If more than one *smoke alarm* is required in a *dwelling unit*, the *smoke alarms* shall be interconnected so that the actuation of one *smoke alarm* will cause all *smoke alarms* within the *dwelling unit* to sound.

13) A *smoke alarm* required by Sentence (2) shall be installed in conformance with CAN/ULC-S553, "Standard for the Installation of Smoke Alarms."

14) Except as permitted in Sentence (15), 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*.

15) *Suites of residential occupancy* equipped with *smoke detectors* installed to CAN/ULC-S524, "Standard for Installation of Fire Alarm Systems," as part of the fire alarm system in lieu of *smoke alarms* as permitted by Sentence (10), need not incorporate the manually operated device required in Sentence (14). (See Note A-3.2.4.20.(10).)

16) 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.

17) Sleeping rooms and bed spaces provided in *care occupancies* in a *building* that is not equipped with a 2-stage fire alarm system shall be equipped with visible signal devices conforming to this Article. (See also Clause 3.2.4.3.(1)(c).)

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, "Standard for 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 for High Buildings

(See also Article 3.2.5.20)

1) A voice communication system required by Subsection 3.2.6. 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 *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) Except where a radio antenna system conforming to Sentence 3.2.5.20.(1) is installed, 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), Article 3.2.4.20. and Section 3.8. shall continue to emit a visible signal while voice instructions are being transmitted.

7) Where the facility is not equipped with staff trained to provide instructions over the loudspeakers, a pre-recorded message shall be provided.

3.2.4.23. One-Way Voice Communication Systems

1) 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 one-way voice communication system shall be installed in *buildings* where a 2-stage fire alarm system is installed and whose *occupant load* exceeds 1 000.

2) The one-way voice communication system required by Sentence (1) 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).)

3) Where the facility is not equipped with staff trained to provide instructions over the loudspeakers, a pre-recorded message shall be provided.

4) The one-way voice communication system required by Sentence (1) shall meet the silencing and transmission requirements of Sentences 3.2.4.22.(2) to (4) and (6).

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 m² 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) Except as permitted by Sentence (2), 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.

2) A building of residential occupancy not more than 4 *storeys* in *building height* need not be provided with direct access from the floor areas immediately below, provided

a) there is no common patio, balcony, or deck area, and

b) dwelling units are provided with direct stair access from floor areas immediately below.

3.2.5.4. Access Routes

1) Every *building* shall be provided with access routes for fire department vehicles

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

1) Except as provided by Sentences (2) and (3), access routes required by Article 3.2.5.4. shall be located so that

a) 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)(a).), and

b) 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 required for fire department use, measured horizontally from the face of the *building*. (See Note A-3.2.5.5.(1).)

2) Paths of travel for firefighters shall not be more than 45 m to the principal *suite* entry for

a) a *building* or portion of a *building*, of *residential occupancy* containing *dwelling units* with means of egress provided directly to the exterior at adjacent ground level, or

b) 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)(b).)

3) The path of travel for firefighters to the main entry of a *dwelling unit* permitted by Clause (2)(a) may be increased to

a) 65 m where

i) *dwelling units* are separated from adjacent *floor areas* by a *fire separation* with at least 1 h *fire-resistance rating*,

ii) the *building sprinkler system* is hydraulically designed to flow all sprinklers within a compartment as required by the relevant sprinkler design standard plus 2 additional sprinklers in that compartment or adjacent connected compartment,

iii) each bathroom, clothes closet, linen closet, and pantry must have sprinkler coverage, notwithstanding the exemptions set out in the applicable sprinkler design standard,

iv) 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*,

v) *sprinkler systems* are monitored by a fire alarm system or residential fire warning system and by an off-site monitoring service,

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 *building* is provided with a fire alarm system and passive graphic with annunciator, or

b) 90 m where

i) the requirements of Subclauses (a)(i) to (a)(vii) are met,

ii) no principal *dwelling unit* or its *ancillary residential unit* is located above another *dwelling unit*,

iii) 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*, and

iv) the location of the fire department hose connections required by Subclause (b)(iii) are indicated on the fire alarm system passive graphic.

4) The access route from the hydrant location to the *building* location or 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. Access Route Design 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 3.2.2.51. or 3.2.2.60., 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 (2), 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.

- 2) A standpipe system need not be installed in a *storage garage* conforming to Article 3.2.2.92., provided the *building* is not more than 15 m high.

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 (5), 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, “Standard for the 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) 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.(4)(c)).

5) A fire department connection shall be provided for every standpipe system.

6) 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.

7) 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, "Standard for the 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) to (4) and (9), an automatic *sprinkler system* shall be designed, constructed, installed and tested in conformance with NFPA 13, "Standard for the Installation of Sprinkler Systems." (See Note A-3.2.5.12.(1).)
- 2) Instead of the requirements of Sentence (1), NFPA 13R, "Standard for the 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 Article 3.2.2.47., 3.2.2.49., 3.2.2.51., 3.2.2.52. or 3.2.2.55., 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, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes," is permitted to be used for the design, construction and installation of an automatic *sprinkler system* installed

a) in a *building of residential occupancy* throughout that contains not more than two *principal dwelling units*, where

i) each *principal dwelling unit* has its own sprinkler water supply, and

ii) a passive purge *sprinkler system* design is used as described in NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes." (See Note 3.2.5.12.(3)(a)(ii).)

b) in a *building of care occupancy*, provided

i) it contains not more than two *suites of care occupancy*,

ii) it has not more than five residents throughout, and

iii) a 30-minute water supply demand can be met, and

c) in a *building of residential occupancy* throughout that contains more than two *principal dwelling units*, provided

i) no *principal dwelling unit* or its *ancillary residential unit* is located above another *principal dwelling unit* or its *ancillary residential unit*,

ii) all *principal dwelling units* are separated by a vertical *fire separation* having a *fire-resistance rating* of not less than 1 h that provides continuous protection from the top of the footing to the underside of the roof deck, with any space between the top of the wall and the roof deck tightly filled with mineral wool or *noncombustible* material,

iii) each *principal dwelling unit* has its own sprinkler water supply provided in accordance with NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes,"

iv) a passive purge *sprinkler system* design is used as described in NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes," and

v) where the *sprinkler system* is taken into consideration for the reduction of *limiting distance*, all rooms, including closets, bathrooms and attached garages, that adjoin an *exposing building face* are *sprinklered*, notwithstanding any exemption stated in NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes.", and

d) a detached *ancillary building* subordinate to a principal detached house or duplex on the same parcel of land, where the associated *building* is also *sprinklered* to NFPA 13D in accordance with this Sentence, where

i) each bathroom, clothes closet, linen closet, and pantry must have sprinkler coverage, notwithstanding the exemptions set out in NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes," and

ii) a passive purge *sprinkler system* design is used as described in NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes." (see Note 3.2.5.12.(3)(a)(ii))

(See Note A-3.2.5.12.(2) also see 3.2.5.5. and 9.10.20.3.)

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) Notwithstanding the requirements of the standards referenced in Sentences (1) and (2) regarding the installation of automatic *sprinkler systems*, in *buildings* conforming to Article 3.2.2.48., 3.2.2.51., 3.2.2.57., 3.2.2.60., or 3.2.2.93., 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.(7).)

8) 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.(8).)

9) 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, "Standard for the Installation of Sprinkler Systems."

10) Fast response sprinklers shall be installed in *residential occupancies*, *care occupancies*, *treatment occupancies* and *detention occupancies*. (See Note A-3.2.5.12.(10).)

11) Except as permitted by Sentence (12), all unenclosed balconies, exterior decks, porches and patios of *buildings* *sprinklered* to NFPA 13R or NFPA 13, shall be provided with sprinklers 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 or assemblies satisfying the criteria of Clause 3.1.5.5.(1)(b).

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* or carport attached to a *building of residential occupancy* where a *fire separation* is not provided between the *storage garage* or carport and adjacent *floor areas*.

14) Where NFPA 13R, "Installation of Sprinkler Systems in Low-Rise Residential Occupancies," is used for the design, construction and installation of an automatic *sprinkler system* installed in a residential *building* containing not more than four *dwelling units* and accessory uses, water service pipe, as defined in the Building By-law Book II (Plumbing Systems) is permitted to be designed and constructed per requirements in NFPA 13D.

15) Where a single detached or duplex building within the scope of Division A, Article 1.3.3.3. is permitted to be design to NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes," a fire department connection is not required despite the requirements of the referenced standard.

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/m².

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 Note 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, "Standard for the 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*,
- 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*, and
- c) *buildings of residential occupancy* only with no more than two principal *dwelling units*.

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.

4) A radio antenna system shall comply with ANSI/CAN/UL 2524 "Standard For Safety In-building 2-Way Emergency Radio Communication Enhancement Systems."

3.2.6. Additional Requirements for High Buildings

(See Note A-3.2.6.)

3.2.6.1. Application

- 1) Except as provided in Sentence (2) and (3), this Subsection applies to a *building*

- a) of Group A, D, E or F *major occupancy* classification that is more than
 - i) 36 m high, measured between *grade* and the floor level of the top *storey*, or
 - ii) 18 m high, measured between *grade* and the floor level of the top *storey*, and in which the cumulative or total *occupant load* on or above any *storey* above *grade*, other than the *first storey*, divided by 1.8 times the width in metres of all *exit* stairs at that *storey*, exceeds 300,
 - b) containing a Group B *major occupancy* in which the floor level of the highest *storey* of that *major occupancy* is more than 18 m above *grade*,
 - c) containing a *floor area* or part of a *floor area* located above the third *storey* designed or intended as a Group B, Division 2 or 3 *occupancy*, or
 - d) containing a Group C *major occupancy* whose floor level is more than 18 m above *grade*.
- 2) Except as required in Clause 3.2.6.1.(1)(c), this Subsection applies to a *building* or part of a *building* constructed in conformance with Article 3.2.2.57. or 3.2.2.93. in which the floor level of the highest *storey* is more than 18 m above *grade*.

3) 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 firefighters 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).),
- e) *exit* stair enclosures are constructed as *fire separations* with a *fire-resistance rating* of not less than a 2 h, and
- 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 m² for every door between the stair shaft and a *floor area*, but not less than 1.8 m²,
 - 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 smoke detectors installed in a) each floor area in front of the elevator(s), b) the elevator hoistway c) the elevator machine room, or d) any room containing elevator control equipment.

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.

8) Smoke detectors installed in an elevator lobby to comply with Clause 3.2.6.4.(5)(a) shall be located such that the detector is not more than its rated detection distance from the elevator doors that it serves.

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 m² 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, "Standard Method for 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 the Safety Standards Act and pursuant regulations 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 conforming to Article 3.2.4.22. shall be provided in *all buildings conforming to 3.2.6.1.(1)*.

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 *accessible* path of travel required by Section 3.8., 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 level of the illumination required by Sentence (1) shall be 10 lx.
- 3) Rooms and spaces used by the public shall be equipped to provide illumination as described in Sentences (4) to (7) and Article 9.34.2.7.
- 4) The minimum level of illumination over the entire length of escalators and moving walks shall be not less than 100 lx at the level of the treads and walking surfaces.

5) Except as provided in Sentence (6) and except for light switches and internally illuminated controls, the minimum level of illumination at controls required by Article 3.8.2.6. shall be not less than 100 lx.

6) Where visual information is provided at controls referred to in Sentence (5), the minimum level of illumination at the controls shall be not less than 200 lx, except where the visual information is internally illuminated.

7) Except for internally illuminated signs, the minimum level of illumination at signs displaying visual information required by Clauses 3.4.6.10.(5)(b) and 3.4.6.16.(5)(g), Subclause 3.4.6.16.(5)(l)(ii), Clause 3.4.6.16.(6)(d), Sentence 3.4.6.18.(3), Clause 3.4.6.18.(4)(a) and Articles 3.4.6.19. and 3.8.2.10. shall be not less than 200 lx.

8) 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 daycare facilities for children,
- k) food preparation areas in commercial kitchens,
- l) public washrooms,
- m) locations where doors are equipped with an electromagnetic lock as described in Clauses 3.4.6.16.(5)(k) and (6)(g), and
- n) universal washrooms, universal shower rooms and accessible change spaces required by Article 3.8.2.8.

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 3.2.2.51. or 3.2.2.60., 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) to (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 3.2.2.51. or 3.2.2.60.,
 - 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 36 m high measured between *grade* and the floor level of the top *storey*, other than in a *building* complying with Sentence 3.2.6.1.(2), and every elevator for firefighters in conformance with Sentence (2),

b) except as provided in Sentence (4), equipment that supplies water for fire suppression as required by Articles 3.2.5.7. and 3.2.5.8. and Sentences 3.2.5.12.(1) and (2) and 3.2.5.18.(1), if the supply depends solely 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.

4) The emergency power supply required by Clause (1)(b) for the equipment that supplies water for fire suppression need not be provided for *sprinkler systems* conforming to NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes."

3.2.7.10. Protection of Electrical Conductors

1) The protection of 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, for:

- a) electrical conductors located within *buildings* identified in Article 3.2.6.1. 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 serving fire pumps, and
- c) electrical conductors serving mechanical systems serving
 - i) areas of refuge identified in Clause 3.3.3.6.(1)(b),
 - ii) *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, "Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data 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)) (see also Clause 3.2.6.5.(6)(b)), 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, "Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data 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 m² 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 m²,
- b) the *building* is *sprinklered* throughout,
- c) closely spaced sprinklers and associated draft stops are installed around the openings in conformance with NFPA 13, "Standard for the Installation of Sprinkler Systems," and
- d) 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)).

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, "Standard for the 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, "Standard for 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) and (3), 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

- 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., 6.3.1.6. 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

(See Note A-3.3.1.3.)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 podium, terrace, platform or contained open space used or intended for *occupancy*, to *exits* in conformance with the requirements of Section 3.4.

4) *Means of egress* from an *occupancy* on a roof serving only a single *dwelling unit* shall be provided in conformance with Article 3.3.4.4.

5) Except as permitted by Sentence (4) and except as required by Sentence (6), a *means of egress* at the roof level, designed in conformance with the requirements for *exits* in Section 3.4., shall be provided from an *occupancy* on a roof.

6) At least two separate *means of egress* at the roof level, designed in conformance with the requirements for *exits* in Section 3.4., shall be provided from a roof used or intended for an *occupant load* more than 60.

7) For the purposes of Sentences (5) and (6), the occupied area of the *occupancy* on a roof shall be used in place of *floor area*.

8) A rooftop enclosure that does not serve as part of a *means of egress* for an *occupancy* on a roof in accordance with Sentence (5) or (6) 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.

9) A rooftop enclosure which is more than 200 m² in area shall be provided with at least 2 *means of egress*.

10) 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 m², or
- b) the travel distance measured from any point in the *service space* to a point of egress is more than 25 m.

11) 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.

12) Except as permitted by this Section and by Sentence 3.4.2.1.(2), at the point where a doorway referred to in Sentence (11) 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.(4) 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 m²,
 - 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)

<i>Occupancy of Room or Suite</i>	Maximum Area of Room or <i>Suite</i> , 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:

(1) 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)

<i>Occupancy of Room or Suite</i>	Maximum Area of Room or <i>Suite</i> , 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 <i>suites</i>	100
individual <i>suites</i>	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:

(1) 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

(see Article 11.3.8.1.)

3.3.1.8. Headroom and Protruding Objects

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).)

2) Except as permitted by Sentence (3) and except for paths of travel in *service rooms* and *dwelling units*, protruding *building* elements located within 1 980 mm of the floor shall not project more than 100 mm horizontally into paths of travel in a manner that would create a hazard. (See Note A-3.3.1.8.(2) and (3).)

3) The horizontal projection of a protruding *building* element referred to in Sentence (2) is permitted to be more than 100 mm, provided the clearance between the protruding element and the floor is less than 680 mm. (See Note A-3.3.1.8.(2) and (3).)

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) If a corridor contains an *occupancy*, the *occupancy* shall not reduce the unobstructed width of the corridor to less than its required width.

4) 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*.

5) 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 m² 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

(See also Sentence 3.8.3.6.(17).)

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 850 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 850 mm,

c) not open onto a step, and

d) have a threshold not more than 13 mm higher than the surrounding finished floor surface, and where it is higher than 6 mm, shall be beveled to a slope not steeper than 1 in 2, 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 11.3.8.1.(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)(b) 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 1 100 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) Except as permitted by Sentence (11), a door in an *access to exit* is permitted to be equipped with an electromagnetic lock conforming with Sentences 3.4.6.16.(5) or (6). (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) An egress door from a *public corridor* or lobby that provides a *means of egress* through a *suite* of Group D *occupancy* to an *exit* may, where *acceptable* to the *Chief Building Official*, be provided with an electromagnetic locking device where

a) the egress door is designed to prevent locking during normal working hours and is provided with signage stating “*This door shall not be locked during the normal hours of business operation.*”,

b) the *public corridor* or lobby, does not contain an *occupancy* and serves only *suites* of Group D *occupancy*,

c) the *public corridor* or lobby is provided with direct access to at least one *exit*,

d) the *building* is *sprinklered* and provided with a *fire alarm system*, and

e) all electromagnetic locking devices along the path to the exit are designed to

i) release immediately on an *alarm signal* or from a *smoke detector* in the *public corridor* or lobby, or upon loss of power controlling the electromagnetic locking mechanism and its associated auxillary control,

ii) release immediately upon actuation of a manually operated switch accessible only to authorized personnel, and

iii) be reset manually by actuation of the switch referred to in Subclause (ii) upon its release.

(See Note A-3.3.1.13.(11).)

3.3.1.14. Ramps and Stairways

1) Except as permitted by Sentence (2), 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).
- 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 Sentences (3) and 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) Openings through *guards* other than those required by Sentence (1) that serve *occupancies* other than *industrial occupancies* shall be of a size that
- a) prevents the passage of a spherical object whose diameter is 100 mm, or
 - b) permits the passage of a spherical object whose diameter is 200 mm.

(See Note A-9.8.8.5.(4).)

4) 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 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 floor pits in *repair garages*,
 - c) to loading docks, or
 - d) 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. Tactile Walking Surface Indicators

- 1) Except as provided in Sentence (2), tactile attention indicators complying with Clauses 4.3.5.3.1, 4.3.5.3.3 and 4.3.5.3.4 of CSA B651, "Accessible design for the built environment," shall be installed
- a) at the top of *flights* of stairs that are unenclosed, and
 - b) at drop-off edges with a change in elevation greater than 300 mm that are unprotected by a *guard*.
- (See Note A-3.3.1.19.(1).)

2) Sentence (1) does not apply to *service spaces*, bleachers addressed in Subsection 3.3.2., *stages*, loading docks, *industrial occupancies*, within *dwelling units*, and to stairs and drop-off edges serving not more than two *dwelling units*.

3.3.1.20. 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 glazing conforming to CAN/CGSB-12.1, "Safety Glazing," 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 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, provided the opening is at least 100 mm above the floor, or
- b) a *guard* in conformance with Article 3.3.1.18.

3.3.1.21. 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 combination smoke/*fire 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*.

3.3.1.22. 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.

3.3.1.23. 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.

3.3.1.24. 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-3.3.1.24.(1).)

3.3.1.25. 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).

3.3.1.26. 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 complies with Sentence 3.4.6.16.(3).

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 m² 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, "Standard for the 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 *Chief Building Official* 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. Safety Glazing

1) Except as permitted in Sentence (3), glazing in all fixed and operable panels of doors shall conform to Class A of CAN/CGSB-12.1, "Safety Glazing."

2) Except as permitted in Sentence (4), glazing in all fixed and operable panels of windows shall conform to Class A of CAN/CGSB-12.1, "Safety Glazing."

3) Glazing in individual fixed or operable panels of a door need not comply with Sentence (1), where

a) the bottom exposed edge of the glazing is located more than 1 525 mm above the walking surface on each side of the door, or

b) the glazed opening in the door does not permit the passage of a sphere whose diameter is more than 75 mm.

4) Glazing in individual fixed or operable panels of a window need not comply with Sentence (2), where

a) the bottom exposed edge of the glazing is located more than 1 525 mm above the walking surface on each side of the window, or

b) the glazing is located more than 915 mm away from the walking surface on each side of the window measured perpendicular to the plane of the glazing.

3.3.2.18. Deleted

(See Article 3.1.2.8.)

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 m² 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 m² 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 3.2.2.93. 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), *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) to (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) to (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)E 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 2.0 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 2.0 m 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) one 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 that can only be released with the use of tools or special knowledge to control the free swinging or sliding operation 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.

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 m² for each door that opens into the vestibule but not less than 0.4 m², or

ii) mechanically at a rate of 14 m³/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 as provided in Sentence 3.9.3.1.(5) or unless the *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 Safety Standards Act and pursuant regulations. (See Note A-3.3.6.2.(4).)

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, "Standard on 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 m³ 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 m² 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

3.3.7.7. 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 or other intervening room or space, the stair tower, vestibules, and intervening room or space shall

a) be provided with glazing arranged to providing the greatest unobstructed view from the *storage garage* into the stair tower or to the elevator,

b) if required by Subsection 3.2.6. to be constructed as a *fire separation* with a *fire-resistance rating*, a vertical *fire separation* containing glazing may be constructed

i) as a *fire separation* with a *fire-resistance rating* of not less than 1 hr,

eii) with full or half glazed *closures* with a *fire-protection rating* of not less than 45 min between the vestibule or other intervening room or space leading to the stair tower or elevator, and

iii) 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.

c) *closures* permitted by Clause (2)(b)(ii) may be glazed with clear wired glass in steel frames or fire protective glazing in fire-resistive frames complying with 3.1.8.16.,

(See Note A-3.3.7.7.(2).)

3) A stair shaft serving a *storage garage* or portion of a *storage garage* with public access and which is connected to a *storey* containing an *occupancy* other than a *storage garage*, shall terminate at that *storey*. (See Note A-3.3.7.7.(3))

4) Except for open-air *storage garages* and *buildings of residential occupancy*, a *storage garage* shall be provided with *exits*

a) which only serve the *storage garage*, do not provide a common path of travel for other *floor areas*, and exit directly outside the *building*, or

b) serve the *storage garage* and *floor areas* at the *exit* level where

i) the *exit* from the stair extends to the exterior door without adjoining dead-ends corridors,

ii) interior and exterior doors in the *exit* from the *storage garage* to the exterior are designed to maximize visibility of the egress route, adjoining spaces within the *exit* enclosure, and spaces provided with door opening into the *exit* enclosure,

iii) doors providing access into the *exit* from *floor areas* other than the *storage garage* are provided with hardware to prevent vandalism and unauthorized access to the *building floor area*, and

iv) the *exit* corridor has an average illumination level of at least 220 lx is maintained.

(see Note A-3.3.7.7.(3) and (4))

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 *building* is

i) fully *sprinklered*, and

ii) equipped with a fire alarm system in conformance with Subsection 3.2.4.,

b) each storage area is provided with

i) individual storage lockers separated from the remainder of the *floor area* by a solid wall assembly without openings, and

ii) provided with a continuous steel mesh installed across the entire storage area,

c) the storage locker

i) does not exceed 50 m² in *floor area*,

ii) travel distance to the egress door does not exceed 10 m, and

iii) is equipped with its own sprinkler head, no lower than 460 mm below the sprinkler head, and

d) the storage locker door is

i) an overhead door serves a single storage locker, and

ii) equipped with a failsafe locking mechanism.

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 3.3.1.20. 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)

<i>Occupancy of Floor Area</i>	Maximum <i>Floor Area</i> , 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)

<i>Occupancy of Floor Area</i>	Maximum <i>Floor Area</i> , 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 rooftop enclosures that comply with Sentences 3.3.1.3.(8) and (9) or where they are served by *means of egress* in conformance with Sentences 3.3.1.3.(4) to (5).

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
<i>Assembly occupancy</i>	150	15
<i>Residential occupancy</i>	100	15
<i>Business and personal services occupancy</i>	200	25
<i>Mercantile occupancy</i>	150	15
<i>Medium-hazard industrial occupancy</i>	150	10
<i>Low-hazard industrial occupancy</i>	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 3.2.2.92., 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 m² of area of treads and landings for each occupant of the *interconnected floor space* (see Note A-3.4.3.2.(6)(a)), 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 m² of space for each occupant of that floor level of the *interconnected floor space*.

(See Note A-3.4.3.2.(6).)

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.-A and 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⁾	850

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 and Passageways, mm	Ramps, mm		Stairs, mm		Doorways, mm	
		Not serving patients' or residents' sleeping rooms ⁽¹⁾	Serving patients' or residents' sleeping rooms ⁽¹⁾	Not serving patients' or residents' sleeping rooms ⁽¹⁾	Serving patients' or residents' sleeping rooms ⁽¹⁾	Not serving patients' or residents' sleeping rooms ⁽¹⁾	Serving 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) Minimum widths of ramps, stairs and doorways do not apply within individual suites of care occupancy.

(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, and
 - 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 providing visual information 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 providing visual information 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, be constructed in conformance with CSA C22.2 No. 141, "Emergency lighting equipment," or

b) where illumination of the sign is not powered by an electrical circuit, be constructed in conformance with CAN/ULC-S572, "Standard for Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems."

(See Note A-3.4.5.1.(3).)

4) Externally illuminated *exit* signs shall be continuously illuminated and be constructed in conformance with CAN/ULC-S572, "Standard for 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. Exit Signs with Tactile Information

1) An *exit* sign displaying the word “EXIT” in tactile form that complies with Subsection 3.8.3. shall be mounted on the approach side of *exit* doors described in Sentence 3.4.5.1.(1), in the direction of travel to the *exit*.

3.4.5.3. 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.

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 50 mm, or
 - b) a non-circular cross-section with a perimeter not less than 100 mm and not more than 160 mm and whose largest cross-sectional dimension is not more than 57 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.

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.(11)).

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*.

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* 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 provided in Sentence (2) and (3) and as provided for aisles in Article 3.3.2.5., *ramps* shall have a uniform slope along their length and a maximum slope of 1 in 12.

2) Except as provided in Section 3.8., *ramps in industrial occupancies* shall have a uniform slope along their length and a maximum slope of

a) 1 in 6 for interior *ramps*, and

b) 1 in 10 for exterior *ramps*.

3) Curb ramps shall be designed in accordance with Clause 3.8.3.4.(1)(b).

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) a rise between successive treads not less than 125 mm and not more than 180 mm, and

b) a riser with either no rakeback or a rakeback of not more than 38 mm, or if nosing is provided, the underside of the nosing with an angle of not less than 60° from the horizontal.

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) Except as permitted by Sentence (10), the top of the nosing of stair treads shall have a rounded or beveled edge extending not less than 6 mm and not more than 13 mm measured horizontally from the front of the nosing.
- 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.

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 m² of clear floor space per person, except that 1.5 m² shall be provided for each person in a wheelchair and 2.5 m² 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

(See also Sentence 3.8.3.6.(17).)

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 **Clauses 11.3.8.3.(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 **Sentences (2) and (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) they

i) serve storage *suites* not more than 28 m² in area that are on the *first storey* in warehousing *buildings*, and

ii) open directly outdoors at ground level, or

d) they serve individual self-service storage units referred to in Section 3.9.

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, "Safety Glazing," 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 glazing conforming to
 - i) CAN/CGSB-12.1, "Safety Glazing," 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 (5) and (6) 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)(b) 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 complying with Sentence (3) 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) The device required in Sentence (2) shall

a) extend across not less than one half of the width of the door,

b) release the latch, and

c) 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*.

4) 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.

5) Except as permitted in Sentence (8), 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 (6), the locking device releases immediately upon actuation of a manually operated switch readily accessible only to authorized personnel,

e) except as provided in Clause (1), 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 visual information sign complying with Subsection 3.8.3. 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) a tactile information sign complying with Subsection 3.8.3. is permanently mounted near the door to indicate that the locking device will release within 15 s of applying pressure to the door-opening hardware,

i) the total time delay for all electromagnetic locks in any path of egress to release is not more than 15 s,

- j) 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 visible 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),
 - k) emergency lighting complying with Sentence 3.2.7.3.(1) is provided, and
 - l) where they are installed on doors providing emergency crossover access to *floor areas from exit stairs directly into a public corridor, or publicly accessed floor area acceptable to the Chief Building Official*, in accordance with Article 3.4.6.18.,
 - 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,
 - ii) a visual information sign displaying the words “Re-entry door unlocked by fire alarm” that complies with Subsection 3.8.3. is permanently mounted on the door on the *exit* stair side, and
 - iii) a tactile information sign displaying the words “Re-entry door unlocked by fire alarm” that complies with Subsection 3.8.3. is permanently mounted near the door on the exit stair side.
- (See Notes A-3.4.6.16.(5) and A-3.3.1.13.(7).)
- 6) 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 visual information sign complying with Subsection 3.8.3. that displays the words “Emergency exit unlocked by fire alarm” is permanently mounted on the door,
 - e) a tactile information sign complying with Subsection 3.8.3. that displays the words “Emergency exit unlocked by fire alarm” is permanently mounted near the door,
 - f) the operation of any by-pass switch, where provided for testing of the fire alarm system, sets off an audible signal and a visible signal at the fire alarm annunciator panel and at the monitoring station referred to in Sentence 3.2.4.7.(4), and
 - g) emergency lighting complying with Sentence 3.2.7.3.(1) is provided.

(See Note A-3.4.6.16.(6).)

7) 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 between 900 mm and 1 100 mm above the finished floor.

8) As an alternative to the requirements of Clauses (e), (f) and (g) in Sentence (5), *acceptable* door release hardware for an electromagnetic lock shall be located in close proximity to the egress 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, and

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.(8).)

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.(5) 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*, or publicly accessed *floor area acceptable to the Chief Building Official*, and comply with Sentences 3.4.6.16.(5) and (6).

3) Doors referred to in Sentence (1) shall be identified by visual and tactile information signs complying with Subsection 3.8.3. mounted 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 visual and tactile information signs complying with Subsection 3.8.3. mounted 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 m² 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 and Identification of Stair Shafts

1) Arabic numerals indicating the assigned floor number in both visual and tactile forms in accordance with Subsection 3.8.3. shall be mounted permanently on the wall on the stair side and on the floor side at the latch side of doors to *exit* stair shafts.

2) Upper case letters indicating the designation assigned to each *exit* stair shaft in both visual and tactile forms in accordance with Subsection 3.8.3. shall be mounted permanently on the wall on the stair side and on the floor side at the latch side of doors to *exit* stair shafts.

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 m².

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 Safety Standards Act and pursuant regulations.

(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 Safety Standards Act and pursuant regulations.

(See Note A-3.5.2.1.(1).)

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.

<i>Fire-Resistance Rating of Fire Separation Required for Floor Assembly</i>	<i>Minimum Fire-Resistance Rating of Vertical Service Space for Elevator Hoistway</i>	<i>Minimum Fire-Resistance Rating of Vertical Service Space for Dumbwaiters</i>
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 provided in Sentence (2), if one or more elevators are provided in a *building*, at least one elevator on each *storey* with access to an elevator shall have 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) The inside dimensions stipulated in Sentence (1) do not apply to limited-use/limited-application elevators designed and installed in accordance with ASME A17.1/CSA B44, "Safety Code for Elevators and Escalators."

3) An elevator satisfying the requirements of Sentence (1) shall be clearly identified on the main entrance level of the *building*.

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 Safety Standards Act and pursuant regulations.

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 Article D-2.3.15. of 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 Safety Standards Act and pursuant regulations 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 rooftop *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. Storage of Combustible Refuse and Recycling

1) Except as required by Sentence 3.6.3.3.(9), a room for the temporary storage of *combustible* refuse and materials for recycling shall be

- a) separated from the remainder of the *building* by a *fire separation* with a *fire-resistance rating* not less than 1 h, except that a *fire separation* with a *fire-resistance rating* not less than 45 min is permitted where the *fire-resistance rating* of the floor assembly is not required to exceed 45 min, 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 required by the Safety Standards Act and pursuant regulations 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 3.3.1.21.(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)

<i>Fire-Resistance Rating of Fire Separation Required for Floor Assembly</i>	<i>Minimum Fire-Resistance Rating of Vertical Service Space</i>
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 3.1.5.15.

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, "Standard for 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, "Standard Method of 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), 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* or in *buildings* or parts of *buildings* permitted to be of *encapsulated mass timber 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, "Standard Method of 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 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, "Standard Methods of Test for Air Ducts,"
 - b) conform to Article 3.1.5.18. in a *building* required to be of *noncombustible construction* or in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*,
 - c) conform to Subsection 3.1.9.,
 - d) are used only in horizontal runs in a *building* required to be of *noncombustible construction* or in a *building* or part of a *building* permitted to be of *encapsulated mass timber 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, "Standard Methods of 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, "Standard Method for 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, "Standard Method for 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 C411, "Standard Specification for 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 3.1.5.15.
- 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 C411, "Standard Specification for 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 in a *building* or part of a *building* permitted to be of *encapsulated mass timber 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, 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) to (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) 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

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 provided in Sentence (2), for the purpose of this Subsection, the *occupant load* shall be determined in accordance with Subsection 3.1.17.
- 2) For the purpose of this Subsection, the *occupant load* for *floor areas* that are classified as an *industrial occupancy* is permitted to be based solely on the total number of staff for which the *floor area* is designed, where the *floor area* is only intermittently occupied or where the presence of occupants is transitory. (See Note A-3.7.2.1.(2).)
- 3) Except as permitted in Sentence (4), 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.
- 4) 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 (2) and 3.7.2.9., 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.
- 2) Both sexes are permitted to be served by a single water closet if the *occupant load* in an *occupancy* referred to in Sentence (4), (8), (10), (11), (12) or (14) is not more than 25.

3) 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.

4) Except as permitted by Sentences (2), (5), (6), (15) and (16) 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.(4)

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

5) The number of water closets required for primary schools and daycare facilities, including daycare facilities for children shall be at least one for each 30 males and one for each 25 females.

6) 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.

7) 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*.

8) Except as permitted by Sentences (2) and (5), the number of water closets required for a *care* or *residential occupancy* shall be at least one for each 10 persons of each sex.

9) At least one water closet shall be provided for each *dwelling unit*.

10) Except as permitted by Sentence (2) and (15), 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.(10) and (14)

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

11) Except as permitted by Sentences (2), (14), and (15), 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.

12) Except as permitted by Sentence (2) and (15), 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.(12)

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

13) In a *building* whose *floor area* is more than 600 m² 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.

14) The number of water closets required in a *suite* of *mercantile occupancy* whose area is not more than 500 m² is permitted to be determined in accordance with Table 3.7.2.2.-B based solely on the total number of staff.

15) 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 m²,
- 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 Article 3.8.3.13.

16) 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 Article 3.8.3.13.

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)(b),

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. Safety Glazing

1) Glazing used for a shower or bathtub enclosure shall conform to Class A of CAN/CGSB-12.1, "Safety Glazing."

3.7.2.5. 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.

3.7.2.6. Floor Drain

1) A floor drain shall be installed in a washroom containing a urinal equipped with an automatic flushing device.

3.7.2.7. Grab Bars

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.

3.7.2.8. 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)(b),

c) have a slip-resistant bottom surface,

d) have grab bars that

i) conform to Sentence 3.7.2.7.(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.

3.7.2.9. Gender Neutral Washroom Requirements

(See Note A-3.7.2.9.)

1) Except as permitted by Sentence (5), a *building* or non-residential *suite* with an occupant load exceeding 200 persons, at least one gender neutral washroom facility complying with Sentences (2) through (6) shall be provided for the *building* or *suite*, providing at least one *accessible* water closet, plus one additional water closet for each additional increment of 100 persons after the first 200 persons. (See Note A-3.7.2.9.(1)).

2) Waterclosets required by Article 3.7.2.2. may be substituted with individual toilet stalls in gender neutral washroom facilities that

- a) have partition walls and doors that are full height with a minimum height of 2000 mm (6'-7") and clear space above of at least 50 mm,

- b) have a locking devices equipped with

- i) display mechanisms to indicates on the outside of the stall door if the stall is occupied, and

- ii) means to enable the lock to be released from the outside in an emergency, and

- c) have a duress alarm in the common area and within each stall in facilities intended for the use of the public.

3) The entrance serving the gender neutral washroom facilities shall have

- a) no door, or

- b) fully or partially glazed doors with an open transom or louvered grill.

4) A gender neutral washroom shall

- a) provide a minimum 42" zone of circulation space in front of the sink area,

- b) be provided with a minimum lighting level of 200 lx at the floor, and

- c) be provided with appropriate signage identifying the washroom.

5) Individual self-contained washroom facilities provided with a water closet, lavatory, shelf and mirror may be substituted for gender neutral washroom stalls that would otherwise be required by Sentence (1) on an equal basis.

6) At least one stall or a self-contained washroom facility in a gender neutral washroom provided in accordance with this Article shall be designed to be accessible in conformance with Article 3.8.3.12. or 3.8.3.13. as applicable.

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

(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) *Alterations* and additions to existing *buildings* shall be provided to the extent required in Division B, Part 11.

4) *Dwelling units* required to be *adaptable dwelling units* shall be designed in accordance with Subsection 3.8.5.

3.8.2. Application

3.8.2.1. Exceptions

(See Note A-3.8.2.1.)

1) Except as required by Sentence (2), the requirements of this Section apply to all *buildings* except

a) detached houses, semi-detached houses, duplexes, triplexes, townhouses, **row housing**, and boarding houses (see Note A-1.4.1.2.(1) of Division A, Secondary Suite),

b) *buildings* of Group F, Division 1 *major occupancy*, and

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

2) *Adaptable dwelling units* shall be designed and constructed in accordance with Subsection 3.8.5.

3.8.2.2. Entrances

(See Note A-3.8.2.2.)

1) Except for service entrances and entrances to *suites* described in Clause 3.8.2.3.(2)(l), all pedestrian entrances to an *accessible storey* of a *building* referred to in Sentence 3.8.2.1.(1) shall be *accessible* and shall connect to an *accessible* exterior path of travel complying with Sentence 3.8.2.5.(1).

2) An *accessible* entrance required by Sentence (1) shall be designed in accordance with Subsection 3.8.3.

3) 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.

4) 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*.

3.8.2.3. Areas Requiring Access

(See Note A-3.8.2.3.)

1) Except as permitted by Sentence (2), an *accessible* path of travel from the entrances required by Sentence 3.8.2.2.(1) to be *accessible* shall be provided throughout the entrance *storey* and within all other normally occupied areas of *buildings*. (See Article 11.3.8.1. for additional requirements regarding *floor areas* which an *accessible* path of travel is required.)

2) Access is not required

a) to *service rooms*,

b) to elevator machine rooms,

c) to janitors' rooms,

d) to *service spaces*,

e) to crawl spaces,

f) to *attic or roof spaces*,

g) to the floor level above or below the entrance level in *suites* with more than one level, provided the floor level above or below (see Note A-3.8.2.3.(2)(g))

i) is not served by a ramp, a passenger elevator, a platform-equipped passenger-elevating device, an escalator or an inclined moving walk,

ii) is less than 600 m² in *floor area*,

iii) contains only facilities that are also contained on the entrance level, and

iv) does not contain an *assembly occupancy* more than 100 m² in *floor area*,

h) within a parking level with no *accessible* parking spaces,

i) within *high-hazard industrial occupancies*,

j) 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,

k) within floor levels of a *suite* of *residential occupancy* that are not at the same level as the entry level to the *suite*,

l) within a *suite* of *residential occupancy* that has not been designated by this **By-law** or an *authority having jurisdiction* to be *accessible* or designed and constructed as an *adaptable dwelling unit*, or

m) in a *building* of *residential occupancy* that is not more than two *storeys* that contains multiple *dwelling units* and common interior space served by a common *building* entrance, on a floor level that

i) is not served by a ramp, passenger elevator, a platform-equipped passenger-elevating device, an escalator or an inclined moving walk,

ii) is less than 600 m² in *floor area*,

iii) is not a *building* entrance level, and

iv) does not contain common facilities that are not also provided on an *accessible* 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 3.8.3.22. for additional requirements.)

4) The number of spaces designated for wheelchair use within waiting rooms or areas with fixed seats shall conform to Table 3.8.2.3. (See Note A-3.8.2.3.(4).) (See also Article 3.8.3.22. for additional requirements.)

5) Except as provided in Sentence (6), in an *assembly occupancy* with more than 25 fixed seats, each row of seats served by two aisles shall have one adaptable seat conforming to Subsection 3.8.3. located adjacent to one of the aisles. (See Note A-3.8.2.3.(5) and (6) and 3.8.3.22.(1) and (4).)

6) At least 5% of the adaptable seats required by Sentence (5) but no more than 20 adaptable seats shall adjoin an *accessible* path of travel. (See Note A-3.8.2.3.(5) and (6) and 3.8.3.22.(1) and (4).)

Table 3.8.2.3.
Designated Wheelchair Spaces
Forming Part of Sentences 3.8.2.3.(3) and (4)

Number of Fixed Seats in Seating Area	Number of Spaces Required for Wheelchairs
2 - 99	2
100 - 499	3, plus 1 for each additional increment of 70 seats in excess of 100
500 - 1 999	9, plus 1 for each additional increment of 80 seats in excess of 500
2 000 - 7 999	28, plus 1 for each additional increment of 95 seats in excess of 2 000
Over 7 999	91, plus 1 for each additional increment of 100 seats in excess of 8 000

3.8.2.4. Access to Storeys Served by Escalators and Moving Walks

1) In a *building* in which a ramp, escalator or inclined moving walk provides access to any floor level, an interior *accessible* path of travel shall also be provided to that floor level. (See Note A-3.8.2.4.(1).)

2) The route from the ramp, 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.

3.8.2.5. Paths of Travel to Building Entrances and Exterior Passenger-Loading Zones

(See Note A-3.8.2.5.)

1) A direct exterior *accessible* path of travel that complies with Subsection 3.8.3. shall be provided between an *accessible* entrance referred to in Article 3.8.2.2. and

- a) a designated *accessible* parking area, where provided,
- b) an exterior passenger-loading zone, where provided,
- c) common ancillary *buildings* on the lot, and
- d) a public thoroughfare. (See Note A-3.8.2.5.(1) and (2).)

2) In *storage garages*, an *accessible* path of travel that complies with Subsection 3.8.3. shall be provided between each parking level with parking spaces designated for *persons with disabilities* and all other parts of the *building* required to be provided with *access* in accordance with Subsection 3.8.2. that are served by that *storage garage*. (See Note A-3.8.2.5.(1) and (2).)

3) Exterior passenger-loading zones shall comply with Subsection 3.8.3.

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

systems and switches, that are intended to be operated generally by the occupant shall comply with Subsection 3.8.3. (See Note A-3.8.2.6.(1).)

2) Electrical outlets that are intended for general occupant use 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), and except for doors provided with hold-open devices, doors equipped with a self-closing device shall be equipped with power door operators complying with Subsection 3.8.3. that allow persons to activate the opening of the doors in the intended direction of travel, where the doors are located

a) in an entrance referred to in Article 3.8.2.2., including the interior doors of a vestibule where provided,

b) in an *accessible* path of travel, between the entrance referred to in Clause (a) and the entrance doors to *suites* or rooms served by a *public corridor* or a corridor used by the public (see Note A-3.8.2.7.(1)(b)), and

c) in an entrance to an *accessible* washroom.

2) Only the active leaf in a multiple leaf door in an *accessible* path of travel need conform to the requirements of this Article.

3) Where more than one doorway is provided at an *accessible* entrance, only one of them is required to comply with this Article. (See Note A-3.8.2.7.(3).)

3.8.2.8. Plumbing Facilities

1) Except as permitted by Sentence (3) and (16), at each location where washrooms are provided in a *storey* to which an *accessible* path of travel is required in accordance with Article 3.8.2.3., at least one universal washroom complying with Subsection 3.8.3. shall be provided. (See Note A-3.8.2.8.(1) to (4).)

2) Except as permitted by Sentence (3), where more than two water closets or a combination of more than one water closet and one urinal are provided in a washroom located in a *storey* to which an *accessible* path of travel is required in accordance with Article 3.8.2.3., at least one water-closet stall shall be *accessible* in accordance with Subsection 3.8.3. (See Note A-3.8.2.8.(1) to (4).)

3) Except as required by Article 3.8.2.13., washrooms located within a *suite of residential occupancy* or a *suite of care occupancy* need not conform to the requirements of Sentence (1) or (2). (See Note A-3.8.2.8.(1) to (4).)

4) In a *building* in which water closets are required in accordance with Subsection 3.7.2., at least one universal washroom shall be provided in the entrance *storey*, unless

a) an *accessible* path of travel is provided to a universal washroom 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 (4).)

5) At least one water-closet stall or enclosure in a washroom required to be *accessible* shall comply with Subsection 3.8.3.

6) Where urinals are provided in an *accessible* washroom, at least one urinal for persons with limited mobility conforming to Subsection 3.8.3. shall be provided for every 10 urinals.

7) Where water-closet stalls are provided in an *accessible* washroom, at least one stall for persons with limited mobility conforming to Subsection 3.8.3. shall be provided for every 10 stalls.

8) An *accessible* washroom shall be provided with a lavatory that complies with Subsection 3.8.3.

9) Where mirrors are provided in an *accessible* washroom, at least one mirror shall comply with Subsection 3.8.3.

10) At each location where one or more drinking fountains are provided, at least one of them shall comply with Subsection 3.8.3.

11) At each location where one or more water-bottle filling stations are provided, at least one of them shall comply with Subsection 3.8.3.

12) Except within a *suite of care occupancy* or 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.

13) At each location where a showering facility is provided for use by the general public or customers, or as part of a common-use area for employees, at least one universal dressing and shower room conforming to Subsection 3.8.3. shall be provided. (See Note A-3.8.2.8.(13).)

14) Where a bathtub is installed in a *suite of residential occupancy* required to be *accessible*, it shall comply with Subsection 3.8.3.

15) In *buildings* containing Group A, Group B, Division 2 or Group E *major occupancies* where at least one of these *major occupancies* has an *occupant load* of more than 500, at least one universal washroom on the *storey* on which the main *accessible* entrance to the *building* is located shall incorporate an *accessible* change space conforming to Subsection 3.8.3. (See Note A-3.8.2.8.(15).)

16) 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 Systems

1) In a *building of assembly occupancy*, all classrooms, auditoria, meeting rooms and *theatres* with an area of more than 100 m², including courtrooms of any size, shall be equipped with an assistive listening system complying with Subsection 3.8.3.

2) In each location where information, goods or services are provided to the public at service counters in *buildings of assembly occupancy*, at least one of the service counters shall be equipped with

- a) an assistive listening system or adaptive technology conforming to Subsection 3.8.3., and
- b) an amplification system, where there is a barrier to communication, such as a glass screen.

(See Note A-3.8.2.9.(2).)

3.8.2.10. Signs and Indicators

1) Unless the degree of *access* provided is such as to make these signs unnecessary, signs providing visual information in accordance with Subsection 3.8.3. shall be installed to indicate the location of

- a) *accessible* entrances,
- b) alternative *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 spaces,
- k) *accessible* passenger loading zones, and
- l) assistive listening systems or adaptive technologies.

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 providing visual and tactile information in accordance with Subsection 3.8.3. shall be installed to indicate the location of *accessible* washrooms.

3) Except for doors that serve *service spaces* or are located within a *suite*, signs installed at or near doors shall provide the same information in both visual and tactile forms in accordance with Subsection 3.8.3.

4) Directional signs shall provide visual information in accordance with Subsection 3.8.3. (See Note A-3.8.2.10.(4).)

3.8.2.11. Counters

1) Where a service counter is provided, at least one section of it shall comply with Subsection 3.8.3. (See Note A-3.8.2.11.(1).) (See also Note A-3.8.2.3.)

3.8.2.12. Telephones

1) In each location where one or more public telephones are installed, at least one telephone shall comply with Subsection 3.8.3.

3.8.2.13. Sleeping Rooms and Bed Spaces

1) At least one for every 20 or part thereof of sleeping rooms or bed spaces shall conform to Subsection 3.8.3. where provided in

- a) hotels and motels (see also Clause 3.2.4.19.(1)(g) and Sentences 3.2.4.20.(7) and (8)), and
- b) not including apartments and condominiums and the *buildings* described in 3.8.2.1.(1)(a), other *buildings* or parts of *buildings* used for *residential major occupancies* (see also Sentence 3.2.4.20.(17)).

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) for each *accessible* application listed independent of other *accessible* applications, the applicable provisions of CSA B651, “Accessible design for the built environment,” listed in Table 3.8.3.1..

(See Note A-3.8.3.1.(1).)

Table 3.8.3.1.
Accessible Design Provisions
Forming Part of Sentence 3.8.3.1.(1) and (2)

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 (3.8.3.9.)	4.5 and 9.4
Drinking fountains (3.8.3.10.)	6.1
Washroom facilities (3.8.3.12. to 3.8.3.16.)	6.2 and 6.3
Bathing facilities (3.8.3.17. and 3.8.3.18.)	6.5
Communication (3.8.3.19. and 3.8.3.21.)	6.6
Counters (3.8.3.20. and 3.8.3.21.)	6.7.1
Spaces in seating areas (3.8.3.22.)	6.7.3

2) The design of each accessible application listed in Table 3.8.3.1. shall comply entirely with Clause (1)(a) or Clause (1)(b).

3.8.3.2. Accessible Path of Travel

1) Except as required elsewhere in this Part or as permitted by Sentence (2) and Article 3.8.3.6. pertaining to doorways, the clear width of an *accessible* path of travel shall be not less than 1 000 mm.

2) The clear width of an *accessible* path of travel is permitted to be reduced to not less than 850 mm for a length of not more than 600 mm, provided the clear floor space at either end of the reduced-clear width section is level within a rectangular area

a) with a dimension parallel to each end of the reduced-clear width section is not less than 1 000 mm, and

b) with a dimension perpendicular to each end of the reduced-clear width section is not less than 1 500 mm.

(See Note A-3.8.3.2.(2).)

3) 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 this Section where the path of travel has a slope steeper than 1 in 20.

(See Note A-3.8.3.2.(3).)

4) 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.

5) The width of an *accessible* path of travel that is more than 24 m long shall be increased to not less than 1 700 mm for a length of 1 700 mm at intervals not exceeding 24 m.

6) Where a section of an *accessible* path of travel is less than 1 500 mm wide for a distance of more than 12 m, it shall end in a clear floor space that is

- a) not less than 1 700 mm in diameter,
- b) not less than 1 700 mm by 1 500 mm, or
- c) T-shaped with overall dimensions measuring 1 700 mm wide by 1 500 mm long, where the two arms of the “T” are not less than 1 000 mm wide and extend not less than 300 mm from each side of the base of the “T” and the base is not less than 1 000 mm wide and extends not less than 500 mm from each arm.

(See Note A-3.8.3.2.(6).)

7) An *accessible* path of travel shall be equipped to provide illumination in accordance with Sentences 3.2.7.1.(1) and (2). (See also Sentences 3.2.7.1.(3) and Article 9.34.2.7.)

8) An exterior mechanical lift and its controls provided in accordance with Sentence (4), shall only be provided

- a) where existing exterior site constraints make use of a ramp or elevator infeasible, and
- b) where 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.(8)(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 1 600 mm wide,
 - c) have a level area conforming to Clause 3.8.3.5.(1)(c) adjacent to an entrance doorway, and
 - d) be designed in accordance with Clause 8.2.1 of CSA B651, “Accessible design for the built environment.”

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, designed in accordance with Clause 8.3.3. of CSA B651, “Accessible design for the built environment,” where there are curbs between the access aisle and the vehicle pull-up space, 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, and shall
 - a) have a firm, slip-resistant and level surface,
 - b) be located adjacent to an *accessible* path of travel, 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 and Stairs

1) Except when designed as a curb ramp in accordance with Clause 3.8.3.4.(1)(b), a *ramp* located in an *accessible* path of travel shall

a) have a clear width not less than 1 000 mm (see Note A-3.4.3.4.),

b) have a uniform slope along its length not more than 1 in 12 (see Note A-3.8.3.5.(1)(b)),

c) have a level area not less than 1 700 mm by 1 700 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 than 1 350 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 handrails 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 ground level 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) Interior and exterior stairs and ramps that are *accessible* to the public are to be provided with a colour contrast or distinctive pattern, visible from both directions of travel, demarcating the leading edge of treads.

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 of the stop on the door frame.

(See Note A-3.8.3.6.(2).)

3) Doorways in a path of travel to at least one bathroom within a *suite of residential occupancy* shall have a clear width not less than 850 mm when measured in accordance with Sentence (2). (See Note A-3.8.3.6.(3).)

- 4) Door-operating devices shall

a) comply with Clause 3.8.3.8.(1)(b), and

b) be operable at a height between 900 mm and 1 100 mm above the floor.

(See also Sentence 3.3.1.13.(4) regarding additional devices.)

(See Note A-3.8.3.6.(4).)

5) A threshold for a doorway referred to in Sentences (2) and (3) shall be not more than 13 mm higher than the finished floor surface and shall be beveled to facilitate the passage of wheelchairs.

- 6) Power door operators required by Sentence 3.8.2.7.(1) shall

a) activate automatically or through the use of controls that

i) are 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)(a)(iii),

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,

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.

(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 an interior 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 swinging door in an *accessible* path of travel shall have a clear space on the latch side extending the height of the doorway and not less than

- a) 600 mm beyond the edge of the door opening if the door swings toward the approach side, and
- b) 300 mm beyond the edge of the door opening if the door swings away from the approach side.

(See Note A-3.8.3.6.(11).)

12) A vestibule located in an *accessible* path of travel shall be arranged to allow the movement of wheelchairs between doors and shall provide a distance between 2 doors in series of not less than 1 350 mm plus the width of any door that swings into the space in the path of travel from one door to another.

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) and Sentence (16), the clear floor space on the pull side of a swinging door in an *accessible* path of travel shall be level within a rectangular area of not less than 1 700 mm by 1 500 mm measured from the hinged side of the door. (See Note A-3.8.3.6.(14) to (16).)

15) Except as provided in Clause 3.8.3.5.(1)(c) and Sentence (16), the clear floor space on the push side of a swinging door and on each side of a sliding door in an *accessible* path of travel shall be level within a rectangular area

- a) whose dimension parallel to the closed door is not less than 1 200 mm, and
- b) whose dimension perpendicular to the closed door is not less than 1 500 mm.

(See Note A-3.8.3.6.(14) to (16).)

16) Where a door referred to in Sentences (14) and (15) is equipped with a power door operator complying with Sentence (6), the width of the clear floor space parallel to the closed door is permitted to be reduced to not less than 1 000 mm. (See Note A-3.8.3.6.(14) to (16).)

17) Except for facilities for persons with cognitive disabilities such as dementia, doorways leading from a *public corridor* or a corridor used by the public that provide access to a public area or an *exit* shall

be provided with a door or door frame that has a readily apparent visual contrast with adjacent wall surfaces. (See Note A-3.8.3.6.(17).) (See also Note A-3.4.6.11.(4).)

3.8.3.7. Passenger-Elevating Devices

1) A passenger-elevating device referred to in Article 3.8.2.3. located in an *accessible* path of travel shall

a) conform to

i) Appendix E of ASME A17.1/CSA B44, "Safety Code for Elevators and Escalators," or

ii) CSA B355, "Platform lifts and stair lifts for barrier-free access,"

b) have a clear floor space not less than 1 500 mm long by 1 000 mm wide, and

c) have entry doors or gates

i) providing a clear width not less than 850 mm in the open position if located on the short side of the passenger-elevating device, or

ii) providing a clear width not less than 1 000 mm in the open position if located at either end of the long side of the passenger-elevating device.

3.8.3.8. Controls and Outlets

1) Controls described in this Section shall

a) where located in a *storey* where an *accessible* path of travel is required and unless otherwise stated,

i) be in or adjacent to the *accessible* path of travel,

ii) be mounted 400 mm to 1 200 mm above the floor, and

iii) be adjacent to and centred on either the length or the width of a clear floor space of 1 350 mm by 800 mm,

b) 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, and

c) where controls provide a feedback signal to the user, it shall be both audible and visible (see Note A-3.8.3.8.(1)(c)).

2) Electrical outlets described in this Section shall be located in conformance with Subclause (1)(a)(ii).

(See Note A-3.8.2.6.(2).)

3.8.3.9. Accessible Signs

1) Visual information signs required by Subsections 3.4.5. and 3.4.6. and Article 3.8.2.10. shall comply with Clauses 4.5.1, 4.5.2, 4.5.3 and 4.5.4 of CSA B651, "Accessible design for the built environment." (See Note A-3.8.3.9.(1) and (2).)

2) Tactile information signs required by Subsections 3.4.5. and 3.4.6. and Article 3.8.2.10. shall

a) have Braille and tactile characters in accordance with Clauses 4.5.6.2 and 4.5.6.3 of CSA B651, "Accessible design for the built environment,"

b) be installed on the wall closest to the latch side of the door or on the nearest wall on the right side of the door, where there is no wall at the latch side, and

c) be centred 1 500 mm above the finished floor with the edge of the sign located not more than 300 mm from the door.

(See Note A-3.8.3.9.(1) and (2).)

3) Signs required by Article 3.8.2.10. shall incorporate the International Symbol of Access, Modified 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.(3).)

3.8.3.10. Drinking Fountains

1) Drinking fountains required by Sentence 3.8.2.8.(10) shall be equipped with controls that

- a) activate automatically, or
- b) comply with Clause 3.8.3.8.(1)(b) and are located on the front or on both sides of the fountain.

2) Where drinking fountains referred to in Sentence (1) are located in a *storey* where an *accessible* path of travel is required, they shall

- a) be located along the *accessible* path of travel,
- b) have a minimum clear floor space of 800 mm by 1 350 mm in front of them,
- c) where they have frontal access, provide a knee clearance in accordance with Clause 3.8.3.16.(1)(e), and
- 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.

(See Sentences 3.3.1.8.(2) and (3) on horizontal projections.)

3.8.3.11. Water-Bottle Filling Stations

1) Water-bottle filling stations required by Sentence 3.8.2.8.(11) shall be equipped with controls that

- a) activate automatically, or
- b) comply with Clause 3.8.3.8.(1)(b).

2) Water-bottle filling stations required by Sentence 3.8.2.8.(11) that are located in a *storey* where an *accessible* path of travel is required shall

- a) be located along the *accessible* path of travel,
- b) have a clear floor space of 800 mm by 1 350 mm in front of them (see Note A-3.8.3.11.(2)(b) and (d)),
- c) where they have frontal access, provide a knee clearance in accordance with Clause 3.8.3.16.(1)(e),
- d) be operable at a height of not more than 1 200 mm above the floor (see Note A-3.8.3.11.(2)(b) and (d)), and
- e) be equipped with controls that
 - i) activate automatically, or
 - ii) comply with Sentence 3.8.3.8.(1).

(See Sentences 3.3.1.8.(2) and (3) on horizontal projections.)

3.8.3.12. Accessible 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 lateral transfer space adjacent to the water closet that
 - i) is at least 1 500 mm long, measured from the wall behind the water closet, and
 - ii) is at least 900 mm wide, measured from the closest edge of the water closet seat,
(see Note A-3.8.3.12.(1)(b))
 - c) have a clear floor space of 1 700 mm by 1 700 mm in front of the accessible stall,
 - d) be equipped with a door that
 - i) can be latched from the inside with a mechanism located 900 mm to 1 100 mm above the floor that conforms to Clause 3.8.3.8.(1)(b),
 - ii) is aligned with either the transfer space adjacent to the water closet or with a clear floor space not less than 1 700 mm by 1 700 mm within the stall,
 - iii) provides a clear opening not less than 850 mm wide when it is open, measured in accordance with Sentence 3.8.3.6.(2),
 - 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 sufficient floor space within the stall for the door to swing inward in addition to a clear floor space of at least 800 mm by 1 350 mm (see Note A-3.8.3.12.(1)(d)(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 1100 mm above the floor (see Note A-3.8.3.12.(1)(d)(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 1100 mm above the floor,
 - e) 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,
 - f) 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-3.8.3.12.(1)(f)(ii)), and
 - iii) complies with Article 3.7.2.7.,
 - g) 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 3.7.2.7.,
 - 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,

h) 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

i) 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.

3.8.3.13. Universal Washrooms

(See Note A-3.8.3.13.)

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)(b) 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, has a horizontal, D-shaped, visually contrasting door pull not less than 140 mm long located on the inside so that its midpoint is not less than 200 mm and not more than 300 mm from the hinged side of the door and not less than 900 mm and not more than 1 100 mm above the floor (see Note A-3.8.3.12.(1)(d)(vi)),

c) have one lavatory conforming to Article 3.8.3.16.,

d) have one water closet conforming to Article 3.8.3.14. and Clause 3.8.3.12.(1)(e),

e) have a clear lateral transfer space adjacent to the water closet that conforms to Clause 3.8.3.12.(1)(b),

f) have grab bars conforming to Clauses 3.8.3.12.(1)(f) and (g),

g) have a coat hook conforming to Clause 3.8.3.12.(1)(h),

h) have a toilet paper dispenser conforming to Clause 3.8.3.12.(1)(i),

i) unless a 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,

j) be designed to permit a wheelchair to turn in an open space not less than 1 700 mm in diameter, and

k) provide emergency lighting conforming to Article 3.2.7.3.

2) A universal washroom required to have an accessible change space as stipulated in Sentence 3.8.2.8.(15) shall

a) be equipped with an adult-sized change table that is

i) designed to carry a minimum load of 1.3 kN,

ii) impervious to water, and

iii) designed to be easily cleaned,

b) have a clear floor space to accommodate the adult-sized change table that is 810 mm wide by 1 830 mm long and does not overlap with the clear spaces required by Clauses (1)(e), (1)(j) and (c), and

c) have a clear transfer space of 900 mm by 1 350 mm adjacent to the long side of the clear floor space for the adult-sized change table.

3.8.3.14. Water Closets

- 1) A water closet for a person with physical disabilities shall
 - a) be equipped with a seat 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 no more than 350 mm from the transfer side, and
 - iii) complies with Clause 3.8.3.8.(1)(b),
 - 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-3.8.3.14.(1).)

3.8.3.15. Water-Closet Stalls and Urinals for Persons with Limited Mobility

- 1) Water-closet stalls for persons with limited mobility required by Sentence 3.8.2.8.(7) shall
 - a) be at least 1 500 mm deep and 890 mm to 940 mm wide,
 - b) be equipped with a door that
 - i) has a latch-operating mechanism conforming to Clause 3.8.3.8.(1)(b) that can be locked from the inside and released from the outside in the event of an emergency,
 - ii) provides a clear opening not less than 850 mm wide when it is open, measured in accordance with Sentence 3.8.3.6.(2),
 - iii) swings outward, unless the minimum dimensions required by Clause (a) do not overlap with the area of the door swing,
 - iv) is self-closing so that, when at rest, the door is ajar by not more than 50 mm beyond the jamb, and
 - v) has a horizontal, D-shaped, visually contrasting door pull on both sides of the door, near the latch side, located 900 mm to 1 100 mm above the finished floor,
 - c) have one water closet conforming to Article 3.8.3.14. centred within the stall,
 - d) have a horizontal grab bar conforming to Article 3.7.2.7. on each side of the water closet that
 - i) is located 750 mm to 850 mm above the floor,
 - ii) begins not more than 300 mm from the wall behind the water closet, and
 - iii) extends at least 450 mm in front of the toilet seat, and
 - e) 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.
- 2) Urinals described in Sentence 3.8.2.8.(6) shall
 - a) be wall-mounted, with the rim located not more than 430 mm above the floor,
 - b) be adjacent to an *accessible* route,

- c) have a clear width of approach that is at least 800 mm wide by 1 350 mm long 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)(b) 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
 - i) complies with Article 3.7.2.7.,
 - ii) is not less than 600 mm long, with its centre line 1 000 mm above the floor, and
 - iii) is located not more than 380 mm from the centre line of the urinal.

3.8.3.16. Lavatories and Mirrors

- 1) Lavatories required by Sentence 3.8.2.8.(8) shall
 - a) be equipped with faucets complying with Sentence 3.7.2.3.(4),
 - b) be located so that the distance between the centre line of the lavatory and any side wall is not less than 460 mm,
 - c) have a clear floor space in front of the lavatory that is at least
 - i) 800 mm wide, centred on the lavatory, and
 - ii) 1 350 mm long, of which no more than 430 mm is beneath the lavatory,
 - d) have a rim height not more than 865 mm above the floor,
 - e) have a clearance beneath the lavatory not less than
 - i) 800 mm wide, centred on the lavatory,
 - ii) 735 mm high at the front edge,
 - iii) 685 mm high at a point 200 mm back from the front edge, and
 - iv) 230 mm high over the distance from a point 280 mm to a point 430 mm back from the front edge, (see Note A-3.8.3.16.(1)(e))
 - f) have insulated water supply and drain pipes where these pipes are exposed (see Note A-3.8.3.16.(1)(f)),
 - g) have a soap dispenser that
 - i) is automatic, or
 - ii) complies with Clause 3.8.3.8.(1)(b) and is located not more than 1 100 mm above the floor, within 500 mm from the front of the lavatory (see Note A-3.8.3.16.(1)(g)), and
 - h) 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.(9) 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.

3.8.3.17. Showers

- 1) Showers required by Sentence 3.8.2.8.(12) shall
 - a) be not less than 1 500 mm wide and 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-3.8.3.17.(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
 - i) that conform to Sentence 3.7.2.7.(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-3.8.3.17.(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)(b), 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.
- 2) A universal dressing and shower room required by Sentence 3.8.2.8.(13) shall
 - a) be located in an *accessible* path of travel,

- b) have a door capable of being locked from the inside and released from the outside in the event of an emergency,
- c) have a lavatory and a mirror conforming to Article 3.8.3.16.,
- d) have a shower conforming to Sentence (1),
- e) have a bench that is
 - i) at least 1 830 mm long by 760 mm wide and 480 mm to 520 mm high,
 - ii) designed to carry a minimum load of 1.3 kN,
 - iii) impervious to water, and
 - iv) designed to be easily cleaned,
- f) have a clear transfer space adjacent to the long side of the bench that is 900 mm wide and as long as the bench (see Note A-3.8.3.17.(2)(f)),
- g) have a coat hook conforming to Clause 3.8.3.12.(1)(h), and
- h) provide emergency lighting conforming to Article 3.2.7.3.

3.8.3.18. Accessible Bathtubs

- 1) A bathtub required by Sentence 3.8.2.8.(14) shall
 - a) be located in a room with a clear floor space not less than 1 700 mm in diameter,
 - b) be not less than 1 500 mm long,
 - c) have a clear floor space at the entrance to the bathtub that is not less than 900 mm deep and at least the same length as the bathtub, except that fixtures are permitted to project into that space provided they do not restrict access to the shower,
 - 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)(b), 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,
 - f) have three grab bars
 - i) that conform to Sentence 3.7.2.7.(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, and
 - h) be equipped with a hand-held shower head with not less than 1 800 mm of flexible hose that can be used in a fixed position at a height of 1 200 mm and 2 030 mm.

3.8.3.19. Assistive Listening Systems

(See Note A-3.8.3.19.)

1) Assistive listening systems required by Sentence 3.8.2.9.(1) shall encompass the entire seating area.

2) Assistive listening systems or adaptive technologies required by Sentence 3.8.2.9.(2) shall provide for the clear communication required for the exchange of information, goods and services.

3.8.3.20. Counters

1) A section of a service counter required to be *accessible* in accordance with Sentence 3.8.2.11.(1) shall

a) be not less than 800 mm long centred over a knee space conforming to Clause (c),

b) have a surface not more than 865 mm above the floor, and

c) where forward-facing interaction with a person or a device is required, have a knee space underneath it that is (see Note A-3.8.3.20.(1)(c))

i) not less than 800 mm wide,

ii) not less than 685 mm high, and

iii) not less than 485 mm deep.

3.8.3.21. Telephones

1) A telephone required to be *accessible* in accordance with Article 3.8.2.12. shall

a) be adjacent to and centred on either the length or the width of a clear floor space not less than 1 350 mm by 800 mm,

b) where a forward approach is provided, have a knee space underneath it conforming to Clause 3.8.3.20.(1)(c), and

c) be located so that its receiver and operable parts are not more than 1 200 mm above the floor.

2) Where provided, shelves or counters for public telephones shall

a) be level,

b) be not less than 305 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, and

d) have a section with a surface not more than 865 mm above the floor serving at least one telephone.

(See Note A-3.8.3.21.(2).)

3.8.3.22. Spaces in Seating Area

1) Spaces designated for wheelchair use in *assembly occupancies* as required by Sentence 3.8.2.3.(3) shall conform to the following:

a) at least one designated space shall be clear and level for each increment of 200 seats and the remaining designated spaces shall be level and have removable seats,

b) they shall be not less than 900 mm wide and 1 700 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) they shall be arranged so that

i) at least two designated spaces are located side by side, and

- ii) at least one fixed seat is located beside each designated space,
 - d) they shall be located adjoining an *accessible* path of travel without infringing on egress from any row of seating or any aisle requirements, and
 - e) they shall be situated, as part of the designated seating plan, to provide a choice of viewing location and a clear view of the event taking place.
- (See Note A-3.8.2.3.(5) and (6) and 3.8.3.22.(1) and (4).)
- 2) Spaces designated for wheelchair use in waiting rooms or areas as required by Sentence 3.8.2.3.(4) shall
- a) be clear and level, and
 - b) comply with Clauses (1)(b) and (d).
- 3) Adaptable seats required by Sentence 3.8.2.3.(5) shall
- a) be located adjoining an aisle without infringing on egress from any row of seating or any aisle requirements,
 - b) be equipped with a movable or removable armrest on the side of the seat adjoining the aisle, and
 - c) be situated, as part of the designated seating plan, to provide a choice of viewing location and a clear view of the event taking place.
- 4) Storage spaces for mobility aids shall be provided in a location
- a) that is on the same level as and in proximity to the adaptable seats required by Sentence 3.8.2.3.(5),
 - b) that is within the room side of the *fire separation* required by Article 3.3.2.2., and
 - c) where they will not infringe on egress.
- (See Notes A-3.8.3.22.(4) and A-3.8.2.3.(5) and (6) and 3.8.3.22.(1) and (4).)

3.8.3.23. Sleeping Rooms and Bed Spaces

- 1) Sleeping rooms and bed spaces required by Sentence 3.8.2.13.(1) to be *accessible* shall have
- a) a clear floor space that permits a turning area of not less than 1 700 mm in diameter, or not less than 1 700 mm by 1 500 mm, that could be adjacent a bed,
 - b) a pathway clearance of not less than 1 000 mm wide, that could be unobstructed by a bed, to allow functional use of the bedroom,
 - c) at least one closet that provides
 - i) a clear opening width of not less than 900 mm,
 - ii) a clear floor space, that need not be separate from the turning areas required in Clause (a), of not less than 1 700 mm by 1 500 mm on at least one side of the closet,
 - iii) clothes hanger rods capable of being lowered to a height of not more than 1 200 mm, and
 - iv) at least one shelf capable of being lowered to a height of not more than 1 200 mm,
 - d) when a balcony is provided, an *accessible* path of travel to an *accessible* balcony conforming to Sentence 11.3.8.1.(4),
 - e) except for dedicated electrical outlets for equipment and appliances, where controls, switches and outlets are intended for frequent operation, they shall conform to Subsection 3.8.3., and

- f) 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 3.8.3.12.(1)(a), (b), (e), (f), (g), (h) and (i) with a water closet conforming to Article 3.8.3.14.,
- ii) provided with a lavatory and mirror conforming to Article 3.8.3.16., and
- iv) provided with a shower conforming to Article 3.8.3.17. or a bathtub conforming to Article 3.8.3.18., only to the extent of providing the same type of facilities provided in sleeping rooms and bed spaces where *access* is not required.

3.8.4. 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 with a clear width of not less than 850 mm ~~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) At least one bathroom in an *adaptable dwelling unit* that includes a floor level exceeding 40 m² shall

- a) have a washbasin,
- b) have a toilet,
- c) have either a bathtub, shower, or be configured to accommodate the future installation of a low barrier shower and shall be constructed with
 - i) the addition of structural reinforcement of framed construction to accommodate the subsequent change in load, or the removal or reduction of the capacity of structural elements to facilitate the future installation of a low barrier shower,
 - ii) pre-plumbing of a drain connection to the greatest extent permitted by this By-law to facilitate the future installation of a low barrier shower where it passes through a concrete floor or floor topping, or
 - iii) alternative 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,
- d) be arranged so as to provide a minimum clear floor space of 750 mm by 1200 mm in front of a washbasin, toilet, bathtub or shower required by Clause (c),
- e) be located on
 - i) the principal floor exceeding 40 m² contain living space with level access to an entry at the adjacent ground level, or
 - ii) a floor provided with features that in the opinion of the *Chief Building Official* can readily be modified to facilitate future use by persons with limited mobility (see Note A-3.8.5.5.(1)).

2) Walls adjacent to the water closet and bathtub or shower shall accommodate the future installation of grab bars conforming to

- a) Clauses 3.8.3.12.(1)(f) and (g) for water closets, and
- b) Clause 3.8.3.17.(1)(f) for showers or 3.8.3.18.(1)(f) for bathtubs.

(See Note A-3.8.5.5.(2).)

3) All bath and shower controls in *adaptable dwelling units* shall be

a) easily accessible from an open floor space ~~or offset~~ which does not require entry into the bath or shower to operate, and

b) equipped with lever-type controls or hardware that does not require a tight grasp or twisting action of the wrist.

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, Outlets and Signalling Devices

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

a) in the opinion of the *Chief Building Official*, a different height is necessary to accommodate appliances or equipment, or

b) 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).

4) Except as permitted by Sentence (5), each adaptable dwelling unit 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).)

5) Where a building is provided with an addressable fire alarm system, a special outlet box described in Sentence (4) is not required provided that

a) the dwelling unit has been designed with fire alarm signaling devices located in accordance with Clause 3.2.4.19.(6)(c), and

b) the fire alarm system and the signaling devices in clause (a) can accommodate the future replacement of audible signaling devices with combination audible visual signaling devices. .

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. Self-service Storage Buildings

3.9.1. General

3.9.1.1. Definition

1) For the purpose of this Section, the term “self-service storage *building*” shall mean a *building* that is open to the public for the sole purpose of providing individual self-service storage units.

3.9.1.2. Application

- 1) This Section applies to self-service storage *buildings* that
 - a) are not more than one *storey* in *building height*,
 - b) do not contain a *basement* or *mezzanine*,
 - c) consist of individual self-service storage units with external access only,
 - d) are used for no purpose other than storage, and
 - e) except as provided in Sentences 3.9.3.1.(2) and (4), contain no other *major occupancy*.

2) Where there is a conflict between the requirements of this Section and other requirements in Part 3, this Section shall govern.

3) The requirements in Part 3 regarding *occupant load* shall not apply to self-service storage *buildings*.

3.9.1.3. Occupancy Classification

- 1) Self-service storage *buildings* shall be classified as Group F, Division 2 *major occupancies*.

3.9.2. Building Fire Safety

3.9.2.1. Building Area

1) For the purpose of applying the requirements of Subsections 3.2.1. and 3.2.2. to self-service storage *buildings*, *building area* shall mean

- a) the *building area* of each *building*, or
- b) the total of the *building areas* of all *buildings* as a group.

(See Note A-3.9.2.1.(1).)

3.9.2.2. Spatial Separation

(See Note A-3.9.2.2.)

1) Except as provided in Sentence (3), the spatial separation requirements in Subsection 3.2.3. shall apply to self-service storage *buildings*.

2) The distance between each group of self-service storage *buildings* shall be not less than 9 m.

3) Subsection 3.2.3. need not apply between *buildings* within a group of self-service storage *buildings*, where the distance between these *buildings* is at least 6 m.

3.9.2.3. Access Route

1) Where Clause 3.9.2.1.(1)(b) is applied to a group of *buildings*, Article 3.2.5.4. and Sentence 3.2.5.5.(1) shall apply to that group of *buildings* as if they were a single *building*.

3.9.3. Floor Areas

3.9.3.1. Safety Requirements Within Floor Areas

- 1) Except as provided in Sentences (2) to (6), the requirements of Section 3.3. shall apply. (See Note A-3.9.3.1.(1).)
- 2) Not more than one *dwelling unit* is permitted to be contained within one of the self-service storage *buildings* on a property.
- 3) A *dwelling unit* referred to in Sentence (2) shall be separated from individual self-service storage units by a *fire separation* having a *fire-resistance rating* not less than 2 h.
- 4) Where an office not more than 50 m² in area is adjacent to a *dwelling unit* referred to in Sentence (2), it shall be considered as part of the *dwelling unit*.
- 5) *Fire separations* required by Sentences 3.3.1.1.(1) and 3.3.5.9.(1) need not be provided between individual self-service storage units.
- 6) The *floor area* of self-service storage *buildings* shall be
 - a) subdivided into compartments not more than 500 m² in area by a *fire separation* having a *fire-resistance rating* not less than 1 h, or
 - b) *sprinklered*.

(See also Sentence 3.4.6.12.(2) for the exemption applying to *exit* doors of individual self-service storage units.)

3.9.3.2. Sanitary Facilities

- 1) Except as provided in Sentence 3.7.2.1.(3), two public washrooms, each containing a water closet and a lavatory, shall be provided within one of the self-service storage *buildings* on the property. (See Note A-3.9.3.2.(1).)

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)**

Provision	Functional Statements and Objectives ⁽¹⁾
3.1.2.8. Daycare Facilities for Children	
(1)	[F02,F03,F05-OS1.2,OS1.3] Applies to the requirement for sprinklers.
	[F11-OS1.5] Applies to fire alarm.
	[F11-OS1.5] Applies to smoke and CO alarm.
	[F03, F10-OS1.5] Applies to fire separations from the remainder of the building.
	[F10-OS1.5] Applies to emergency lighting.

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]
3.1.3.3. 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]
3.1.3.5. 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)	[F02,F03-OP3.1]

(2)	[F02,F03-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]
3.1.5.25. Di-electric Liquid Filled Equipment	
(1)	(a) [F31-OS1.2] (b) [F02, F03-OS1.1, 1.2, OP1.1, 1.2] (c) [F03-OS1.2.
3.1.6.2. Materials Permitted	
(1)	[F02-OS1.2]
	[F02-OP1.2]
3.1.6.3. Structural Mass Timber Elements	
(2)	[F04-OS1.3]
	[F04-OP1.3]
(3)	[F02-OS1.2]
	[F02-OP1.2]
3.1.6.4. Encapsulation of Mass Timber Elements	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F02-OS1.2]
	[F02-OP1.2]
3.1.6.5. Determination of Encapsulation Ratings	
(1)	[F02-OS1.2]
	[F04-OS1.3]
	[F02-OP1.2]
	[F04-OP1.3]

3.1.6.9. Exterior Cladding	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(5)	[F02,F03-OP3.1]
(7)	[F03-OS1.2]
	[F03-OP1.2]
3.1.6.17. Penetration by Outlet Boxes	
(3)	[F03-OS1.2]
	[F03-OP1.2]
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 <i>fire separations</i> be protected with <i>closures</i> , shafts or other means.
	[F03-OP1.2] Applies to the requirement that openings in <i>fire separations</i> be protected with <i>closures</i> , 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)	[F03-OS1.2]
	[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 <i>fire damper</i> 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 <i>fire damper</i> 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 <i>fire damper</i> 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 ... inspection ..."
	[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 ... inspection ..."
	[F82-OP1.2] Applies to portion of By-law text: "A tightly fitted access door shall be installed for each ... <i>fire damper</i> 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]

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, Glass Block and Safety Glazing	
(1)	[F05-OS1.5] [F31-OS1.2]
	[F30-OS3.1]
(2)	[F05-OS1.5] [F31-OS1.2]
3.1.9.1. Firestops	
(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]
(6)	[F03-OS1.2]
	[F03-OP1.2]
(7)	[F03-OS1.2]
	[F03-OP1.2]
3.1.9.3. Penetration by Outlet Boxes	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
3.1.9.4. Combustible Piping Penetrations	
(3)	[F03-OS1.2] [F02,F04-OS1.3]
	[F03-OP1.2] [F02,F04-OP1.3]
(7)	[F03-OS1.2] [F02-OS1.3] [F04-OS1.3]

	[F03-OP1.2] [F02-OP1.3] [F04-OP1.3]
3.1.9.5. 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 <i>firewall</i> that separates a <i>building</i> or <i>buildings</i> with <i>floor areas</i> containing a Group E or a Group F, Division 1 or 2 <i>major occupancy</i> shall be constructed as a <i>fire separation of noncombustible construction</i> having a <i>fire-resistance rating</i> not less than 4 h ..."
	[F03-OP1.2] Applies to portion of By-law text: "A <i>firewall</i> that separates a <i>building</i> or <i>buildings</i> with <i>floor areas</i> containing a Group E or a Group F, Division 1 or 2 <i>major occupancy</i> shall be constructed as a <i>fire separation of noncombustible construction</i> having a <i>fire-resistance rating</i> not less than 4 h ..."
	[F03-OP3.1] Applies to portion of By-law text: "A <i>firewall</i> that separates a <i>building</i> or <i>buildings</i> with <i>floor areas</i> containing a Group E or a Group F, Division 1 or 2 <i>major occupancy</i> shall be constructed as a <i>fire separation of noncombustible construction</i> having a <i>fire-resistance rating</i> 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 <i>firewall</i> shall extend from the ground continuously through, or adjacent to, all <i>storeys</i> of a <i>building</i> or <i>buildings</i> so separated ..."
	[F03-OP1.2] Applies to portion of By-law text: "A <i>firewall</i> shall extend from the ground continuously through, or adjacent to, all <i>storeys</i> of a <i>building</i> or <i>buildings</i> so separated ..."
	[F03-OP3.1] Applies to portion of By-law text: "A <i>firewall</i> shall extend from the ground continuously through, or adjacent to, all <i>storeys</i> of a <i>building</i> or <i>buildings</i> so separated ..."

3.1.10.4. Parapets	
(1)	[F03-OP1.2]
	[F03-OS1.2]
	[F03-OP3.1]
3.1.10.5. Maximum Openings	
(2)	[F03-OP1.2]
	[F03-OS1.2]
	[F03-OP3.1]
3.1.10.7. Combustible Projections	
(1)	[F03-OP1.2] Applies to portion of By-law text: " <i>Combustible</i> material shall not extend across the end of a <i>firewall</i> ..."
	[F03-OS1.2] Applies to portion of By-law text: " <i>Combustible</i> material shall not extend across the end of a <i>firewall</i> ..."
	[F03-OP3.1] Applies to portion of By-law text: " <i>Combustible</i> material shall not extend across the end of a <i>firewall</i> ..."
(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)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[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]
	[F02,F03-OS1.2] [F04-OS1.3]
(4)	[F02,F03-OS1.2]
	[F04-OS1.3]
	[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]
(6)	[F04-OP1.2]
	[F04-OS1.2]
(7)	[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. Vegetated Roof Assemblies	
(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]
(4)	[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]
3.1.18.2. Restrictions	
(1)	[F10,F12,F36-OS3.7]
	[F20-OS2.2]
(2)	[F10,F36-OS3.7] Applies to portion of By-law text: "An <i>air-supported structure</i> shall not be used for Groups B, C, ... <i>major occupancies</i> or for classrooms."
	[F01,F02,F36-OS1.5] Applies to portion of By-law text: "An <i>air-supported structure</i> shall not be used for ... Group F, Division 1 <i>major occupancies</i> ..."
(3)	[F10-OS3.7]
3.1.18.3. Clearance to Other Structures	
(2)	(a) [F03-OS1.2]
	(b) [F10-OS3.7]
	(a) [F03-OP3.1]
3.1.18.4. Clearance to Flammable Material	
(1)	[F01-OS1.1] [F03-OS1.2]
	[F01-OP1.1] [F03-OP1.2]
3.1.18.5. Flame Resistance	
(1)	[F02-OS1.2]
3.1.18.6. Emergency Air Supply	
(1)	[F20-OS3.7]
3.1.18.7. Electrical Systems	
(1)	[F34-OP1.1]
	[F34-OS3.3]
	[F34-OS1.1]
(2)	[F81-OP1.1]
	[F81-OS1.1]
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]
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]
3.2.2.10. 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 <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> 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)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
(2)	[F02-OS1.2] Applies to portion of By-law text: "The <i>building</i> referred to in Sentence (1) is permitted to be of <i>heavy timber construction</i> or <i>noncombustible construction</i> used singly or in combination ..."
	[F02-OP1.2] Applies to portion of By-law text: "The <i>building</i> referred to in Sentence (1) is permitted to be of <i>heavy timber construction</i> or <i>noncombustible construction</i> 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 <i>fire separations</i> ... (a)(i) with a <i>fire-resistance rating</i> not less than 45 min ..." and to Clause (b).
	[F03-OP1.2] [F04-OP1.2,OP1.3] Applies to portion of By-law text: "... (a) floor assemblies shall be <i>fire separations</i> ... (a)(i) with a <i>fire-resistance rating</i> not less than 45 min ..." and to Clause (b).
3.2.2.22. Group A, Division 1, One Storey, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> 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]
3.2.2.23. Group A, Division 2, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> 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)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
(2)	[F02-OS1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(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 <i>combustible construction</i> , a <i>fire-resistance rating</i> 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 <i>combustible construction</i> , a <i>fire-resistance rating</i> not less than 45 min, ..." and to Clause (d).
	(a) [F03-OS1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	(a) [F03-OP1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	(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)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
(2)	(a) [F03-OS1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	(a) [F03-OP1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	(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)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> 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 <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> 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 <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "Except as permitted by Clauses (c) and (d), the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(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 (c)(i) have a <i>fire-resistance rating</i> not less than 45 min, ..." and to Clause (d).
	[F04-OP1.3] Applies to portion of By-law text: "... (c) roof assemblies shall (c)(i) have a <i>fire-resistance rating</i> 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)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
(2)	[F02-OS1.2] Applies to portion of By-law text: "Except as permitted by Clause (c) ... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "Except as permitted by Clause (c) ... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(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 <i>combustible construction</i> , a <i>fire-resistance rating</i> 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 <i>combustible construction</i> , a <i>fire-resistance rating</i> 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)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
3.2.2.35. Group A, Division 4	
(1)	[F02-OS1.2] Applies to portion of By-law text: "... a <i>building</i> classified as Group A, Division 4 shall be of <i>noncombustible construction</i> ."
	[F02-OP1.2] Applies to portion of By-law text: "... a <i>building</i> classified as Group A, Division 4 shall be of <i>noncombustible construction</i> ."
(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 <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> 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)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
(2)	[F02-OS1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(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 <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> 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]
3.2.2.39. Group B, Division 2, up to 3 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
(2)	[F02-OS1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(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)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> 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)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> 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 <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> 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)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
(2)	[F02-OS1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(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)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> 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]
3.2.2.45. Group B, Division 3, up to 2 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> 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)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
3.2.2.47. Group C, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> 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 12 storeys, Sprinklered	
(2)	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.49. Group C, up to 6 Storeys, Sprinklered, Noncombustible Construction	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
(2)	[F02-OS1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(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]
3.2.2.50. Group C, up to 3 Storeys, Noncombustible Construction	
(2)	[F02-OS1.2] Applies to portion of By-law text: "The <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "The <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F03-OS1.2] [F04-OS1.2,OS1.3] Applies to portion of By-law text: "... (a) ... floor assemblies shall be <i>fire separation</i> with a <i>fire-resistance rating</i> 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 <i>fire separations</i> with a <i>fire-resistance rating</i> 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]
3.2.2.51. 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 <i>fire separations</i> with a <i>fire-resistance rating</i> 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]
	(c) [F04-OS1.3] Applies to portion of By-law text: "... the roof assembly shall be constructed of noncombustible construction or fire-retardant-treated wood conforming to Article 3.1.4.5., ..."
	(c) [F04-OP1.3] Applies to portion of By-law text: "... the roof assembly shall be constructed of noncombustible construction or fire-retardant-treated wood conforming to Article 3.1.4.5., ..."
3.2.2.52. Group C, up to 4 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the building is sprinklered throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... 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]
3.2.2.53. 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]
3.2.2.54. 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 (c).
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.55. Group C, up to 3 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the building is sprinklered throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... 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]
3.2.2.56. 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 ..."
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the building shall be sprinklered throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... 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]
3.2.2.57. Group D, up to 12 storeys, Sprinklered	
(2)	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.58. 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).
3.2.2.59. Group D, up to 6 Storeys, Sprinklered, Noncombustible Construction	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the building is sprinklered throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... 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]
3.2.2.60. 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]
	(c) [F04-OS1.3] Applies to portion of By-law text: "... the roof assembly shall be constructed of <i>noncombustible construction or fire-retardant-treated wood</i> conforming to Article 3.1.4.5., ..."
	(c) [F04-OP1.3] Applies to portion of By-law text: "... the roof assembly shall be constructed of <i>noncombustible construction or fire-retardant-treated wood</i> conforming to Article 3.1.4.5., ..."
3.2.2.61. Group D, up to 4 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> 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]
3.2.2.62. Group D, up to 3 Storeys	
(2)	[F04-OS1.3] Applies to portion of By-law text: "... (c) roof assemblies shall have, if of <i>combustible construction</i> , a <i>fire-resistance rating</i> 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 <i>combustible construction</i> , a <i>fire-resistance rating</i> not less than 45 min, ..." and to Clause (d).
	(a) [F03-OS1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	(a) [F03-OP1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	(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]
3.2.2.63. Group D, up to 3 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
(2)	(a) [F03-OS1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	(a) [F03-OP1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .

	(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]
3.2.2.64. Group D, up to 2 Storeys	
(2)	(a) [F03-OS1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	(a) [F03-OP1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.65. Group D, up to 2 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
(2)	(a) [F03-OS1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	(a) [F03-OP1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.66. Group E, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> 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]
3.2.2.67. Group E, up to 4 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> 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]
3.2.2.68. 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]
3.2.2.69. Group E, up to 3 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> 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]
3.2.2.70. 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]
3.2.2.71. Group E, up to 2 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
(2)	[F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(b) [F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.72. 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 <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> 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]
3.2.2.73. Group F, Division 1, up to 3 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
(2)	[F02-OS1.2] Applies to portion of By-law text: "The <i>building</i> referred to in Sentence (1) is permitted to be of <i>heavy timber construction</i> or <i>noncombustible construction</i> used singly or in combination ..."
	[F02-OP1.2] Applies to portion of By-law text: "The <i>building</i> referred to in Sentence (1) is permitted to be of <i>heavy timber construction</i> or <i>noncombustible construction</i> used singly or in combination ..."
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]

3.2.2.74. Group F, Division 1, up to 2 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
(2)	(a) [F03-OS1.2] Applies to portion of By-law text: "... [<i>noncombustible</i>] floor assemblies shall be <i>fire separations</i> ..."
	(a) [F03-OP1.2] Applies to portion of By-law text: "... [<i>noncombustible</i>] floor assemblies shall be <i>fire separations</i> ..."
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.76. Group F, Division 2, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> 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]
3.2.2.77. Group F, Division 2, up to 4 Storeys, Increased Area, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
(2)	[F02-OS1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(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]
3.2.2.78. 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 <i>combustible construction</i> , a <i>fire-resistance rating</i> 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 <i>combustible construction</i> , a <i>fire-resistance rating</i> not less than 45 min, ..." and to Clause (d).
3.2.2.79. Group F, Division 2, up to 4 Storeys, Sprinklered	

(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> 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]
3.2.2.80. Group F, Division 2, up to 2 Storeys	
(2)	(a) [F03-OS1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	(a) [F03-OP1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.81. Group F, Division 2, up to 2 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
(2)	(a) [F03-OS1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	(a) [F03-OP1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.82. Group F, Division 3, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> shall be <i>sprinklered</i> 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]
3.2.2.83. Group F, Division 3, up to 6 Storeys	
(2)	[F02-OS1.2] Applies to portion of By-law text: "The <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "The <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(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]
3.2.2.84. Group F, Division 3, up to 6 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
(2)	[F02-OS1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "... the <i>building</i> referred to in Sentence (1) shall be of <i>noncombustible construction</i> ..."
	(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 4 Storeys	
(2)	[F04-OS1.3] Applies to portion of By-law text: "... (c) roof assemblies shall have, if of <i>combustible construction</i> , a <i>fire-resistance rating</i> 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 <i>combustible construction</i> , a <i>fire-resistance rating</i> not less than 45 min, ..." and to Clause (d).
	(a) [F03-OS1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	(a) [F03-OP1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	(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]
3.2.2.86. Group F, Division 3, up to 4 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
(2)	(a) [F03-OS1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	(a) [F03-OP1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	(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]
3.2.2.87. Group F, Division 3, up to 2 Storeys	
(2)	(a) [F03-OS1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	(a) [F03-OP1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]

3.2.2.88. Group F, Division 3, up to 2 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
(2)	(a) [F03-OS1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	(a) [F03-OP1.2] Applies to the requirement that <i>noncombustible</i> floor assemblies be <i>fire separations</i> .
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.89. Group F, Division 3, One Storey	
(1)	[F02-OS1.2] Applies to portion of By-law text: "A <i>building</i> classified as Group F, Division 3 is permitted to be of <i>heavy timber construction</i> or <i>noncombustible construction</i> used singly or in combination ..."
	[F02-OP1.2] Applies to portion of By-law text: "A <i>building</i> classified as Group F, Division 3 is permitted to be of <i>heavy timber construction</i> or <i>noncombustible construction</i> used singly or in combination ..."
3.2.2.90. Group F, Division 3, One Storey, Sprinklered	
(1)	[F02-OS1.2] Applies to portion of By-law text: "A <i>building</i> classified as Group F, Division 3 is permitted to be of <i>heavy timber construction</i> or <i>noncombustible construction</i> used singly or in combination ..."
	[F02-OP1.2] Applies to portion of By-law text: "A <i>building</i> classified as Group F, Division 3 is permitted to be of <i>heavy timber construction</i> or <i>noncombustible construction</i> used singly or in combination ..."
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "... the <i>building</i> is <i>sprinklered</i> throughout ..."
3.2.2.91. Group F, Division 3, One Storey, Any Area, Low Fire Load Occupancy	
(2)	[F02-OS1.2]
	[F02-OP1.2]
3.2.2.92. Group F, Division 3, Storage Garages up to 22 m High	
(1)	[F02-OS1.2] Applies to portion of By-law text: "A <i>building</i> used as a <i>storage garage</i> with all <i>storeys</i> constructed as <i>open-air storeys</i> and having no other <i>occupancy</i> above it is permitted to have its floor, wall, ceiling and roof assemblies constructed without a <i>fire-resistance rating</i> provided it is (a) of <i>noncombustible construction</i> ..."
	[F02-OP1.2] Applies to portion of By-law text: "A <i>building</i> used as a <i>storage garage</i> with all <i>storeys</i> constructed as <i>open-air storeys</i> and having no other <i>occupancy</i> above it is permitted to have its floor,wall, ceiling and roof assemblies constructed without a <i>fire-resistance rating</i> provided it is (a) of <i>noncombustible construction</i> ..."
3.2.2.93. Encapsulated Mass Timber Construction, Various Heights and Occupancies, Sprinklered	
(2)	(b), (c) [F04 – OS1.3]
	(b), (c) [F04 – OP1.3]
	(a), (c) [F03 – OS1.2][F04 – OS1.2, OS1.3]
	(a), (c) [F03 – OP1.2][F04 – OP1.2, OP1.3]
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]
3.2.3.4. 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-OP3.1]
(4)	[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 <i>noncombustible construction</i> ..."
	[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)	[F81-OP1.2]
	[F82-OS1.2]
(6)	[F82-OS1.2]
	[F82-OP1.2]
(7)	[F82-OS1.2,OP1.2]
(8)	[F82-OS1.2,OP1.2]
(9)	[F82-OS1.2,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. 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-OS1.5]
(8)	[F11,F81-OS1.5]

(9)	[F11,F81-OS1.5]
(10)	[F11,F81-OS1.5]
(11)	[F11-OS1.5]
(13)	[F11-OS1.5]
3.2.4.19. Visible Signals	
(1)	[F11-OS1.5]
(3)	[F11-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-OS1.5]
(8)	[F11-OS1.5]
(9)	[F11,F81-OS1.5]
(10)	[F11,F81-OS1.5]
(12)	[F11-OS1.5]
(13)	[F81,F11-OS1.5]
(14)	[F11,F81-OS1.5]
(16)	[F11-OS1.5]
3.2.4.21. Residential Fire Warning Systems	
(1)	[F11,F81-OS1.5]
3.2.4.22. Voice Communication Systems for High Buildings	
(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]
3.2.4.23. One-Way Voice Communication Systems	
(1)	[F11-OS1.5]
(2)	[F11-OS1.5]
(3)	[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-OS1.2]
	[F12-OP1.2]
(6)	[F12-OS1.2]
	[F12-OP1.2]
3.2.5.6. Access Route Design	
(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]
(4)	[F02-OS1.2]
	[F02-OP1.2]
(5)	[F12-OS1.2]
	[F12-OP1.2]
(6)	[F12-OS1.2,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)	[F03-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]
(4)	[F30-OS3.1]
(5)	[F74-OA2]
(6)	[F74-OA2]
(7)	[F10-OS3.7]
	[F74-OA2]
	[F30-OS3.1]
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 <i>building</i> .
	[F12-OP1.2] Applies to the requirement for a suitably identified shut-off valve outside the <i>building</i> .
	[F12-OH5] Applies to the requirement for a suitably identified shut-off valve outside the <i>building</i> .

	[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]
(2)	[F02-OS1.2] [F11-OS1.5] [F13-OS1.5,OS1.2]
	[F02,F13-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]
3.3.1.7. Deleted	
3.3.1.8. Headroom and Protruding Objects	
(2)	[F30,F73-OS3.1]
3.3.1.9. Corridors	
(1)	[F10,F12-OS3.7]
(2)	[F10,F12-OS3.7]
(3)	[F10,F12-OS3.7]
(4)	(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] [F30-OS3.1]
	(c) [F10-OS3.7] [F30-OS3.1]
	(d) [F10-OS3.7]
(2)	[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]
(11)	[F10-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]H
(4)	[F30-OS3.1]
(6)	[F30-OS3.1]
3.3.1.19. Tactile Walking Surface Indicators	
(1)	[F30-OS3.1]
3.3.1.20. 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]
3.3.1.21. 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.
3.3.1.22. Janitors' Rooms	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F02-OS1.2]
	[F02-OP1.2]
3.3.1.23. Common Laundry Rooms	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F02-OS1.2]
	[F02-OP1.2]
3.3.1.24. Obstructions	
(1)	[F10-OS3.7]
3.3.1.25. Signs in Service Spaces	
(1)	[F10-OS3.7]
3.3.1.26. 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 <i>sprinklered</i> .
	[F03-OS1.2] Applies where space under tiers of seats is <i>sprinklered</i> .

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. Safety Glazing	
(1)	[F20,F30-OS3.1]
(2)	[F20,F30-OS3.1]
3.3.2.18. Daycare Facilities with Children under 30 Months	
(1)	(a) [F02,F03,F05-OS1.2,OS1.3]
	(b) [F10-OS1.5]
(2)	[F11-OS1.5]
(3)	[F11-OS1.5]

(4)	[F11-OS1.5]
	[F81-OS1.4]
(5)	[F11-OS1.5]
	[F81-OS1.4]
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 <i>basements</i> and to rooms containing <i>building</i> services from the remainder of the <i>building</i> .
	[F06-OP1.2] Applies to the separation of entrances from the remainder of the <i>building</i> .

	[F05-OS1.5] [F06-OS1.2,OS1.5] Applies to the separation of <i>exits</i> from the remainder of the <i>building</i> .
	[F06-OP1.2] Applies to the separation of <i>exits</i> from the remainder of the <i>building</i> .
(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]
	[F01,F02,F03,F81-OP1.1,OP1.2]
(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 <i>fire separations</i> .
	(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 <i>fire separations</i> .
	(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. Exit Signs with Tactile Information	
(1)	[F10-OS3.7]
3.4.5.3. 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]
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)	[F10-OS3.7] [F30-OS3.1]
(2)	[F10-OS3.7] [F30-OS3.1]
(3)	[F10-OS3.7] [F30-OS3.1]
(4)	[F10-OS3.7] [F30-OS3.1]
(5)	[F30-OS3.1] [F10-OS3.7]
(7)	[F30-OS3.1] [F10-OS3.7]
(9)	[F10-OS3.7] [F30-OS3.1]
(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]
(2)	[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]
3.4.6.9. Curved Flights in Exits	
(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] [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)	[F10-OS3.7] [F30-OS3.1]
(3)	[F30-OS3.1] [F10-OS3.7]
	[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-OS3.7]
(5)	[F10,F81-OS3.7]
(6)	[F10,F81-OS3.7]
(8)	[F10-OS3.7]
	[F73-OA1]
3.4.6.17. Security for Banks and Mercantile Floor Areas	
(1)	[F02-OS1.2] Applies to <i>sprinklered buildings</i> .
	[F10,F81-OS3.7] Applies to <i>exit</i> 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-OS3.7]
	[F12-OS3.7]
	[F12-OP1.2]
	[F12-OS1.2,OS1.5]
(5)	[F10-OS3.7]
3.4.6.19. Floor Numbering and Identification of Stair Shafts	
(1)	[F10,F12,F73-OS3.7]
	[F73-OA1]
	[F12-OP1.2]
	[F12-OS1.2]
(2)	[F10,F12,F73-OS3.7]
	[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]
(3)	[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. Storage of Combustible Refuse and Recycling	
(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 <i>service room</i> containing a <i>boiler</i> or incinerator shall swing outward from the room ..."
	[F30-OS3.1] Applies to portion of By-law text: "A swing-type door from a <i>service room</i> containing a <i>boiler</i> or incinerator shall swing ... inward if the door opens onto a corridor or any room used for an <i>assembly occupancy</i> ."
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	
(3)	[F72-OH2.1]
(4)	[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 ..."
(4)	[F72-OH2.1]
(5)	[F72-OH2.1]
(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]
3.7.2.3. Lavatories	
(1)	[F71-OH2.3]
(3)	[F30-OS3.1]
(4)	[F71-OH2.3]
3.7.2.4. Safety Glazing	
(1)	[F20-OS3.1]
3.7.2.5. Surface Protection	
(1)	[F72-OH2.1] [F40-OH2.4]
(2)	[F72-OH2.1] [F40-OH2.4]
3.7.2.6. Floor Drain	
(1)	[F40-OH2.4]
	[F30-OS3.1]
3.7.2.7. Grab Bars	
(1)	[F20-OS3.1]
3.7.2.8. 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]
	(b) [F01,F02-OS1.1]
	(b) [F01,F02-OP1.1]
3.8.2.2. Entrances	
(1)	[F73-OA1]
(4)	[F73-OA1]
3.8.2.3. Areas Requiring a Barrier-Free Path of Travel	
(1)	[F73-OA1]
(3)	[F74-OA2]
(4)	[F74-OA2]

(5)	[F74-OA2]
	[F10-OS3.7] Applies to portion of By-law text: "... each row of seats served by two aisles shall have one adaptable seat conforming to Subsection 3.8.3. located adjacent to one of the aisles."
(6)	[F74-OA2]
3.8.2.4. Access to Storeys Served by Escalators and Moving Walks	
(1)	[F73-OA1]
(2)	[F73-OA1]
3.8.2.5. Exterior Barrier-Free Paths of Travel to Building Entrances and Exterior Passenger-Loading Zones	
(1)	[F73-OA1]
(2)	[F73-OA1]
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]
(2)	[F74-OA2]
	[F72-OH2.1] [F71-OH2.3]
(4)	[F72-OH2.1]
	[F73-OA1]
(13)	[F74-OA2]
(15)	[F74-OA2]
3.8.2.9. Assistive Listening Systems	
(2)	[F74-OA2]
3.8.2.10. Signs and Indicators	
(1)	[F74-OA2]
(2)	[F74-OA2]
(3)	[F74-OA2]
(4)	[F74-OA2]
3.8.2.11. Counters	
(1)	[F74-OA2]
3.8.2.12. Telephones	
(1)	[F74-OA2]
3.8.3.2. Barrier-Free Path of Travel	
(1)	[F73-OA1]
(3)	(a),(b) [F30-OS3.1]
	(a),(b) [F73-OA1]
	(c),(d) [F73-OA1]

	(e),(f) [F73-OA1]
	(e),(f) [F30-OS3.1]
	(c),(d) [F30-OS3.1]
(5)	[F73-OA1]
(6)	[F73-OA1]
(8)	[F80, F82-OA1]
3.8.3.3. Exterior Walks	
(1)	(a) [F73-OA1]
	(a) [F30-OS3.1]
	(b) [F73-OA1]
	(d) [F30-OS3.1]
3.8.3.4. Exterior 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)	(b),(e) [F73-OA1]
	(d) [F30-OS3.1]
	(c) [F73-OA1]
	(d) [F73-OA1]
	(b),(e) [F30-OS3.1]
	(c) [F30-OS3.1]
(4)	(a) [F73-OA1]
	(b),(c) [F30-OS3.1]
(5)	[F30-OS3.1]
(6)	[F73-OA1]
3.8.3.6. Doorways and Doors	
(2)	[F73-OA1]
(3)	[F74-OA2]
	[F30-OS3.1]
(4)	[F74-OA2]
	[F10-OS3.7]
(5)	[F74-OA2]
	[F10-OS3.7]
(6)	[F73-OA1]

(7)	[F30-OS3.1]
(8)	[F73-OA1]
(10)	[F30-OS3.1]
	[F73-OA1]
(11)	[F73-OA1]
(12)	[F30-OS3.1]
	[F73-OA1]
(14)	[F73-OA1]
(15)	[F73-OA1]
(17)	[F74-OA2]
	[F10-OS3.7]
3.8.3.7. Passenger-Elevating Devices	
(1)	[F73-OA1]
	[F74-OA2]
	[F30-OS3.1] [F10-OS3.7]
3.8.3.8. Controls	
(1)	[F74-OA2]
	[F10-OS3.7]
3.8.3.9. Accessible Signs	
(1)	[F74-OA2]
	[F73-OA1]
(2)	[F74-OA2]
	[F73-OA1]
(3)	[F74-OA2]
	[F73-OA1]
3.8.3.10. Drinking Fountains	
(1)	[F74-OA2]
(2)	[F74-OA2]
3.8.3.11. Water-Bottle Filling Stations	
(1)	[F74-OA2]
(2)	[F74-OA2]
3.8.3.12. Accessible Water-Closet Stalls	
(1)	[F74-OA2]
	[F72-OH2.1]
	(d)(i) [F74-OA2]
	(f),(g) [F30,F20-OS3.1]

	(h) [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 ..."
3.8.3.13. Universal Washrooms	
(1)	[F74-OA2]
	(b) [F10-OS3.7]
	(g) [F30-OS3.1] Applies to the requirement for a coat hook.
	(i) [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: "... a door ... capable of being locked from the inside ..."
(2)	[F72-OH2.1] [F71-OH2.3]
3.8.3.14. Water Closets	
(1)	[F74-OA2]
	[F72-OH2.1]
3.8.3.15. Water-Closet Stalls and Urinals for Persons with Limited Mobility	
(1)	[F74-OA2]
	(d) [F30-OS3.1]
(2)	[F74-OA2]
	(f) [F30-OS3.1]
3.8.3.16. Lavatories and Mirrors	
(1)	[F74-OA2]
	[F71-OH2.3]
	(f) [F31-OS3.2]
(2)	[F74-OA2]
3.8.3.17. Showers	
(1)	[F74-OA2]
	(d),(e) [F30-OS3.1]
	(f) [F30-OS3.1]
	(h) [F31-OS3.2]
(2)	[F74-OA2]
	[F71-OH2.3]
	(a) [F73-OA1]
	(b) [F10-OS3.7]
	(b) [F74-OA2]
	(g) [F74-OA2]
3.8.3.18. Accessible Bathtubs	
(1)	[F74-OA2]
3.8.3.19. Assistive Listening Systems	

(1)	[F74-OA2]
	[F11-OS3.7]
(2)	[F74-OA2]
3.8.3.20. Counters	
(1)	[F74-OA2]
3.8.3.21. Telephones	
(1)	[F74-OA2]
(2)	[F74-OA2]
3.8.3.22. Spaces in Seating Area	
(1)	[F74-OA2]
	[F30-OS3.1] Applies to portion of By-law text: "... level ... level and have removable seats, ..."
	(d) [F10-OS3.7] Applies to portion of By-law text: "... without infringing on egress from any row of seating or any aisle requirements ..."
(2)	[F74-OA2]
	[F30-OS3.1] Applies to portion of By-law text: "... level, ..."
(3)	(a) [F10-OS3.7] Applies to portion of By-law text: "... without infringing on egress from any row of seating or any aisle requirements ..."
	[F74-OA2]
(4)	[F10-OS3.7]
3.9.1.2. Application	
(1)	(d) [F02-OS1.1]
3.9.2.2. Spatial Separation	
(2)	[F12-OP3.1]
(3)	[F56-OH3.1]
3.9.3.1. Safety Requirements Within Floor Areas	
(2)	[F02-OS1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(6)	[F02-OP1.2]
3.9.3.2. Sanitary Facilities	
(1)	[F72-OH2.1]
	[F71-OH2.3]

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 the local firefighting service, 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, "Recommended Practice for 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)

Gymnasias

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-3.1.2.7. **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 will permit the suite to be located in a building to which Part 9 of the **By-law** is applicable, or when the suite is located in a building where the adjoining occupancy is a Group F, Division 1 high hazard occupancy.

A-3.1.2.8. **Daycare Facilities for Children.** A daycare facility for children is 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. (See also A-3.3.2.18.)

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 firestop 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).

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.(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/m² above the opening.

A-3.1.5.14.(5)(d) Foamed Plastic Insulation Protection. The standard fire exposure temperature in CAN/ULC-S101, “Standard Method of Fire Endurance Tests of Building Construction and Materials,” is the same as in CAN/ULC-S124, “Standard Method of 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 **By-law** 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-3.1.5.25. Di-electric Liquid Filled Equipment. The Canadian Electric Code includes requirements in Rule 26-014, that require the protection of a building from dielectric liquid-filled equipment. Where the limits of Rule 26-014 cannot be satisfied, certain construction requiring noncombustible material and protection of openings are identified, but without specifying what is considered acceptable. The requirements 3.1.5.25. provide a solution acceptable to the Chief Building Official. However, this is not to suggest that other solutions are not acceptable. If an alternative approach is desired, then documentation support such as an approach and demonstrating that the intents of the CEC have been satisfied should be submitted to the Chief Building Official for consideration.

A-3.1.6. Encapsulated Mass Timber Construction and Materials Permitted. The permission to use encapsulated mass timber construction and other combustible materials stated in Articles 3.1.6.2., 3.1.6.3., 3.1.6.9. and 3.1.6.10. does not waive the requirements regarding types of construction and cladding stated in Article 3.2.3.7.

A-3.1.6.3. Structural Mass Timber Elements. Structural timber elements may consist of any number of large cross-section timber products, such as solid-sawn timber, glued-laminated timber (glulam), structural composite lumber (SCL), cross-laminated timber (CLT), and nail-laminated timber (NLT).

The minimum dimensions required for structural timber elements in encapsulated mass timber construction were established so that such elements will exhibit the fire performance characteristics of mass timber rather than those of lightweight, small-dimensioned wood elements (e.g., lumber), including reduced-ignition propensity and reduced average rate of fuel contribution. Note that the dimensions stated in Table 3.1.6.3. do not reflect a specific fire-resistance rating; larger dimensions may be required to satisfy fire-resistance rating requirements.

The reference to Article 3.2.2.16. means that heavy timber construction is permitted to be used for the roof assembly (and its supports) in buildings of encapsulated mass timber construction that are sprinklered and not more than 2 storeys in building height. It follows that the minimum dimensions stated in Table 3.1.4.7. would apply to those elements rather than the ones stated in Table 3.1.6.3. Furthermore, the roof elements and supports made of heavy timber construction do not need to conform to the encapsulation requirements of Article 3.1.6.4., nor are they limited by the flame-spread rating or maximum thickness or cut-through requirements of Article 3.1.6.14.

A-3.1.6.4.(1) Encapsulation of Mass Timber Elements. The general intent of Sentence 3.1.6.4.(1), which generally applies for any building where a 50- or 70-minute encapsulation rating is otherwise required, is that all exposed surfaces of the mass timber elements be encapsulated, including the upper surface of a mass timber floor assembly. However, for some buildings, depending on the building height and occupancy, portions of mass timber elements are permitted to be exposed to varying degrees in accordance with the permissions stated in Sentences 3.1.6.4.(3) to (8). Also, the exposed surfaces in certain concealed spaces formed by or contained within mass timber elements are exempted from complying with this Sentence (see Sentences 3.1.6.3.(4), 3.1.6.16.(2) and 3.1.6.17.(2), and Articles 3.1.6.7. and 3.1.6.12.). Moreover, the upper surface of a mass timber roof assembly need not be encapsulated where there is no concealed space above it. As well, the exterior side of a mass timber exterior wall assembly need not be encapsulated; however, the provisions of Article 3.1.6.9. and Subsection 3.2.3. for exterior walls still need to be considered.

A-3.1.6.4.(3) to (8) Fire-Resistance Rating of Mass Timber with Exposed Surfaces. Portions of mass timber elements required to have a fire-resistance rating are permitted to be exposed in accordance with the permissions stated in Sentences 3.1.6.4.(3) to (68); however, it is important to note that applying those permissions does not waive the requirement for these elements to have a fire-resistance rating.

In the calculation of the total wall area of the perimeter of a suite or fire compartment in Sentences 3.1.6.4.(3), (5) and (7), the area of any wall openings, such as doors or windows, is included.

A-3.1.6.4.(4) Exposed Surfaces of Mass Timber Walls. The primary objective of encapsulating mass timber elements is to limit the probability that these elements will significantly contribute to fire spread and fire duration in the event of a fire. Since thick wood members require a source of imposed heat flux to burn, Clause 3.1.6.4.(4)(a) stipulates that, for any building where a 50-minute encapsulation rating is required, any portions of the exposed surfaces of different mass timber walls within a suite either face the same direction or have a minimum horizontal distance between one another. If the sprinkler system fails to operate or to control the fire, this directional orientation or minimum distance is intended to avoid or reduce the potential for re-radiation between portions of burning mass timber surfaces on different walls, and particularly those that either face or are in close proximity to one another, which could sustain flaming combustion into the decay phase of a fire. Additionally, if the sprinkler system fails to operate or to control the fire, the maximum percentage of exposed surface areas and maximum flame-spread ratings stated in Article 3.1.6.4. are intended to be insufficient to sustain a ventilation-controlled fire that might provide the radiation required to sustain flaming combustion into the decay phase of a fire.

A-3.1.6.6. Encapsulation Materials. Research has been conducted on different types of encapsulation materials, such as gypsum board, gypsum concrete and cement board. The results of tests using an intermediate-scale furnace and of cone calorimeter tests indicate that a combustible timber element protected with a 38 mm thick layer of gypsum-concrete topping or with one (25 min), two (50 min) or three (80 min) layers of 12.7 mm Type X gypsum board or two layers (70 min) of 15.9 mm Type X gypsum board will not ignite or contribute significant heat to a fire until the time at which average temperatures of 325°C to 380°C are attained at the interface between the encapsulation material or assembly of materials and the combustible substrate. These temperatures are consistent with the ignition temperatures of wood-based materials.

A-3.1.6.6.(6) Protection of Gypsum Board from Foot Traffic. Where gypsum board is used as the encapsulation material on the top of a mass timber floor assembly, it should be protected from physical impact arising from normal pedestrian traffic that could damage it and possibly compromise its encapsulation rating.

A-3.1.6.9.(1), (2), (4) and (6) Exterior Cladding. The requirements in Sentences 3.1.6.9.(1), (2), (4) and (6) are intended to reduce the potential for fire spread on the exterior cladding of buildings of encapsulated mass timber 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 proven to resist flame propagation as a function of increasing building height, including provisions to allow 100% combustible cladding where the height does not exceed 4 storeys. These cladding/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 the requirements in Article 3.1.6.9. do not supersede the provisions in Subsection 3.2.3. regarding spatial separation and exposure protection.

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 firestopping, 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, "Standard for 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.(2) Fire Separation Continuity. The continuity of a fire separation with a fire-resistance rating is maintained by installing a firestop system at the juncture where it abuts against another fire separation, a floor, a ceiling or a roof assembly. The continuity of a fire separation without a fire-resistance rating that abuts another fire separation is maintained by filling all openings at the juncture of the assemblies with a fire-resistance-rated joint firestop system that will ensure the integrity of the fire separation at that location.

Test methods for the evaluation of joint systems are described in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," which covers joint systems between adjacent fire-resistance-rated assemblies and between a fire-resistance-rated floor and a non-fire-resistance-rated exterior wall. ASTM E2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-storey Test Apparatus," is a test method applicable to joint systems between a fire-resistance-rated floor and a non-fire-resistance-rated exterior wall.

Fire-resistance-rated joint firestop systems can be tested and listed as either static or dynamic. Dynamic joint firestop systems are subjected to movement cycling prior to undergoing fire testing at maximum joint extension. This approach ensures that the fire-resistance rating of the joint firestop system will be maintained even after the joint has cycled through its anticipated range of movement over the service life of the building. Most joints between fire-resistance-rated assemblies, other than those between loadbearing elements, experience some movement over the service life of the building.

A-3.1.8.3.(5) Joints. Firestops need not be installed between joints of interior finish materials that are arranged so as to create a smoke-tight joint.

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.(1).

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 or structural element 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. Firestopping of membrane penetrations and through-penetrations 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 the penetrations.

Products for firestopping 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) Penetration. 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 firestopping for a service penetration through a concrete slab or wall.

A-3.1.9.2.(1) Service Equipment Penetrations. 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 are firestopped as described in Sentence 3.1.9.3.(1).

The installation of fire dampers, smoke dampers or combination smoke/fire dampers is intended to comply with Subsection 3.1.8. and Sentence 3.1.9.1.(5), and the conditions of their listing and labeling, which may or may not permit the installation of firestopping around the duct.

A-3.1.9.3. Outlet Boxes. For the purposes of Article 3.1.9.3., 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-3.1.9.4.(8) Combustible Branches. Combustible branches for drain, waste and vent piping are permitted to be used to connect to a plumbing fixture within a fire compartment. The integrity of the fire separation is maintained through the use of a firestop system where the vertical stack piping penetrates the fire separation.

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-3.1.11.3.(3) Fire Blocks between Nailing and Supporting Elements. Sentence 3.1.11.3.(3) applies to the portion of the combustible ceiling finish that is attached using nailing elements and constructed in accordance with Sentence 3.1.6.14.(3), which permits 10% of the ceiling finish within a fire compartment to have a flame-spread rating not more than 150. Where this portion of ceiling finish creates a concealed space above it, exposed combustible elements within that space require fire blocks to limit the spread of fire.

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 or encapsulated mass timber 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) and (4) Fire Blocks in Concealed Spaces. To reduce the risk of fire spread in combustible concealed spaces within the types of buildings referred to in Sentences 3.1.11.5.(3) and (4), 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 3.2.2.51. and buildings constructed in accordance with Article 3.2.2.48., 3.2.2.57., 3.2.2.60., or 3.2.2.93. are required to be sprinklered in accordance with NFPA 13, "Standard for the 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 not to be sprinklered 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 combustible concealed spaces that are not sprinklered, NFPA 13 mandates fire blocking beyond the minimum specified in Sentence 3.1.11.5.(3).

A-3.1.11.7.(7) Integrity of Fire Blocks. Sentence 3.1.11.7.(7), 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 firestops such as mineral wool, gypsum plaster or Portland cement mortar, or by the use of sealants that form part of a firestop tested in accordance with CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems."

A-3.1.11.7.(8) Fire Blocks. Figure A-3.1.11.7.(8) 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.

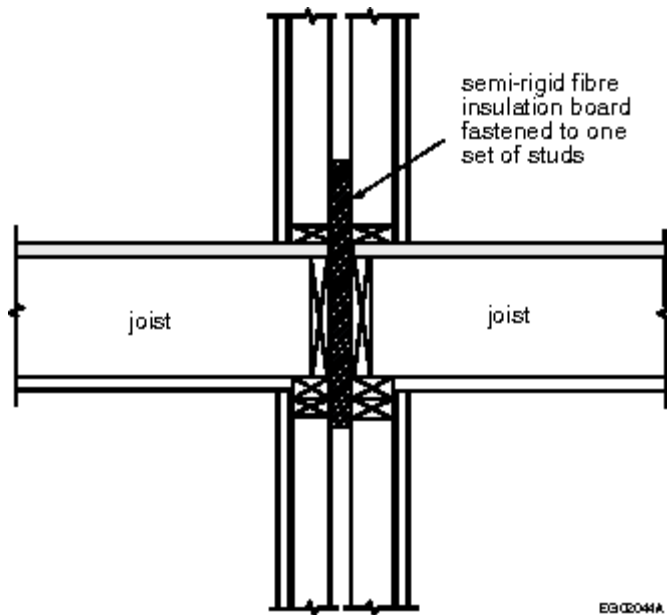


Figure A-3.1.11.7.(8)
Fire block

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 4.6m² per person is permitted.

A-3.1.18. **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 3.1.18. 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-3.2.1.1.(3)(a) **Mezzanine Area.** The permitted area of the mezzanine for the purposes of determining the allowable percentage is to be based on the open area of the floor of the space in which the mezzanine is located. The By-law does not restrict the enclosing of space below the mezzanine but the enclosed area must be deducted from the area of the overall space before applying the percentage allowance.

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 3.2.2.51. and 3.2.2.60. 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 by subdividing a building into floor areas not exceeding 1,000 m². 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 horizontally 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-3.2.2.2.(1) Special and Unusual Structures. Examples of structures which cannot be identified with the descriptions of buildings in Articles 3.2.2.20. to 3.2.2.92. 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-3.2.2.17.(1) Roof Assemblies in Gymnasiums, Swimming Pools, Arenas and Rinks. The permission to waive the fire-resistance rating requirements for roof assemblies over gymnasiums, swimming pools, arenas and rinks that meet the conditions of Sentence 3.2.2.17.(1) includes the permission to waive the requirements relating to minimum size and construction details stated in Article 3.1.4.7. for wood elements in roof assemblies of heavy timber construction on buildings conforming to Articles 3.2.2.25. and 3.2.2.32. However, wood elements in roof assemblies of heavy timber construction on buildings conforming to Article 3.2.2.30. must nevertheless meet the requirements of Article 3.1.4.7.

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 3.2.2.92. 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.

Note A-3.2.2.48.(4), 3.2.2.57.(3) and 3.2.2.93.(5) to (7) Occupancy Combinations in Buildings of Mixed Construction. Buildings conforming to the building height and area limits and the other fire protection requirements of Article 3.2.2.48., 3.2.2.57. or 3.2.2.93. may be entirely constructed of encapsulated mass timber construction and incorporate the occupancies specifically permitted by Sentence 3.2.2.48.(4), 3.2.2.57.(3) or 3.2.2.93.(5) to (7): e.g., Group A, Division 2 major occupancies on the first to third storeys, Group E major occupancies on the first and second storeys, and a parking garage on the first to fourth 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 construction conforming to the building height and area limits for encapsulated mass timber construction and in which the lower storeys are of noncombustible construction and the upper storeys are of encapsulated mass timber construction. For example, a Group A, Division 2 or Group B, Division 3 major occupancy could be located on the first 4 storeys of a 12-storey Group C building constructed in accordance with Article 3.2.2.48., as long as these first 4 storeys were constructed of noncombustible construction in accordance with Article 3.2.2.23. or 3.2.2.42., as applicable. (See also Articles 3.2.2.6. and 3.2.2.7.)

A-3.2.2.51.(5) and 3.2.2.60.(4) Occupancy Combinations in Buildings of Mixed Construction. Buildings conforming to the building height and area limits and the other fire protection requirements of Article 3.2.2.51. or 3.2.2.60. are permitted to be entirely constructed of combustible construction and incorporate the occupancies specifically permitted by Sentence 3.2.2.51.(5) or 3.2.2.60.(4): for example, Group A, Division 2 and Group E major occupancies on the first and 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 construction conforming to the building height and area limits of Article 3.2.2.51. or 3.2.2.60. and in which the lower storeys are of noncombustible construction and the upper storeys are of combustible construction. For example, a Group A, Division 2 or Group B, Division 3 major occupancy could be located on the first 4 storeys of a 6-storey Group C building constructed in accordance with Article 3.2.2.51., as long as these first 4 storeys were constructed of noncombustible construction in accordance with Article 3.2.2.23. or 3.2.2.42., as applicable. (See also Articles 3.2.2.6. and 3.2.2.7.)

A-3.2.2.93.(1) and Table 3.2.2.93. Occupancy Combinations in Buildings of Mixed Encapsulation Ratings. Buildings conforming to the building height and minimum encapsulation rating requirements and the other fire protection requirements of Article 3.2.2.93. may be entirely constructed of encapsulated mass timber construction and incorporate the multiple major occupancies otherwise permitted by Articles 3.2.2.4. to 3.2.2.6. This would also include permitting mixing of major occupancies that require different levels of encapsulation for structural mass timber elements in accordance with Table 3.2.2.6.

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 authority having jurisdiction 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).

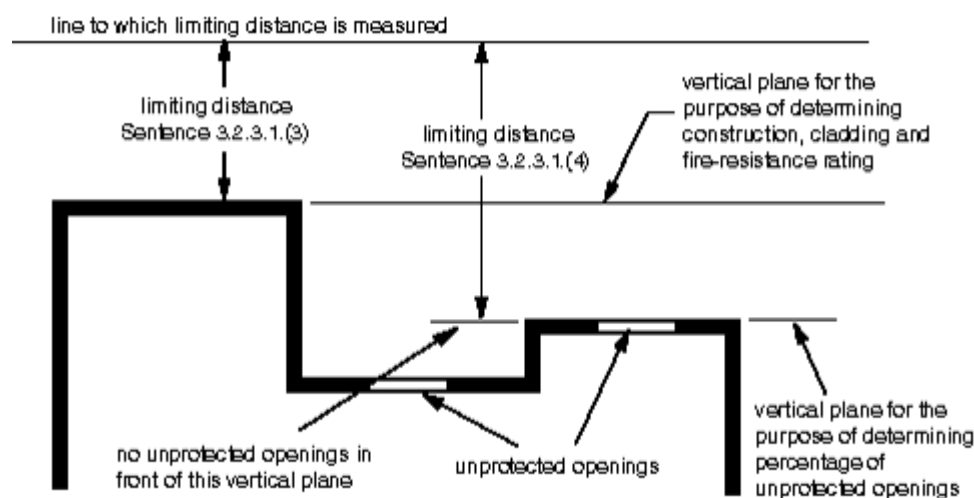


Figure A-3.2.3.1.(4)
Spatial separation design

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, "Standard for the 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-3.2.3.7.(4)(d)(iv) Thickness of Cladding. In the case of insulated vinyl siding, the maximum 2 mm thickness stated in Subclause 3.2.3.7.(4)(d)(iv) refers to the total thickness of the siding and the insulation, not of the siding alone.

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.

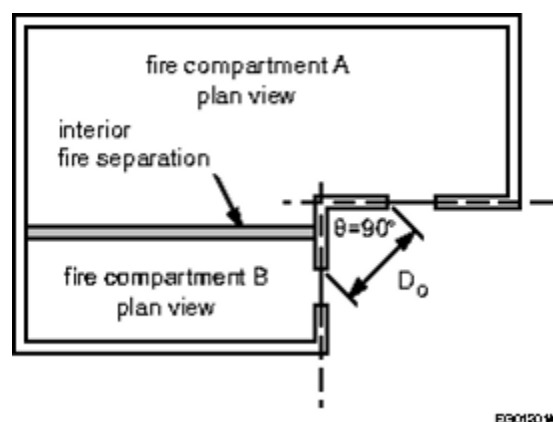


Figure A-3.2.3.14.(1)-A
Openings in walls at a right-angle corner

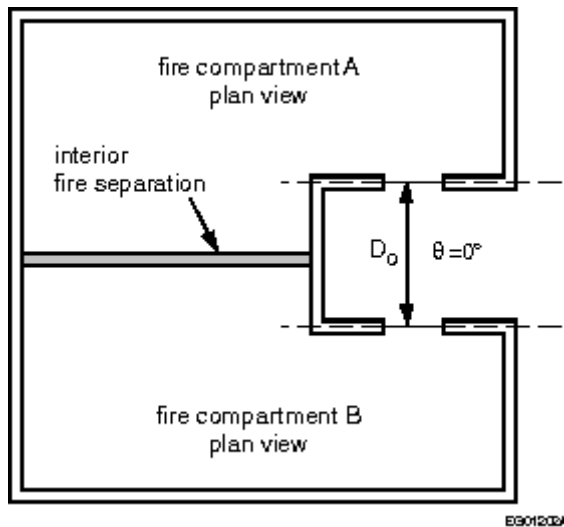


Figure A-3.2.3.14.(1)-B
Openings in walls that are parallel to one another

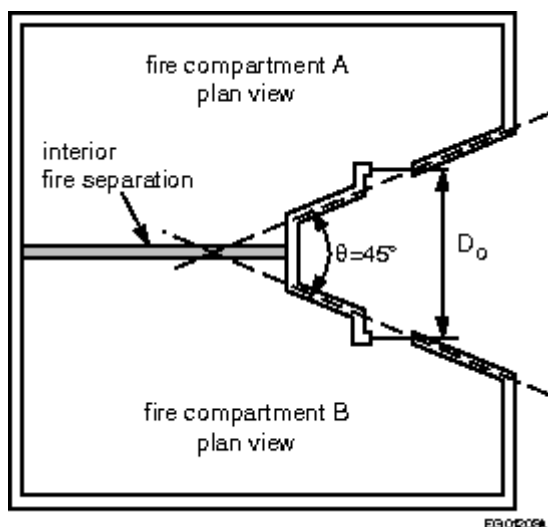


Figure A-3.2.3.14.(1)-C
Openings in walls with an included angle of 45°

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. or 3.2.4.23., 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, "Standard for Installation and Services for Fire Signal Receiving Centres and Systems," which is referenced in Sentence 3.2.4.7.(4), and CAN/ULC-S524, "Standard for 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, "Standard for the Installation of Stationary Pumps for Fire Protection," which is referenced in NFPA 13, "Standard for the 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.

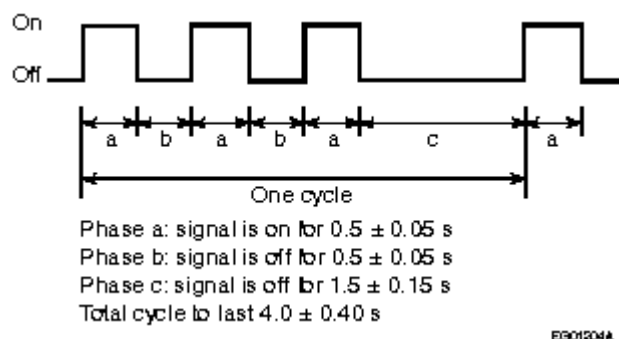


Figure A-3.2.4.18.(2)-A
Temporal pattern for fire alarm signal

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.

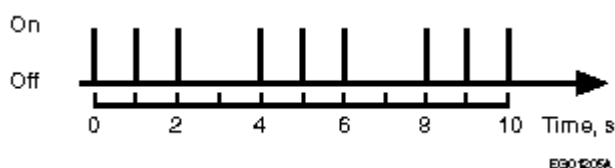


Figure A-3.2.4.18.(2)-B
Temporal pattern imposed on a single stroke bell or chime

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.(6) **Low Frequency Signal.** Audible signal devices that emit a low frequency signal in the range of 470 Hz to 570 Hz have been shown to be more effective in waking people.

A-3.2.4.18.(8) **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.(9) and (10) **Signal Circuits.** Clause 3.2.4.18.(9)(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.(9)(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, "Standard for Installation of Fire Alarm Systems."

A-3.2.4.18.(14) **Deck and Balcony Audible Signal Devices.** Deck and balcony spaces are dependent upon the building egress system. If occupants are not provided with adequate notification of conditions within the building, then the safe and orderly egress of persons from these spaces may be compromised by evolving conditions. This By-law requires that provisions for notification of the occupants of these spaces be provided.

Because these are areas exterior to the building envelope, establishing an ambient level of sound for the purposes of satisfying the sound pressure requirements of Article 3.2.4.18. will be challenging at best. Therefore, the provisions of Sentence 3.2.4.18.(14) address this only generally, by requiring audible notification devices be provided in a location proximate to deck or balcony so that occupants will be able to distinguish an alarm signal under reasonably expected conditions. It is not intended that a specific sound pressure level be achieved for the deck or balcony occupants, only that good design practices be followed and that minimum measures to facilitate the timely notification of persons on a deck or balcony be provided.

A-3.2.4.19.(1)(g) **Visible Alarm Signals in Hotels and Motels.** Visible signal devices should be installed in a combination of regular suites and designated accessible suites in hotels and motels so that people who are deaf or hard of hearing can safely occupy either type of suite.

Visible signal devices are not required to be installed in all the rooms of the suite. The signal should be visible from any room in the suite, which can be accomplished by installing glazing panels between the rooms or additional visible signal devices.

In addition, CAN/ULC-S524, "Standard for Installation of Fire Alarm Systems," requires that high-intensity strobes be used in sleeping rooms.

A-3.2.4.19.(3) **Visible Alarm Signal.** CAN/ULC-S526, "Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories," applies to visible 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 visible and audible alarms to have the same temporal pattern. Visible 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. Visible 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.(9)(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.(10) **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, "Standard for 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 D 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.

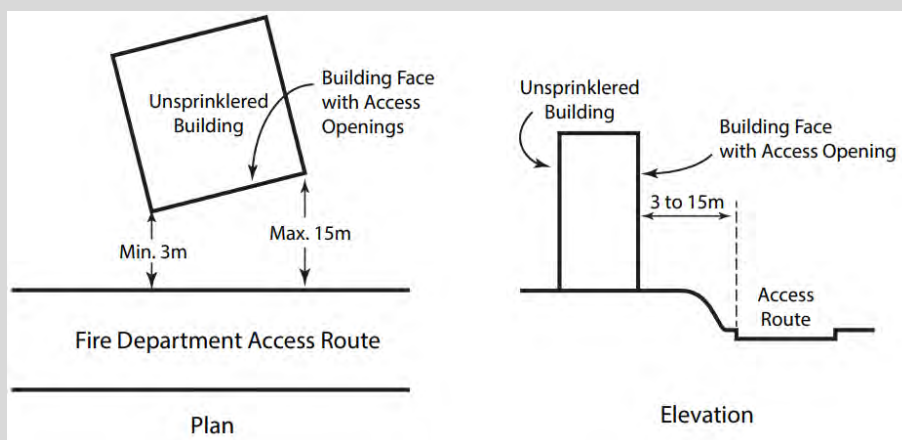


Figure A-3.2.5.5.-A

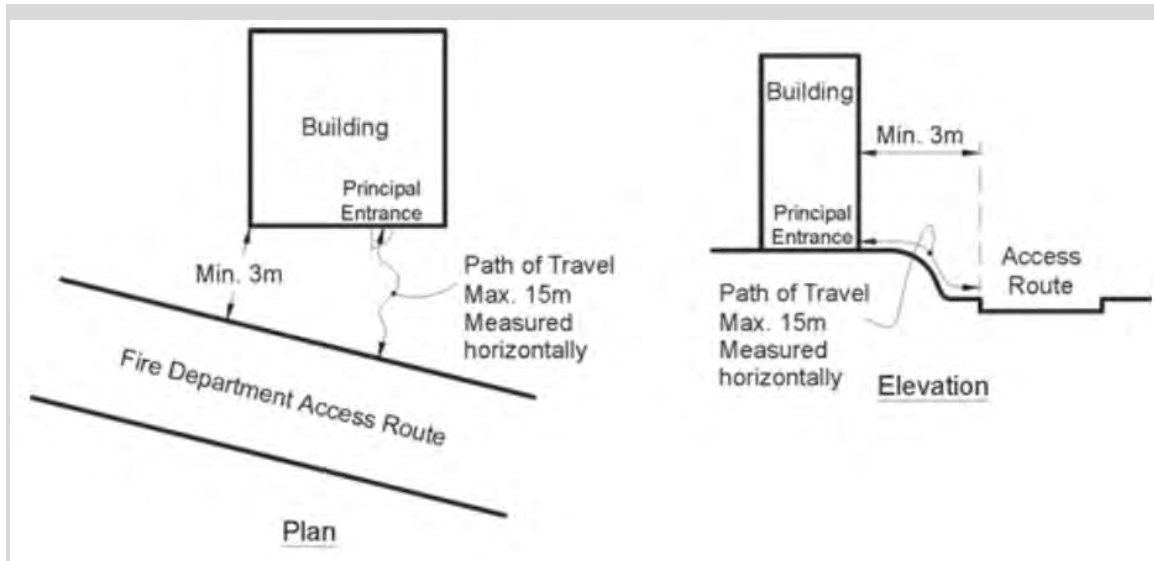


Figure A-3.2.5.5.-B

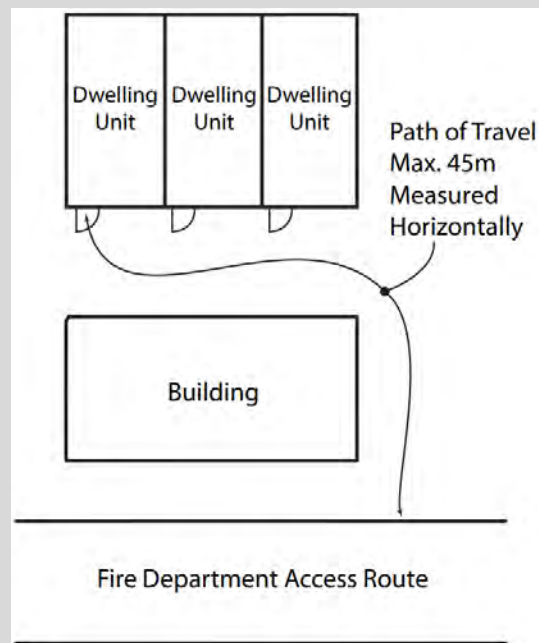


Figure A-3.2.5.5.-C

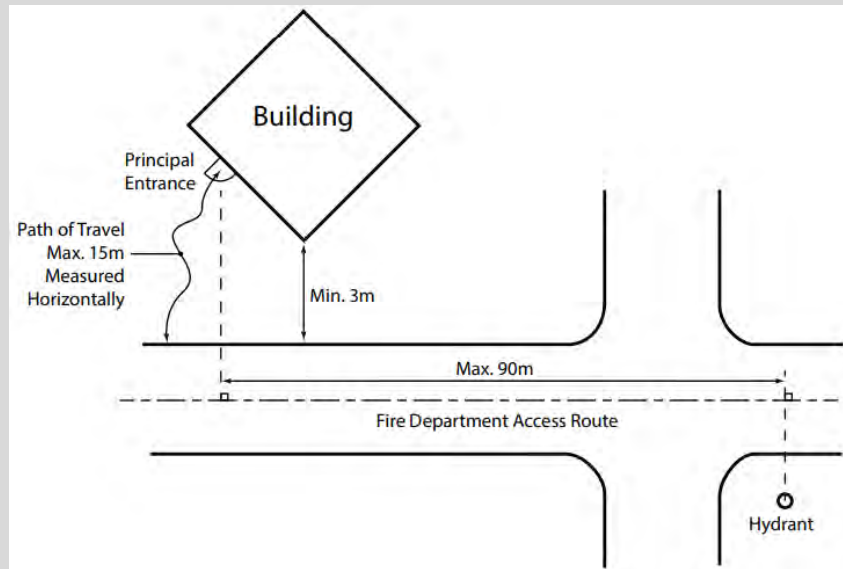


Figure A-3.2.5.5.-D

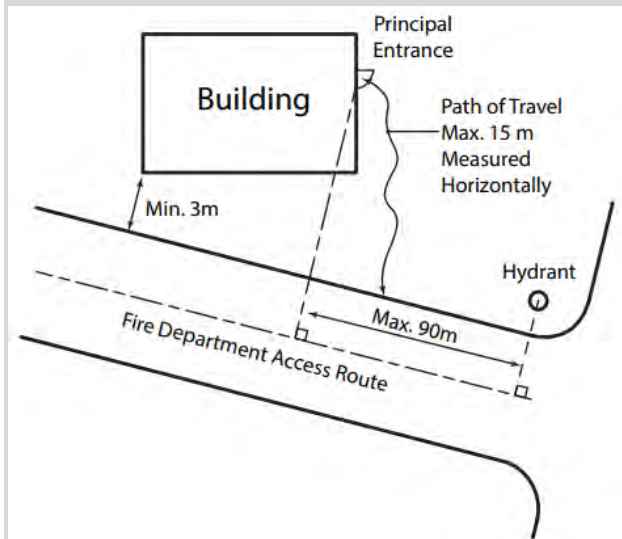


Figure A-3.2.5.5.-E

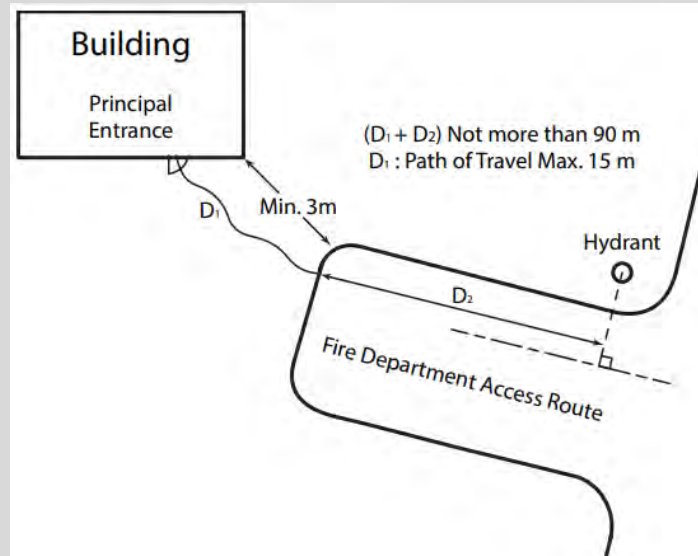


Figure A-3.2.5.5.-F

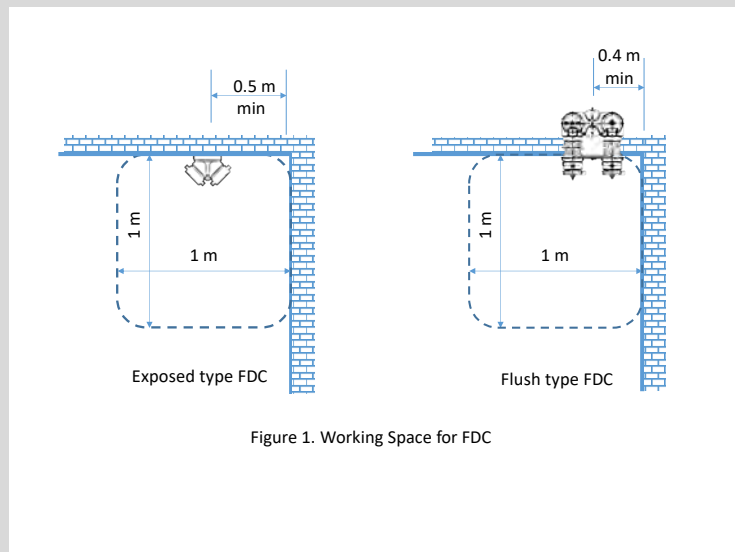


Figure 1. Working Space for FDC

Figure A-3.2.5.5.-G

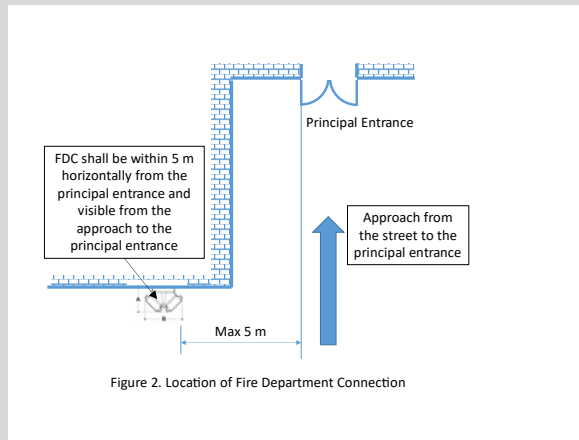


Figure A-3.2.5.5.-H

A-3.2.5.6.(1) Fire Department Access Route. 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.(4)(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, "Standard for the 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, "Standard for the 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, "Standard for the 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.(3) Superimposed Residential Suites. Sentence 3.2.5.12.(3) provides for the application of NFPA 13D, "Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes," where a residential building contains not more than two principal dwelling units or row housing. However, designers should recognize that the provisions of NFPA 13D are based in fire testing of conventional single dwelling arrangements of the 1970's and U.S. NFIRS statistical data through to 2009 for conventional single dwellings, duplex, and mobile home arrangements as evidenced in the Annex notes to NFPA 13D. They are therefore intended only to allow for arrangements where dwelling units are located in a side-by-side (horizontally connected) configuration.

Residential arrangements wherein which dwelling units are superimposed above another unit (residential or commercial) are to be designed to NFPA 13 or 13R as permitted by Article 3.2.5.12. Ancillary Residential Units are the notable exception to these requirements and are addressed separately in Section 9.37.

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, "Standard for the 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, "Standard for the 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) 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.(8) Sprinkler Rating. The requirements of this Sentence can be met by using sprinklers with a rating of 79°C to 107°C.

A-3.2.5.12.(10) 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 s0.5•m0.5 to 33 s0.5•m0.5. RTI values for standard response sprinklers will typically be in the range of 83 s0.5•m0.5 to 110 s 0.5•m0.5.

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-3.2.5.13.(1) Hazard Classification for Sprinkler Selection. The reference to light hazard occupancies is based on the descriptions of these occupancies given in NFPA 13, "Standard for the 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, "Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies," and NFPA 13D, "Standard for the 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, one and

two family dwellings, 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 CONNECTION 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.

A-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-3.2.6.1.(2)(c) Principal Entry for Firefighting. The limitation on vertical travel of 18 m describes the acceptable travel from the principal entry to the uppermost floor area. However this does not account for changes of height or specific entry arrangements outside of the building. In order to accommodate the potential need to set up hoses and other fire fighting equipment, or the movement of stretchers or other equipment, the route from the designed fire department route to the principal entry assumes a clear and relatively level entry with only modest change in elevation throughout. The acceptability of complicated entry arrangements, or of significant slopes or changes in grade should be discussed with the fire department and other first responders in applying the provision of this Article.

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 m² for each storey served by the stairway, less 0.01 m² for each weatherstripped door and 0.02 m² 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 m³/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.

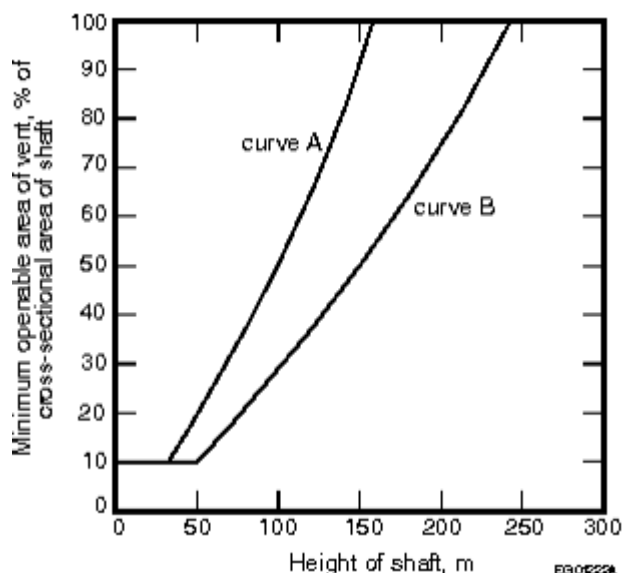


Figure A-3.2.6.2.(4)-A

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 3.1.9.4.
- (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 m² for every 10 m² of shaft wall area in the case of Curve A and 0.015 m² for every 10 m² 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 firestop 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.

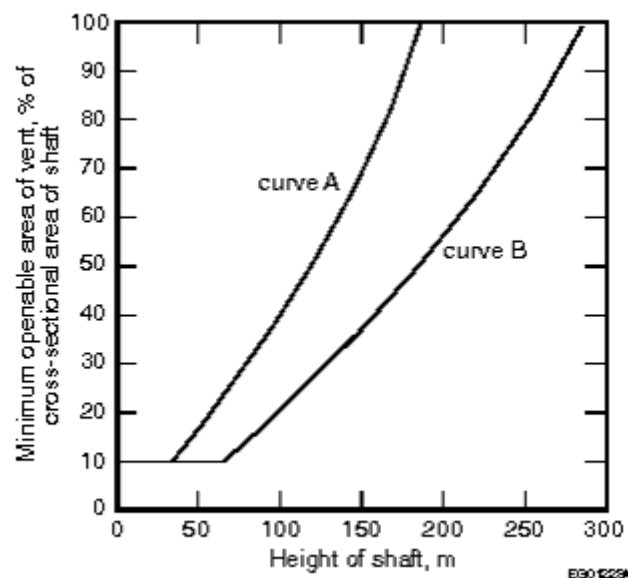


Figure A-3.2.6.2.(4)-B

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 3.1.9.4.
- (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 m² for every 10 m² of shaft wall area in the case of Curve A and 0.015 m² for every 10 m² 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 Clause (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 $10(0.023 d + 0.00045 a) \text{ m}^2$, 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.

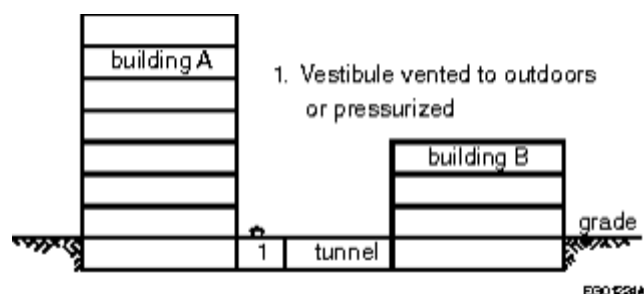


Figure A-3.2.6.3.(1)-A

Buildings connected by a tunnel

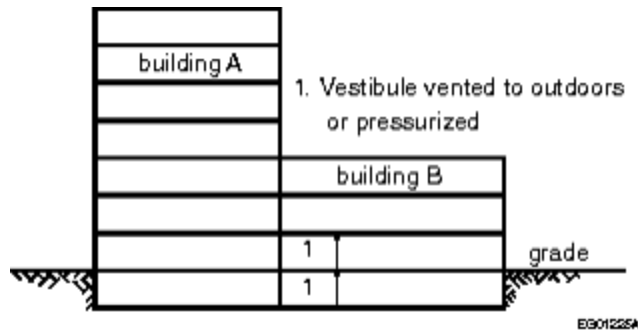


Figure A-3.2.6.3.(1)-B

Buildings connected at a firewall

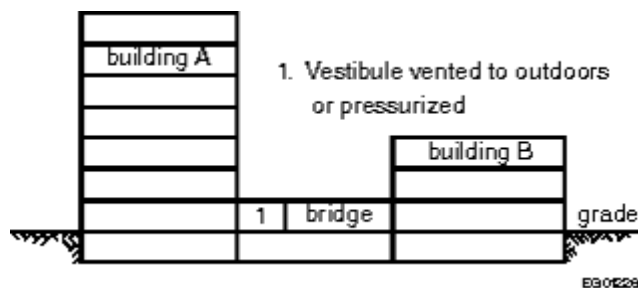


Figure A-3.2.6.3.(1)-C

Buildings connected by a bridge

A-3.2.6.5.(6)(b) Protection of Electrical Conductors. 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 important to understand how they will be installed and to know if the fire performance of the system as a whole was tested.

A-3.2.6.6.(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, m ²	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 total 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 studs	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, "Standard Method of 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 m², 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 NFC. 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, “Standard for Fire Doors and Other Opening Protectives,” includes appendix information concerning protection of openings through vertical fire separations. NFPA 13, “Standard for the 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 By-law 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, podiums 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, "Standard for 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 NFC. 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 "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, "Standard for 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-3.3.1.3 Means of Egress Serving Podiums and Terraces. The requirements for podiums and terraces in Sentence 3.3.1.3.(2) and (3) are intended for areas situated on a level that is not at the highest elevation in a building, and where the area can be accessed by a storey of the building. The requirements of Sentence 3.3.1.3.(4) to (9) are intended for roof-top areas, including "terraces" where the area is at the highest elevation of the building, and there is no access to a storey of the building at that level.

A-3.3.1.7.(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 3.3.1.7.(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 3.3.1.7.(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 persons using wheelchairs in fixed seating areas. If more precise information is available, it should be used for sizing the zones.

For residential occupancies, the choice of protection include the option to provide an accessible balcony, but it is not required that balconies be the chosen means of protection.

A-3.3.1.8.(2) and (3) Protruding Building Elements in Paths of Travel. The term “protruding building elements” refers to elements regulated by this By-law that are permanently affixed to the building and protrude into the path of travel.

The sweep of a cane normally detects protruding building elements that are within 680 mm of the floor. Any protruding element 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-3.3.1.13.(11) Access to Exit from Elevator Lobbies. The intent of Sentence 3.3.1.13.(11) is to address frequent requests by building owners and tenants to secure the suite entry doors on a floor of office occupancy, which contains at least one exit which is not directly accessible from the common corridor system outside of the regular hours of business operations.

Conceptually, the public corridor and lobby are a floor areas containing only a transitory occupancy, and not otherwise occupied after hours. However, because operating hours for a given business may vary or change over time, signage and other measures to limit the probability of the doors in the means of egress leading to an exit must be provided by the owner/operator. Significant discretion may be required on the part of the Chief Building Official to assess the reliability of such measures.

Owner/operators should expect to demonstrate how the locking system occupancy will be controlled during and after hours of operation so that unimpeded egress to two exit is provided when occupant are expected to be present on the storey. This may be difficult to achieve in a practical manner where a storey includes more than one suite.

A-3.3.1.19.(1) Tactile Attention Indicators at Unenclosed Stairs and at Drop-off Edges. Stairs in open spaces, stairs from mezzanines, and stairs that are not separated from the floor area by an element, such as a door or gate, are examples of stairs that are unenclosed. Transit platforms and the edges of a reflecting pool are examples of locations with drop-off edges where tactile attention indicators should be installed.

A-3.3.1.24.(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.

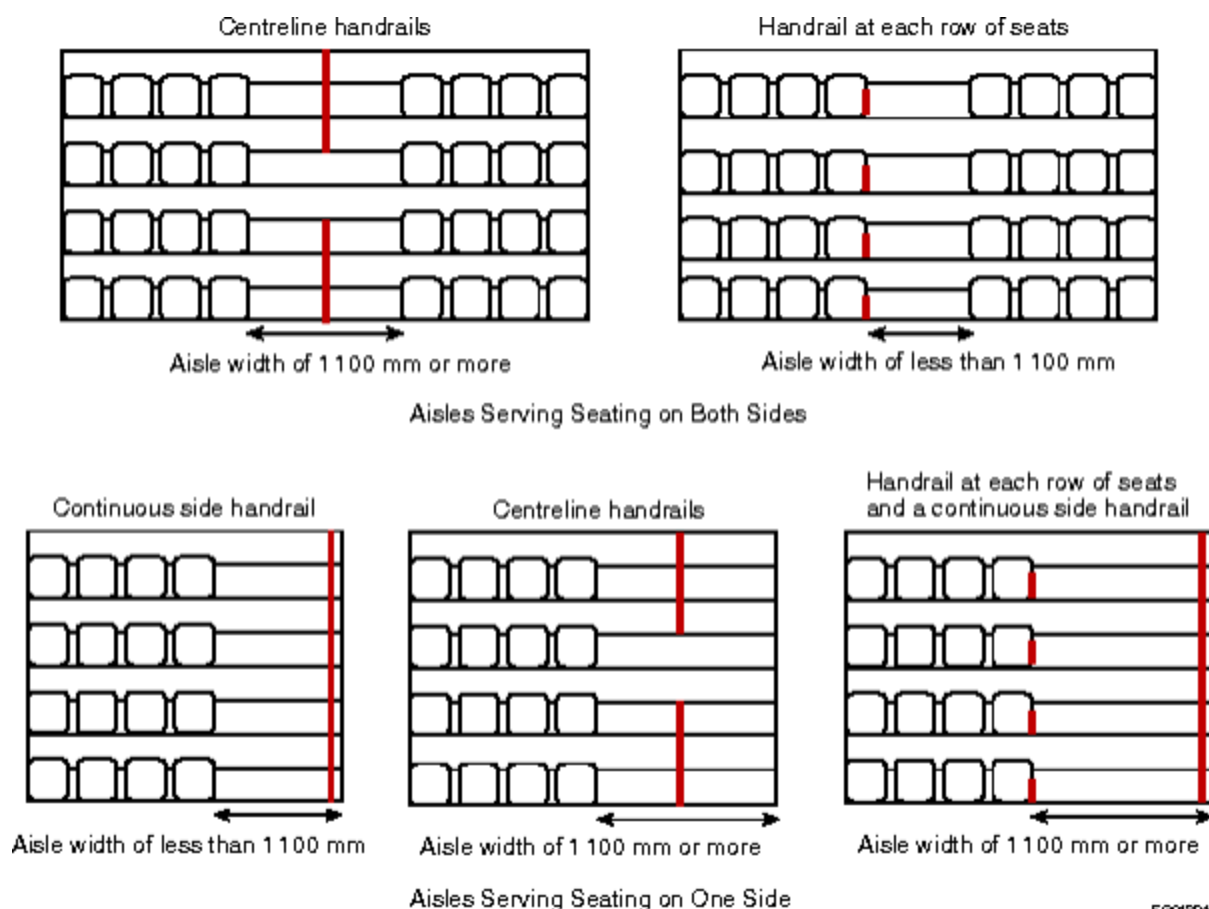


Figure A-3.3.2.10.

Handrail installation configurations

A-3.3.2.18. Daycare Facilities for Children under 30 Months. These daycare facilities are subject to additional requirements to address the unique profile of the occupants. The Community Care and Assisted Living Act and pursuant regulations establish care programs and prescribes the ages for children in those various programs. The By-law's requirements for daycare facilities for children under 30 months is intended to coordinate with those care programs, which inform the intended use and applicable By-law requirements, but the By-law does not regulate the actual ages of children in those care programs or in the facility (See Note A-3.1.2.8.)

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 1 050 mm minimum clear width of doorways accounts for door stops and, thus, is intended to allow for the use of 1 100 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; perhenates; 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-3.3.6.2.(4) Wiring and Electrical Equipment in Hazardous Locations. In addition to the general requirements of CSA C22.1, "Canadian Electrical Code, Part I," special attention must be given to Sections 18, 20 and 22: Section 18 specifies wiring requirements for Class I, II and III hazardous locations; Section 20 provides specific requirements for areas where flammable or combustible liquids are stored or dispensed; Section 22 specifies wiring requirements for areas where corrosive liquids or vapours or excessive moisture are present.

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-3.3.7.7.(3) and (4) Security for Storage Garage. The provision of Sentence 3.3.7.7.(3) and (4) are to intended restrict access from the parking storeys to adjacent non-parking storeys of the building by mandating that the exits serving a parking storeys discharge directly to the exterior.

Clause (4)(b) is intended to provide a relaxation for mixed use buildings where reasonable security features have been implemented to ensure that occupant are not subject to an unacceptable risk of physical assault. Occupants may be made aware of conditions in the exit by means of increased glazing and clear lines of sight, and can remain in a place of safety until they exit. In situation where direct lines of sight cannot be maintained, mirrors or other means to increase visibility for occupants are to be implemented.

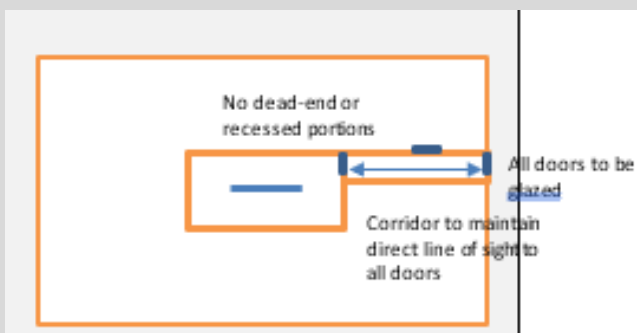


Figure A-3.3.7.7.(3) & (4)

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.

The intent of this Sentence is to permit a reduced distance between exits where a public corridor exists. However in some buildings, due to prevailing business conditions the entire floor area of a storey may be converted into a full storey tenant space. This may be challenging when the location of the existing exits have been established based on the presumption that a public corridor remains in place. Provided that the existing corridor arrangement is maintained in its current state, it is considered reasonable to maintain the existing condition as a corridor used by the public for the purposes of determining compliance with this Sentence as this can readily be shown not to reduce the existing level of performance.

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 m² 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.

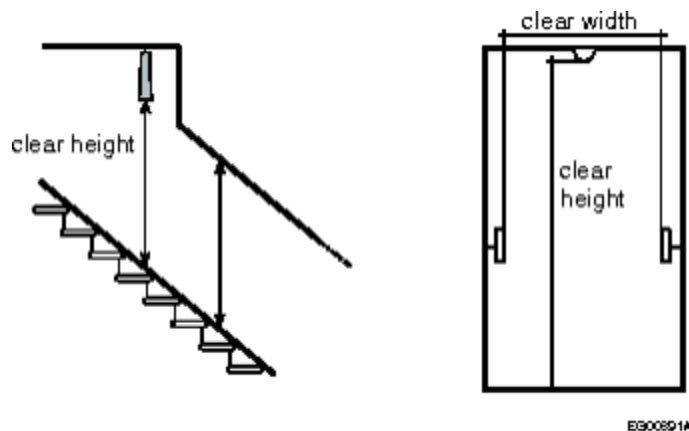


Figure A-3.4.3.4.

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)” symbol from ISO 7010



Figure A-3.4.5.1.(2)(c)-B

“E005 Direction, arrow (90° increments), safe condition” symbol from ISO 7010

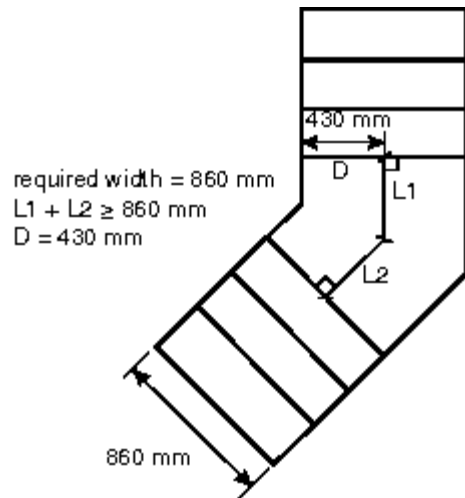
A-3.4.5.1.(3) Internally Illuminated Signs. Photoluminescent signs are not internally illuminated and therefore must conform to Sentence 3.4.5.1.(4).

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), these types of signs must be lit in conformance with the charging requirements indicated on the exit signs in accordance with CAN/ULC-S572, “Standard for Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems.”

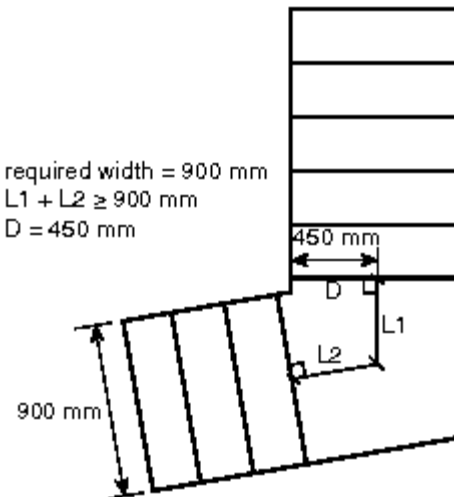
A-3.4.6. Application to Means of Egress. The requirements in Subsection 3.4.6. apply to interior and exterior exits, as well as to ramps, stairways and passageways used by the public as access to exit. The treads, risers, landings, handrails and guards for the latter access to exit facilities must thus 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.

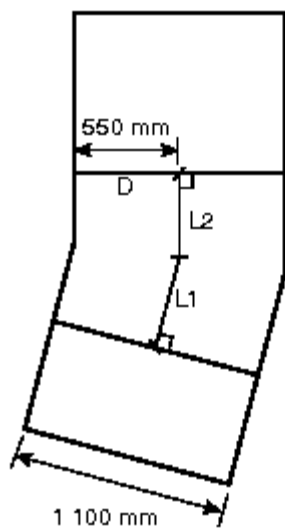
Figure A-3.4.6.4. illustrates how to measure the length of a landing for various landing configurations turning less than 90°, including straight landings.



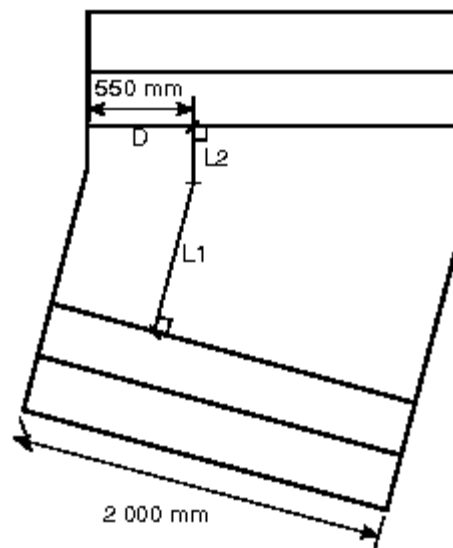
Stairs within dwelling units



Public stairs



Exit ramp
 (not part of a barrier-free path of travel)



Wide stairs

EG01307A

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.(11) Termination of Handrails. Handrails should terminate at the wall, floor or post so as not to constitute a hazard to 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.

Exit Doors Concealed with Murals

Some people with cognitive disabilities such as dementia are at risk of wandering away from the residence or healthcare facility in which they are being treated. To reduce this risk, some residences and healthcare facilities install special hardware on egress and exit doors that can only be operated by designated persons. This solution keeps residents/patients from wandering, but the doors can still trigger anxiety in residents/patients who may nevertheless try to leave the space through them, without success.

Recent studies have shown that applying murals (of a landscape, for example) on exit and egress doors in these environments can help reduce anxiety in people with cognitive disabilities who tend to view them as a pleasant natural barrier rather than as a means of escape.

Where this approach is implemented and the doors are not reasonably discernible, an alternative means of egress from the space should be provided. It is expected that the designers and authorities having jurisdiction will use judgement in determining whether or not an alternative means of egress is required. Where this approach is implemented, the murals should be applied with care so that they do not conceal or impair the operation of any fire and life safety systems installed nearby, including, but not limited to, exit signage, emergency lighting, fire alarm devices, sprinklers or door hardware. Egress and exit doors with murals should be reasonably discernible to residential care or healthcare staff who will be required to assist residents/patients in the event that the space must be evacuated, and to visitors who will be expected to evacuate on their own.

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)(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 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.(6) 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-3.4.6.16.(8) Electromagnetic Lock for Main Entry Doors. The provisions of Sentence 3.4.6.16.(8) are intended to provide an alternative arrangement for electromagnetic locking devices installed on doors in high-traffic locations, such as the main entry of buildings. This arrangement permits the use of automatic sensing devices that can release the electromagnetic locking device as an occupant approaches, and then relock that door after a period of time, provided that a backup means to request exit is provided in the immediate vicinity should the primary means of release be non-functional. In order to minimize user

confusion, the design of the means to release the electromagnetic lock has been standardized in order to facilitate its recognition throughout the City.

In an emergency, it is possible that persons may be approaching the doors quickly in order to egress, and the sensors may be unable to recognize oncoming traffic before occupants reach the doors. As a result, the electromagnetic locking device is required to design to be disengaged and remain disengage on an alarm signal from the building fire alarm system.

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-3.5.2.1.(1) Elevator Design. The reference to the Safety Standards Act and pursuant regulations in this Sentence implies conformance with all requirements of the pursuant regulations 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 2 010 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.

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) Storage of Combustible Refuse and Recycling. 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. The storage of hazardous materials destined for recycling may need to satisfy other requirements than those stated in Sentence 3.6.2.5.(1).

A-3.6.2.7.(5) Explosion Relief. Examples of good engineering practice for this application can be found in NFPA 68, "Standard on Explosion Protection by Deflagration Venting," NFPA 69, "Standard on 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, "Standard for 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, "Standard Method of 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.

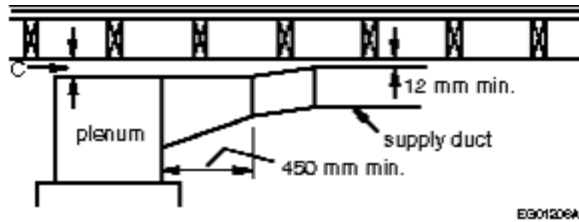


Figure A-3.6.5.6.(2)

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.

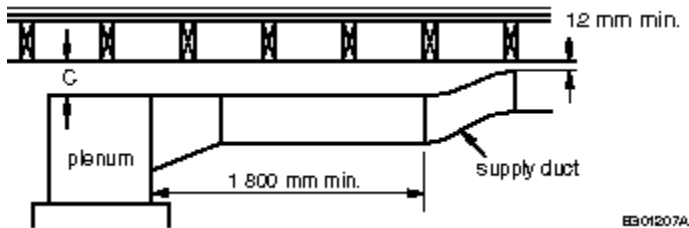


Figure A-3.6.5.6.(3)

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.

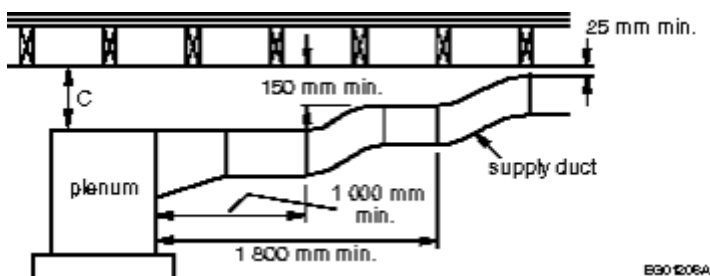


Figure A-3.6.5.6.(4)

Clearance for warm-air supply ducts

A-3.7.2.1.(2) Washroom Units in Industrial Occupancies. Substations and parking garages are examples of industrial occupancies where staff presence may be permanent or may be intermittent. In the case of parking garages, the presence of occupants other than staff is transitory.

A-3.7.2.9. 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.

Example signage from Public Service and Procurement Canada's Guide for Supporting Trans Employees is included below.



Figure 3.7.2.9.-A
Example Gender-Inclusive Signage.

3.7.2.9.(1) Gender Neutral Washrooms in Large Suites. The provisions of Sentence 3.7.2.9.(1) establish a minimum number of gender neutral washrooms for larger suites or buildings without suites where the occupant loads exceed 200 persons. This requirement can be satisfied by a universal washroom required by Article 3.8.2.8., provided that the suite or floor area includes access to the universal washroom.

3.7.2.9.(2)(c) Duress Alarms. The duress alarm referenced by Clause 3.7.2.9.(2)(c) is a safety device designed to assist individuals in emergencies or dangerous situations. These alarms typically consist of a button or pull cord that, when activated, sends an alert to a designated location, such as a constantly attended location or locally if no such location exists. The primary purpose of these alarms is to provide a quick way to summon assistance, to ensuring the safety and well-being of users.

A-3.8. Accessible Design Principles. This Section contains minimum requirements for the design of buildings that accommodate people with diverse abilities, across their lifespan, including, but not limited to, people who use wheelchairs or

other assistive mobility devices (e.g., walking aids, canes, crutches, braces, prosthetics), people with personal care providers, people with hearing or vision loss, and people with service animals, so they can access and use buildings.

Building Access Handbook

An illustrated guide and commentary has been produced to assist users of Section 3.8. and other access requirements of the Building By-law. This handbook contains the entire text of Section 3.8. and other access requirements, and is supplemented by commentary and illustrations on specific requirements.

Examples of basic accessibility requirements of the By-law are as follows:

- a clear floor space of at least 800 mm by 1 350 mm,
- a 1 000 mm clear width allowing a 90° turn,
- a 2 100 mm diameter clear floor space allowing a 180° turn in one motion, and
- a 1 700 mm diameter clear floor space allowing a 180° turn in multiple motions.

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-3.8.2.2. 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 people 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.

Article 3.8.2.2. applies to all entrances, including public and employee entrances, that provide access to an accessible storey. Doors that open onto exterior facilities that are only accessible from inside the building (e.g., hotel pools) are not considered entrances in the context of Article 3.8.2.2.

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)(k) and (l)),
- 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 (4),
- to any facility required by this Section to be designed to accommodate persons with physical disabilities,

- onto every balcony provided in conformance with Clause 3.3.1.7.(1)(c), and
- to service counters used by the general public (examples include ticket 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 with not less than a 1700 diameter clear floor area 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.

Seating booths and banquettes in restaurants and bars are considered furniture, which is beyond the scope of the **By-law**. However, various types of seating should be considered to ensure the availability of accessible options. Policies for seating such as those based on reservations or sequence of when patrons arrive is beyond the scope of the **By-law**.

The concept of wheelchair accessibility does not extend to building service facilities, nor to all floor levels within a storey, e.g., mezzanines not served by an elevator. Mezzanines that are accessible by an elevator are therefore not excluded.

A-3.8.2.3.(2)(g) Access to Facilities on a Floor Level other than the Entrance Level. Subclauses 3.8.2.3.(2)(g)(ii) to (iv) are intended to exempt certain storeys other than the entrance level—including basements and mezzanines that are less than 600 m² in floor area or 100 m² or less in floor area in assembly occupancies, that are self-contained and that contain the same facilities as the entrance level—from the requirement to have an accessible path of travel. Examples of buildings and spaces to which this exemption may apply are small office buildings with additional workspaces on the second storey and small restaurants with a second storey that contains only additional seating. However, if a restaurant's only washrooms are in the basement, they must have an accessible path of travel as they are an integral part of the principal function of the first storey. Similarly, staff lunchrooms and washrooms are also integral to the principal function of a restaurant; as such, if they are located in a floor area such as a second storey, basement or mezzanine that contains the only facilities, they must have an accessible path of travel for potential employees with disabilities.

Mezzanines that are not considered as stories for the purpose of determining building height are considered as stories for the purpose of applying Clause 3.8.2.3.(2)(g).

A-3.8.2.3.(4) Waiting Areas with Fixed Seats. Many types of buildings have waiting areas, such as airports, hospitals, and government office buildings. Waiting areas should have a sufficient number of spaces designated for persons using wheelchairs so they can use the waiting area without blocking any means of egress.

The number of people using wheelchairs is typically much higher in treatment occupancies than in other types of occupancies. Designers should consider adding more designated wheelchair spaces in waiting areas than the numbers indicated in Table 3.8.2.3. in occupancies where a higher number of persons using wheelchairs is expected due to the types of services provided.

A-3.8.2.3.(5) and (6) and 3.8.3.22.(1) and (4) Distribution of Adaptable Seats, Designated Wheelchair Spaces, and Mobility Aid Storage Spaces in Assembly Occupancies.

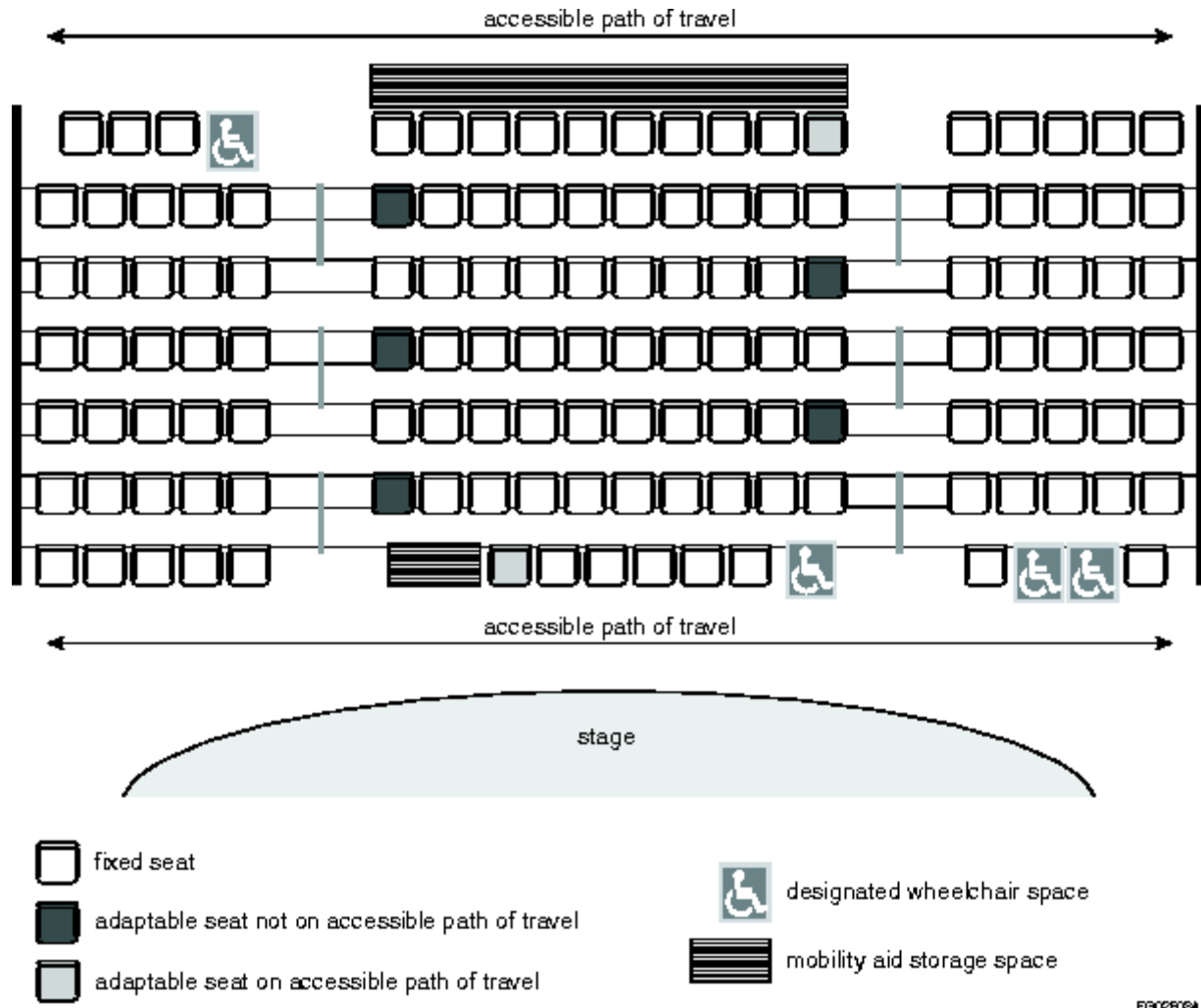


Figure A-3.8.2.3.(5) and (6) and 3.8.3.22.(1) and (4)

Example of distribution of adaptable seats, designated wheelchair spaces, and mobility aid storage spaces in an auditorium

A-3.8.2.4.(1) **Accessible 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, people must be provided with an equally convenient means of moving between the same floor levels within the building. This may be accomplished by providing elevators, platform-equipped passenger-elevating devices, or ramps, for example.

A-3.8.2.5. **Parking Areas.** In Vancouver, the design, adequacy, and number of accessible parking spaces for persons with physical disabilities determined in accordance with the Parking By-law (see Sentence 3.8.3.4.(2) for additional details). Further to the Parking By-law requirements, where feasible designers should consider maintaining consistency with provincial guidelines. The CSA B651, "Accessible design for the built environment," standard as well as the following provides guidance to determine appropriate provisions. If parking spaces are provided, parking spaces for use by persons with physical disabilities should be provided in proportion considerate of anticipated use. Where parking spaces are provided, parking spaces for use by persons with physical disabilities should 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 2 600 mm wide, provided on one side with an access aisle not less than 2 000 mm wide, provided a perpendicular and adjacent rear access aisle not less than 2 000 mm wide, and have a clear height contiguous with the routes of the vehicular approach and exit of not less than 2 750 mm,
- (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 1 500 mm above ground level, with the International Symbol of Access

Shared access aisle

Asphalt, concrete and firm, compacted gravel are acceptable parking surfaces. Curb ramps should be not less than 1500 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. 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 including the necessary vehicle clearances.

A-3.8.2.5.(1) and (2) Exterior Accessible Paths of Travel. The intent of Sentences 3.8.2.5.(1) and (2) is to ensure that exterior accessible paths of travel are readily available, direct and accessible so that persons of all abilities can move to and from a building with minimal effort.

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 this 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-3.8.2.7.(1)(b) Power Door Operators for Interior Doors. It is not intended that all doors located in an accessible path of travel be equipped with a power door operator, but rather those that are located within public areas of the building, such as public corridors or corridors used by the public. Doors of suites served by a public area do not need to be equipped with a power door operator.

A-3.8.2.7.(3) Accessible Entrances with Multiple Doorways. In selecting which doorway to equip with a power door operator as required by Sentence 3.8.2.7.(3), consideration should be given to the location of accessible paths of travel, to the ease of access, and to minimizing congestion.

A-3.8.2.8.(1) to (4) Accessible and Universal Washrooms. A universal washroom is an accessible space providing privacy for one person and their care attendant(s), regardless of their gender. It is intended that a universal washroom be available in close proximity to each bank of washrooms in a floor area. In the case where only one water closet is provided, a universal washroom would satisfy the requirement of Sentence 3.8.2.8.(1).

A-3.8.2.8.(13) Universal Dressing and Shower Rooms. A universal dressing and shower room is an accessible space that contains a shower and a space for dressing for one person and their care attendant(s) and provides privacy, regardless of gender.

It is intended that a universal dressing and shower room be available within close proximity to each bank of showers in a floor area. In cases where only one shower is provided, a universal dressing and shower room would satisfy the requirement.

A-3.8.2.8.(15) Accessible Change Spaces. The intent of Sentence 3.8.2.8.(15) is to ensure that in large major occupancies, such as large shopping malls, public pools and libraries, occupants who may need assistance with personal hygiene will have access to an accessible change space that can be found in a consistent location.

Universal washrooms containing an accessible change space should be located so that they are available to the public when the large major occupancy is occupied. A suitable location could be in the lobby of a building housing the large major occupancy that remains open during that major occupancy's business hours, for example.

A-3.8.2.9.(2) Assistive Listening Systems and Adaptive Technologies. The intent of Sentence 3.8.2.9.(2) is to require that at least one counter with an assistive listening system or adaptive technology be provided at each group of service counters providing the same exchange of information, goods or services. For example, in a stadium with ticket counters at multiple

building entrances, at least one ticket counter at each entrance should be equipped with an assistive listening system or adaptive technology.

A-3.8.2.10.(4) Directional Signage. This By-law requires that directional signs be provided in a number of situations. Although they are only required to provide visual information, tactile directional signs should also be provided where practicable.

In some buildings, it may be necessary to supplement signs that provide visual and tactile information with visual displays, such as information displays and electronic interactive displays (e.g., wayfinding, exhibits and self-serve points-of-sale). Visual displays are common in motion picture theatres, law courts, exhibition halls, passenger stations/depots, museums, conference facilities, shops, stores and markets.

Wherever practicable, visual displays should be designed so that they are accessible to all people. In order to be accessible to people with low vision, visually displayed information should also be audibly communicated, either electronically or orally. Where touch screens are installed, an alternative means of accessing the information should be provided, for example by providing tactile buttons on an interactive display or by ensuring an attendant is always available to assist customers or visitors. Visual displays should also be accessible to people who use mobility devices. The degree of operability should accommodate people using a wide range of mobility devices (e.g., wheelchairs, scooters, walkers, canes) and people with a wide range of arm and hand mobility. Approach side, mounting height above the finished floor, amount of knee space, types of controls and the ability to reach them are particularly important considerations.

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 include check-in counters and those 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 work surfaces in industrial occupancies.

A-3.8.3.1.(1) Accessible Design Standards. By-law users who opt to apply the provisions of CSA B651, "Accessible design for the built environment," listed in Table 3.8.3.1. must do so without exception: they cannot randomly select and apply a mix of provisions from this By-law and that standard.

A-3.8.3.2.(2) Reduction in Clear Width of an Accessible Path of Travel. Figure A-3.8.3.2.(2) presents schematic examples of accessible paths of travel with a section whose clear width is reduced as permitted by Sentence 3.8.3.2.(2).

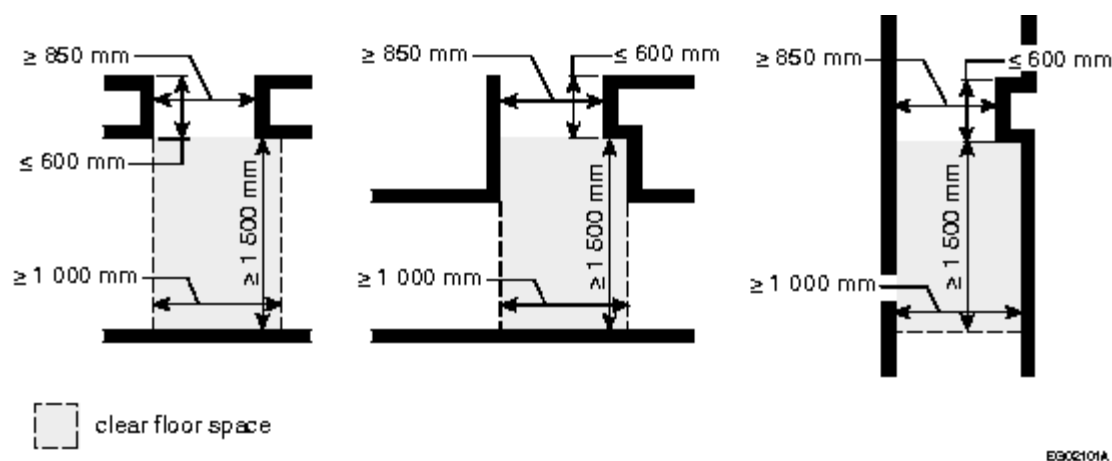


Figure A-3.8.3.2.(2)

Accessible paths of travel with a reduced clear-width section

A-3.8.3.2.(3) Surfaces in an Accessible Path of Travel. Floor finishes, including walk-off mats and carpet, should be selected, installed and securely fixed to provide a firm and stable surface so that people, including those who use 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, particularly those with vision loss. For the same reasons, heavily patterned flooring should also be avoided.

A-3.8.3.2.(6) **Wheelchair-Turning Space.** Sentence 3.8.3.2.(6) presents three options for the design of clear floor spaces at the end of long narrow sections of accessible paths of travel to allow persons using a wheelchair to turn around instead of having to back up.

Figure A-3.8.3.2.(6) illustrates one possible configuration of a T-shaped wheelchair-turning space.

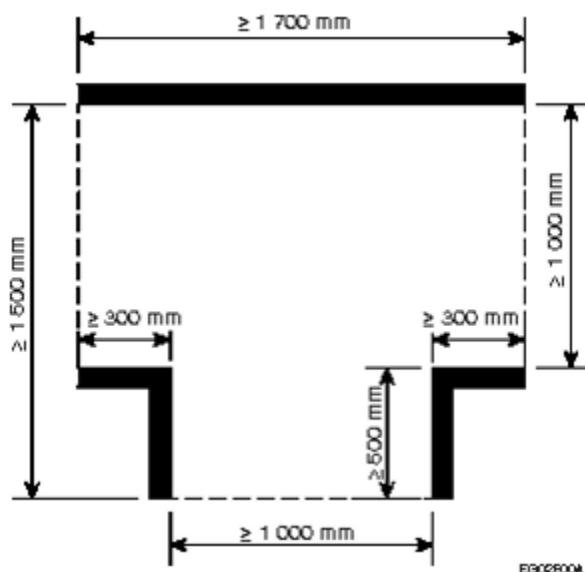


Figure A-3.8.3.2.(6)

T-shaped wheelchair-turning space

A-3.8.3.2.(8)(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.(1) **Passenger-Loading Zones.** The provision of the VBBL regarding Passenger-Loading Zones are applicable to dedicated spaces for the loading and unloading of passengers from vehicles which may require additional clearances due the use of lifts, or a larger than usual door swing to facilitate accessibility.

Sentence 3.8.3.4.(1) is intended to be applied to space for the standing of a vehicle for the purpose of discharging or taking on passengers – exterior on-site with direct grade level access such as a porte-cochere or covered loading area, or interior within the building floor area, where a bus, accessible passenger directed vehicle, or similar commercial passenger vehicle may be expected to be present. As such, this aligns with the requirements of the Parking By-law, where Passenger Class B or larger loading spaces are required by Section 7, or as otherwise required by the Director of Planning, in consultation with the City Engineer.

Note that the design of vehicular access, ingress and egress routes to and from these loading areas, are required to comply with the appropriate provision of the Parking By-law.

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 with upper body mobility 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.

The phrase “uniform slope along its length” is intended to mean that the slope remains constant along the length of individual ramp segments.

A-3.8.3.5.(1)(c) Landing Design at Doorways Leading to Ramps.

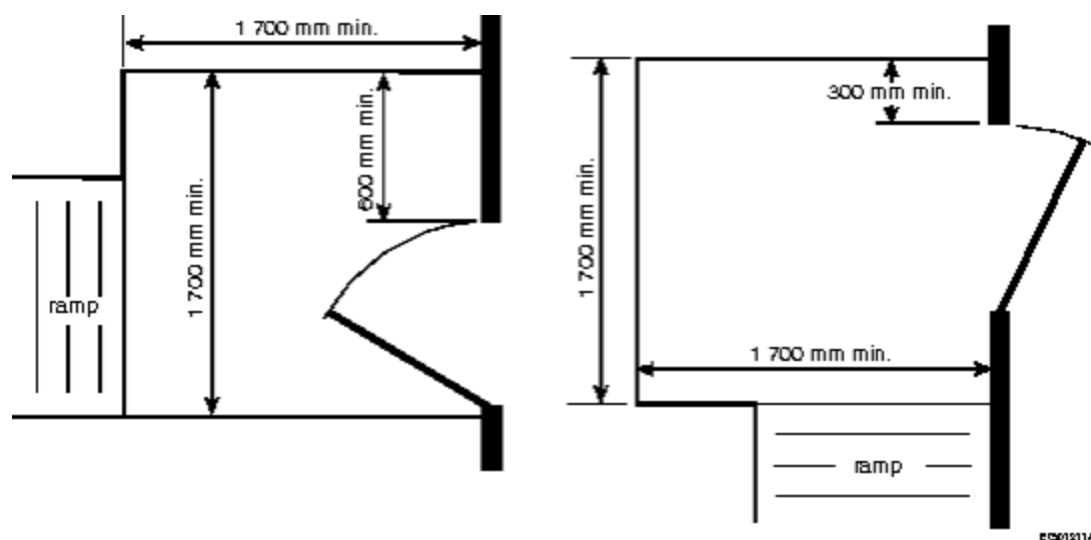


Figure A-3.8.3.5.(1)(c)

Landing design at doorways leading to ramps

A-3.8.3.5.(4)(a) **Surface of Ramps.** Sentence 3.8.3.2.(3) 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 should be taken into account, including the location of door stops other than on the door frame, and the installation of door closers and exit devices, even if they do not span the width of the entire door. 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 using a wheelchair. It is recognized that there are many types of door frames and door mounts, but the overall objective is to maintain a clear width of not less than 850 mm.

Figure 3.8.3.6.(2) depicts a somewhat restrictive scenario, as many doors can open wider than 90° to ensure the minimum clear width of 850 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.

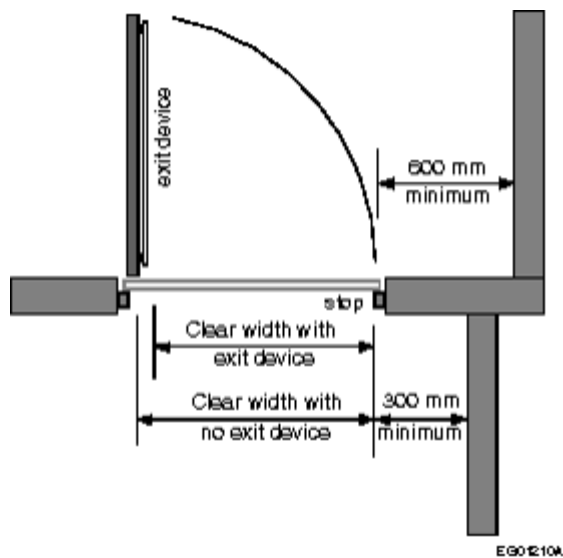


Figure A-3.8.3.6.(2)

Clear doorway width

A-3.8.3.6.(3) Washrooms in Residential Occupancies. This requirement ensures that the doorway to the washroom in a 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. 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.

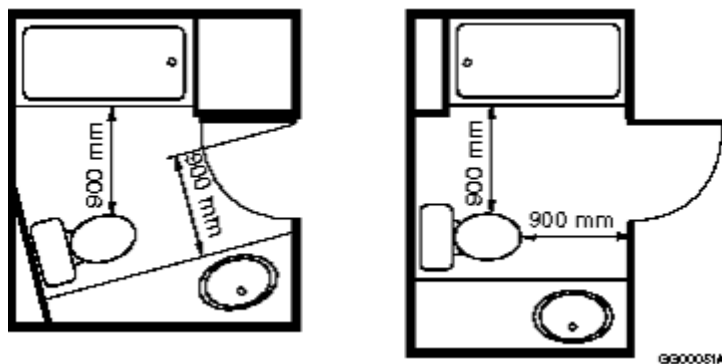


Figure A-3.8.3.6.(3)

Residential washrooms

A-3.8.3.6.(4) Lever Handles. Lever handles are usable by most people 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 of Access 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.

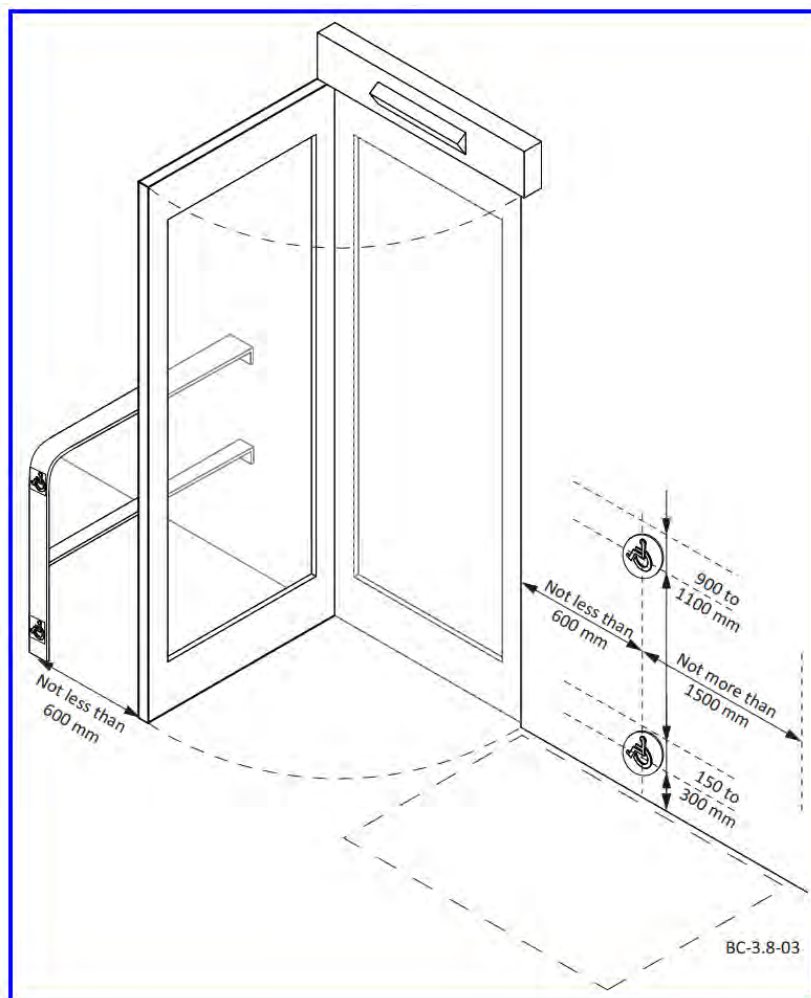


Figure A-3.8.3.6.(6) and (7)

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 delayed action closer are therefore more susceptible to damage should the door be opened with too much force or should someone try 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).

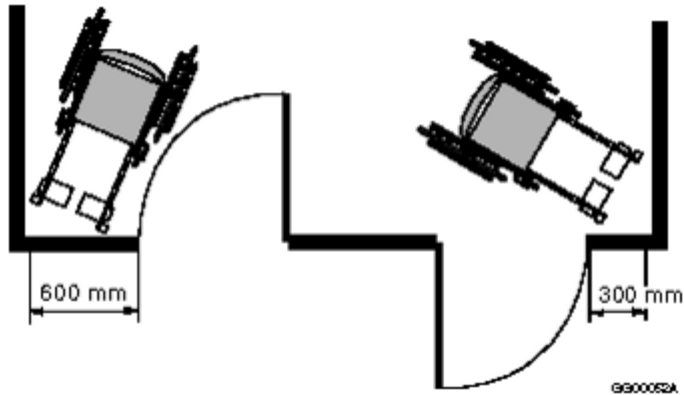


Figure A-3.8.3.6.(11)

Doorway clearance

A-3.8.3.6.(14) to (16) Minimum Clear Floor Space at Doors in an Accessible Path of Travel. Figure A-3.8.3.6.(14) to (16) presents schematic examples of the minimum clear floor space required at doors in an accessible path of travel. Power door operators serving doorways with a reduced width of the clear floor space should be operational at all times when the space is intended to be occupied.

	Without a Power Door Operator	With a Power Door Operator
Inward Swinging Door		
Outward Swinging Door		
Sliding Door		

EG00504A

Figure A-3.8.3.6.(14) to (16)

Minimum clear floor space required at doors in an accessible path of travel

A-3.8.3.6.(17) Public Area. In the context of Sentence 3.8.3.6.(17), “public area” is intended to refer to a suite, room or area that is generally open to building occupants, such as a cafeteria, lounge room, washroom or office, but is not intended to include a space such as a janitor’s room, service space or service room.

A-3.8.3.8.(1)(c) Controls with Feedback Signals. Security access systems are a typical example of systems that have controls that provide feedback signals, such as illumination and an audible cue, which should be accessible to all users.

A-3.8.3.9.(1) and (2) Visual and Tactile Information Signs.

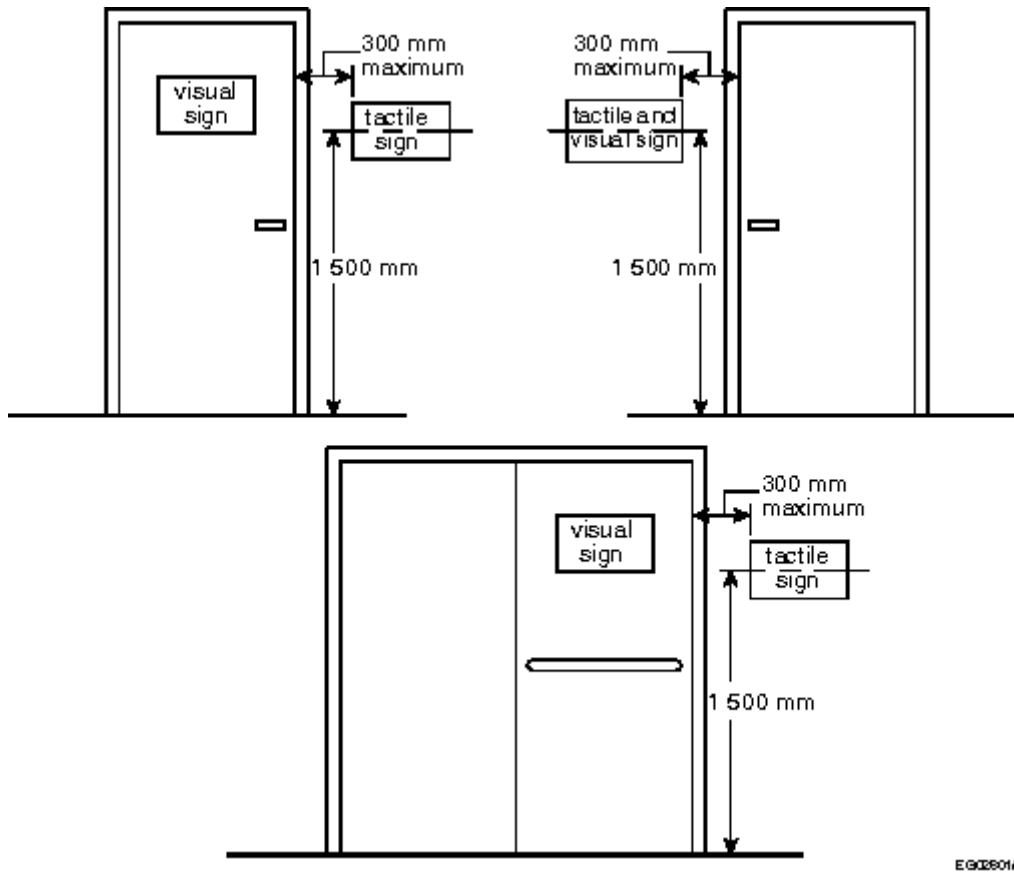


Figure A-3.8.3.9.(1) and (2)

Positioning of visual and tactile information signs on and near doors

A-3.8.3.9.(3) Accessibility Signs. The International Symbol of Access shown in Figure A-3.8.3.9.(3)-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.(3)-A

Signs indicating accessible facilities

The International Symbol of Access for Hearing Loss shown in Figure A-3.8.3.9.(3)-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.(3)-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 1 500 mm above the finished floor and within 150 mm of the jamb.

A-3.8.3.11.(2)(b) and (d) Water-Bottle Filling Stations.

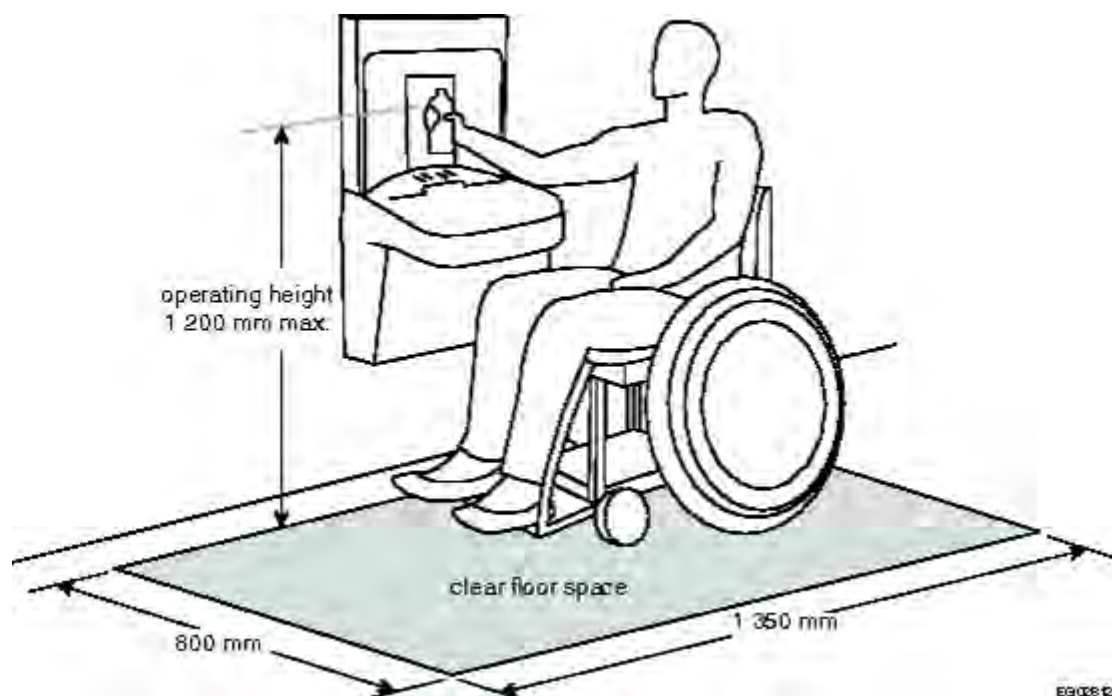
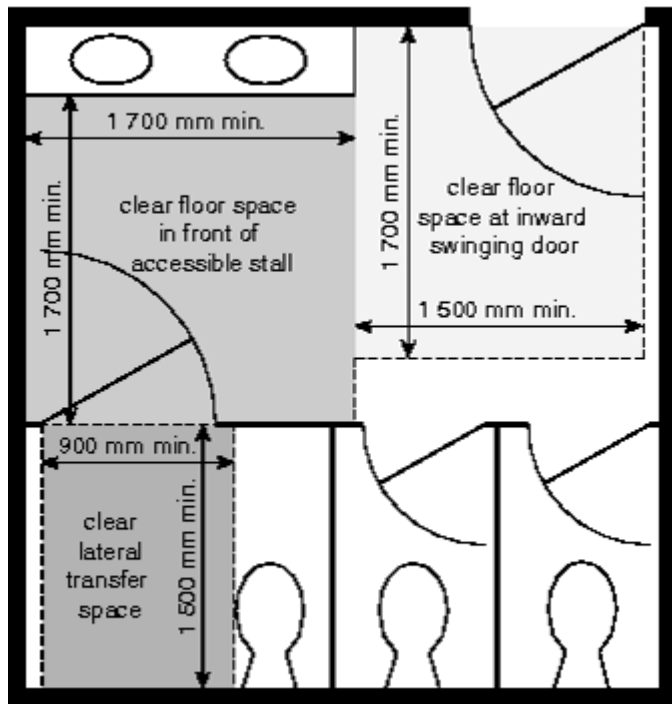


Figure A-3.8.3.11.(2)(b) and (d)

Clear floor space and operating height requirements for water-bottle filling stations

A-3.8.3.12.(1)(b) **Lateral Transfer Space on Alternate Sides of Water Closet.** The lateral transfer space required by Clause 3.8.3.12.(1)(b) should be provided on the right side in one accessible stall or universal washroom and on the left side in another so that users can choose the facility with a transfer space on the side they prefer to use.

A-3.8.3.12.(1)(d)(v) **Water-closet Stalls.** Doors to water-closet stalls for persons with physical disabilities should swing outward, preferably against a side wall.



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Figure A-3.8.3.12.(1)(d)(v)

Water-closet stalls

A-3.8.3.12.(1)(d)(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.

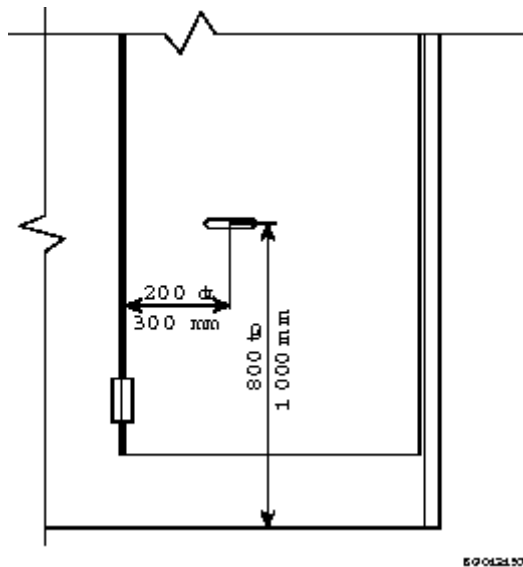


Figure A-3.8.3.12.(1)(d)(vi)-A

Door pull location

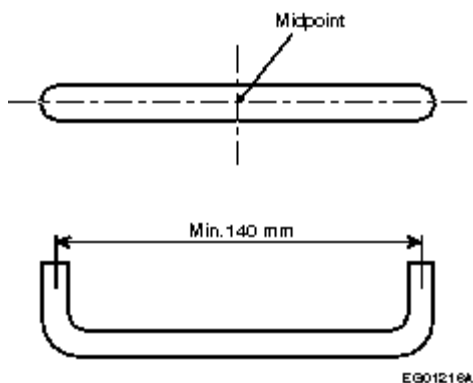


Figure A-3.8.3.12.(1)(d)(vi)-B

Door pull details

A-3.8.3.12.(1)(f)(ii) Additional Grab Bars. It is the designer's prerogative to exceed the minimum requirements found in this 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-3.8.3.13. Clear Floor Space in 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. 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 outward swinging doors are preferable for accessibility, inward swinging doors are also permitted. Figures A-3.8.3.13.-A and A-3.8.3.13.-B show design options that meet the intent of Article 3.8.3.13.

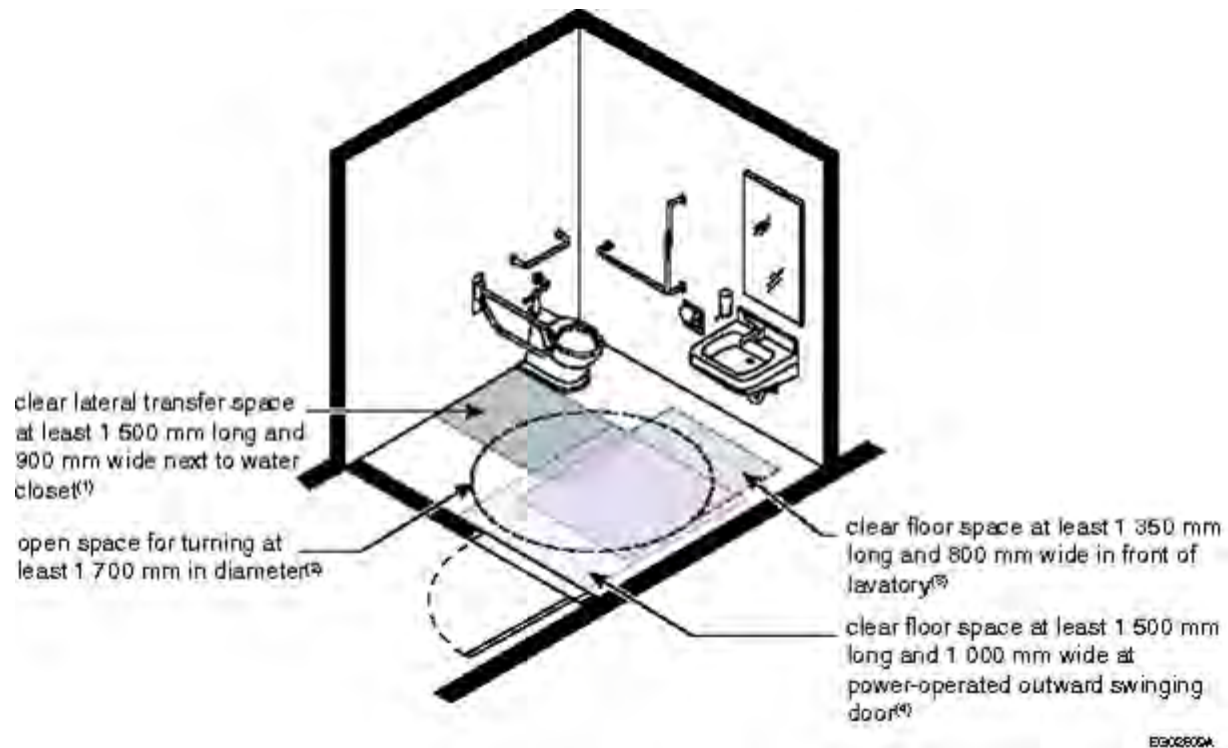


Figure A-3.8.3.13.-A

Universal washroom with outward swinging door

Notes to Figure A-3.8.3.13.-A:

- (1) See Article 3.8.3.12.
- (2) See Article 3.8.3.13.
- (3) See Article 3.8.3.16.
- (4) See Article 3.8.3.6.

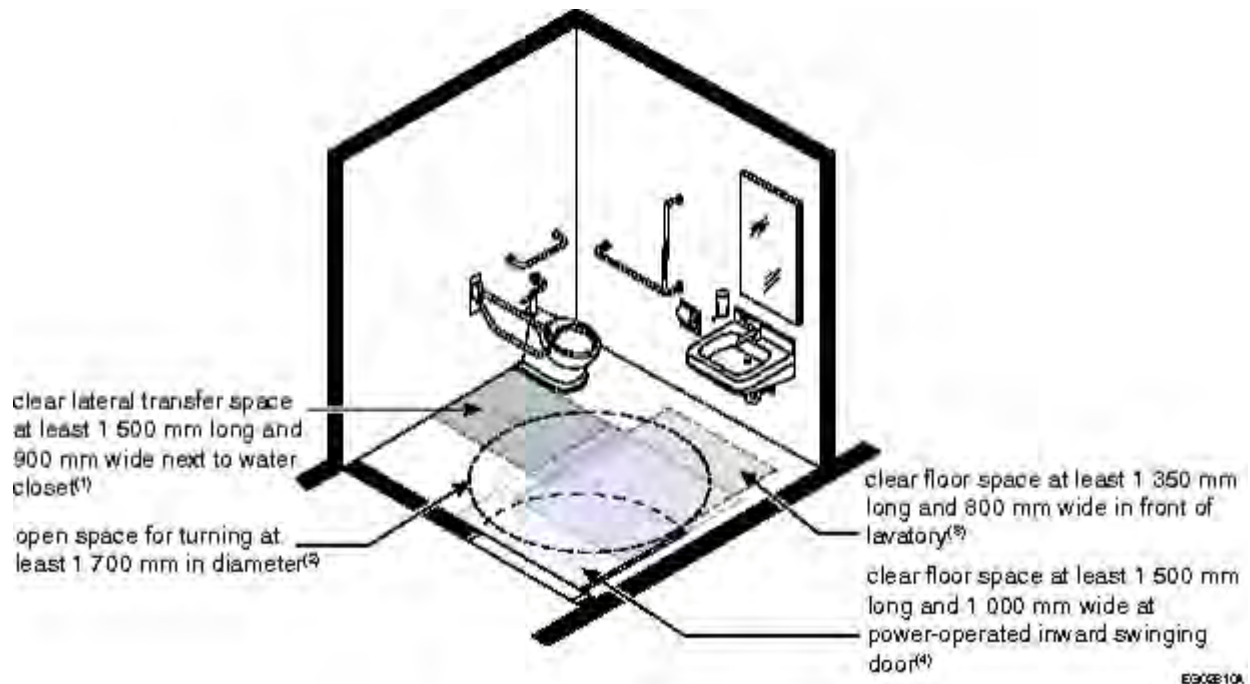


Figure A-3.8.3.13.-B

Universal washroom with inward swinging door

Notes to Figure A-3.8.3.13.-B:

- (1) See Article 3.8.3.12.
- (2) See Article 3.8.3.13.
- (3) See Article 3.8.3.16.
- (4) See Article 3.8.3.6.

A-3.8.3.14.(1) Water Closets. Wall- or floor-mounted water closets with recessed bases are preferable because they provide the least amount of obstruction.

A-3.8.3.16.(1)(e) Clearances Beneath a Lavatory.

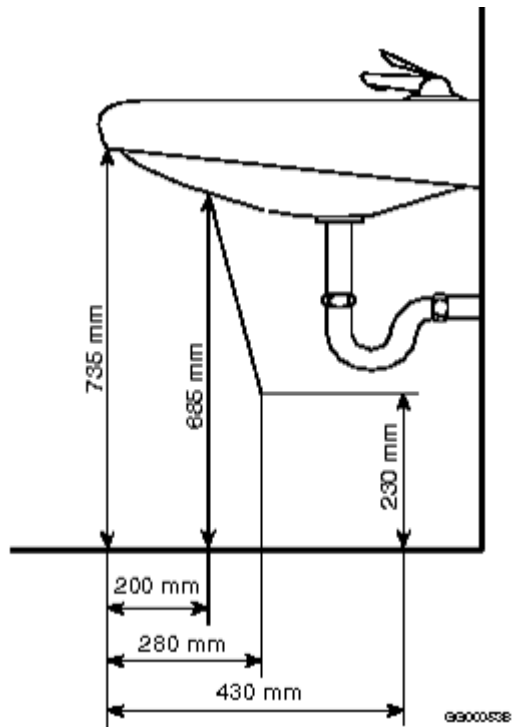


Figure A-3.8.3.16.(1)(e)

Clearances beneath a lavatory

A-3.8.3.16.(1)(f) Pipe Protection. The pipes referred to in Clause 3.8.3.16.(1)(f) 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-3.8.3.16.(1)(g) 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-3.8.3.17.(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.

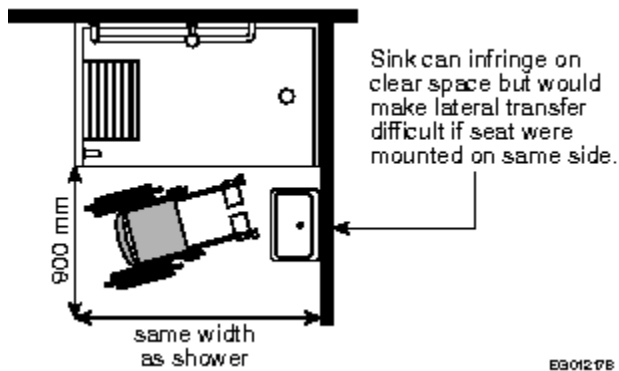


Figure A-3.8.3.17.(1)(b)

Shower design

A-3.8.3.17.(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.(2)(f) **Grab Bar at Bench.** Where a bench in a universal dressing and shower room is located adjacent to a wall, it is recommended that a grab bar be installed to assist users in transferring to the bench.

A-3.8.3.19. **Assistive Listening Systems.** Examples of assistive listening systems include FM, infrared and induction loop systems. However, the technology in this field is advancing rapidly; as such, other types of assistive listening systems could be considered in the design of a space. In choosing the most appropriate system, a number of factors must be taken into account including cost, installation and maintenance requirements, suitability for the intended user or audience, ease of operation, and the need for privacy. Information on designers and suppliers of such systems can be obtained from the Canadian Hearing Society. The intent of Article 3.8.3.19. is to provide clear communication where information, goods or services are provided to the public.

Wireless sound transmission systems, including FM, infrared and magnetic induction loop systems, improve sound reception for persons who are hard of hearing by providing amplification that can be adjusted by each user while blocking out unwanted background noise. Some of these systems transmit a signal that is picked up by a special receiver (FM, infrared) available for use by a person who is hard of hearing, whether or not a hearing aid is used. None of the systems interfere with the listening enjoyment of others.

The transmitter can be connected into an existing public address (P.A.) system amplifier or used independently with microphones. The induction loop system (see Figure A-3.8.3.19.-C) requires users with a hearing aid or cochlear implant to be 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 and infrared systems can be designed to broadcast signals that cover the entire room and thus do not restrict seating to any one area. Figures A-3.8.3.19.-A and A-3.8.3.19.-B show the general configuration of FM and infrared systems. Although portable systems (FM systems, 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 connection is provided at a particular seat in an auditorium, for example) might meet this requirement when adequate provisions are made to accommodate persons with hearing aids.

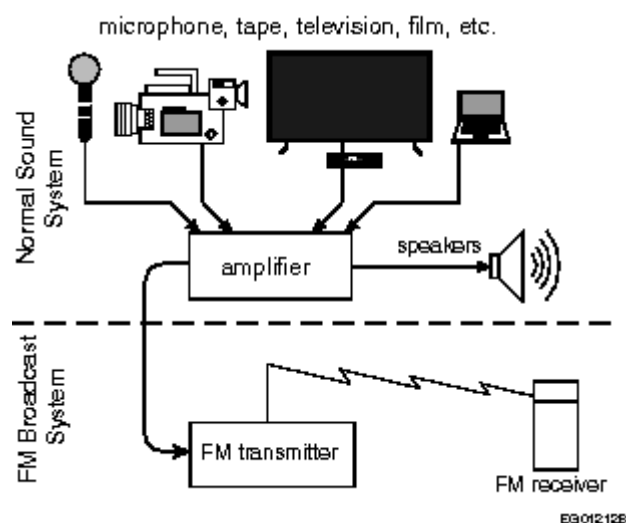


Figure A-3.8.3.19.-A

FM sound transmission system

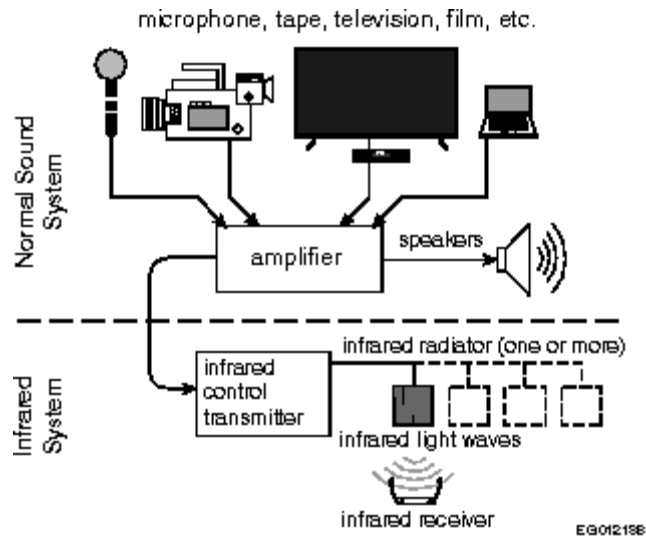


Figure A-3.8.3.19.-B
Infrared sound transmission system

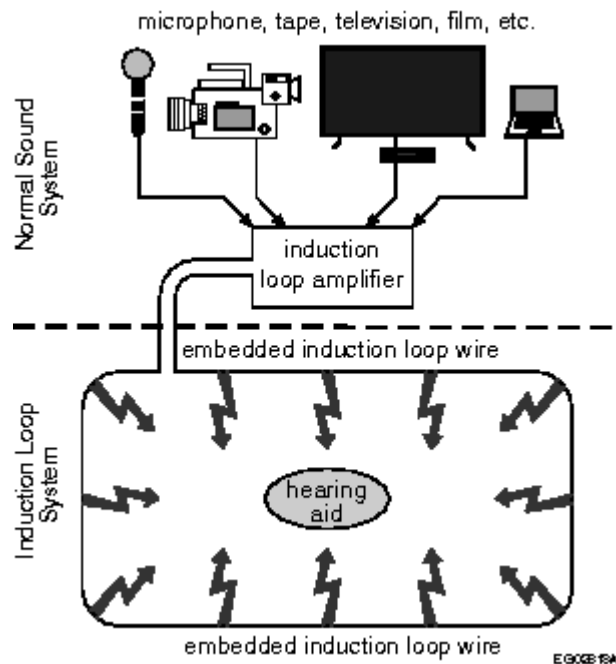


Figure A-3.8.3.19.-C
Induction loop sound transmission system

A-3.8.3.20.(1)(c) Knee Space at Service Counters. Where forward-facing interaction with a person is required, the knee space requirement of Clause 3.8.3.20.(1)(c) applies to both sides of the service counter to ensure accessibility for both service providers and those receiving services.

A-3.8.3.21.(2) 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 person using a wheelchair.

A-3.8.3.22.(4) Storage Spaces for Mobility Aids. The intent of Sentence 3.8.3.22.(4) is that a sufficient number of storage spaces for mobility aids other than wheelchairs and scooters (e.g., walkers) be located such that they can be accessed without leaving the seating area. These storage spaces should preferably be visible from the adaptable seats. The storage spaces may be located adjacent to an aisle but must not reduce the required egress width of the aisle or obstruct egress from the rows of seats.

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.

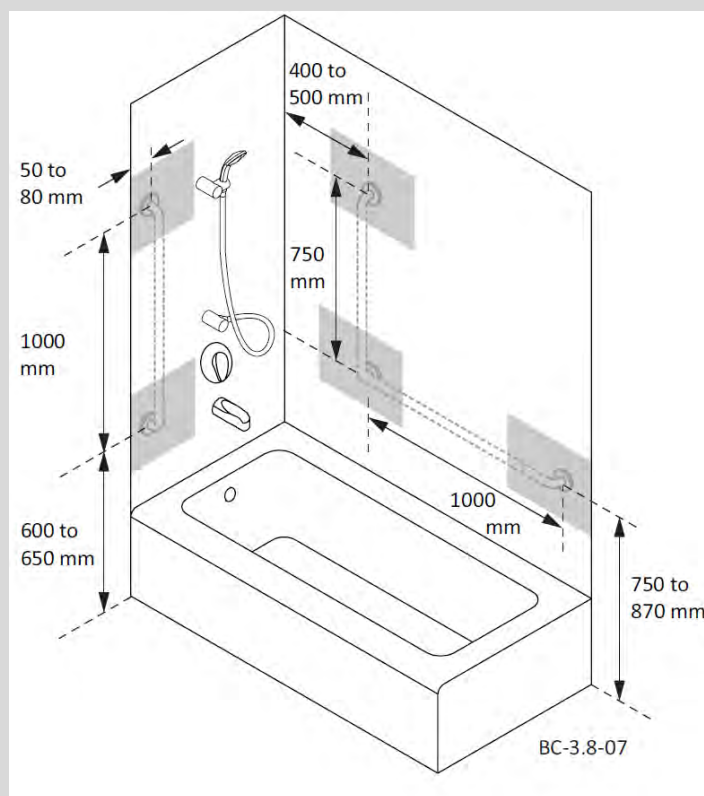


Figure A-3.8.5.5.

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.(1) Location of Adaptable Dwelling Unit Bathrooms. One of the fundamental objectives of the Adaptable Dwelling Unit provisions is to allow for the future installation of a three piece bathroom on the principal floor of each unit with features facilitating use for a persons with a range of abilities. Consequently, the requirements of Article 3.8.5.5.(1) are intended to ensure

that sufficient space is allocated at the outset so that the principal floor of the dwelling unit can accommodate a future three piece bathroom and space for the effective use of its fixtures. This allows for the flexible use of the living space most readily providing access to the exterior for persons with varying degrees of mobility.

In the event that the specific design constraints of the ground floor does not allow for the effective inclusion of a bathroom, the Chief Building Official may permit the allocation of space for the piece washroom on another floor. Similarly, a minimum 40 m² floor area has been established to account for the decreasing efficiency in space use and impact on livability in smaller units.

CBO's Interim Position on the design of spaces for the future accommodation of low barrier showers (Updated April 15, 2025):

1. That the triggering requirement for the adaptable bathroom would be based upon an assessment of the size of the livable floor space of a suite on a floor-by-floor basis, meaning that:
 - a. at least one adaptable bathroom in a suite is required where any livable floor space exceeds 40 m²,
 - b. the determination of livable floor space is based upon that portion of the floor area of a given storey of the building which is intended for daily use containing kitchen, living, or dining facilities,
 - c. that the adaptable washroom should be provided on the principal living space with ground level access, on a floor area that is 40 m² or more in order to perform its intended function, and
 - d. the current extent of the adaptable bathroom requirements for 3.8.5.5. require either a 3 piece bathroom set, or a sink and toilet plus suitable provision for future installation of a low barrier shower.
2. The underlying general intent of the adaptable bathroom provisions of 3.8.5.5. are to require a dedicated bathroom space ready for future adaptation to accommodate an occupant whose may have physical needs have changes such that they differ from what the present arrangement can accommodate at a minimal cost to the owner.
3. Where an owner opts to forego a 3 piece bathroom, a proposal for a two piece adaptable washroom generally complying with Article 3.8.5.5. shall include the following:
 - a. a washbasin and toilet;
 - b. the pre allocation of a dedicated space for the installation of a low barrier shower which:
 - i. is a dedicated separate space that is not currently a part of the 2 piece bathroom, (such as a 3'X3' / 3'X 4' / 3'X5' / 5'x2.5' bathtub size);
 - ii. may include storage space or similar non-essential space;
 - iii. may not include the current washer and dryer location, service rooms or spaces,
 - iv. shall have suitable structural support to accommodate the future installation of the low barrier shower and surrounds; and
 - v. where the floor is concrete or has a concrete topping, it shall be constructed to accommodate for the future installation of the shower that does not require extensive demolition or cutting of the concrete.
 - c. a minimum clear floor space of 750mm X 1200mm for maneuvering shall be provided in front of the washbasin, toilet, and the dedicated bathtub / shower space.
 - i. The clear floor space is to be designed to allow sufficient maneuvering room for the occupant to readily transition to and from the future low barrier shower from dedicated separate space without unusual effort; and
 - ii. The minimum clear floor space may not overlap the sink, toilet, or the dedicated space for the lower barrier shower.
 - d. The washroom fixtures shall not overlap nor shall they overlap the dedicated space.
 - e. Preplumbing shall be required to support the future installation of a low barrier shower:
 - i. with domestic cold and hot water;
 - ii. with a drain intended for the future installation of a low barrier shower; and
 - iii. without requiring extensive or costly modification to a facilitate the future installation of the low barrier shower.; and
 - f. The design drawings shall indicate:
 - i. the location and extents of the dedicated space for the low barrier shower and indicate the location of all pre-plumbing roughed-in at the dedicated separate space on the initial permit application drawings,
 - ii. walls intended to be demolished or renovated to make way for a future low barrier shower shall not contain equipment, service panels, wiring, piping, or other services that cannot be readily relocated.

A-3.8.5.5.(2) 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.

A-3.8.5.5.(3)(a) Offset controls. The intent of offset controls is to facilitate access to fixture controls for persons in a wheelchair, having limited mobility, or requiring a mobility aid. The offset typically includes a change in position of the controls from the traditional halfway mark at the centreline of the bathtub or shower to towards the exterior edge adjacent to the clear floor area. It should not be required for a person in a wheelchair to transfer to an adjacent fixture in order to reach the controls (see CSA-B651 for examples of good design practice).

A-3.9.2.1.(1) Building Area of Self-service Storage Buildings. Sentence 3.9.2.1.(1) permits a group of self-service storage buildings to be treated as a single building for determining the construction requirements and number of streets that the group faces under Subsection 3.2.2. This can often result in more stringent construction criteria for the individual buildings than would be required if their construction requirements were determined based on each building's individual area.

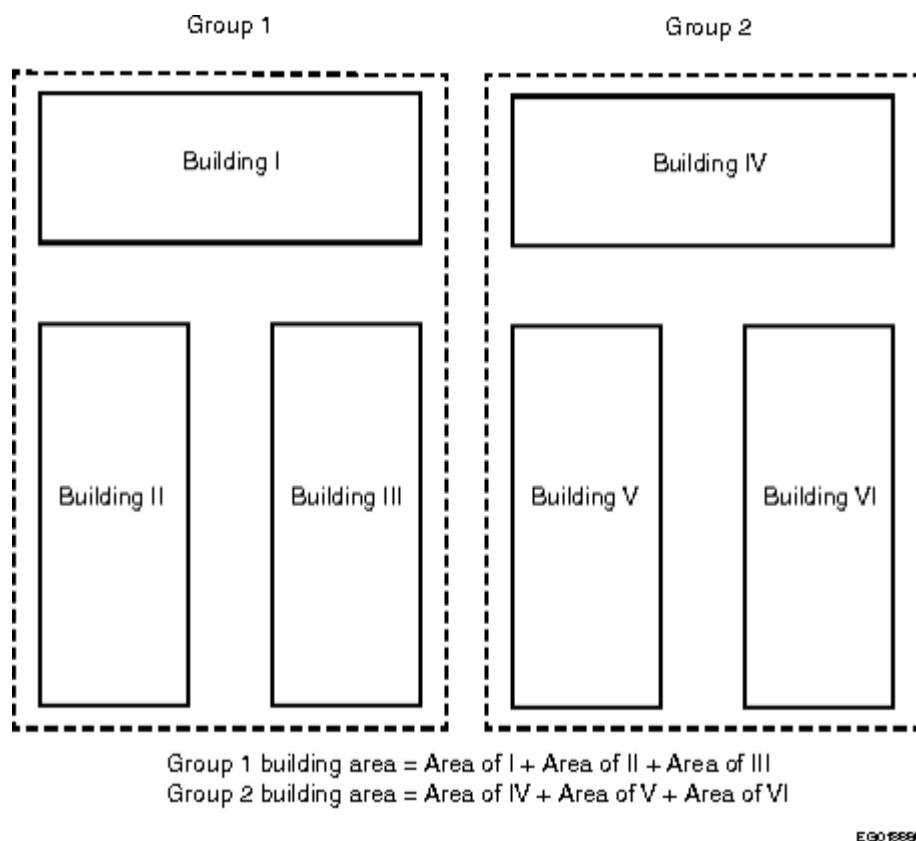


Figure A-3.9.2.1.(1)

Building area of self-service storage buildings

A-3.9.2.2. Spatial Separation Between Self-service Storage Buildings. Where a group of self-service storage buildings is treated as a single building as permitted in Sentence 3.9.2.1.(1), buildings within the same group are exempted from the spatial separation requirements in Subsection 3.2.3. as long as a minimum distance of 6 m is provided between each of them. If the owner wants less distance between the buildings, the requirements of Subsection 3.2.3. must be applied.

In addition, where there are multiple groups of buildings on a single property, the minimum distance required to separate one group from another group is the greater of 9 m and the limiting distance calculated in Subsection 3.2.3.

Except as provided in Article 3.9.2.2., Subsection 3.2.3. applies to each building within a group.

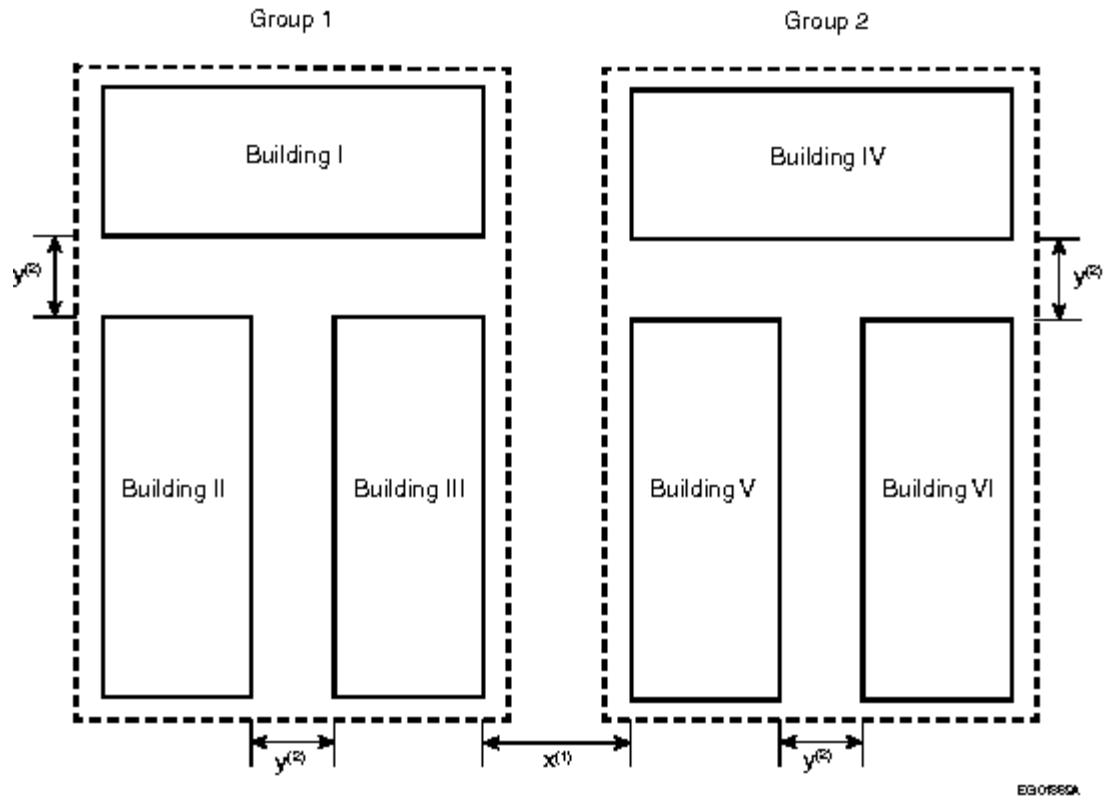


Figure A-3.9.2.2.

Spatial separation between self-service storage buildings

Notes to Figure A-3.9.2.2.:

- (1) $x = 9$ m, or the distance calculated in Subsection 3.2.3., whichever is greater.
 (2) $y \geq 6$ m, or Subsection 3.2.3. applies.

A-3.9.3.1.(1) Storage of Flammable and Combustible Liquids. Refer to Subsection 4.2.12. of Division B of the NFC for requirements regarding the storage of flammable and combustible liquids in individual self-service storage units.

A-3.9.3.2.(1) Sanitary Facilities. Properties with self-service storage buildings on them may have multiple buildings or one large building. Due to the low occupant load of these types of buildings, only one building on the property is required to have a pair of washrooms.

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 and formwork,"
- b) CSA S269.2, "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.,

LxC *live load* exclusive of crane loads,

C *live load* due to cranes including self weight,

Cd self weight of all cranes positioned for maximum effects,

C7 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⁽¹⁾
Forming Part of Sentence 4.1.2.1.(3)

Type of Building	Importance Category
A Low Importance Category <i>building</i> is a <i>building</i> that represents a low direct or indirect hazard to human life in the event of structural failure.	Low
A Normal Importance Category <i>building</i> is a <i>building</i> that does not meet the criteria for a Low Importance Category <i>building</i> , High Importance Category <i>building</i> or <i>post-disaster building</i> .	Normal
A High Importance Category <i>building</i> is a <i>building</i> that provides a greater degree of safety to human life than a Normal Importance Category <i>building</i> . Community centres and elementary, middle and secondary schools are High Importance Category <i>buildings</i> .	High
A <i>post-disaster building</i> .	Post-disaster

Notes to Table 4.1.2.1.:

⁽¹⁾ See Note A-Table 4.1.2.1.

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. (See Note A-4.1.2.2.(1).)

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 (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* $-0.9D$ in load combination cases 2, 3 and 4 and $1.0D$ in load combination case 5 in Table 4.1.3.2.-A, and $0.9D$ in load combination cases 1 to 5 and $1.0D$ 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), and 4.2.4.1.(3)

Case	Load Combination ⁽¹⁾	
	Principal Loads	Companion Loads
1	1.4D ⁽²⁾	—
2	(1.25D ⁽³⁾ or 0.9D ⁽⁴⁾) + 1.5L ⁽⁵⁾	1.0S ⁽⁶⁾ or 0.4W
3	(1.25D(3) or 0.9D(4)) + 1.5S	1.0L(6)(7) or 0.4W
4	(1.25D(3) or 0.9D(4)) + 1.4W	0.5L ⁽⁷⁾ or 0.5S
5	1.0D(4) + 1.0E ⁽⁸⁾	0.5L(6)(7) + 0.25S(6)

Notes to Table 4.1.3.2.-A:

⁽¹⁾ See Sentences 4.1.3.2.(2) to (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	(1.25D ⁽²⁾ or 0.9D ⁽³⁾) + (1.5C + 1.0L _{xc})	1.0S ⁽⁴⁾ or 0.4W
2	(1.25D(2) or 0.9D(3)) + (1.5L _{xc} ⁽⁵⁾ + 1.0C)	1.0S(4) or 0.4W
3	(1.25D(2) or 0.9D(3)) + 1.5S	1.0C + 1.0L _{xc} (4) ⁽⁶⁾
4	(1.25D(2) or 0.9D(3)) + 1.4W	1.0C ⁽⁷⁾ + 0.5L _{xc} (4)(6)
5	(1.25D(2) or 0.9D(3)) + C ₇	—
6	1.0D(3) + 1.0E ⁽⁸⁾	1.0C _d + 0.5L _{xc} (4)(6) + 0.25S(4)

Notes to Table 4.1.3.2.-B:

(1) See Sentences 4.1.3.2.(2) to (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 m, 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).)

2) The effect of service loads on the serviceability limit states shall be determined in accordance with this Article and the load combinations listed in Table 4.1.3.4., the applicable combination being that which results in the most critical effect.

3) Other load combinations that must also be considered are the principal loads acting with the companion loads taken as zero.

4) Deflections calculated for load types *P*, *T* and *H*, if present, with load factors of 1.0 shall be included with the calculated deflections due to principal loads.

5) The determination of the deflection shall consider the following:

a) for materials that result in increased deformations over time under sustained loads, the deflection calculation shall consider the portion of *live load*, *L*, that is sustained over time, *L_s*, and the portion that is transitory, *L_t*, and

b) the calculated deflection due to *dead load*, *D*, and sustained *live load*, *L_s*, shall be increased by a creep factor as specified in the standards listed in Section 4.3. to obtain the additional long-term deflection.

6) The determination of the long-term settlement of *foundations* shall consider the following:

a) for foundation soil types that result in increased settlement over time under sustained loads, the additional long-term settlements shall be determined for the portion of *live load*, *L*, that is sustained over time, *L_s*, and the portion that is transitory, *L_t*, and

b) the additional long-term settlements due to *dead load*, *D*, and sustained *live loads*, *L_s*, shall be calculated from the *foundation soil* properties provided by a qualified professional geotechnical engineer.

Table 4.1.3.4.

Loads and Load Combinations for Serviceability
Forming Part of Sentence 4.1.3.4.(2)

Limit State	Structural Parameter	Load Case	Load Combinations	
			Principal Loads	Companion Loads
Deflection for materials not subject to creep	Deflection of the structure or of components of the structure ⁽¹⁾	1	1.0D + 1.0L	0.3W or 0.35S
		2	1.0D + 1.0W	0.35L ⁽²⁾ or 0.35S
		3	1.0D + 1.0S	0.3W or 0.35L(2)
Deflection for materials subject to creep	Total deflection of the structure or of components of the structure ⁽³⁾	1	1.0D + 1.0L _s ⁽⁴⁾ + 1.0L _t ⁽⁵⁾	0.3W or 0.35S
		2	1.0D + 1.0W	0.35L(2) or 0.35S
		3	1.0D + 1.0S	0.3W or 0.35L(2)
Vibration serviceability	Acceleration	⁽⁶⁾		

Notes to Table 4.1.3.4.:

⁽¹⁾ The calculated deflection due to dead load, D, is permitted to be excluded where specified in the standards listed in Section 4.3.

⁽²⁾ The companion load factor of 0.35 for *live load*, L, shall be increased to 0.5 for storage areas, equipment areas and service rooms.

⁽³⁾ The calculated immediate deflection due to dead load, D, is permitted to be excluded where specified in the standards listed in Section 4.3.

⁽⁴⁾ L_s = sustained portion of the *live load*, L.

⁽⁵⁾ L_t = transitory portion of the *live load*, L.

⁽⁶⁾ See Note A-Table 4.1.3.4.

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 floor vibrations caused by resonance with operating machinery or equipment are anticipated, dynamic analysis of the floor system shall be carried out. (See Note A-4.1.3.6.(2).)

3) 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.(3).)

4) 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.(4).)

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 *soil*, superimposed earth, plants and trees.

2) In areas of a *building* for which *partitions* are shown on the drawings, the weight of *partitions* referred to in Clause (1)(c) shall be taken as the actual weight of such *partitions*. (See Note A-4.1.4.1.(2).)

3) In areas of a *building* for which *partitions* are not shown on the drawings, the weight of *partitions* referred to in Clause (1)(c) shall be a *partition* weight allowance determined from the anticipated weight and position of the *partitions*, but shall not be less than 1 kPa over the area of floor being considered. (See Note A-4.1.4.1.(3).)

4) The weights of *partitions* and *partition* weight allowances used in the design shall be shown on the drawings as provided in Clause 2.2.4.3.(1)(d) of Division C.

5) Where the *partition* weight allowance referred to in Sentence (3) is counteractive to other loads, it 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 to other loads, 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	4.8
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	
Gymnasias	
Lecture halls ⁽¹⁾ (areas without fixed seats that have backs)	
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:	2.9

Arenas ⁽¹⁾	
Grandstands ⁽¹⁾	
Stadia ⁽¹⁾	
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 <i>residential occupancies</i> only	1.4
Having limited <i>accessibility</i> so that there is no storage of equipment or material	0.5
Balconies	
Exterior	4.8
Interior and <i>mezzanines</i> that could be used by an assembly of people as a viewing area ⁽¹⁾	4.8
Interior and <i>mezzanines</i> 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)	(3)
Equipment areas and <i>service rooms</i> including	
Generator rooms	
Mechanical equipment exclusive of elevators	
Machine rooms	3.6 ⁽⁴⁾
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 ⁽¹⁾	12.0
Kitchens (other than residential)	4.8
Libraries	
Stack rooms	7.2
Reading and study rooms	2.9

Office areas ⁽¹⁾ (not including record storage and computer rooms) located in	
<i>Basements</i> , and floors, including <i>mezzanines</i> , with direct access to the exterior at ground level	4.8
Other floors	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)	1.9
Bedrooms	
Other areas	
Stairs within <i>dwelling units</i>	
Retail and wholesale areas	4.8
Roofs ⁽¹⁾	1.0 ⁽⁵⁾
Sidewalks and driveways over areaways and <i>basements</i> ⁽¹⁾	12.0 ⁽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 effect.

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 and exterior areas accessible to vehicular traffic shall be designed

a) for the appropriate load combination listed in Sentence 4.1.3.2.(2) with a *live load*, L , consisting of either a uniformly distributed *live load* as specified in Table 4.1.5.3. or a concentrated *live load* as listed in Table 4.1.5.9., whichever produces the most critical effect, and a companion snow load, S , as prescribed in Subsection 4.1.6., but with the companion-load factor reduced to 0.2, and

b) such that the load combination in Clause (a) is not less than the snow and rain loads prescribed in Subsection 4.1.6. with the *live load* taken as zero.

5) Roof parking decks that are used for the long-term storage of vehicles shall be designed for the appropriate load combination listed in Sentence 4.1.3.2.(2) with a *live load*, L , consisting of either a uniformly distributed *live load* as specified in Table 4.1.5.3. or a concentrated *live load* as listed in Table 4.1.5.9., whichever produces the most critical effect, and a snow load, S , as prescribed in Subsection 4.1.6.

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 m² 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) One- and two-way floor slabs shall have no reduction for tributary area applied to *live load*.

2) 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.

3) Where a structural member supports a tributary area of a floor or a roof, or a combination thereof, that is greater than 80 m² 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*.

4) Where a structural member supports a tributary area of a floor or a roof, or a combination thereof, that is greater than 20 m² and used for any use or *occupancy* other than those indicated in

Sentences (2) and (3), 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*.

5) Where the specified *live load* for a floor is reduced in accordance with Sentence (3) or (4), the structural drawings shall indicate that a *live load* reduction factor for tributary area has been applied and which structural elements are impacted by this factor.

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 × mm
Roof surfaces	1.3	200 × 200
Floors of classrooms	4.5	750 × 750
Floors of offices, manufacturing <i>buildings</i> , hospital wards and <i>stages</i>	9.0	750 × 750
Floors and areas used by vehicles not exceeding 4 000 kg gross weight	18	120 × 120
Floors and areas used by vehicles exceeding 4 000 kg but not exceeding 9 000 kg gross weight	36	120 × 120
Floors and areas used by vehicles exceeding 9 000 kg gross weight	54 ⁽¹⁾	250 × 600(1)
Driveways and sidewalks over areaways and <i>basements</i>	54(1)	250 × 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 Sentence 4.1.5.11.(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 Safety Standards Act and pursuant regulations.

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 horizontal specified *live 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) 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 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 horizontal specified *live 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 horizontal specified *live load* of 0.5 kN applied outward 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.

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 horizontal 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 specified *live loads* required in Sentence (3) need not be considered to act simultaneously with the loads provided for in Sentences (1), (2), (6) and (7).

6) The minimum specified *live 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 specified *live load* provided for in Sentences (1), (3) and (7).

7) Handrails and their supports shall be designed and constructed to withstand the following minimum specified *live loads*, which need not be considered to act simultaneously:

a) 0.9 kN applied at any point and in any direction for all handrails, and

b) 0.7 kN/m applied in any direction for 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. (See Note A-4.1.6.1.(1).)

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) to (7),

C_a = 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, I_s	
	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)

$$C_b = 0.8 \text{ for } l_c \leq \left(\frac{70}{C_w^2} \right), \text{ and}$$

ii)

$$C_b = \frac{1}{C_w} \left[1 - (1 - 0.8 C_w) \exp \left(- \frac{l_c C_w^2 - 70}{100} \right) \right] \text{ for } l_c > \left(\frac{70}{C_w^2} \right)$$

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,

b) conform to Table 4.1.6.2.-B, using linear interpolation for intermediate values of $l_c C_w^2$, or

c) be taken as equal to 1 for any roof structure with a mean height of less than $1 + S_s/\gamma$, in m, above grade, where γ is the specific weight of snow determined in accordance with Article 4.1.6.13.

(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 $C_b C_w S_s / \gamma$, in m, 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) $(70^\circ - \alpha)/40^\circ$ 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 $l_c > (70/C_w^2)$
Forming Part of Sentence 4.1.6.2.(2)**

Value of $l_c C_w^2$	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, C_s , 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) $(60^\circ - \alpha)/45^\circ$ 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 as secondary drainage systems 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 bottom 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:

$$C_a = C_{a0} - (C_{a0} - 1)(x/x_d) \text{ for } 0 \leq x \leq x_d,$$

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) to (5) 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:

$$x_d = 5 \frac{C_b S_s}{\gamma} (C_{a0} - 1)$$

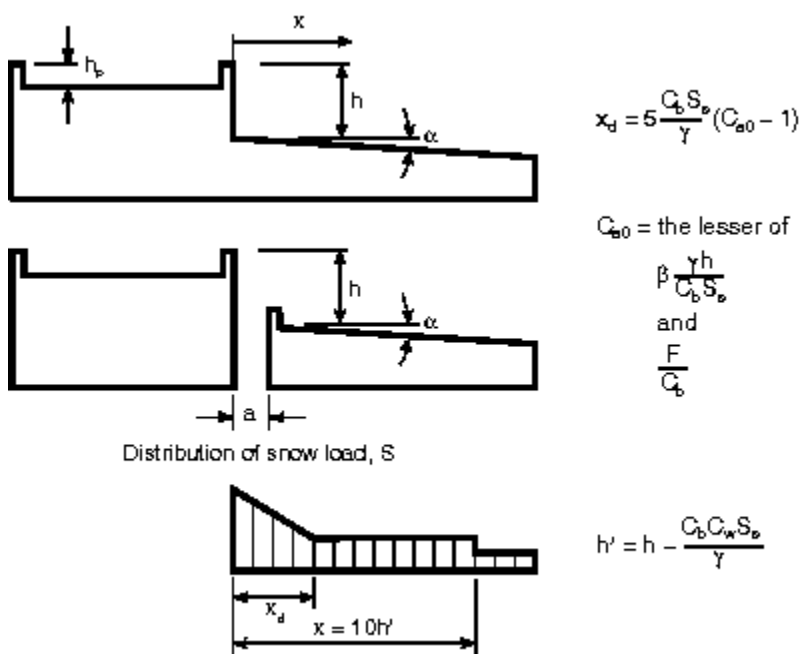
where

γ = specific weight of snow as specified in Article 4.1.6.13.

Figure 4.1.6.5.-A

Snow load factors for lower level roofs

Forming Part of Sentences 4.1.6.5.(1) and (3), Table 4.1.6.5.-A and Sentence 4.1.6.6.(1)



Notes to Figure 4.1.6.5.-A:

(1) If $a > 5$ m or $h \leq 0.8S_s/\gamma$, drifting from the higher roof need not be considered.

(2) If $h \geq 5$ m, the value of C_{a0} for Case I is permitted to be determined in accordance with Sentence 4.1.6.5.(4).

Table 4.1.6.5.-A

Wind Exposure, Slope and Accumulation Factors in Figure 4.1.6.5.-A

Distance from Roof Step, x	Factors		
	C_w	$C_{s^{(1)}}$	C_a
0	1.0	$f(\alpha)$	C_{a0}
$0 < x \leq x_d$	1.0	$f(\alpha)$	$C_{a0} - (C_{a0} - 1)(x/x_d)$
$x_d < x \leq 10h'$	1.0	$f(\alpha)$	1.0
$x > 10h'$	1.0 for unexposed roof areas	$f(\alpha)$	1.0
	0.75 for exposed roof areas		
	0.5 for exposed roof areas north of tree line		

Notes to Table 4.1.6.5.-A:

⁽¹⁾ For lower roofs with parapets, $C_s = 1.0$; otherwise, C_s varies as a function of slope, α , as defined in Sentences 4.1.6.2.(5) and (6).

3) Except as provided in Sentence (4), 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

$\beta = 1.0$ 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 $l_{cs} = 2w_s - \frac{w_s^2}{l_r}$, 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

$$h'_p = h_p - \left(\frac{0.8 S_s}{\gamma} \right), \text{ but } 0 \leq h'_p \leq \left(\frac{l_{cs}}{5} \right)$$

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) Where $h \geq 5$ m, the value of C_{a0} for Case I is permitted to be taken as

$$C_{a0} = \left(\frac{25 - h}{20} \right) \left(\frac{F}{C_b} - 1 \right) + 1 \text{ for } 5 \text{ m} \leq h \leq 25 \text{ m, and}$$

$$C_{a0} = 1 \text{ for } h > 25 \text{ m}$$

5) 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 Sentences (3) and (4) and Figure 4.1.6.5.-B.

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 (5), and Table 4.1.6.5.-B

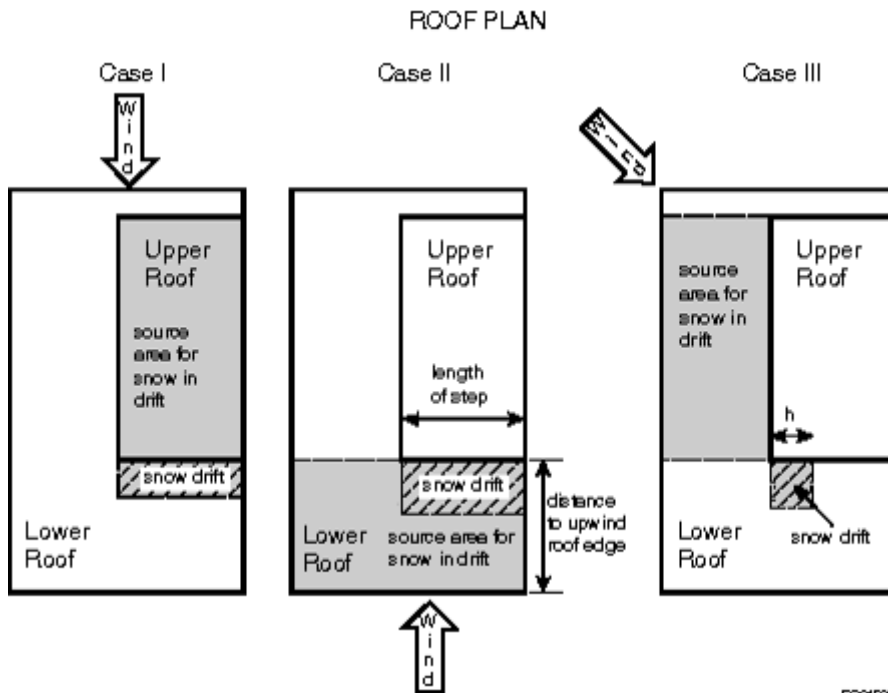


Table 4.1.6.5.-B
Parameters for Snow Load Cases in Figure 4.1.6.5.-B

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 the source area on the 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

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 $a \leq 5$ m, C_a for the lower roof shall be calculated in accordance with Article 4.1.6.5. for values of $x \geq a$.

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

$$0.67 \frac{\tau h}{C_b S_s} \text{ and } \frac{\tau l_0}{7.5 C_b S_s} + 1, \text{ and}$$

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 the higher of the two loads shall be applied where the drifts overlap 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)

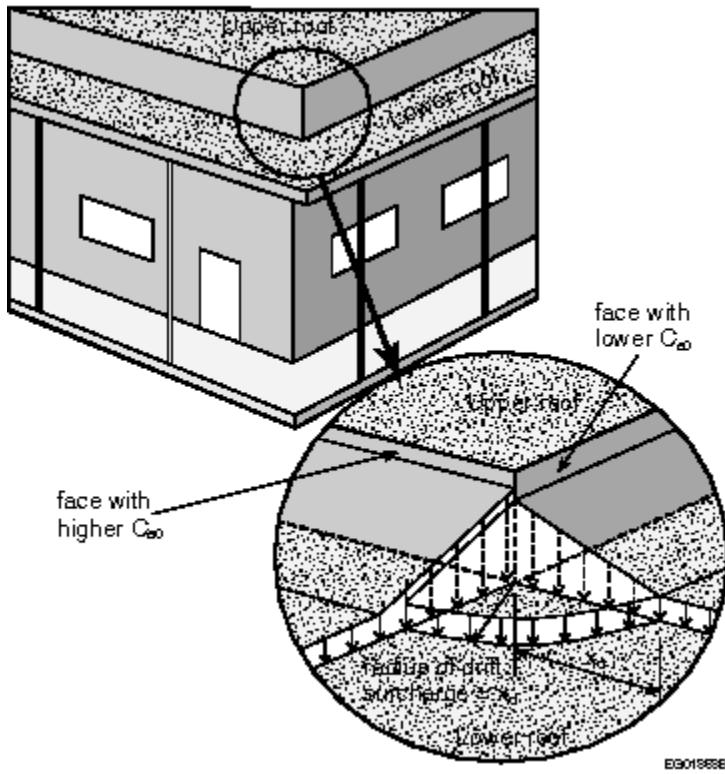
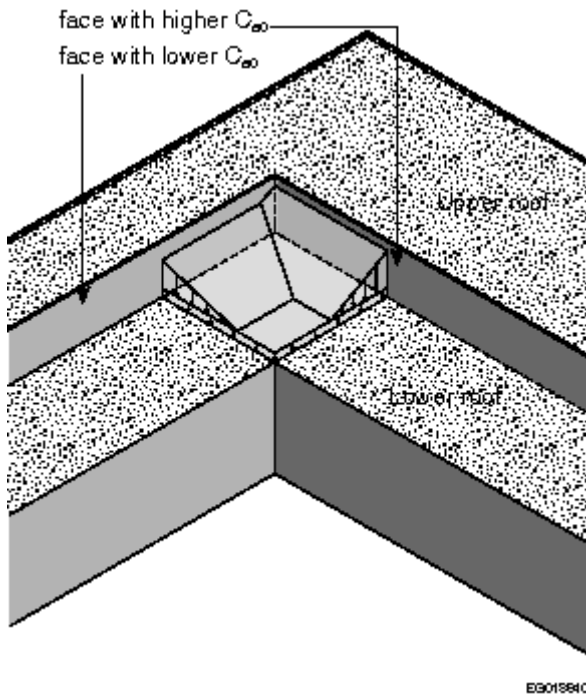


Figure 4.1.6.8.-B
Snow load at inside corner
Forming Part of Sentence 4.1.6.8.(2)



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 $\alpha > 15^\circ$, 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 $15^\circ \leq \alpha \leq 20^\circ$, and
 - ii) 1.25, where $20^\circ < \alpha \leq 90^\circ$.
- 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 $\alpha_e \leq 30^\circ$ (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

$$C_a = \frac{xh}{0.03C_b b^2} \text{ for } 0.05 < \frac{h}{b} \leq 0.12 \text{ and}$$

$$C_a = \frac{4x}{C_b b} \text{ for } \frac{h}{b} > 0.12$$

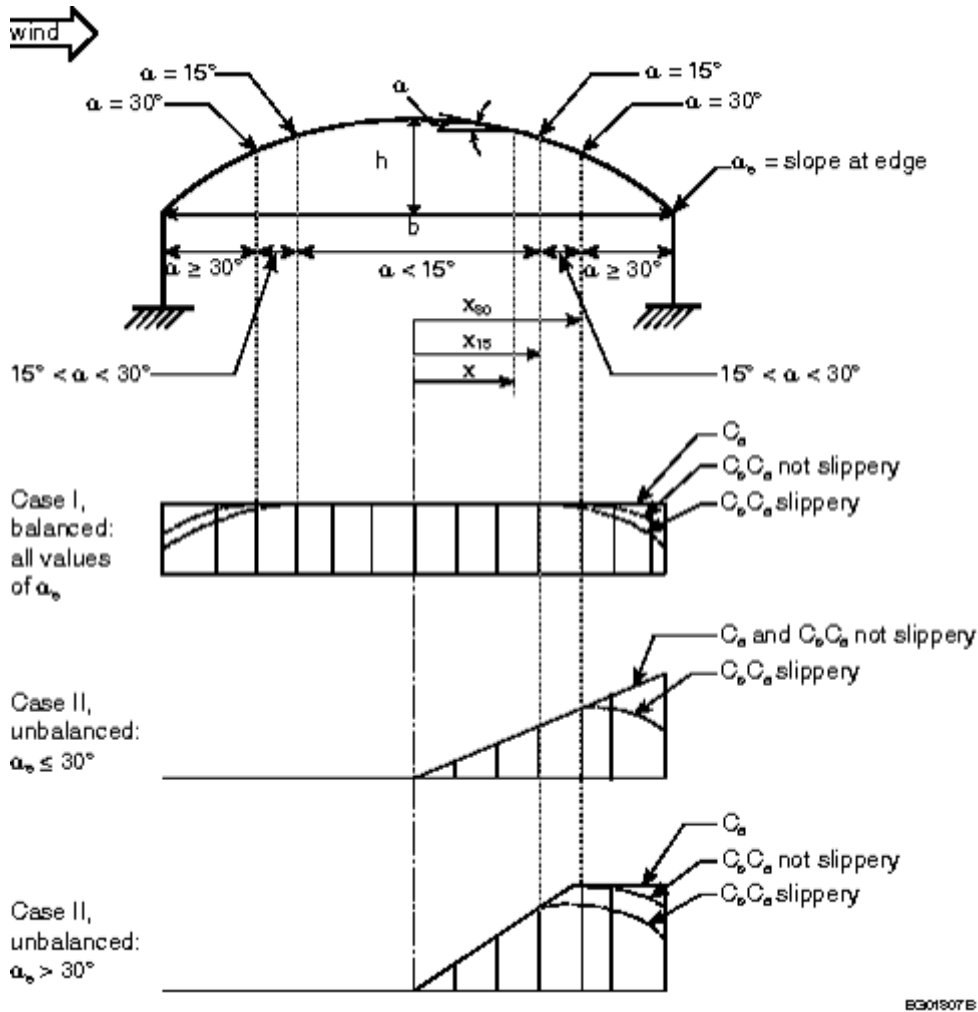
where

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)



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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 $\alpha_e > 30^\circ$ (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,

i) for the part of the roof between the peak and point where the slope $\alpha = 30^\circ$, taken as

$$C_a = \frac{xh}{0.06 C_b x_{30} b} \text{ for } 0.05 < \frac{h}{b} \leq 0.12, \text{ and}$$

$$C_a = \frac{2x}{C_b x_{30}} \text{ for } \frac{h}{b} > 0.12$$

where

x, h, b = as specified in Sentence (2), and

x_{30} = value of x where the slope $\alpha = 30^\circ$, and

ii) for the part of the roof where the slope $\alpha > 30^\circ$, taken as

$$C_a = \frac{h}{0.06 C_b b} \text{ for } 0.05 < \frac{h}{b} \leq 0.12, \text{ and}$$

$$C_a = \frac{2}{C_b} \text{ for } \frac{h}{b} > 0.12$$

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 Upwind 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 $\leq 30^\circ$ $h/b > 0.05$ all values of x	1.0	0.0	$C_a = \frac{xh}{0.03 C_b b^2} \text{ for } \frac{h}{b} \leq 0.12$ $C_a = \frac{4x}{C_b b} \text{ for } \frac{h}{b} > 0.12$	$C_a(x, y) = C_a(x, 0) \left(1 - \frac{y}{r}\right)$
	Slope at edge $> 30^\circ$ $h/b > 0.05$ $0 < x < x_{30}$	1.0	0.0	$C_a = \frac{xh}{0.06 C_b x_{30} b} \text{ for } \frac{h}{b} \leq 0.12$ $C_a = \frac{2x}{C_b x_{30}} \text{ for } \frac{h}{b} > 0.12$	
	Slope at edge $> 30^\circ$ $h/b > 0.05$ $x \geq x_{30}$	1.0	0.0	$C_a = \frac{h}{0.06 C_b b} \text{ for } \frac{h}{b} \leq 0.12$ $C_a = \frac{2}{C_b} \text{ for } \frac{h}{b} > 0.12$	

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,

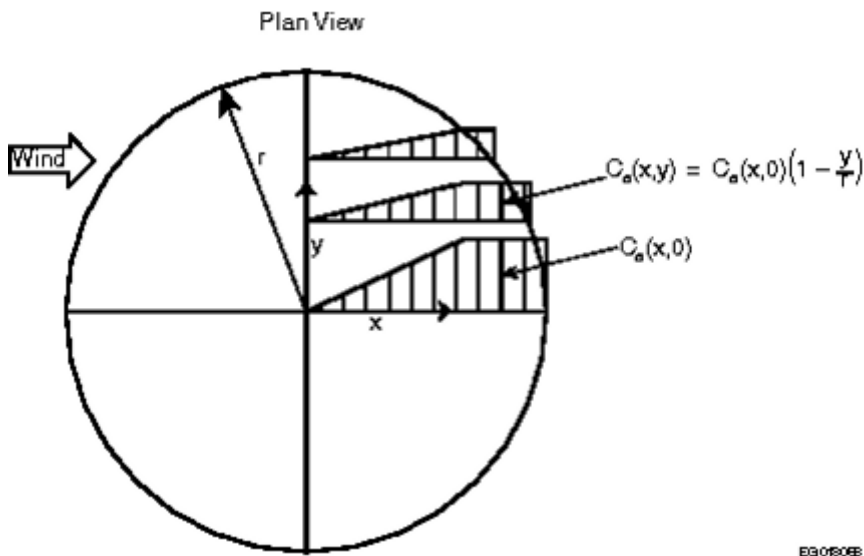
y = horizontal coordinate normal to the x direction, and

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 $C_a(x, 0)$.

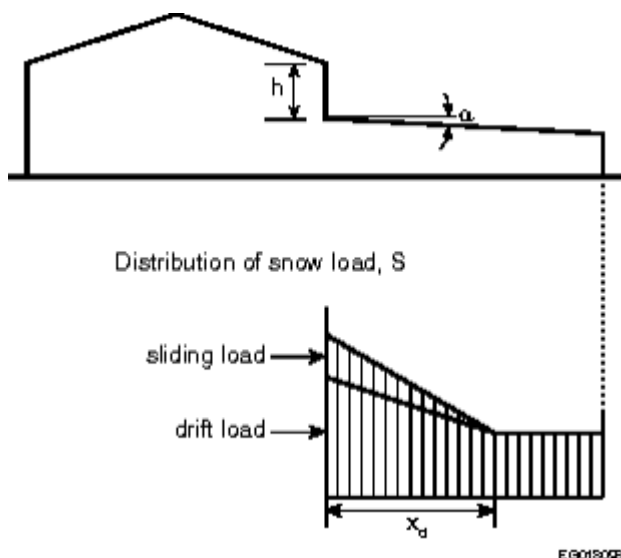
4.1.6.11. Snow Loads Due to Sliding

1) Except as provided in Sentence (2), where an upper roof, or part thereof, slopes downwards with a slope $\alpha > 0$ 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 $\alpha > 10^\circ$, 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:

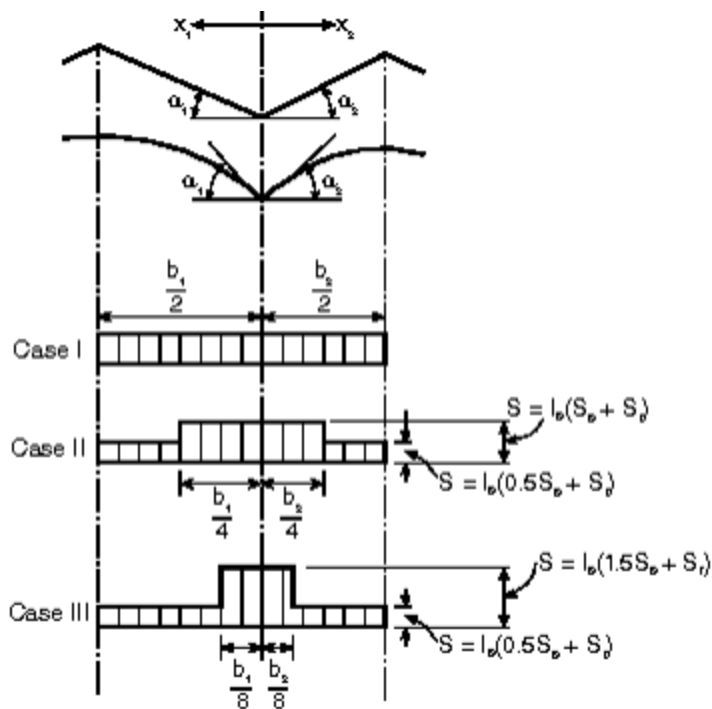
$$C_a = \frac{1.5}{C_b} \text{ for } 0 < x \leq b/8, \text{ and}$$

$$C_a = \frac{0.5}{C_b} \text{ for } b/8 < x \leq b/2$$

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/m^3 or $0.43S_s + 2.2 \text{ kN/m}^3$, 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 CAN/CSA-S37, "Antennas, towers, and antenna-supporting structures."

4.1.6.16. Roofs with Solar Panels

(See Note A-4.1.6.16.)

1) Where solar panels are installed on a roof, the snow loads, S , shall be determined in accordance with Sentences (2) to (6) or with the requirements for roofs without solar panels, whichever produces the most critical effect.

2) For the purposes of this Article, solar panels shall be classified as

a) Parallel Flush, where the panels are installed parallel to the roof surface with their upper surface less than or equal to $C_b C_w S_s / \gamma$ above the roof surface,

b) Parallel Raised, where the panels are installed parallel to the roof surface with their upper surface greater than $C_b C_w S_s / \gamma$ above the roof surface, or

c) Tilted, where the panels are installed at an angle to the roof surface with their highest edge greater than $C_b C_w S_s / \gamma$ above the roof surface.

3) For sloped roofs with solar panels, the snow loads, S , shall be determined in accordance with the requirements for roofs without solar panels, except that the slope factor, C_s , shall be

a) taken as 1.0 for roof areas extending upslope from the downslope edge of a panel or array of panels at an angle of 45° from each side edge of the panel or array, and

b) as specified in Sentences 4.1.6.2.(5) to (7) for all other roof areas.

(See Note A-4.1.6.16.(3).)

4) For sloped roofs with Parallel Flush solar panels, the snow loads, S , shall be determined in accordance with the requirements for roofs without solar panels, except that

a) C_s shall be determined in accordance with Sentence (3),

b) where the gap width, w_g , between the panels along the roof slope is greater than or equal to the panel width, w_p , along the roof slope, the accumulation factor, C_a , shall be taken as

i) 0.0 for the panels,

ii) 2.0 for roof areas within a distance of w_p downslope from a downslope panel edge, and

iii) 1.0 for all other roof areas

(see Note A-4.1.6.16.(4)(b)), and

c) where the gap width, w_g , between the panels along the roof slope is less than the panel width, w_p , along the roof slope, C_a shall be taken as

i) 0.0 for panel areas within a distance of w_g downslope from an upslope panel edge,

- ii) 1.0 for other panel areas,
 - iii) 2.0 for roof areas in gaps between the panels, and
 - iv) 1.0 for all other roof areas
- (see Note A-4.1.6.16.(4)(c)).

5) For roofs with Parallel Raised solar panels, the snow loads, S , shall be determined in accordance with the requirements for roofs without solar panels, except that

- a) where the roof is flat, C_a shall be taken as

- i) 1.0 for the panels,
- ii) 1.0 for roof areas not under the panels,

iii) 1.0 for roof areas under the panels within a distance of $\min(2h_g, 2w_g)$ from a panel edge, where h_g is the gap height between the lower surface of the panels and the roof surface, and w_g is the gap width between the panels, and

- iv) 0.0 for other roof areas under the panels

(see Note A-4.1.6.16.(5)(a)), and

- b) where the roof is sloped, the snow loads, S , derived from Clause (a) shall be used, except that

- i) C_s shall be determined in accordance with Sentence (3),
- ii) S shall be taken as 0.0 on the panels, and

iii) S for all roof areas shall be taken as the sum of S on the panels, as derived from Subclause (a)(i) and shifted by a distance of w_p downslope onto the roof, where w_p is the panel width along the roof slope, and S on the roof areas, as derived from Subclauses (a)(ii) to (a)(iv)

(see Note A-4.1.6.16.(5)(b)).

6) For flat roofs with Tilted solar panels, the snow loads, S , shall be determined in accordance with the requirements for roofs without solar panels, except that

- a) C_a shall be taken as 0.0 for the panels,

b) C_a shall be taken as 1.0 for roof areas beyond a distance of $5(h - C_b C_w S_s / \gamma)$ from the lowest edge of the panels, where h is the height of the highest edge of the panels above the roof surface,

c) except as provided in Clauses (d) and (e), for roof areas within a distance of $5(h - C_b C_w S_s / \gamma)$ from the lowest edge of the panels, C_a shall be taken as

i) 1.25 for $(h_g - C_b C_w S_s / \gamma) \leq 0.3$ m, where h_g is the gap height between the lowest edge of the panels and the roof surface,

ii) $1.294 - 0.1471(h_g - C_b C_w S_s / \gamma)$ for $0.3 < (h_g - C_b C_w S_s / \gamma) \leq 2.0$ m, and

iii) 1.0 for $(h_g - C_b C_w S_s / \gamma) > 2.0$ m

(see Note A-4.1.6.16.(6)(c)),

d) except as provided in Clause (e), C_a shall be taken as 2.0 for roof areas within a distance of w_{ph} beyond the lowest edge of the panels, where w_{ph} is the horizontal projection of the panel width, w_p , along the sloped panel edges, and

e) where the panels, panel supports or back plates obstruct snow from sliding under the panels, the load of the increased volume of snow in the gaps between the panels shall be considered to be uniformly distributed.

(See Note A-4.1.6.16.(6).)

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 4.1.7.14.

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 4.1.7.14.

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 4.1.7.14., 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 4.1.7.14.

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

(See Note A-4.1.7.2.(2))

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) it contains a human *occupancy*, and 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 4.1.7.8.(4)

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, $C_g C_p$, the values of C_g and C_p 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:

$$C_{gi} = 1 + \frac{1}{\sqrt{1 + \frac{V_0}{6950A}}}$$

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

$$\Delta S = \Delta S_{\max} \left(1 - \frac{|x|}{kL_h}\right) \exp(-\alpha z/L_h)$$

where

$\Delta S_{\max}$ = 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.

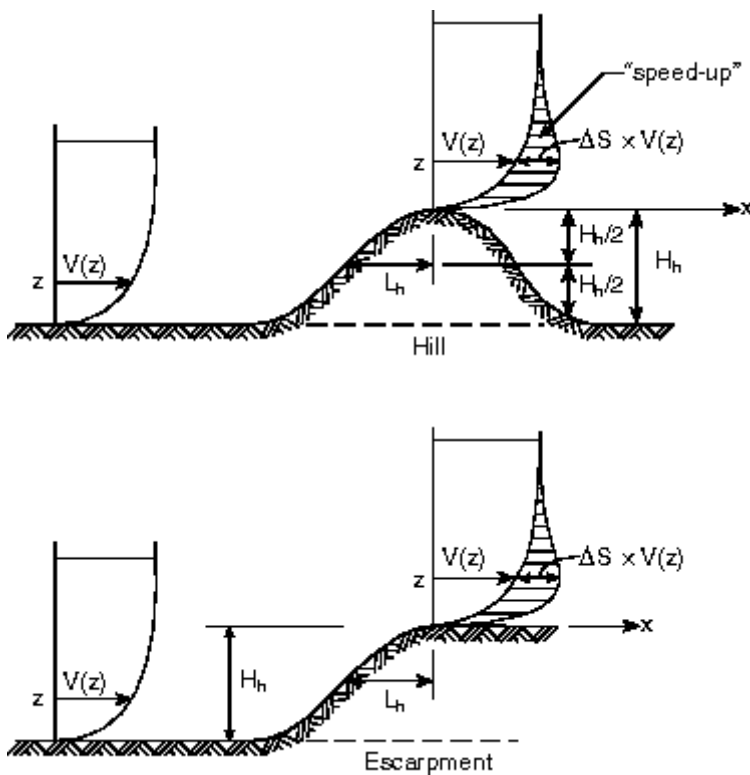
Table 4.1.7.4.
Parameters for Maximum Speed-up Over Hills and Escarpments
Forming Part of Sentence 4.1.7.4.(2)

Shape of Hill or Escarpment	$\Delta S_{\max^{(1)}}$	α	k	
			x < 0	x ≥ 0
2-dimensional hill	$2.2H_h/L_h$	3	1.5	1.5
2-dimensional escarpment	$1.3H_h/L_h$	2.5	1.5	4
3-dimensional axi-symmetrical hill	$1.6H_h/L_h$	4	1.5	1.5

Notes to Table 4.1.7.4.:

- (1) For $H_h/L_h > 0.5$, assume $H_h/L_h = 0.5$ and substitute $2H_h$ for L_h in the equation for ΔS .

Figure 4.1.7.4.
Speed-up of mean velocity on a hill or escarpment
Forming Part of Sentence 4.1.7.4.(2)



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Note to Figure 4.1.7.4.:

- (1) $V(z)$ = wind speed

4.1.7.5. External Pressure Coefficients

- 1) Applicable values of external pressure coefficients, C_p , are provided in
 - a) Sentences (2) to (9), 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,

$$C_p = 0.6 \text{ for } H/D < 0.25$$

$$= 0.27(H/D + 2) \text{ for } 0.25 \leq H/D < 1.0, \text{ and}$$

$$= 0.8 \text{ for } H/D \geq 1.0,$$

b) on the leeward face,

$$C_p = -0.3 \text{ for } H/D < 0.25,$$

$$= -0.27(H/D + 0.88) \text{ for } 0.25 \leq H/D < 1.0, \text{ and}$$

$$= -0.5 \text{ for } H/D \geq 1.0, \text{ and}$$

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 $H/D \geq 1.0$, $C_p = -1.0$, and

b) for $H/D < 1.0$,

$$C_p = -1.0 \text{ for } x \leq H, \text{ and}$$

$$= -0.5 \text{ for } x > H.$$

(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) Except as provided in Sentence (6), 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 .

6) Where the top of the balcony *guard* is 2.0 m or less below the roof surface, the values of C_p shall be taken as equal to those determined for parapets in Sentences (7) and (8).

7) To determine the contribution from parapets to the wind loads on the main structural system, the values of C_p shall be taken as

- a) on the outer faces, equal to those on the walls below,
- b) on the inner face of the windward parapet, equal to that on the upwind edge of a roof surface at the level of the top of the parapet, and
- c) on the inner faces of the other parapets, zero.

8) For the structural design of parapets themselves, the values of C_p shall be taken as equal to those specified in Sentence (7), except that the value of C_p on the inner face of the leeward parapet shall be taken as equal to that on the outer face of the windward parapet.

9) For the design of cladding on parapets, the values of C_p shall be taken as

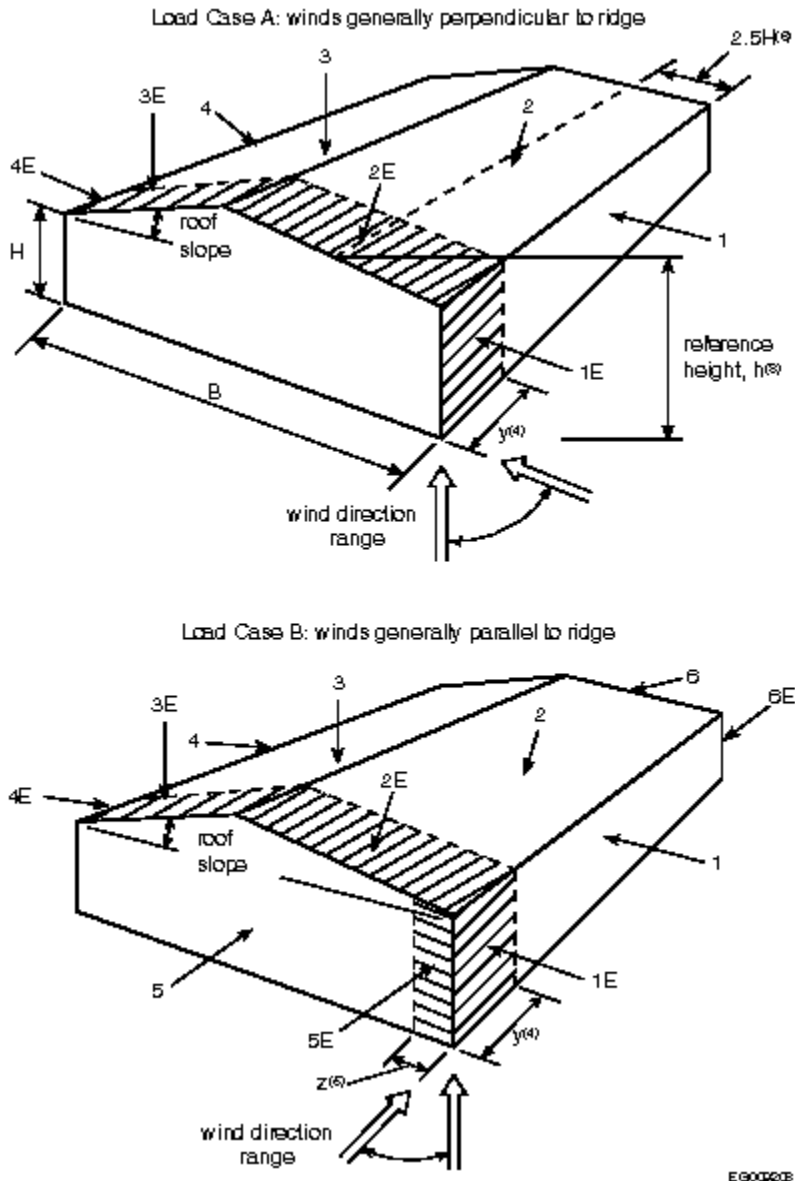
- a) on the outer vertical surfaces, equal to those on the cladding on the walls below, and
- b) on the inner and top surfaces, equal to those on the cladding of a roof surface at the level of the top of the parapet.

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, $C_g C_p$, 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 as shown in Figure 4.1.7.6.-A, the values of $C_g C_p$ are provided in Table 4.1.7.6.

Figure 4.1.7.6.-A
Primary structural actions arising from wind load acting simultaneously on all surfaces of low
buildings ($H \leq 20$ m)
Forming Part of Sentence 4.1.7.6.(2) and Table 4.1.7.6.



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 the design of *foundations*, exclusive of anchorages to the frame, only 70% of the effective load is to be considered.
- (3) 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° .
- (4) 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 width y may be the distance between the end and the first interior frame.

(5) 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.

(6) For $B/H > 5$ in Load Case A, the negative coefficients listed for surfaces 2 and 2E in Table 4.1.7.6. 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.

Table 4.1.7.6.
External Peak Values of C_gC_p in Figure 4.1.7.6.-A
Forming Part of Sentence 4.1.7.6.(2)

Load Case	Roof Slope	External Peak Values of $C_gC_p^{(1)(2)}$											
		Building Surfaces											
		1	1E	2	2E	3	3E	4	4E	5	5E	6	6E
A	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	-	-	-	-
B	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

Notes to Table 4.1.7.6.:

⁽¹⁾ For values of roof slope not shown, the coefficient C_gC_p can be interpolated linearly.

⁽²⁾ Positive coefficients denote forces toward the surface, whereas negative coefficients denote forces away from the surface.

3) For the design of individual walls and wall cladding, the values of C_gC_p 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_gC_p are provided in Figure 4.1.7.6.-C.

5) For the design of flat roofs with steps in elevation, the values of C_gC_p 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_gC_p are provided in Figure 4.1.7.6.-E.

7) For the design of gabled, multi-ridge roofs, the values of C_gC_p 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_gC_p 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_gC_p 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°.

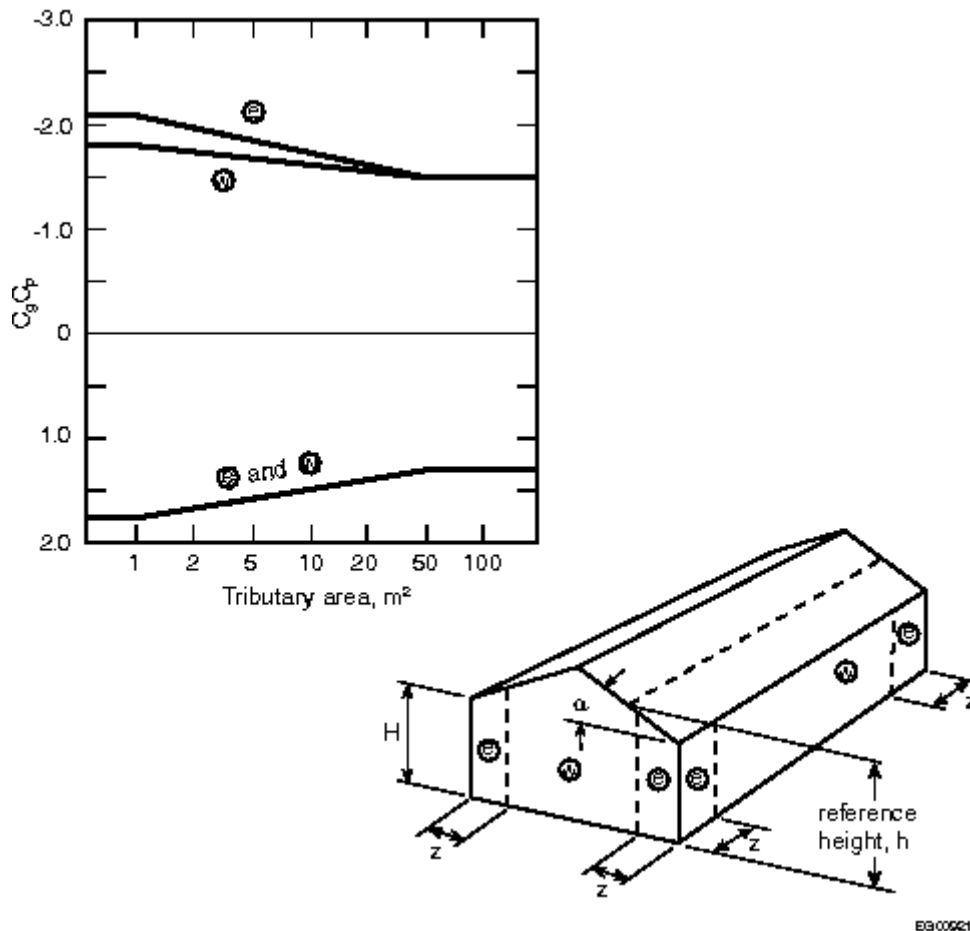
10) The wind loads on balcony *guards* on low *buildings* shall be as specified in Sentences 4.1.7.5.(5) and (6).

11) The wind loads on parapets on low *buildings* shall be as specified in Sentences 4.1.7.5.(7) to (9).

Figure 4.1.7.6.-B

External peak values of C_gC_p on individual walls for the design of cladding and secondary structural members

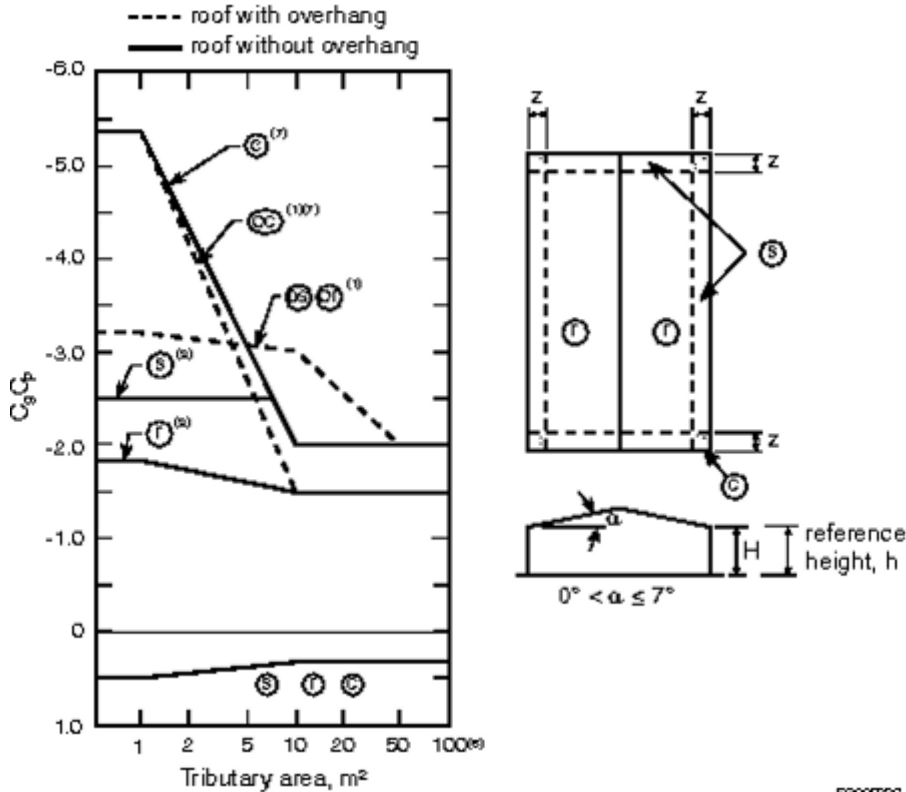
Forming Part of Sentence 4.1.7.6.(3)



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_gC_p of -2.8 applies to zone e.

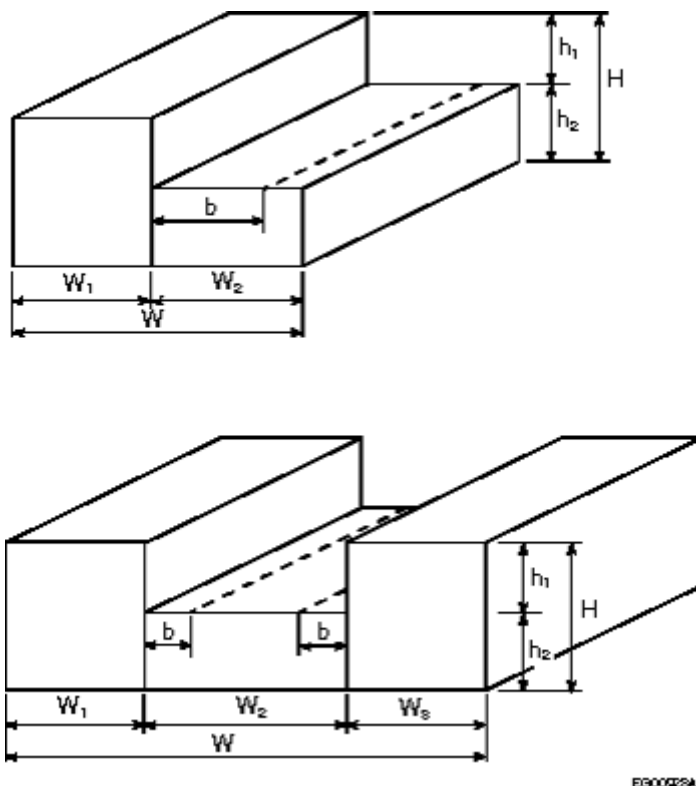
Figure 4.1.7.6.-C
External peak values of C_gC_p on roofs with a slope of 7° or less for the design of structural components and cladding
Forming Part of Sentences 4.1.7.6.(4), (7), (8) and (9)



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_gC_p may be reduced from -1.5 to -1.1 at $x/H = 2$ 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_gC_p for tributary areas less than $1 m^2$ can be reduced from -5.4 to -4.4 .

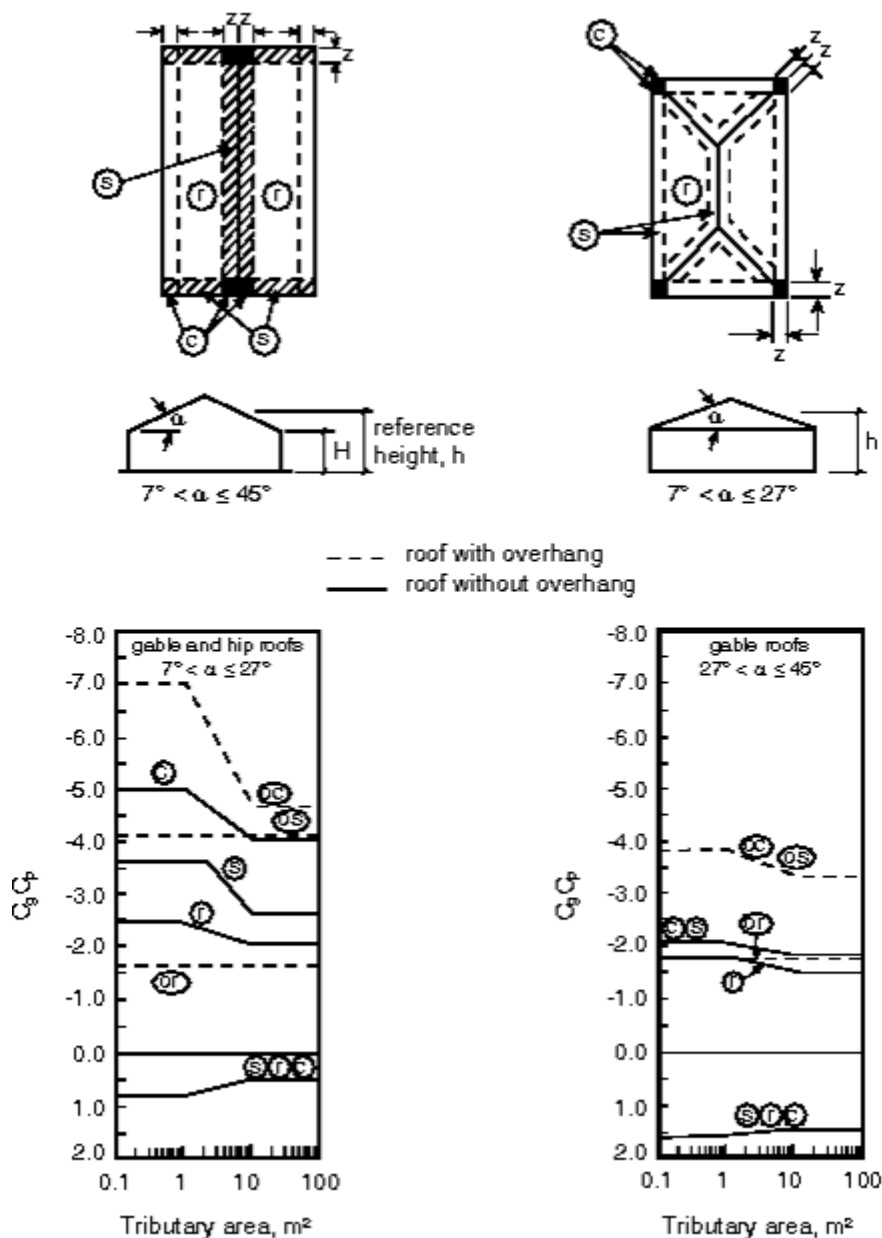
Figure 4.1.7.6.-D
External peak values of C_gC_p for the design of the structural components and cladding of
buildings with stepped roofs
 Forming Part of Sentence 4.1.7.6.(5)



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 $C_g C_p$ 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)



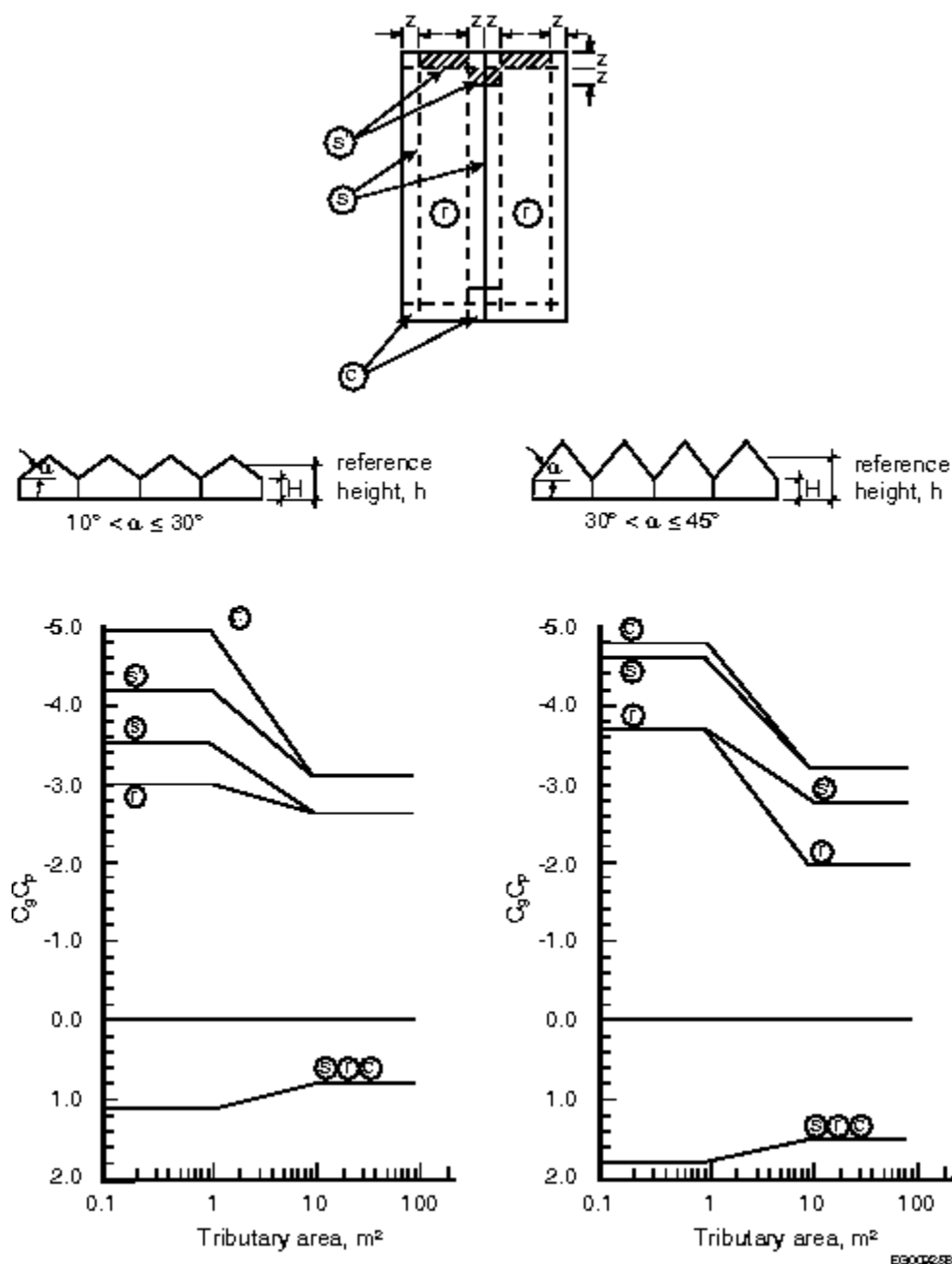
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Notes to Figure 4.1.7.6.-E:

- (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 $7^\circ < \alpha \leq 27^\circ$, 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 $C_g C_p$ 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:

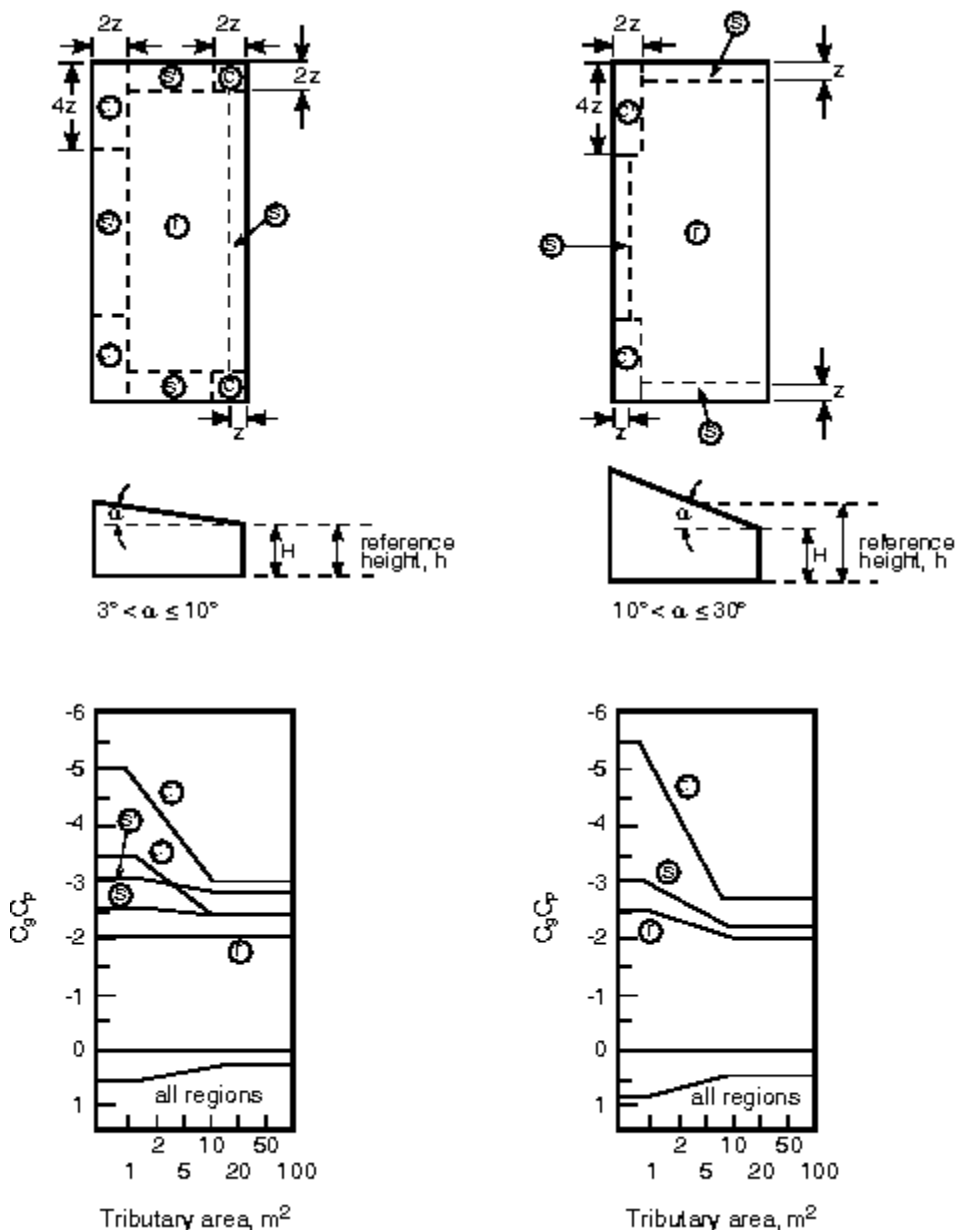
- (1) End-zone width z is the lesser of 10% of the least horizontal dimension and 40% of height, H , but not less than 4% of the least horizontal dimension or 1 m.
- (2) Combinations of external and internal pressures must be evaluated to obtain the most severe loading.

- (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 $\alpha \leq 10^\circ$, the coefficients given in Figure 4.1.7.6.-C apply, but for cases where $\alpha > 7^\circ$, use $\alpha = 7^\circ$.

Figure 4.1.7.6.-G

External peak values of $C_g C_p$ on monoslope roofs for the design of structural components and cladding

Forming Part of Sentence 4.1.7.6.(8)

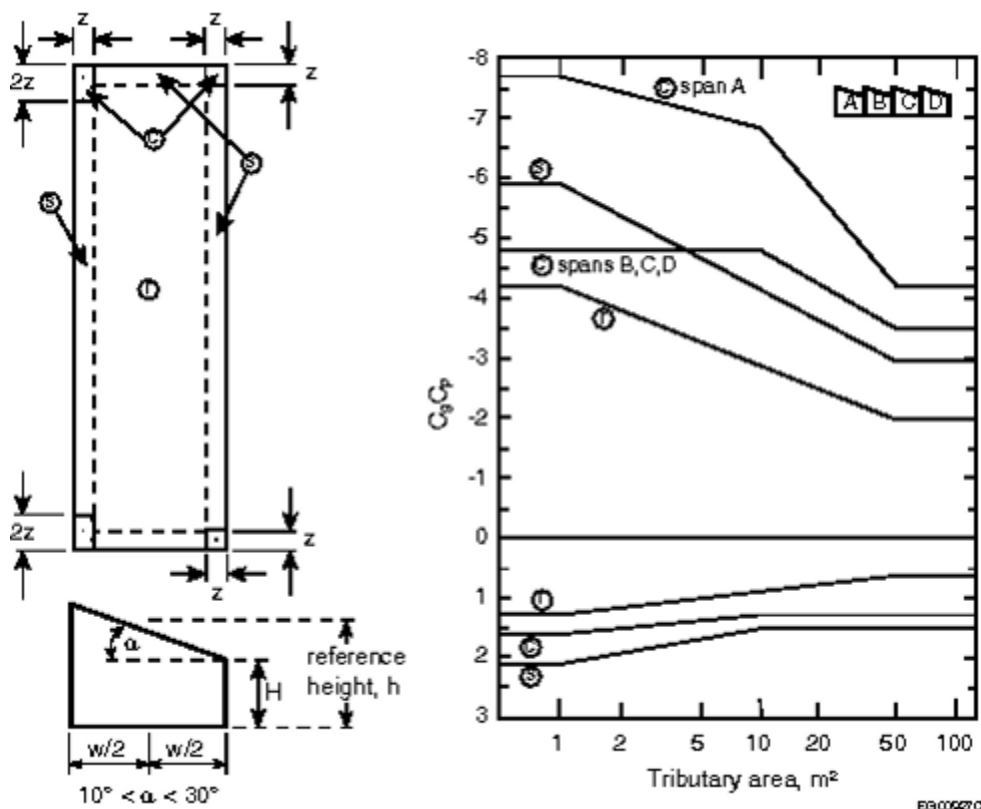


Notes to Figure 4.1.7.6.-G:

- (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 $\alpha \leq 3^\circ$, the coefficients given in Figure 4.1.7.6.-C apply.

Figure 4.1.7.6.-H
External peak values of $C_g C_p$ 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 $\alpha \leq 10^\circ$, the coefficients given in Figure 4.1.7.6.-C apply, but for cases where $\alpha >$ than 7° , use $\alpha = 7^\circ$.

4.1.7.7. Internal Pressure Coefficient

- 1) The internal pressure coefficient, C_{pi} , for *buildings* 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

2) The internal pressure coefficient, C_{pi} , for cladding on parapets shall be -0.70 to +0.70. (See Note A-4.1.7.7.(2).)

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:

$$C_e = 0.5 \left(\frac{h}{12.7} \right)^{0.50}, \text{ but } 0.5 \leq C_e \leq 2.5$$

(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 $\sqrt{2 \ln(\nu T)} + \frac{0.577}{\sqrt{2 \ln(\nu T)}}$, and

$$\sigma/\mu = \sqrt{\frac{K}{C_{eH}} \left(B + \frac{sF}{\beta} \right)},$$

where

ν = average fluctuation rate calculated as $\frac{1}{T} \sqrt{\frac{sF}{sF + \beta B}}$,

$T = 3\,600 \text{ s}$,

$K = 0.08$ 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 $-\frac{\pi}{3} \left[\frac{1}{1 + \frac{s^2}{3} \frac{H}{w}} \right] \left[\frac{1}{1 + \frac{10}{3} \frac{H}{w}} \right]$,

F = gust energy ratio calculated as $\frac{x_0^2}{(1+x_0^2)^{3/2}}$, where $x_0 = (1.220f_{nD}/V_H)$, 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,

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 $V \sqrt{C_{sH}}$,

Where

V = reference wind speed at a height of 10 m, in m/s, calculated as $\sqrt{\frac{2I_w q}{\rho}}$,

where

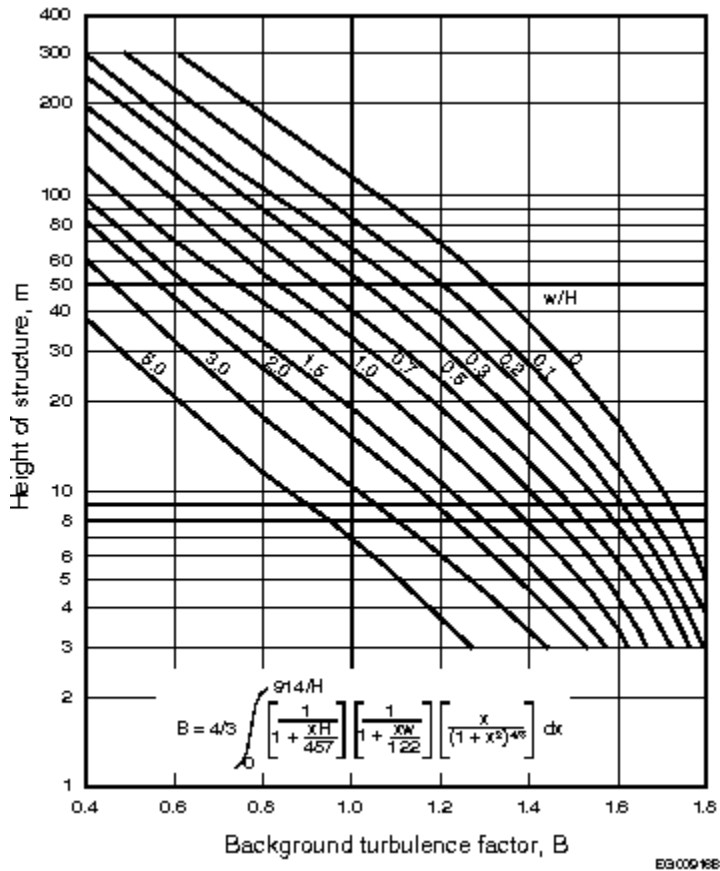
I_w = importance factor for wind load, as provided in Table 4.1.7.3.,

q = reference velocity pressure, in Pa, and

ρ = air density = 1.2929 kg/m³.

(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 $C_g C_p$ 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) 75% of the wind loads described in Clause (a) but offset from the central geometric axis of the building by 15% of its width normal to the direction of the force to produce the worst load effect,
- c) 75% of the wind loads described in Clause (a) but with both axes considered simultaneously, and
- d) 56% of the wind loads described in Clause (a) but with both axes considered simultaneously and offset from the central geometric axis of the building by 15% of its width normal to the direction of the force.

(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 CAN/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. Attached Canopies on Low Buildings with a Height $H \leq 20$ m

(See Note A-4.1.7.12.)

1) For the purposes of this Article, "attached canopy" shall mean a horizontal canopy with a maximum slope of 2% that is attached to a building wall at any height, h_c , above ground level.

2) The specified external wind pressure, p , and the specified net external wind pressure, p_{net} , for attached canopies on exterior walls of low *buildings* with a height $H \leq 20$ m shall be determined as follows:

$$p = I_w q C_e C_t C_g C_p, \text{ and}$$

$$p_{net} = I_w q C_e C_t (C_g C_p)_{net}$$

where

p = specified external wind pressure acting statically and in a direction normal to the upper or lower surface of the canopy, considered positive when acting towards the surface and negative when acting away from the surface,

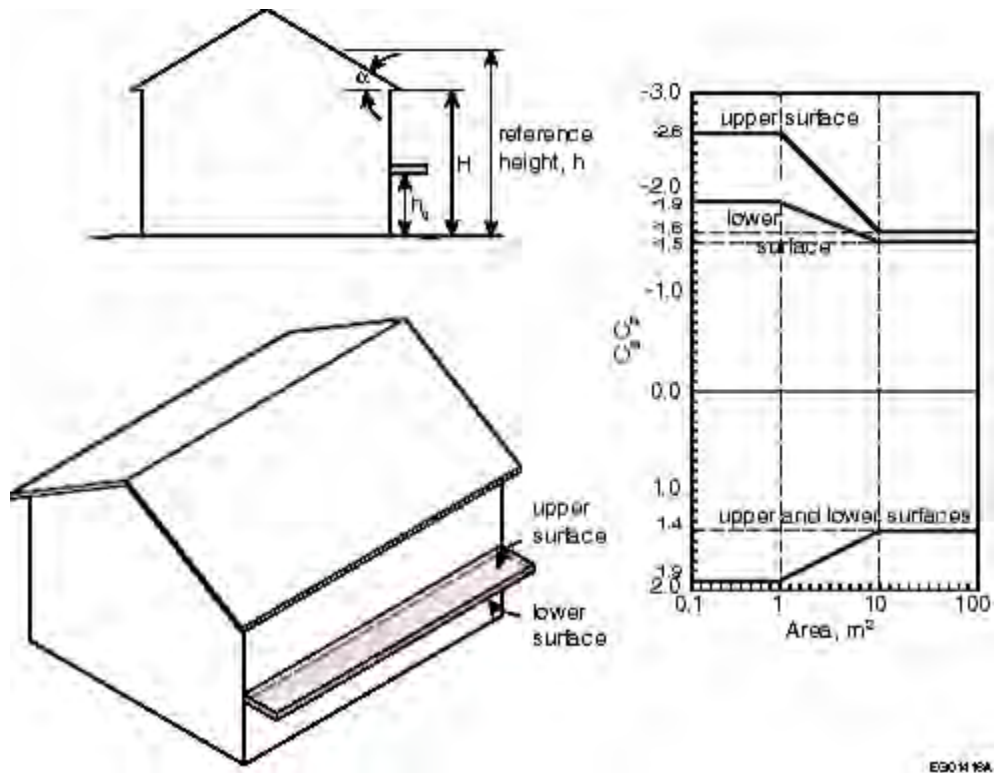
p_{net} = specified net external wind pressure acting statically on the canopy, considered positive when acting in a downward direction and negative when acting in an upward direction,

I_w, q, C_e, C_t = as defined in Sentence 4.1.7.3.(1),

$C_g C_p$ = gust pressure coefficient on the upper or lower surface of the canopy, as given in Figure 4.1.7.12.-A, and

$(C_g C_p)_{net}$ = net gust pressure coefficient on the canopy, considering simultaneous contributions from the upper and lower surfaces of the canopy, as given in Figure 4.1.7.12.-B.

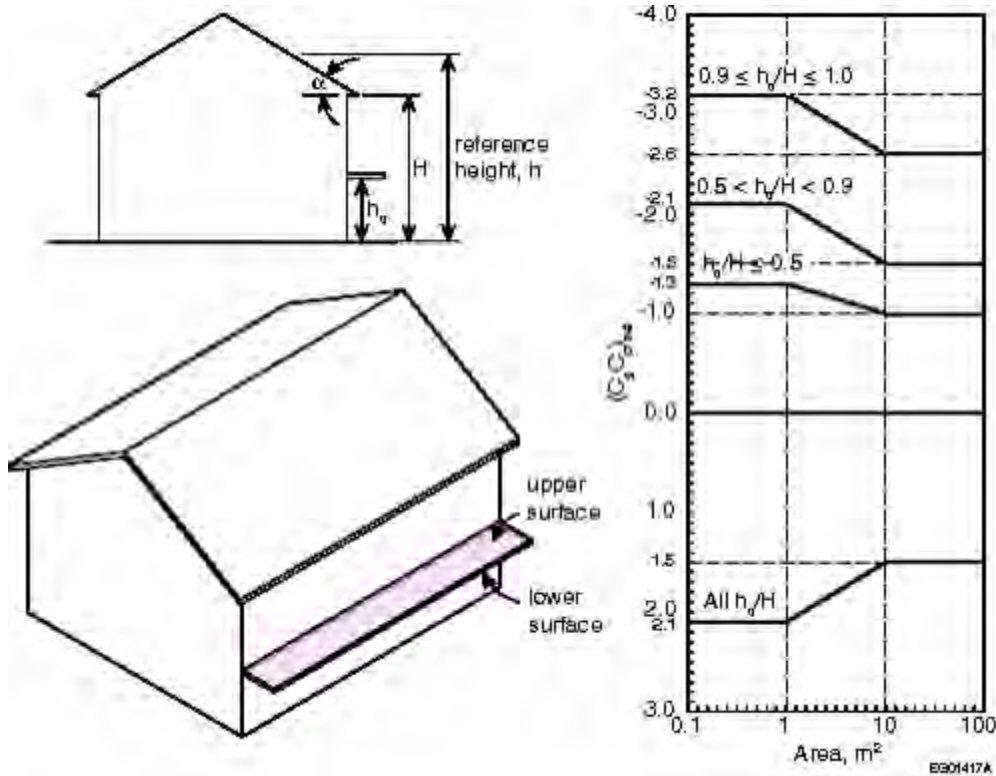
Figure 4.1.7.12.-A
Gust pressure coefficients on the upper and lower surfaces of attached canopies with no gap
between the canopy and the building
Forming Part of Sentence 4.1.7.12.(2)



Notes to Figure 4.1.7.12.-A:

- (1) The coefficients apply for any roof slope, α .
- (2) The reference height, h , is the mid-height of the roof or 6 m, whichever is greater.
- (3) Positive $C_g C_p$ values denote forces acting towards the upper or lower surface of the canopy, whereas negative $C_g C_p$ values denote forces acting away from the surface. Each structural element must be designed to resist both the positive and negative forces.

Figure 4.1.7.12.-B
Net gust pressure coefficients on attached canopies, considering simultaneous contributions
from the upper and lower surfaces of the canopy
Forming Part of Sentence 4.1.7.12.(2)



Notes to Figure 4.1.7.12.-B:

- (1) The coefficients apply for any roof slope, α .
- (2) The reference height, h , is the mid-height of the roof or 6 m, whichever is greater.
- (3) Positive $(C_g C_p)_{net}$ values denote net forces acting in a downward direction on the canopy, whereas negative $(C_g C_p)_{net}$ values denote net forces acting in an upward direction on the canopy. The canopy must be designed to resist both the positive and negative net forces.

4.1.7.13. Roof-Mounted Solar Panels on Buildings of Any Height

(See Note A-4.1.7.13.)

1) Where solar panels are installed on a roof, the roof wind loads shall account for the wind loads on the solar panels, as determined in accordance with Sentences (2) to (7), or shall be determined in the same way as for the roof without solar panels, whichever approach results in the most critical effect.

2) For an array of solar panels where the panels are installed close and parallel to the roof surface with their upper surface not more than 250 mm above the roof surface and with gaps around the panels of not less than 6 mm, the net positive or negative pressure difference between the upper and lower surfaces of a panel or the array shall be calculated as follows:

$$p = I_W q C_e C_t C_g C_p E \gamma_a$$

where

$I_W, q, C_e, C_t, C_g, C_p$ = as defined in Sentence 4.1.7.3.(1), determined in the same manner as for the roof cladding,

E = edge factor, as provided in Sentence (4), and

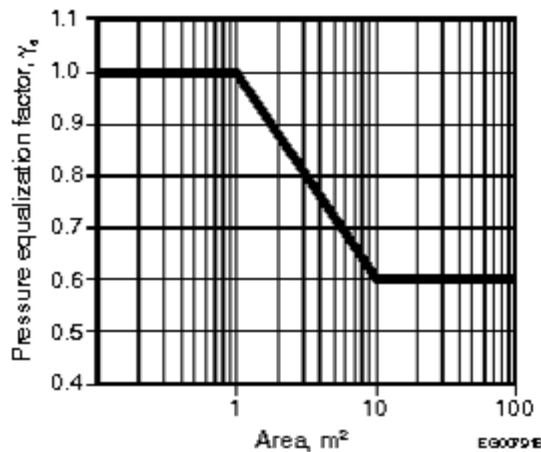
γ_a = pressure equalization factor, as provided in Sentence (3).

3) The pressure equalization factor, γ_a , in Sentence (2) shall be

a) for a panel or an array where the panel chord length, L_p , is greater than 2 m or for a panel or an array that is within a distance of $2h_2$ from the roof edge or ridge, where h_2 is the height of the panel's highest point above the roof surface, taken as 1.0, and

b) for other panels or arrays, determined from Figure 4.1.7.13.-A based on the area of the panel or array over which the wind load is being calculated.

Figure 4.1.7.13.-A
Pressure equalization factor, γ_a , for solar panels or arrays mounted on roofs of *buildings* of any height
Forming Part of Clause 4.1.7.13.(3)(b)



4) The edge factor, E , in Sentence (2) shall be taken as

a) 1.5 within a distance of $1.5L_p$ from an exposed edge of the array of solar panels, as defined in Sentence (5), and

b) 1.0 elsewhere.

5) For the purposes of Clause (4)(a), an exposed edge of the array of solar panels shall be considered to occur

a) where the distance to the next row of panels or the distance across a gap in the same row of panels exceeds $4h_2$ or 1.2 m, whichever is greater, or

b) where the distance to the roof edge exceeds $4h_2$ or 1.2 m, whichever is greater, and exceeds $0.5h$, where h is the reference height of the roof.

6) For an array of solar panels mounted on a roof with a slope, α , less than or equal to 7° , where the panels are tilted relative to the roof surface, have a chord length, L_p , not greater than 2 m, and are installed such that the height of their lowest point above the roof surface, h_1 , is not greater than 0.6 m, height of their highest point above the roof surface, h_2 , is not greater than 1.2 m, and their tilt angle relative to the roof surface, ω , is not greater than 35° , or where the panels are installed parallel to the roof surface with their upper surface greater than 250 mm above the roof surface and with gaps not less than 6

mm between the panels, the net positive or negative pressure difference between the upper and the lower surfaces of a panel or the array shall be calculated as follows:

$$p_{net} = I_w q C_e C_t (C_g C_p)_{net}$$

where

I_w , q , C_e , C_t = as defined in Sentence 4.1.7.3.(1), determined in the same manner as for the roof cladding, and

$(C_g C_p)_{net}$ = net gust pressure coefficient, as provided in Sentence (7).

7) The net gust pressure coefficient, $(C_g C_p)_{net}$, in Sentence (6) shall be calculated as follows:

$$(C_g C_p)_{net} = \pm \gamma_p \gamma_c E (C_g C_p)_n$$

where

γ_p = parapet factor, determined as the lesser of 1.2 and $(0.9 + h_{pt}/h)$,

γ_c = chord factor, determined as the greater of $(0.6 + 0.2L_p)$ and 0.8,

E = as defined in Sentence (2), and

$(C_g C_p)_n$ = normalized gust pressure coefficient, determined from Figure 4.1.7.13.-B based on ω and A_N ,

where

h_{pt} = height of the parapet above the roof surface, in m,

h = reference height of the roof, in m,

L_p = panel chord length, in m,

ω = panel tilt angle relative to the roof surface, and

A_N = normalized panel or array area, calculated as $A_N = \frac{1000A}{\max(L_b^2, 25)}$

where

A = panel or array area over which the wind load is being calculated, in m², and

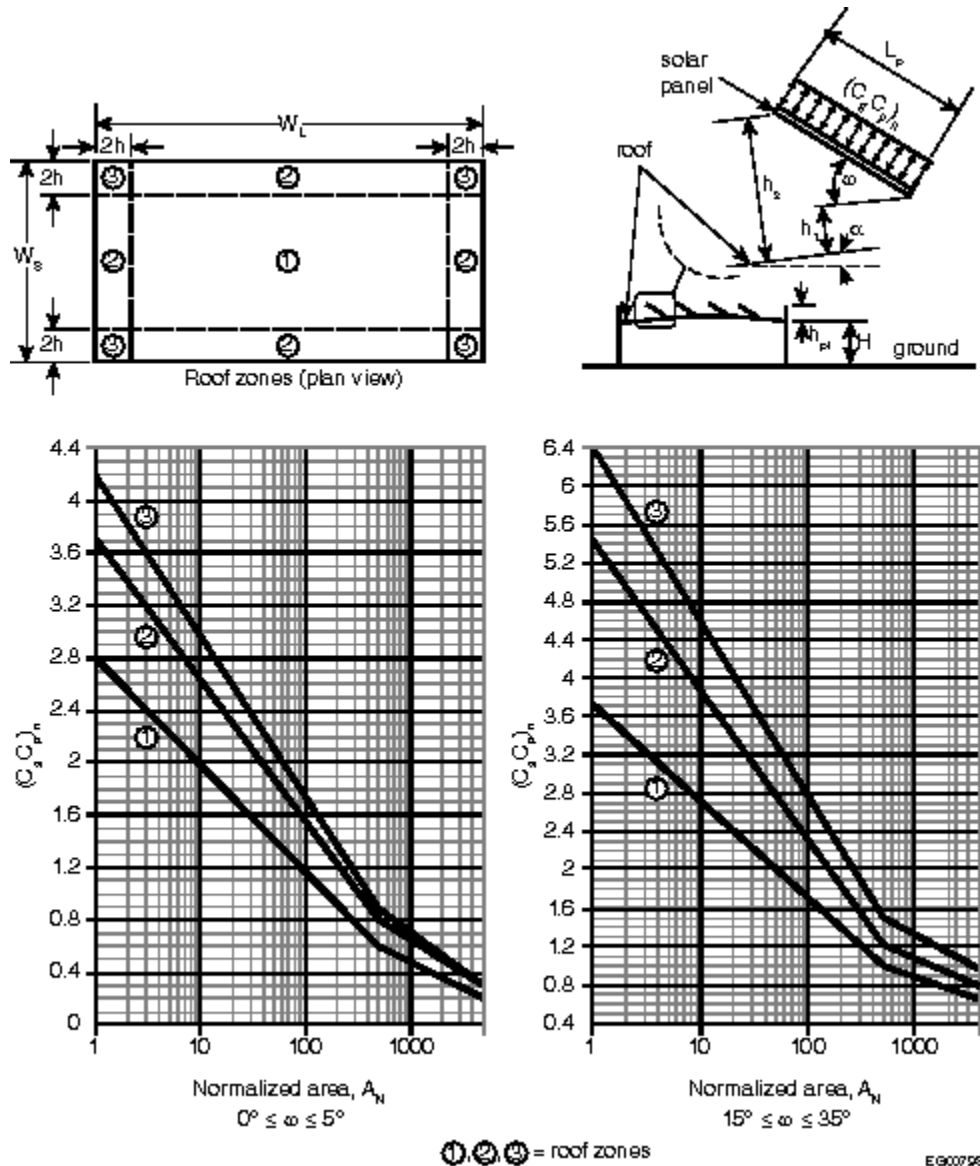
L_b = normalized building length, in m, determined as the lesser of $(0.4 \sqrt{h W_L})$, h and W_s ,

where

W_L = longest horizontal dimension of the building, in m, and

W_s = smallest horizontal dimension of the building, in m.

Figure 4.1.7.13.-B
Normalized gust pressure coefficient, $(C_g C_p)_n$, for solar panels or arrays mounted on low-sloped
roofs of buildings of any height
Forming Part of Sentence 4.1.7.13.(7)



Notes to Figure 4.1.7.13.-B:

- (1) H = height of the building.
- (2) h = reference height of the roof.
- (3) $(C_g C_p)_n$ values are for both positive and negative values.
- (4) For panels with $5^\circ < \omega < 15^\circ$, linear interpolation is permitted.

4.1.7.14. 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) $C_g = 2.5$ and $C_p = \pm 0.72$, where the building's height is greater than 20 m or greater than its minimum effective width, and

b) $C_g C_p = 80\%$ 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 4.1.8.23.

2) Where $I_E F_s S_a(0.2, X_{450})$ and $I_E F_s S_a(2.0, X_{450})$ 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* in the Low, Normal, High and Post-disaster Importance Categories respectively,

b) F_s is the site coefficient based on the average $\bar{N}_{60}$ or $\bar{s}_u$, 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 $\bar{N}_{60} > 50$ or $\bar{s}_u > 100$ kPa,

ii) 1.6 when $15 \leq \bar{N}_{60} \leq 50$ or $50 \text{ kPa} \leq \bar{s}_u \leq 100 \text{ kPa}$, and

iii) 2.8 for all other cases, and

c) $S_a(T, X_{450})$ is the 5%-damped spectral acceleration value at period T for site designation X_{450} , as defined in Article 4.1.8.2., determined in accordance with Subsection 1.1.3. and corresponding to a 2% probability of exceedance in 50 years.

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 in an earthquake to the 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 an SFRS designed in accordance with CSA S136, "North American Specification for the Design of Cold-Formed Steel Structural Members (using the Appendix B provisions applicable to Canada)," shall be less than 15 m.

6) Earthquake forces shall be assumed to act horizontally and independently about any two orthogonal axes.

7) The specified lateral earthquake force, V_s , at the base of the structure in the direction under consideration shall be calculated as follows:

$$V_s = F_s S_a(T_s, X_{450}) I_E W / R_s$$

where

$S_a(T_s, X_{450})$ = value of $S_a(T_s, X_{450})$ determined by linear interpolation between the values of $S_a(0.2, X_{450})$, $S_a(0.5, X_{450})$ and $S_a(1.0, X_{450})$,

= $S_a(0.2, X_{450})$ for $T_s \leq 0.2$ s, and

= $S_a(1.0, X_{450})$ for $T_s \geq 1.0$ s,

W = 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,

= $0.1N$ 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, in m, above the base to level n , as defined in Article 4.1.8.2., and

N = total number of *storeys* above exterior grade to level n , as defined in Article 4.1.8.2.,

except that, in cases where $R_s = 1.5$, V_s need not be greater than $F_s S_a(0.5, X_{450}) I_E W / R_s$.

8) The specified lateral earthquake 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 to level x or i respectively, as defined in 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 interstorey 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 interstorey 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:

$$V_{sp} = 0.9 S_a(0.2, X_{450}) F_s I_E W_p$$

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 = element or component force amplification factor to account for type of attachment, as defined in Sentence 4.1.8.18.(1),

A_x = height factor at level x to account for variation of response of an element or component 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 an element or component, 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 = acceleration-based site coefficient for application in standards referenced in Subsection 4.1.8., as defined in Sentence 4.1.8.4.(7),

F_s = site coefficient as defined in Sentence 4.1.8.1.(2) for application in Article 4.1.8.1.,

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 = velocity-based site coefficient for application in standards referenced 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 = height, in m, 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 = interstorey 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 effects 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 ,

N_{60} = average standard penetration resistance, in blows per 0.3 m, in the top 30 m of soil, corrected to a rod energy efficiency of 60% of the theoretical maximum,

$PGA(X)$ = peak ground acceleration, expressed as a ratio to gravitational acceleration, for site designation X , as defined in Sentence 4.1.8.4.(1),

PGV(X) = peak ground velocity, in m/s, for site designation X, as defined in Sentence 4.1.8.4.(1),

PI = plasticity index for soil,

R_d = ductility-related force modification factor reflecting the capability of a structure to dissipate energy through reversed cyclic inelastic behaviour, as defined 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_p = element or component response modification factor, as defined in Sentence 4.1.8.18.(1),

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_a(T,X) = 5%-damped spectral acceleration, expressed as a ratio to gravitational acceleration, at period T for site designation X, as defined in Sentence 4.1.8.4.(1),

SC = Seismic Category assigned to a building based on its Importance Category and the design spectral acceleration values at periods of 0.2 s and 1.0 s, as defined in Article 4.1.8.5.,

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 acceleration, expressed as a ratio to gravitational acceleration, at period T, as defined in Sentence 4.1.8.4.(6),

$\bar{s}_u$ = average undrained shear strength, in kPa, in the top 30 m of soil,

T = period, in s,

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),

V = specified lateral earthquake force at the base of the structure, as determined in Article 4.1.8.11.,

V_d = specified lateral earthquake force at the base of the structure, as determined in Article 4.1.8.12.,

V_e = lateral earthquake elastic force at the base of the structure, as determined in Article 4.1.8.12.,

V_{ed} = adjusted lateral earthquake elastic force at the base of the structure, as determined in Article 4.1.8.12.,

V_p = specified lateral earthquake force on an element or component, as determined in Article 4.1.8.18.,

V_s = specified lateral earthquake force at the base of the structure, as determined in Sentence 4.1.8.1.(7), for application in Article 4.1.8.1.,

V_{s30} = average shear wave velocity, in m/s, in the top 30 m of soil or rock,

W = specified *dead load*, as defined in Article 4.1.4.1., except that the minimum partition weight as defined in Sentence 4.1.4.1.(3) need not exceed 0.5 kPa, plus 25% of the specified snow load as defined 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,

X = site designation, either X_v or X_s ,

X_s = site designation in terms of Site Class, where S is the Site Class determined in accordance with Sentence 4.1.8.4.(3),

X_v = site designation in terms of V_{s30} , where V is the V_{s30} value calculated from in situ measurements of shear wave velocity,

X_{450} = site designation X_v with $V_{s30} = 450$ m/s,

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 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 modeling 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) For site designation X , as determined in accordance with Sentence (2) or (3), the peak ground acceleration, $PGA(X)$, the peak ground velocity, $PGV(X)$, and the 5%-damped spectral acceleration values, $S_a(T, X)$, at periods T of 0.2 s, 0.5 s, 1.0 s, 2.0 s, 5.0 s and 10.0 s shall

- a) except as provided in Sentence (4), be determined in accordance with Subsection 1.1.3., and
- b) except as provided in Article 4.1.8.23., correspond to a 2% probability of exceedance in 50 years.

2) Except as provided in Sentence (3), the site designation referred to in Sentence (1) shall be determined using the average shear wave velocity, V_{s30} , calculated from in situ measurements of shear wave velocity, as follows:

- a) for the ground profiles described in Table 4.1.8.4.-A, the site designation shall be determined in accordance with the Table, and
- b) for all other ground profiles, the site designation shall be X_V , where V is the value of V_{s30} .

(See Note A-4.1.8.4.(2) and (3).)

Table 4.1.8.4.-A
Exceptions for Site Designation Using V_{s30} Calculated from In Situ Measurements
Forming Part of Sentence 4.1.8.4.(2)

Ground Profile Characteristics		Site Designation
Average Shear Wave Velocity in Top 30 m, V_{s30} , Calculated from In Situ Measurements, in m/s	Additional Characteristics	
$V_{s30} > 760$	Ground profile contains more than 3 m of softer materials between rock and the underside of footing or mat <i>foundations</i>	X_{760}
$V_{s30} > 140$	Ground profile contains more than 3 m of soil with all the following characteristics: • plasticity index, $PI > 20$, • moisture content, $w \geq 40\%$, and • undrained shear strength, $s_u < 25$ kPa	X_E
$V_{s30} > 140$	Ground profile contains	X_F

	• liquefiable soil, quick and highly sensitive clay, collapsible weakly cemented soil, or other soil susceptible to failure or collapse under seismic loading, • more than 3 m of peat and/or highly organic clay, • more than 8 m of highly plastic soil (with $PI > 75$), or • more than 30 m of soft to medium-stiff clay	
$V_{s30} \leq 140$	n/a	X_F

3) Where V_{s30} calculated from in situ measurements is not available, the site designation referred to in Sentence (1) shall be X_S , where S is the Site Class determined using the energy-corrected average standard penetration resistance, $\bar{N}_{60}$, or the average undrained shear strength, $\bar{s}_u$, in accordance with Table 4.1.8.4.-B, $\bar{N}_{60}$ and $\bar{s}_u$ being calculated based on rational analysis. (See Notes A-4.1.8.4.(3) and A-4.1.8.4.(2) and (3).)

Table 4.1.8.4.-B
Site Classes, S, for Site Designation X_S
Forming Part of Sentence 4.1.8.4.(3)

Site Class, S	Ground Profile	Ground Profile Characteristics		
		Average Shear Wave Velocity in Top 30 m, V_{s30} , in m/s ⁽¹⁾	Average Standard Penetration Resistance in Top 30 m, $\bar{N}_{60}$, in Blows per 0.3 m	Average Undrained Shear Strength in Top 30 m, $\bar{s}_u$, in kPa
A	Hard rock ⁽²⁾	$V_{s30} > 1\,500$	n/a	n/a
B	Rock ⁽²⁾	$760 < V_{s30} \leq 1\,500$	n/a	n/a
C	Very dense soil and soft rock	$360 < V_{s30} \leq 760$	$\bar{N}_{60} > 50$	$\bar{s}_u > 100$
D	Stiff soil	$180 < V_{s30} \leq 360$	$15 < \bar{N}_{60} \leq 50$	$50 < \bar{s}_u \leq 100$
E	Soft soil	$140 < V_{s30} \leq 180$	$10 < \bar{N}_{60} \leq 15$	$40 < \bar{s}_u \leq 50$
		Any ground profile other than Site Class F that contains more than 3 m of soil with all the following characteristics: • plasticity index, $PI > 20$, • moisture content, $w \geq 40\%$, and • undrained shear strength, $s_u < 25$ kPa		
F	Other soils ⁽³⁾	$V_{s30} \leq 140$	$\bar{N}_{60} \leq 10$	$\bar{s}_u \leq 40$
		Any ground profile that contains • liquefiable soil, quick and highly sensitive clay, collapsible weakly cemented soil, or other soil susceptible to failure or collapse under seismic loading, • more than 3 m of peat and/or highly organic clay, • more than 8 m of highly plastic soil (with $PI > 75$), or • more than 30 m of soft to medium-stiff clay		

Notes to Table 4.1.8.4.-B:

⁽¹⁾ See Note A-4.1.8.4.(2) and (3).

⁽²⁾ Site designations X_A and X_B , corresponding to Site Classes A and B, are not to be used in cases where the ground profile contains more than 3 m of softer materials between rock and the underside of footing or mat foundations. The appropriate site designation for such cases is X_{760} .

⁽³⁾ Site-specific geotechnical evaluation is required.

4) Site-specific geotechnical evaluation is required to determine the values of $PGA(X_F)$, $PGV(X_F)$ and $S_a(T, X_F)$ for site designation X_F .

5) Where structures on liquefiable soils have a fundamental lateral period, T_a , of 0.5 s or less, the site designation X and the corresponding values of $S_a(T, X)$ and $PGA(X)$ are permitted to be determined in accordance with Sentence (1) by assuming that the soils are not liquefiable.

6) The design spectral acceleration, $S(T)$, shall be determined in accordance with Table 4.1.8.4.-C, using log-log or linear interpolation for intermediate values of T . (See Note A-4.1.8.4.(6).)

Table 4.1.8.4.-C
Design Spectral Acceleration
Forming Part of Sentence 4.1.8.4.(6)

Period, T , in s	Design Spectral Acceleration, $S(T)$
≤ 0.2	$S_a(0.2, X)$ or $S_a(0.5, X)$, whichever is greater
0.5	$S_a(0.5, X)$
1.0	$S_a(1.0, X)$
2.0	$S_a(2.0, X)$
5.0	$S_a(5.0, X)$
10.0	$S_a(10.0, X)$

7) Where required for the application of a standard referenced in this Subsection, the acceleration-based site coefficient, F_a , for site designation X shall be taken as $S(0.2)/S_a(0.2, X_{450})$ and the velocity-based site coefficient, F_v , for site designation X shall be taken as $S(1.0)/S_a(1.0, X_{450})$.

4.1.8.5. Importance Factor and Seismic Category

1) The earthquake importance factor, I_E , shall be determined according to Table 4.1.8.5.-A

Table 4.1.8.5.-A
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.-A:

⁽¹⁾ See Article 4.1.8.13.

⁽²⁾ See Note A-Table 4.1.8.5.-A.

2) *Buildings* shall be assigned a Seismic Category in accordance with Table 4.1.8.5.-B.

Table 4.1.8.5.-B
Seismic Categories for Buildings
Forming Part of Sentence 4.1.8.5.(2)

Seismic Category ⁽¹⁾	$I_E S(0.2)$	$I_E S(1.0)$
SC1	$I_E S(0.2) < 0.2$	$I_E S(1.0) < 0.1$

SC2	$0.2 \leq I_{eS}(0.2) < 0.35$	$0.1 \leq I_{eS}(1.0) < 0.2$
SC3	$0.35 \leq I_{eS}(0.2) \leq 0.75$	$0.2 \leq I_{eS}(1.0) \leq 0.3$
SC4	$I_{eS}(0.2) > 0.75$	$I_{eS}(1.0) > 0.3$

Notes to Table 4.1.8.5.-B:

⁽¹⁾ The Seismic Category of a building shall be taken as the more severe of the categories determined on the basis of $I_{eS}(0.2)$ and $I_{eS}(1.0)$, irrespective of the fundamental lateral period of the building, T_a .

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 (1) may be considered regular.
- 3) Except as required by Article 4.1.8.10., where the Seismic Category is SC3 or SC4, structures designated as irregular must satisfy the provisions referenced in Table 4.1.8.6.

Table 4.1.8.6.

Structural Irregularities(1)(2)

Forming Part of Sentences 4.1.8.6.(1) and (3), Clause 4.1.8.7.(1)(c) and Article 4.1.8.10.

Type	Irregularity Type and Definition	Notes
1	Vertical Stiffness Irregularity For concrete and masonry shear walls, vertical stiffness irregularity shall be considered to exist where the lateral stiffness of the SFRS in any storey is less than 70% of the stiffness in an adjacent storey, or less than 80% of the average stiffness in the three storeys above or below. For all other types of SFRS, vertical stiffness irregularity shall be considered to exist where the interstorey deflection under lateral earthquake forces divided by the interstorey height, h_s , of any storey is greater than 130% of that of an adjacent storey.	(3)(4)(5)
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.	(3)
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.	(3)(4) ^(a)
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.	(3)(4)(6)
5	Out-of-Plane Offsets Discontinuities in a lateral force path, such as out-of-plane offsets of the vertical elements of the SFRS.	(3)(4)(6)
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.	(3)(4)
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.	(3)(4) ^(c)
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.	(3) ^(a)
9	Gravity-Induced Lateral Demand Irregularity Gravity-induced lateral demand irregularity on the SFRS shall be considered to exist where the	(3)(4)(8)

	ratio α calculated in accordance with Sentence 4.1.8.10.(7) exceeds 0.1 for an SFRS with self-centering characteristics and 0.03 for other systems.	
10	Sloped Column Irregularity Sloped column irregularity shall be considered to exist where a vertical member that is inclined more than 2° from the vertical supports a portion of the weight of the building in axial compression.	(4)

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 Note A-Table 4.1.8.6.

⁽³⁾ See Article 4.1.8.7.

⁽⁴⁾ See Article 4.1.8.10.

⁽⁵⁾ Increased stiffness in storeys below grade need not be considered in the determination of vertical stiffness irregularity.

⁽⁶⁾ See Article 4.1.8.15.

⁽⁷⁾ See Sentences 4.1.8.11.(10) and (11), and 4.1.8.12.(4).

⁽⁸⁾ See Article 4.1.8.8.

4.1.8.7. Methods of Analysis

1) Analysis for 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) where the Seismic Category is SC1 or SC2,
- 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 a structural irregularity of Type 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 the Seismic Category is SC1 or SC2, 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 the Seismic Category is SC3 or SC4, analysis of the structure independently in any two orthogonal directions for 100% of the specified earthquake loads applied in one direction plus 30% of the specified 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 Modification Factors and General Restrictions

1) Except as provided in Articles 4.1.8.20. and 4.1.8.22., 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, $R_d R_o$ shall be taken as the lowest value of $R_d R_o$ corresponding to these systems.

4) For vertical variations of $R_d R_o$, 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 $R_d R_o$ used in the design of any *storey* shall be less than or equal to the lowest value of $R_d R_o$ 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 defined 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 Sentences 4.1.8.9.(1) and (5), 4.1.8.10.(5) and (6), 4.1.8.11.(12), 4.1.8.15.(9) and 4.1.8.20.(8)

Type of SFRS	R _d	R _o	Restrictions ⁽²⁾			
			Seismic Category			
			SC1	SC2	SC3	SC4
Steel Structures Designed and Detailed According to CSA S16 ⁽³⁾⁽⁴⁾						
Ductile moment-resisting frames	5.0	1.5	NL	NL	NL	NL
Moderately ductile moment-resisting frames	3.5	1.5	NL	NL	NL	NL
Limited ductility moment-resisting frames	2.0	1.3	NL	NL	60	30
Moderately ductile truss moment-resisting frames	3.5	1.6	NL	NL	50	30
Moderately ductile concentrically braced frames						
Tension-compression braces	3.0	1.3	NL	NL	40	40
Tension only braces	3.0	1.3	NL	NL	20	20
Limited ductility concentrically braced frames						
Tension-compression braces	2.0	1.3	NL	NL	60	60
Tension only braces	2.0	1.3	NL	NL	40	40
Ductile buckling-restrained braced frames	4.0	1.2	NL	NL	40	40
Ductile eccentrically braced frames	4.0	1.5	NL	NL	NL	NL
Ductile plate walls	5.0	1.6	NL	NL	NL	NL
Moderately ductile plate walls	3.5	1.3	NL	NL	40	40
Limited ductility plate walls	2.0	1.3	NL	NL	60	60
Conventional construction of moment-resisting frames, braced frames or plate walls						
Assembly occupancies	1.5	1.3	NL	NL	15	15
Other occupancies	1.5	1.3	NL	NL	60	40
Other steel SFRSs not defined above	1.0	1.0	15	15	NP	NP
Concrete Structures Designed and Detailed According to CSA A23.3						
Ductile moment-resisting frames	4.0	1.7	NL	NL	NL	NL
Moderately ductile moment-resisting frames	2.5	1.4	NL	NL	60	40
Ductile coupled walls	4.0	1.7	NL	NL	NL	NL
Moderately ductile coupled walls	2.5	1.4	NL	NL	NL	60
Ductile partially coupled walls	3.5	1.7	NL	NL	NL	NL
Moderately ductile partially coupled walls	2.0	1.4	NL	NL	NL	60
Ductile shear walls	3.5	1.6	NL	NL	NL	NL
Moderately ductile shear walls	2.0	1.4	NL	NL	NL	60
Conventional construction						

Moment-resisting frames	1.5	1.3	NL	NL	20	10 ⁽⁵⁾⁽⁶⁾
Shear walls	1.5	1.3	NL	NL	40	30
Two-way slabs without beams	1.3	1.3	20	15	NP	NP
Tilt-up construction						
Moderately ductile walls and frames	2.0	1.3	30	25	25	25
Limited ductility walls and frames	1.5	1.3	30	25	20	20 ⁽⁷⁾
Conventional walls and frames	1.3	1.3	25	20	NP	NP
Other concrete SFRSs not listed above	1.0	1.0	15	15	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
Shear walls: wood-based and gypsum panels in combination	2.0	1.7	NL	NL	20	20
Moderately ductile cross-laminated timber shear walls: platform-type construction	2.0	1.5	30	30	30	20
Limited ductility cross-laminated timber shear walls: platform-type construction	1.0	1.3	30	30	30	20
Braced or moment-resisting frames with ductile connections						
Moderately ductile	2.0	1.5	NL	NL	20	20
Limited ductility	1.5	1.5	NL	NL	15	15
Other wood- or gypsum-based SFRSs not listed above	1.0	1.0	15	15	NP	NP
Masonry Structures Designed and Detailed According to CSA S304						
Ductile shear walls	3.0	1.5	NL	NL	60	40
Moderately ductile shear walls	2.0	1.5	NL	NL	60	40
Conventional construction						
Shear walls	1.5	1.5	NL	60	30	15
Moment-resisting frames	1.5	1.5	NL	30	NP	NP
Unreinforced masonry	1.0	1.0	30	15	NP	NP
Other masonry SFRSs not listed above	1.0	1.0	15	NP	NP	NP
Cold-Formed Steel Structures Designed and Detailed According to CSA S136						
Shear walls						
Screw-connected shear walls – wood-based panels	2.5	1.7	20	20	20	20
Screw-connected shear walls – wood-based and gypsum panels in combination	1.5	1.7	20	20	20	20
Diagonal strap concentrically braced walls						
Limited ductility	1.9	1.3	20	20	20	20
Conventional construction	1.2	1.3	15	15	NP	NP

Other cold-formed SFRSs not defined above	1.0	1.0	15	15	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 Code.

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 are limited to a maximum of 2 *storeys*.

⁽⁶⁾ The maximum height limit is permitted to be increased to 15 m where $I_e S(1.0) \leq 0.3$.

⁽⁷⁾ Frames are 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 the Seismic Category is SC1 and the forces used for design of the SFRS are multiplied by $R_d R_o$.

2) *Post-disaster buildings* shall

a) not have Type 1, 3, 4, 5, 7, 9 or 10 irregularities as described in Table 4.1.8.6., where the Seismic Category is SC3 or SC4,

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,

d) where they are constructed with concrete or masonry shear walls, have no *storey* with a lateral stiffness that is less than that of the *storey* above it, and

e) where they are constructed with other types of SFRS, have no *storey* for which the interstorey deflection under lateral earthquake forces divided by the interstorey height, h_s , is greater than that of the *storey* above it.

3) High Importance Category *buildings* shall

a) not have Type 1, 3, 4, 5, 7, 9 or 10 irregularities as described in Table 4.1.8.6., where the Seismic Category is SC4,

b) not have a Type 6 irregularity as described in Table 4.1.8.6.,

c) have an SFRS with an R_d of at least

i) 2.0 where the Seismic Category is SC4, and

ii) 1.5 otherwise,

d) where they are constructed with concrete or masonry shear walls, have no *storey* with a lateral stiffness that is less than that of the *storey* above it, and

e) where they are constructed with other types of SFRS, have no *storey* for which the interstorey deflection under lateral earthquake forces divided by the interstorey height, h_s , is greater than that of the *storey* above it.

4) Where the fundamental lateral period, T_a , is greater than or equal to 1.0 s and $I_e S(1.0)$ 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 Type 4 or 5 irregularities as described in Table 4.1.8.6.

5) For *buildings* in Seismic Category SC3 or SC4 that are constructed with more than 4 *storeys* of continuous wood construction, timber SFRSs 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 5 irregularities as described in Table 4.1.8.6. (See Note A-4.1.8.10.(5) and (6).)

6) For *buildings* in Seismic Category SC3 or SC4 that are constructed with more than 4 *storeys* of continuous wood construction, timber SFRSs consisting of moderately ductile or limited ductility cross-laminated timber shear walls, platform-type construction, as defined in Table 4.1.8.9. within the continuous wood construction shall not have Type 4, 5, 6, 8, 9 or 10 irregularities as described in Table 4.1.8.6. (See Note A-4.1.8.10.(5) and (6).)

7) 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:

$$\alpha = Q_G / Q_y$$

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 earthquake loads, which need not be taken as less than R_0 multiplied by the specified 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.(7).)

8) For *buildings* with a Type 9 irregularity as described in Table 4.1.8.6. and where $I_E S(0.2)$ is equal to or greater than 0.5, deflections determined in accordance with Article 4.1.8.13. shall be multiplied by 1.2.

9) For *buildings* where the value of α , as determined in accordance with Sentence (7), exceeds twice the appropriate limit specified in Table 4.1.8.6. for a Type 9 irregularity and where $I_E S(0.2)$ is equal to or greater than 0.5, a Non-linear Dynamic Analysis of the structure shall be carried out in accordance with Article 4.1.8.12. and the following criteria:

- a) the analysis shall account for the effects of the vertical response of the building mass,
- b) the analysis shall account for the effects of the vertical response of building components that undergo a vertical displacement when displaced laterally,
- c) the analysis shall use vertical ground motion time histories that are compatible with horizontal ground motion time histories scaled to the target response spectrum and that are applied concurrently with the horizontal ground motion time histories,
- d) the largest interstorey deflection at any level of the building as determined from the analysis shall not be greater than 60% of the appropriate limit stated in Sentence 4.1.8.13.(3), and
- e) the results of an analysis using the ground motion time histories in Clause (c) multiplied by 1.5 shall satisfy the non-linear acceptance criteria.

(See Note A-4.1.8.10.(9).)

10) The design of *buildings* in Seismic Category SC3 or SC4 with a Type 10 irregularity as described in Table 4.1.8.6. shall satisfy the following requirements:

- a) the structure shall be designed to resist the additional earthquake forces due to the vertical accelerations of the mass supported by inclined vertical members (see Note A-4.1.8.10.(10)(a)), and

b) the effects of the horizontal and vertical movements of inclined vertical members, while undergoing earthquake-induced deformations, on the floor systems they support shall be considered in the design of the building and accounted for in the application of Sentence 4.1.8.3.(5).

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 specified lateral earthquake force, V , shall be calculated using the following formula:

$$V = S(T_a)M_v I_E W / (R_d R_o)$$

except

a) for walls, coupled walls and wall-frame systems, V shall not be less than

$$S(4.0)M_v I_E W / (R_d R_o)$$

b) for moment-resisting frames, braced frames, and other systems, V shall not be less than

$$S(2.0)M_v I_E W / (R_d R_o), \text{ and}$$

c) for *buildings* located on a site designated as other than X_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

$$(2/3)S(0.2)I_E W / (R_d R_o) \text{ and}$$

$$S(0.5)I_E W / (R_d R_o)$$

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 lateral earthquake 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:

i) $0.085(h_n)^{3/4}$ for steel moment frames,

ii) $0.075(h_n)^{3/4}$ for concrete moment frames, or

iii) $0.1N$ for other moment frames,

b) $0.025h_n$ for braced frames,

c) $0.05(h_n)^{3/4}$ for shear wall and other structures, 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 as greater than 1.5 times that determined in Clause (a),

ii) for braced frames, T_a shall not be taken as greater than 2.0 times that determined in Clause (b),

iii) for shear wall structures, T_a shall not be taken as greater than 2.0 times that determined in Clause (c),

- iv) for other structures, T_a shall not be taken as 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) $0.05(h_n)^{3/4} + 0.004L$ for shear walls,
- b) $0.035h_n + 0.004L$ 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 specified lateral earthquake force, V , shall be distributed such that

a) a portion, F_t , is concentrated at the top of the building, where F_t is equal to $0.07T_aV$ but need not exceed $0.25V$ and may be considered as zero where the fundamental lateral period, T_a , does not exceed 0.7 s, and

b) the remainder, $V - F_t$, is 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, M_v , and Base Overturning Moment 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 $T_a \leq 0.5$	M_v for $T_a = 1.0$	M_v for $T_a = 2.0$	M_v for $T_a \geq 5.0$	J for $T_a \leq 0.5$	J for $T_a = 1.0$	J for $T_a = 2.0$	J for $T_a \geq 5.0$
Moment-Resisting Frames								
5	1	1	1	(5)	1	1	0.95	(5)
20	1	1	1	(5)	1	0.97	0.88	(5)
40	1	1	1	(5)	1	0.90	0.79	(5)

70	1	1	1	(5)	0.98	0.88	0.70	(5)
Coupled Walls ⁽⁶⁾								
5	1	1	1	1 ⁽⁷⁾	1	1	0.95	0.80 ⁽⁸⁾
20	1	1	1	1.09(7)	1	0.97	0.88	0.66(8)
40	1	1	1	1.33(7)	1	0.90	0.79	0.52(8)
70	1	1	1	1.90(7)	0.98	0.88	0.70	0.40(8)
Braced Frames								
5	1	1	1	(5)	1	0.98	0.93	(5)
20	1	1	1	(5)	1	0.91	0.80	(5)
40	1	1	1	(5)	0.91	0.82	0.72	(5)
70	1	1	1.19	(5)	0.91	0.77	0.61	(5)
Walls, Wall-Frame Systems								
5	1	1	1	1.30(7)	1	1	0.85	0.59(8)
20	1	1	1.18	2.50(7)	1	0.80	0.60	0.35(8)
40	1	1.25	1.85	4.10(7)	0.80	0.59	0.42	0.23(8)
70	1	1.25	2.30	6.40(7)	0.80	0.56	0.30	0.18(8)
Other Systems								
5	1	1	1	(5)	1	1	0.85	(5)
20	1	1	1.18	(5)	1	0.80	0.60	(5)
40	1	1.25	1.85	(5)	0.80	0.59	0.44	(5)
70	1	1.37	2.30	(5)	0.80	0.56	0.30	(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. For spectral ratios less than 5, M_v and J shall be obtained by linear interpolation with their values at a spectral ratio of 0 taken as equal to 1. For spectral ratios greater than 70, M_v and J shall be taken as equal to their values at a spectral ratio of 70.

⁽²⁾ For intermediate values of the fundamental lateral period, T_a , in cases where $S(T_a)$ is obtained by log-log interpolation, M_v shall be obtained by linear interpolation using the values of M_v obtained in accordance with Note (1). In cases where $S(T_a)$ is obtained by linear interpolation, the product $S(T_a)M_v$ 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 SFRSs 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 SFRSs 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 determined 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 forces determined in Sentence (7) acting at distances $\pm 0.10D_{nx}$ 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 forces determined in Sentence (7).

11) Torsional effects shall be accounted for as follows:

a) for a building with $B \leq 1.7$ or in Seismic Category SC1 or SC2, 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) $T_x = F_x(e_x + 0.10D_{nx})$, and

ii) $T_x = F_x(e_x - 0.10D_{nx})$

where F_x is determined in accordance with 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 Seismic Category SC3 or SC4, 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 specified lateral earthquake force, V , as determined in 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.(5) and (6).)

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.(6).

3) The ground motion time 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.(6). (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 $(\pm 0.10D_{nx})F_x$ 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 $R_d R_o / I_e$, 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 $-0.05D_{nx}$ and $+0.05D_{nx}$.

5) Except as provided in Sentence (6), the adjusted elastic base shear, V_{ed} , shall be equal to the elastic base shear, V_e , obtained from a Linear Dynamic Analysis.

6) For *buildings* located on a site designated as other than X_F that have an SFRS with R_d equal to or greater than 1.5, the elastic base shear, V_e , obtained from a Linear Dynamic Analysis may be multiplied by the larger of the following factors to obtain V_{ed} :

$$(2/3)S(0.2)/S(T_a) \leq 1.0 \text{ and}$$

$$S(0.5)/S(T_a) \leq 1.0$$

7) V_{ed} shall be multiplied by the earthquake importance factor, I_e , as determined in Article 4.1.8.5., and shall be divided by $R_d R_o$, as determined in Article 4.1.8.9., to obtain the specified lateral earthquake force, V_d .

8) Except as required by Sentence (9) or (12), if V_d , as determined in Sentence (7), is less than 80% of V , as determined in 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 V_d , as determined in Sentence (7), and 100% of V , as determined in Article 4.1.8.11.

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.

11) For the purpose of calculating deflections, it is permitted to use a value of V based on the value of 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), V_d shall be taken as the larger of V_d , as determined in Sentence (7), and 100% of V , as determined in Article 4.1.8.11. (See Note A-4.1.8.10.(5) and (6).)

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 $R_d R_o / I_E$ and increased as required in Sentences 4.1.8.10.(8) 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 interstorey deflection at any level shall be limited to $0.01h_s$ for *post-disaster buildings*, $0.02h_s$ for High Importance Category *buildings*, and $0.025h_s$ 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 be

a) separated by a distance equal to at least the square root of the sum of the squares of their individual deflections calculated in Sentence 4.1.8.13.(2), or

b) 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 $R_d R_o$ 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:

a) forces 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 specified lateral earthquake force, V , divided by N for the diaphragm at level x .

(See Note A-4.1.8.15.(1).)

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 specified lateral earthquake force, V ,

b) for wood diaphragms acting in combination with other SFRSs, not less than the force corresponding to $R_d R_o = 2.0$, and

c) for steel deck roof diaphragms, not less than the force corresponding to $R_d R_o = 2.0$.

3) Where diaphragms are designed in accordance with Sentence (2), the struts shall be designed in accordance with Clause (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 $R_o R_d (\Delta_B + \Delta_D) - R_o \Delta_D$,

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) Where the Seismic Category is SC3 or SC4, 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 $R_d R_o$ satisfying Sentence 4.1.8.9.(4), the elements of the SFRS below the level where the change in $R_d R_o$ 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 $R_d R_o$ 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 $R_d R_o$ 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 forces determined in Sentence 4.1.8.7.(1) using $R_d R_o = 1.0$, 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 $R_d R_o = 2.0$.

(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) Where the Seismic Category is SC3 or SC4, 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) Where the Seismic Category is SC3 or SC4, *basement* walls shall be designed to resist earthquake lateral pressures from backfill or natural ground. (See Note A-4.1.8.16.(7).)

8) Where the Seismic Category is SC4, 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 designated as X_v , where V_{s30} is less than or equal to 180 m/s, X_E or X_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 Clause (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 $0.1I_E S(0.2)$, 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 specified lateral earthquake force, V_p , distributed according to the distribution of mass:

$$V_p = 0.3 S(0.2) I_E S_p W_p$$

where

$S(0.2)$ = design spectral acceleration value at a period of 0.2 s, as defined in Sentence 4.1.8.4.(6),

I_E = earthquake importance factor for the building, as defined in Article 4.1.8.5.,

S_p = $C_p A_r A_x / R_p$ (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 $(1 + 2h_x/h_n)$,

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) to (3), (6), (7) and (16), and Clauses 4.1.8.23.(2)(c)
and (3)(c)**

Category	Part or Portion of Building	C _p	A _r	R _p
Architectural and Structural Components				
1	All exterior and interior walls, and cladding panels, except those in Category 2 or 3	1.00	1.00	2.50
2	Cantilever parapet and other cantilever walls, including cantilever cladding panels, 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, <i>chimneys</i> , 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
Mechanical and Electrical Components				
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
Other System Components				
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 Safety Standards Act and pursuant regulations.

⁽⁴⁾ See Sentence (13) and Note A-Table 4.1.8.18.

2) For *buildings* in Seismic Category SC1 or SC2, other than *post-disaster buildings*, seismically isolated *buildings*, and *buildings* with supplemental energy dissipation systems, 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 and 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) except as provided in Sentence (17), friction due to gravity loads shall not be considered to provide resistance to earthquake 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 shallow post-installed mechanical, post-installed adhesive, and cast-in-place anchors in concrete shall be 1.5, where shallow anchors are those with a ratio of embedment length to diameter of less than 8,

d) post-installed mechanical, drop-in and adhesive anchors in concrete shall be pre-qualified for seismic applications by cyclic load testing in accordance with

i) CSA A23.3, "Design of concrete structures," and

ii) ACI 355.2, "Qualification of Post-Installed Mechanical Anchors in Concrete (ACI 355.2-19) and Commentary," or ACI 355.4, "Qualification of Post-Installed Adhesive Anchors in Concrete (ACI 355.4-19) and Commentary," as applicable,

e) post-installed mechanical and adhesive anchors in masonry and post-installed mechanical anchors in structural steel shall be pre-qualified for seismic applications by cyclic tension load testing (see Note A-4.1.8.18.(7)(e)),

f) power-actuated fasteners shall not be used for cyclic tension loads,

g) 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

h) 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 according to CSA A344.2, "Standard for the design and construction of steel storage racks," and 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.(13) and 4.4.3.1.(1).)

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) $D_{\text{fallout}} \geq 1.25I_E D_p$, 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.(14) and (15).)

15) Glass need not comply with Sentence (14), provided at least one of the following conditions is met:

a) the Seismic Category is SC1 or SC2,

b) the glass has sufficient clearance from its frame such that $D_{\text{clear}} \geq 1.25D_p$ calculated as follows:

$$D_{\text{clear}} = 2C_1(1 + h_p C_2 / (b_p C_1))$$

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, 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.

(See Note A-4.1.8.18.(14) and (15).)

16) For structures with supplemental energy dissipation, elements and components of buildings described in Table 4.1.8.18. and their connections to the structure shall be designed for a specified lateral earthquake force, V_p , determined at each floor level as follows:

$$V_p = S_{\text{sed}} I_E (C_p A_r / R_p) W_p$$

where

S_{sed} = peak spectral acceleration, $S_a(T, X)$, in the period range of $T = 0$ s to $T = 0.5$ s determined from the mean 5%-damped floor spectral acceleration values by averaging the individual 5%-damped floor response spectra at the centroid of the floor area at that floor level determined using Non-linear Dynamic Analysis, and

I_E, C_p, A_r, R_p, W_p = as defined in Sentence (1).

(See Note A-4.1.8.18.(16).)

17) For a ballasted array of interconnected solar panels mounted on a roof, where $I_{ES}(0.2)$ is less than or equal to 1.0, friction due to gravity loads is permitted to be considered to provide resistance to seismic forces, provided

a) the roof is not normally occupied,

b) the roof is surrounded by a parapet extending from the roof surface to not less than the greater of

i) 150 mm above the centre of mass of the array, and

ii) 400 mm above the roof surface,

- c) the height of the centre of mass of the array above the roof surface is less than the lesser of
 - i) 900 mm, and
 - ii) one half of the smallest plan dimension of the supporting base of the array,
- d) the roof slope at the location of the array is less than or equal to 3° ,
- e) the factored friction resistance calculated using the kinetic friction coefficient determined in accordance with Sentence (18) and a resistance factor of 0.7 is greater than or equal to the specified lateral earthquake force, V_p , on the array determined in accordance with Sentence (1) using values of $A_r = 1.0$, $A_x = 3.0$, $C_p = 1.0$, and $R_p = 1.25$,
- f) the minimum clearance between the array and other arrays or fixed objects is the greater of
 - i) 225 mm, and
 - ii) $1\,500(I_e S(0.2) - 0.4)^2$, in mm, and
- g) the minimum clearance between the array and the roof parapet is the greater of
 - i) 450 mm, and
 - ii) $3\,000(I_e S(0.2) - 0.4)^2$, in mm.

18) For the purpose of Clause (17)(e), the kinetic friction coefficient shall be determined in accordance with ASTM G115, "Standard Guide for Measuring and Reporting Friction Coefficients," through experimental testing that

- a) is carried out by an accredited laboratory on a full-scale array or a prototype of the array,
- b) models the interface between the supporting base of the array and the roof surface, and
- c) accounts for the adverse effects of anticipated climatic conditions on the friction resistance.

(See Note A-4.1.8.18.(18).)

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 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) 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 time 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.(6) for site designations X_V , where V_{s30} is greater than 360 m/s, X_A , X_B and X_C , and

ii) a 5%-damped response spectrum based on a site-specific evaluation for site designations X_V , where V_{s30} is less than or equal to 360 m/s, X_D , X_E and X_F , and

c) amplitude-scaled in an appropriate manner over the period range of $0.2T_1$ to $1.5T_1$, 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) and 4.1.8.21.(5).)

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 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 $R_d R_o = 1.0$, except

- a) for structures with $I_E < 1.5$, all SFRSs shall be detailed in accordance with the requirements for $R_d \geq 1.5$ and the applicable referenced design standards, and
- b) for structures with $I_E = 1.5$, all SFRSs shall be detailed in accordance with the requirements for $R_d \geq 2.0$ 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) 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 an 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 time 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.(6), and

c) amplitude-scaled in an appropriate manner over the period range of $0.2T_1$ to $1.5T_1$, where T_1 is the fundamental lateral period of the structure with the supplemental energy dissipation system.

(See Note A-4.1.8.19.(4) and 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 interstorey 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) All components of a supplemental energy dissipation device, except that portion of the device that dissipates energy, shall be designed to remain elastic.

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 $R_d R_o = 1.0$, 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 $R_d R_o = 1.0$, 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 earthquake 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.

4.1.8.23. Additional Performance Requirements for Post-disaster Buildings, High Importance Category Buildings, and a Subset of Normal Importance Category Buildings

1) *Buildings* designed in accordance with Articles 4.1.8.19. to 4.1.8.22. need not comply with this Article.

2) The design of *post-disaster buildings* in Seismic Category SC2, SC3 or SC4 shall be verified using 5%-damped spectral acceleration values based on a 5% probability of exceedance in 50 years and shall satisfy the following requirements:

a) the building shall be shown to behave elastically for a specified lateral earthquake force, V , determined in accordance with Sentence 4.1.8.11.(2) using $I_E = 1.0$ and $R_d R_o = 1.3$,

b) the largest interstorey deflection at any level of the building, as determined in accordance with Sentence 4.1.8.13.(2) using $I_E = 1.0$ and $R_d R_o = 1.0$, shall not exceed $0.005h_s$, and

c) the connections of elements and components of the building described in Table 4.1.8.18. with $R_p > 1.5$ shall be shown to behave elastically for a specified lateral earthquake force, V_p , determined in accordance with Sentence 4.1.8.18.(1) using $R_p = 1.5$.

3) The design of High Importance Category *buildings* in Seismic Category SC3 or SC4 shall be verified using 5%-damped spectral acceleration values based on a 10% probability of exceedance in 50 years and shall satisfy the following requirements:

a) the building shall be shown to behave elastically for a specified lateral earthquake force, V , determined in accordance with Sentence 4.1.8.11.(2) using $I_E = 1.0$ and $R_d R_o = 1.3$,

b) the largest interstorey deflection at any level of the building, as determined in accordance with Sentence 4.1.8.13.(2) using $I_E = 1.0$ and $R_d R_o = 1.0$, shall not exceed $0.005h_s$, and

c) the connections of elements and components of the building described in Table 4.1.8.18. with $R_p > 1.3$ shall be shown to behave elastically for a specified lateral earthquake force, V_p , determined in accordance with Sentence 4.1.8.18.(1) using $R_p = 1.3$.

4) For Normal Importance Category *buildings* in Seismic Category SC4 with a height above grade of more than 30 m, the structural framing elements not considered to be part of the SFRS shall be designed to behave elastically for a specified lateral earthquake force, V , determined in accordance with Sentence 4.1.8.11.(2) using spectral acceleration values based on a 10% probability of exceedance in 50 years and $R_d R_o = 1.3$.

5) For the purposes of applying Sentences (2) to (4), torsional moments due to accidental eccentricities need not be considered if B , as determined in accordance with Sentence 4.1.8.11.(10), does not exceed 1.7.

6) For the purposes of applying Sentences (2) to (4), elements of the SFRS and structural framing elements not considered to be part of the SFRS, when included in the analysis, shall be modeled in accordance with Sentence 4.1.8.3.(8) using elastic properties.

7) All other requirements of Articles 4.1.8.2. to 4.1.8.18. shall be satisfied in meeting the additional requirements of this Article.

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, rock 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 standard as follows:

- a) CAN/CSA-O80.1, "Specification of treated wood,"
- b) CAN/CSA-O80.2, "Processing and treatment," or
- c) CAN/CSA-O80.3, "Preservative formulations."

2) Wood treated as required in Sentence (1) shall be cared for as provided in Clause 4 of CAN/CSA-O80.0, "General requirements for 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 A252, "Standard Specification for Welded and Seamless Steel Pipe Piles,"
- b) ASTM A283/A283M, "Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates,"
- c) ASTM A1008/A1008M, "Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable,"

d) ASTM A1011/A1011M, "Standard Specification for 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) Except as provided in Sentence (2), *buildings* and their structural members made of wood shall conform to CSA O86, "Engineering design in wood." (See also the applicable row in Table 1.3.1.2.)

2) *Buildings* or parts of *buildings* of encapsulated mass timber construction and their structural members made of wood shall conform to CSA O86, "Engineering Design in Wood ." (See also the applicable row in Table 1.3.1.2.)

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 (using the Appendix B provisions applicable to Canada)." (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 CSA S157/S157.1, "Strength design in aluminum/Commentary on CSA S157-17, 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 E1300, “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-, Cable- and Frame-Supported Membrane Structures

4.4.1.1. Design Basis for Air-, Cable- and Frame-Supported Membrane Structures

1) The structural design of air-, cable- and frame-supported membrane 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 Storage Garages and Repair Garages

1) Storage garages and repair garages, including associated ramps and pedestrian areas, shall be designed in conformance with the performance requirements of CSA S413, “Parking structures.” (See Note A-4.4.2.1.(1).)

4.4.3. Storage Racks

4.4.3.1. Design Basis for Storage Racks

1) Storage racks, including anchorage of racks, shall be designed for loads in accordance with this Part. (See Note A-4.1.8.18.(13) and 4.4.3.1.(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 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 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)**

Provision	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]
(2)	[F22-OP2.4]
	[F22-OH4]
(3)	[F22-OP2.4]
	[F22-OH4]
(4)	[F22-OP2.4]
	[F22-OH4]
(5)	(b),(c),(d) [F22-OP2.4]
	[F22-OP2.4]
	[F22-OH4]
(6)	[F21-OS2.5]
	[F21-OP2.4,OP2.5]
	[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]
(3)	[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]
(5)	[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]
(2)	[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 and Handrails	
(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)	[F20-OS2.1]
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 Code text: "The accumulation factor, C_a , shall be 1.0, ..."
	[F20-OP2.1] [F22-OP2.4] Applies to portion of Code text: "The accumulation factor, C_a , shall be 1.0, ..."
	(a) to (f) [F20-OS2.1] Applies to roof shapes and configurations that call for a higher accumulation factor.
	(a) to (f) [F20-OP2.1] [F22-OP2.4] Applies to roof shapes and configurations that call for a higher 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]
(5)	[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]
4.1.6.16. Roofs with Solar Panels	
(1)	[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]
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]
(6)	[F20-OS2.1]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(8)	[F20-OS2.1]
(9)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
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]
(2)	[F20-OS2.1]
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. Attached Canopies on Low Buildings with a Height $H \leq 20$ m	
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.7.13. Roof-Mounted Solar Panels on Buildings of Any Height	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
(4)	[F20-OS2.1]
(5)	[F20-OS2.1]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.7.14. 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]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.5. Importance Factor and Seismic Category	
(1)	[F20-OS2.1]
	[F20-OP2.1,OP2.3] [F22-OP2.4]
(2)	[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 Modification 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)	(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]
(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]
(8)	[F22-OS2.3,OS2.4]
	[F22-OP2.3,OP2.4]
(9)	[F22-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(10)	(a) [F20-OS2.1]
	(a) [F20-OP2.1] [F22-OP2.4]
	(b) [F20-OS2.1]
	(b) [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]
	[F20-OP2.1]
(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 Code 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 (1) ..."
	[F20,F22-OP2.3,OP2.4] Applies to portion of Code 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 (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),(f) [F20,F22-OS2.4]
	(d),(f) [F20,F22-OP2.3,OP2.4]
	(g) [F20,F22-OS2.4]
	(g) [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]
4.1.8.23. Additional Performance Requirements for Post-disaster Buildings, High Importance Category Buildings, and a Subset of Normal Importance Category Buildings	

(2)	[F20-OS2.1]
	[F22-OP2.3,OP2.4]
(3)	[F20-OS2.1]
	[F22-OP2.3,OP2.4]
(4)	[F20-OS2.1]
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 <i>bearing surface</i> of a foundation shall be below the level of potential damage, including damage resulting from <i>frost action</i> ..."
	[F21-OP2.4] Applies to portion of By-law text: "... the foundation shall be designed to prevent damage resulting from <i>adfreezing</i> 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]
(2)	[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-, Cable- and Frame-Supported Membrane 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 Storage Garages 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.:

⁽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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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

A minor storage building is an example of a Low Importance Category building.

Low-human-occupancy farm buildings with an occupant load of 1 person or less per 40 m² of floor area are also examples of Low Importance Category buildings.

Normal Importance Category

Most buildings will fall into the Normal Importance Category.

The following types of buildings may be classified in the Normal Importance Category: buildings that are equipped with secondary containment of dangerous goods, including, but not limited to, double-walled tanks, dikes of sufficient size to contain a spill, and 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.

High Importance Category

The following buildings may contain sufficient quantities of dangerous goods to be classified in the High Importance Category:

- petrochemical facilities,
- fuel storage facilities (other than those required for post-disaster use), and
- manufacturing or storage facilities containing dangerous goods.

Information on community centres can be found in the Commentary entitled Limit States Design in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

Post-disaster Importance Category

Before classifying a building as a post-disaster building, Code users should consider the intent of the classification and look beyond the name of the building. For example, a building that is named “ABC Treatment” but is used for emergency care should be considered as a hospital and, as such, classified as a post-disaster building. Conversely, a building named “XYZ Hospital” that is only used for walk-in medical services could be classified as a Normal Importance Category building.

A-4.1.2.2.(1) Loads Not Listed. The intent of Sentence 4.1.2.2.(1) is to draw attention to the fact that there are loads, forces and effects that need to be considered in addition to those specified in the Code. These loads, forces and effects will vary in need, application, and magnitude for each use and location. Some may result from environmental considerations (e.g., ice accretion, wave and ice action, water flow) while others will result from the use and occupancy of the facility (e.g., dangerous goods storage, manufacturing and mining operations). The reasonable determination of the probability, type and magnitude of project-specific loads must be assessed by a knowledgeable project team that includes the building owner/operator and experienced design professionals, and incorporated into the design where deemed necessary to maintain the safety and integrity of the facility.

In recent years, security issues have prompted the consideration of loads and effects due to improvised explosive devices and other methods of sabotage. Consideration of these loads is driven by operational and public safety requirements, and their incorporation in the design is not considered a mandatory provision of the Code.

A-4.1.3. Limit States Design. Information on limit states design can be found in the Commentary entitled Limit States Design in the “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 2018, “Crane-Supporting Steel Structures: Design Guide (Third Edition).”

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, 1.5H is added to load combinations 2 to 4. For cantilever retaining wall structures, see the Commentary entitled Limit States Design in the “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-Table 4.1.3.4. Acceleration due to Vibrations. Information on the determination of acceleration due to vibrations resulting from loads L and W can be found in the Commentary entitled Wind Load and Effects in the “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.3.6.(2) Floor Vibrations Caused by Resonance with Operating Machinery or Equipment. Guidance on floor vibration effects caused by operating machinery and equipment can be found in the Commentary entitled Deflection and Vibration Criteria for Serviceability and Fatigue Limit States in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.3.6.(3) 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 “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.3.6.(4) 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 “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.4.1.(2) Permanent Partitions Fixed to the Structure. Partitions in residential buildings, including condominiums, apartments and hotels, are typically permanent and fixed to the structure. In such cases, the weight of partitions referred to in Clause 4.1.4.1.(1)(c) is the actual weight of the partitions that are shown on the drawings.

A-4.1.4.1.(3) Partitions Not Shown on the Drawings. The potential locations of partitions in work areas, such as offices, are not typically shown on the drawings. For such areas, a partition weight allowance must be considered based on the anticipated weight and location of partitions, but not less than 1 kPa over the area of floor being considered.

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 4.1.5.10. 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.

Office Areas

The general minimum specified load for office areas, including mezzanines, is 2.4 kPa.

A minimum specified load of 4.8 kPa applies to office areas in basements, which are normally slab-on-grade, and to office areas in floor areas that may be subject to an increase in loading for brief periods, for example, when tenants temporarily use that floor area to store furniture, equipment and files while moving in or out of the building.

Where an office building is situated on a level site, all floors are uniform in elevation, and there are no mezzanines, allocating the correct loads is straightforward. However, where the site is steeply sloped, the situation is more complex—even more so where there are also mezzanines.

The principle is that floor levels and mezzanines with access to the exterior at ground level could be used as staging areas during a move, and so, must be designed for a minimum of 4.8 kPa. Also, there is usually an area adjacent to the exterior exit that can accommodate trucks.

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.

Information on the design of roof parking decks and exterior areas that are accessible to vehicular traffic can be found in the Commentary entitled Live Loads in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.5.8. Tributary Area. Information on tributary area can be found in the Commentary entitled Live Loads in the "Structural Commentaries (User's Guide – NBC 2020: 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 "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.6.1.(1) Specified Load Due to Rain or to Snow and Associated Rain. The location of a new building or obstruction may affect the snow loads on the roof of an adjacent existing building – on the same property or on an adjacent one – that is lower in height. In such cases, designers should consider Sentence 2.2.2.1.(1) of Division C.

Additional guidance can be found in the Commentary entitled Snow Loads in the "Structural Commentaries (User's Guide – NBC 2020: 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 "Structural Commentaries (User's Guide – NBC 2020: 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 $l_e C_w^2$.

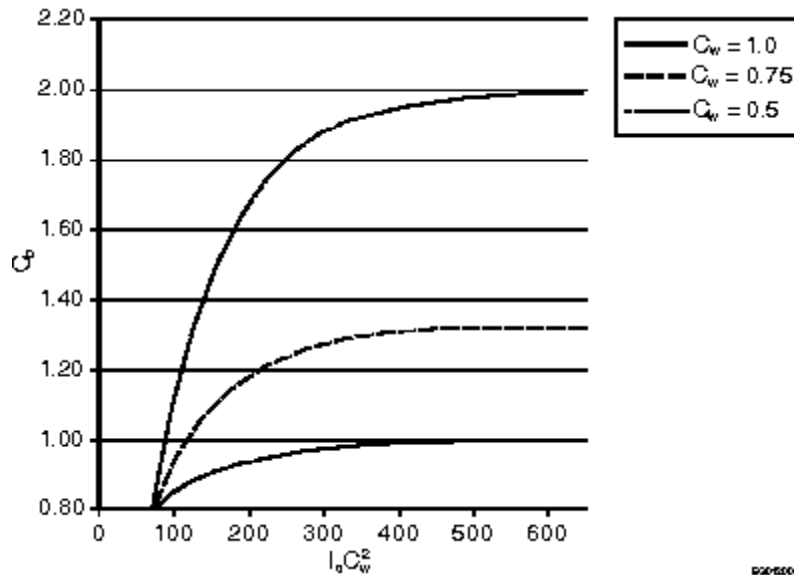


Figure A-4.1.6.2.(2)
Basic roof snow load factor, C_b

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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.6.4.(3) Flow Control Drains. The National Plumbing Code (NPC) contains requirements regarding the use of flow control roof drains. The designer must ensure that the building complies with the Vancouver Building By-law Book I and Book II: Plumbing Systems

A-4.1.6.7.(1) Roof Projections. Elevator, air-conditioning and fan housings, small penthouses and wide chimneys are examples of roof projections.

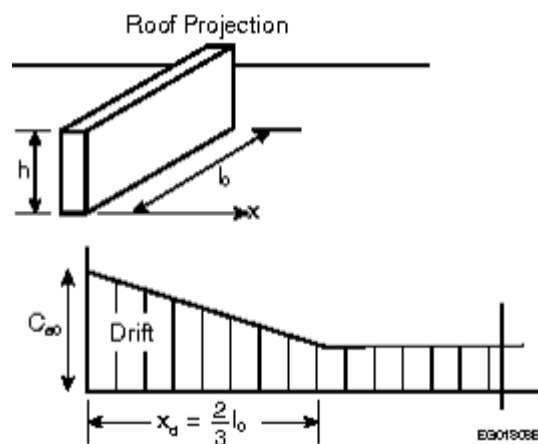


Figure A-4.1.6.7.(1)
Roof projections

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.

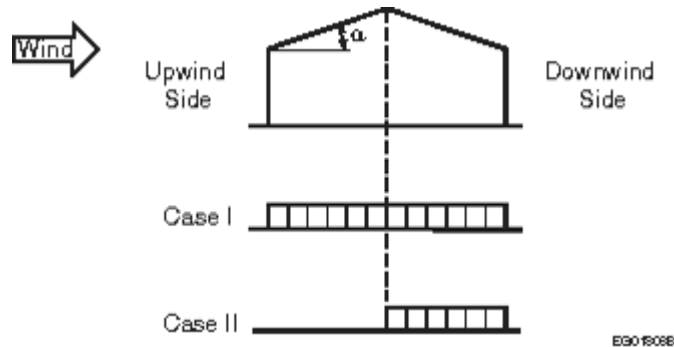


Figure A-4.1.6.9.
Load cases for gable roofs

Table A-4.1.6.9.
Wind Exposure, Slope and Accumulation Factors for Load Cases in Figure A-4.1.6.9.

Load Case	Roof Slope, α	Factors			
		C_w	$C_s^{(1)}$	C_a	
				Upwind Side	Downwind Side
I	$0^\circ \leq \alpha \leq 90^\circ$	⁽²⁾	$f(\alpha)$	1.0	1.0
II ⁽³⁾	$15^\circ < \alpha \leq 20^\circ$	1.0	$f(\alpha)$	0.0	$0.25 + \alpha/20$
	$20^\circ < \alpha \leq 90^\circ$				1.25

Notes to Table A-4.1.6.9.:

⁽¹⁾ C_s varies as a function of slope, α , as defined in Sentences 4.1.6.2.(5) and (6).

⁽²⁾ The value of C_w for load case I is as prescribed in Sentences 4.1.6.2.(3) and (4).

⁽³⁾ Case II loading does not apply to gable roofs with slopes of 15° or less, to single-sloped (shed) roofs, or to flat roofs.

A-4.1.6.16. Roofs with Solar Panels. Information on the design of roofs with solar panels can be found in the Commentary entitled Snow Loads in the "Structural Commentaries (User's Guide - NBC 2020: Part 4 of Division B)."

A-4.1.6.16.(3) Snow Obstructed from Sliding by Solar Panels. Figure A-4.1.6.16.(3) shows the areas on sloped roofs with solar panels where snow is considered to be obstructed from sliding by the solar panels and the slope factor, C_s , must be taken as 1.0.

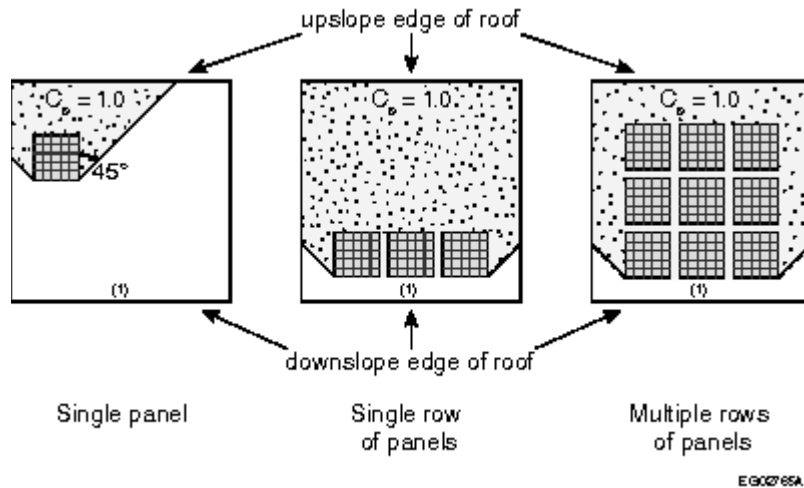


Figure A-4.1.6.16.(3)

Areas on sloped roofs with solar panels where snow is obstructed from sliding by the solar panels

Note to Figure A-4.1.6.16.(3):

(1) C_s = as specified in Sentences 4.1.6.2.(5) to (7)

A-4.1.6.16.(4)(b) Snow Loads for a Sloped Roof with Parallel Flush Solar Panels Where $w_g \geq w_p$. Figure A-4.1.6.16.(4)(b) shows the snow loads for a sloped roof with Parallel Flush solar panels where the gap width, w_g , between the panels is greater than or equal to the panel width, w_p .

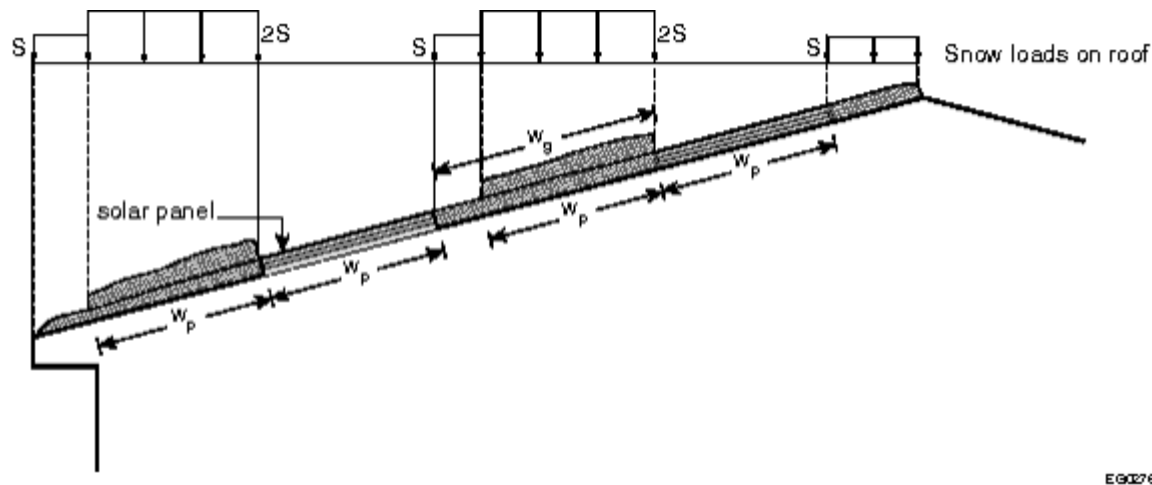


Figure A-4.1.6.16.(4)(b)

Snow loads for a sloped roof with Parallel Flush solar panels where $w_g \geq w_p$

A-4.1.6.16.(4)(c) Snow Loads for a Sloped Roof with Parallel Flush Solar Panels Where $w_g < w_p$. Figure A-4.1.6.16.(4)(c) shows the snow loads for a sloped roof with Parallel Flush solar panels where the gap width, w_g , between the panels is less than the panel width, w_p .

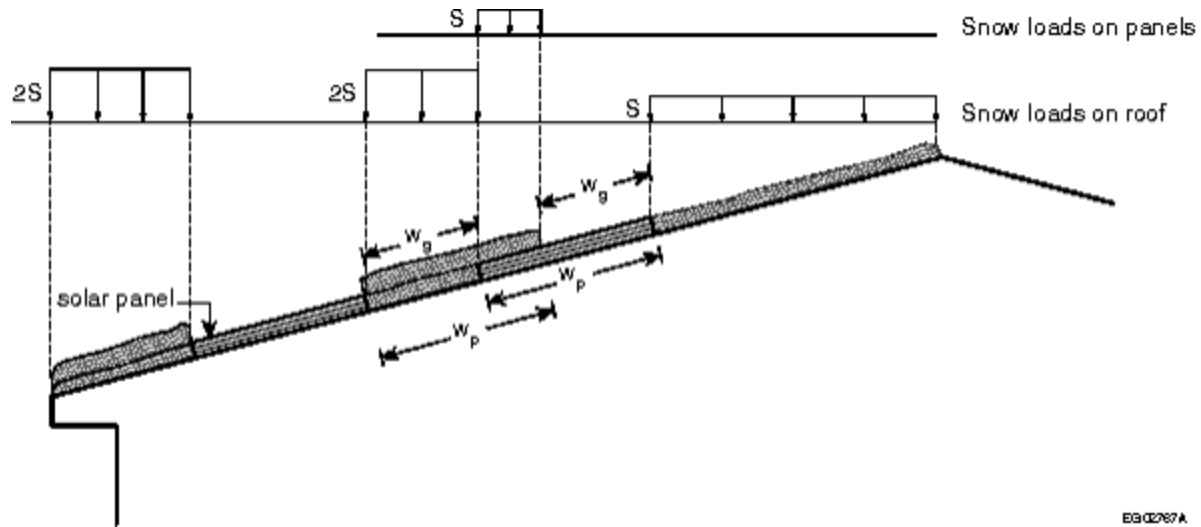


Figure A-4.1.6.16.(4)(c)
Snow loads for a sloped roof with Parallel Flush solar panels where $w_g < w_p$

A-4.1.6.16.(5)(a) Snow Loads for a Flat Roof with Parallel Raised Solar Panels. Figure A-4.1.6.16.(5)(a) shows the snow loads for a flat roof with Parallel Raised solar panels.

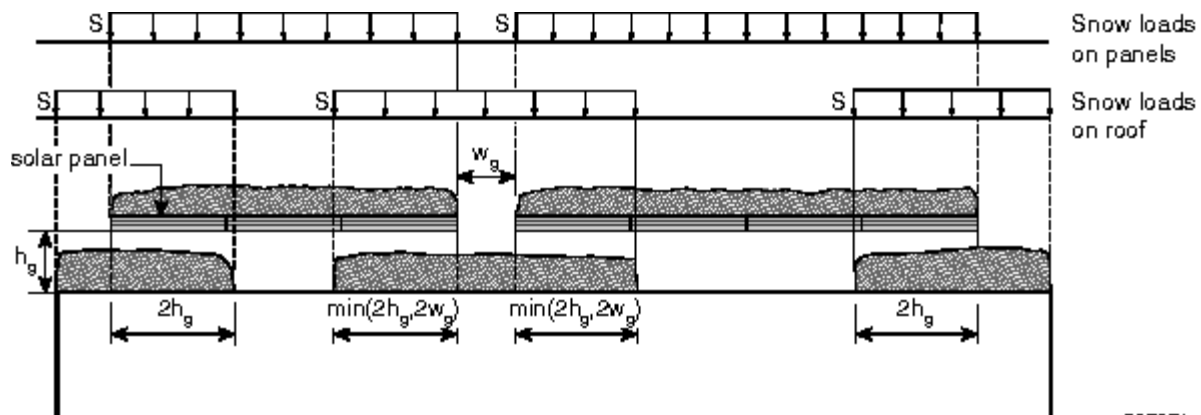


Figure A-4.1.6.16.(5)(a)
Snow loads for a flat roof with Parallel Raised solar panels

A-4.1.6.16.(5)(b) Snow Loads for a Sloped Roof with Parallel Raised Solar Panels. Figure A-4.1.6.16.(5)(b) shows the snow loads for a sloped roof with Parallel Raised solar panels.

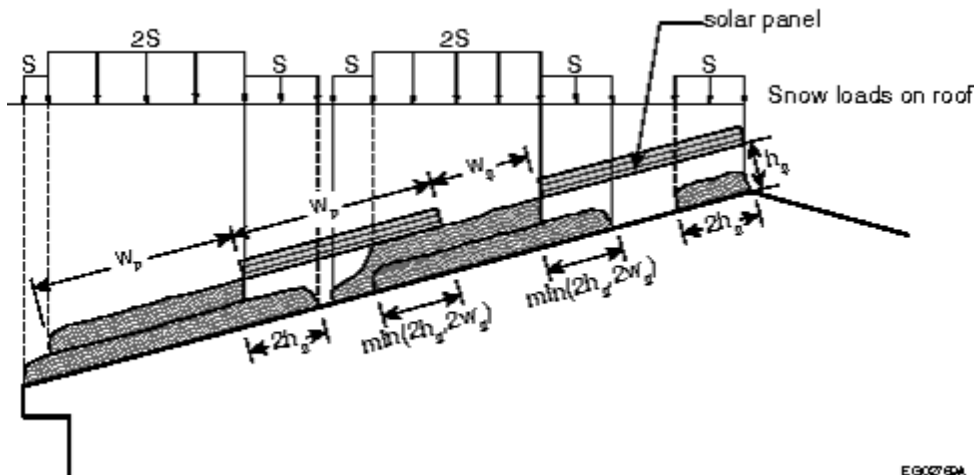


Figure A-4.1.6.16.(5)(b)
Snow loads for a sloped roof with Parallel Raised solar panels

A-4.1.6.16.(6) Snow Loads for a Flat Roof with Tilted Solar Panels. Figure A-4.1.6.16.(6) shows the snow loads for a flat roof with Tilted solar panels.

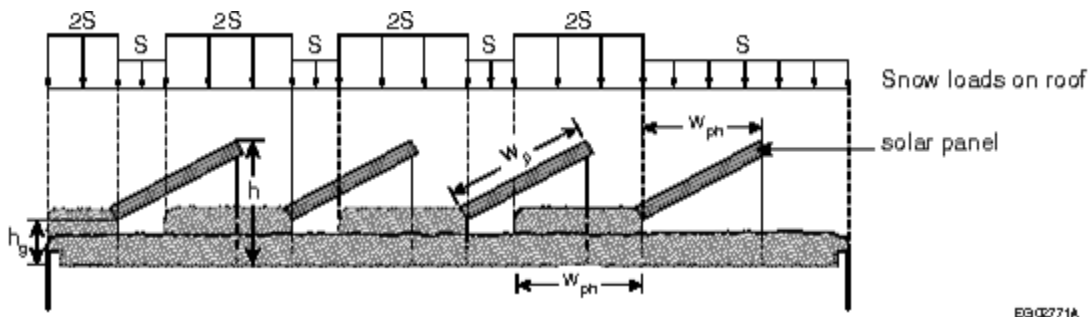


Figure A-4.1.6.16.(6)
Snow loads for a flat roof with Tilted solar panels

A-4.1.6.16.(6)(c) Variation of C_a with $h_g - C_b C_w S_e / \gamma$. Figure A-4.1.6.16.(6)(c) shows the variation of the accumulation factor, C_a , with the height of the lowest edge of the panels above the surface of the uniform snow load, $h_g - C_b C_w S_e / \gamma$, for a flat roof with Tilted solar panels.

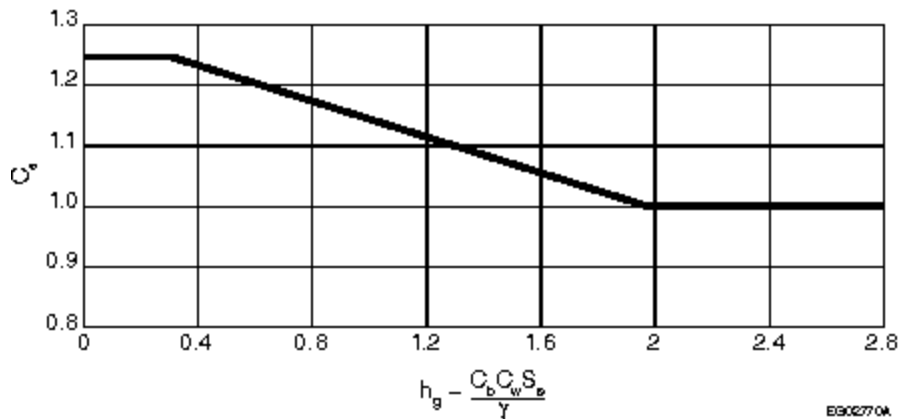


Figure A-4.1.6.16.(6)(c)

Variation of C_a with $h_g - C_b C_w S_s / \gamma$ for a flat roof with Tilted solar panels

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.(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 "Structural Commentaries (User's Guide - NBC 2020: 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 "Structural Commentaries (User's Guide - NBC 2020: 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 "Structural Commentaries (User's Guide - NBC 2020: Part 4 of Division B)."

A-4.1.7.5.(2) and (3) Pressure Coefficients for Main Structural System on Rectangular Buildings.

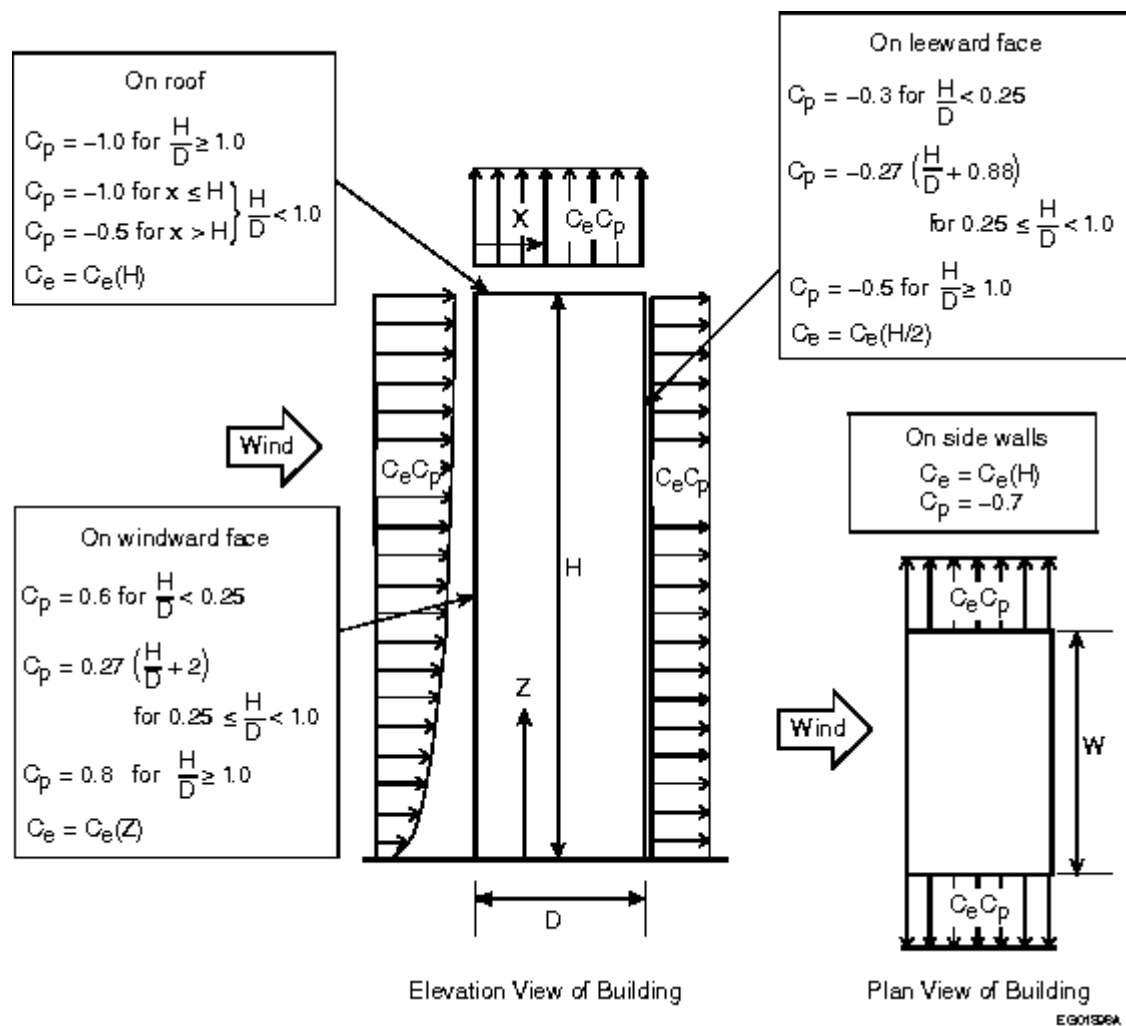


Figure A-4.1.7.5.(2) and (3)

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.

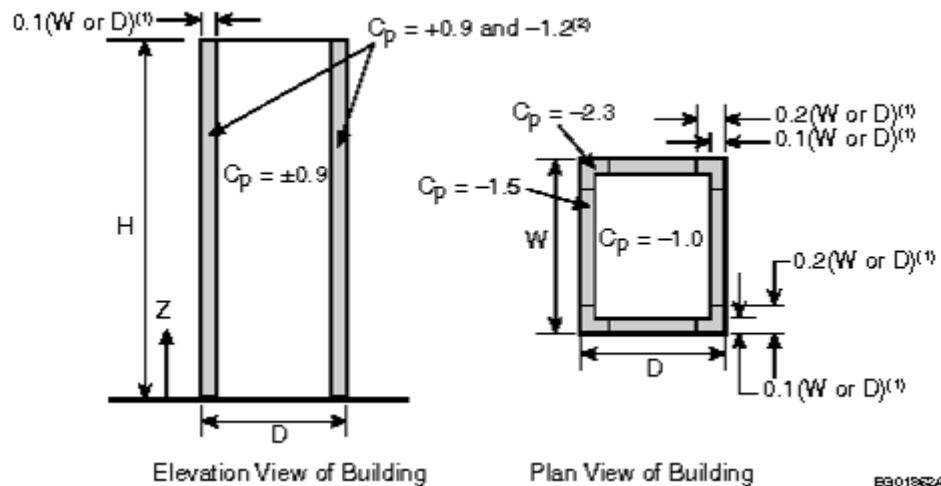


Figure A-4.1.7.5.(4)

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-4.1.7.7.(2) Cladding on Parapets. Information on the design of cladding on parapets can be found in the Commentary entitled Wind Load and Effects in the "Structural Commentaries (User's Guide - NBC 2020: Part 4 of Division B)."

A-4.1.7.8.(2) and (3) Exposure Factor for Dynamic Procedure.

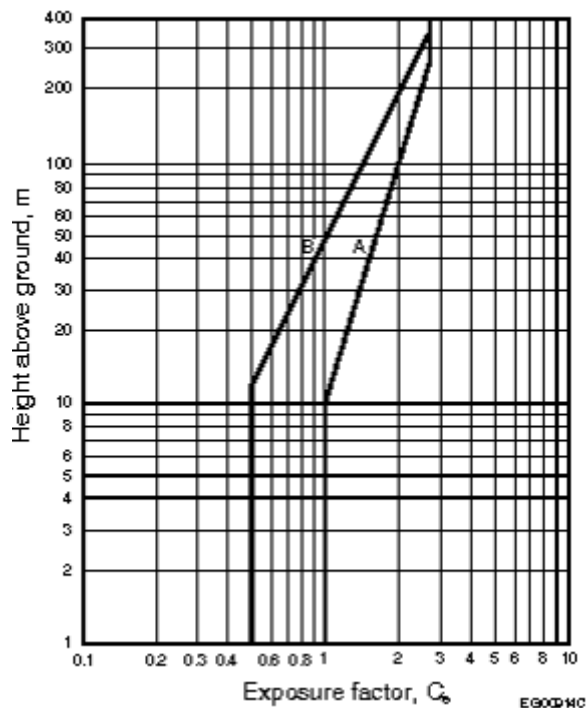


Figure A-4.1.7.8.(2) and (3)

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.

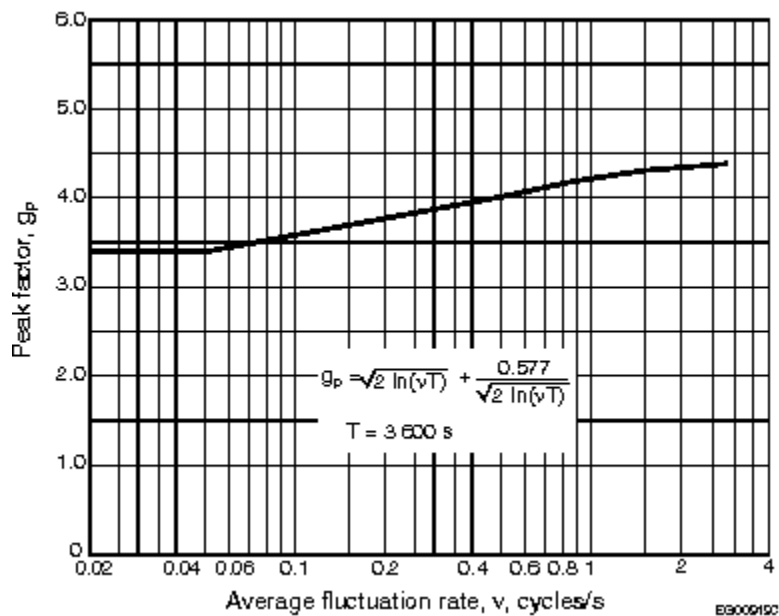


Figure A-4.1.7.8.(4)-A

Peak factor, g_p

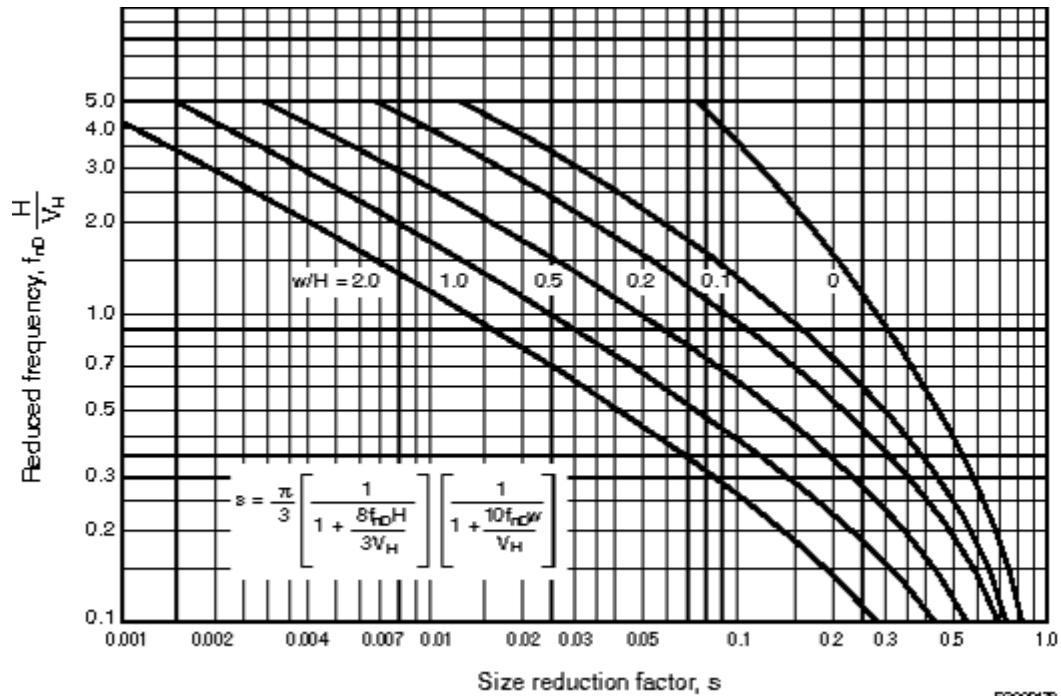


Figure A-4.1.7.8.(4)-B
Size reduction factor, s

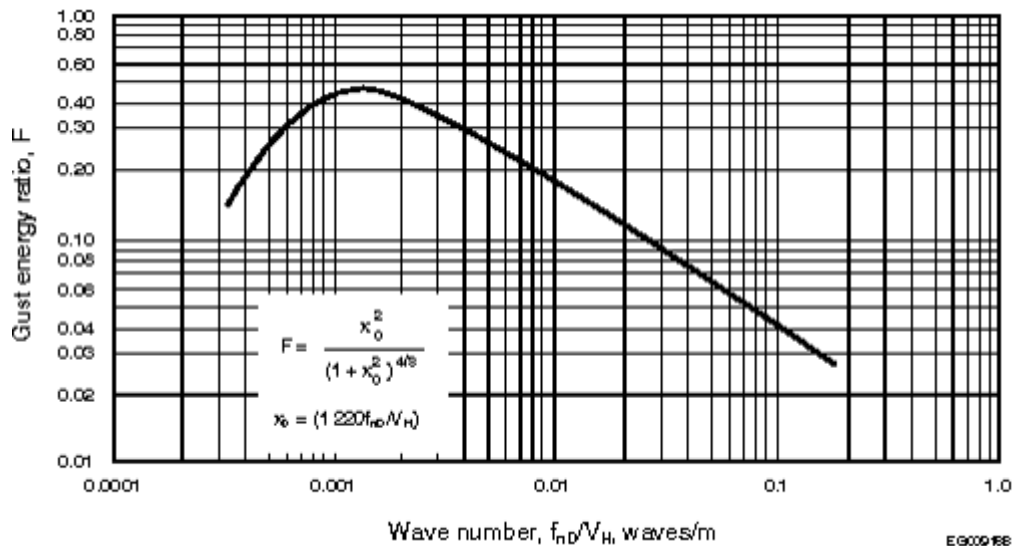


Figure A-4.1.7.8.(4)-C
Gust energy ratio, F

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 "Structural Commentaries (User's Guide - NBC 2020: Part 4 of Division B)."

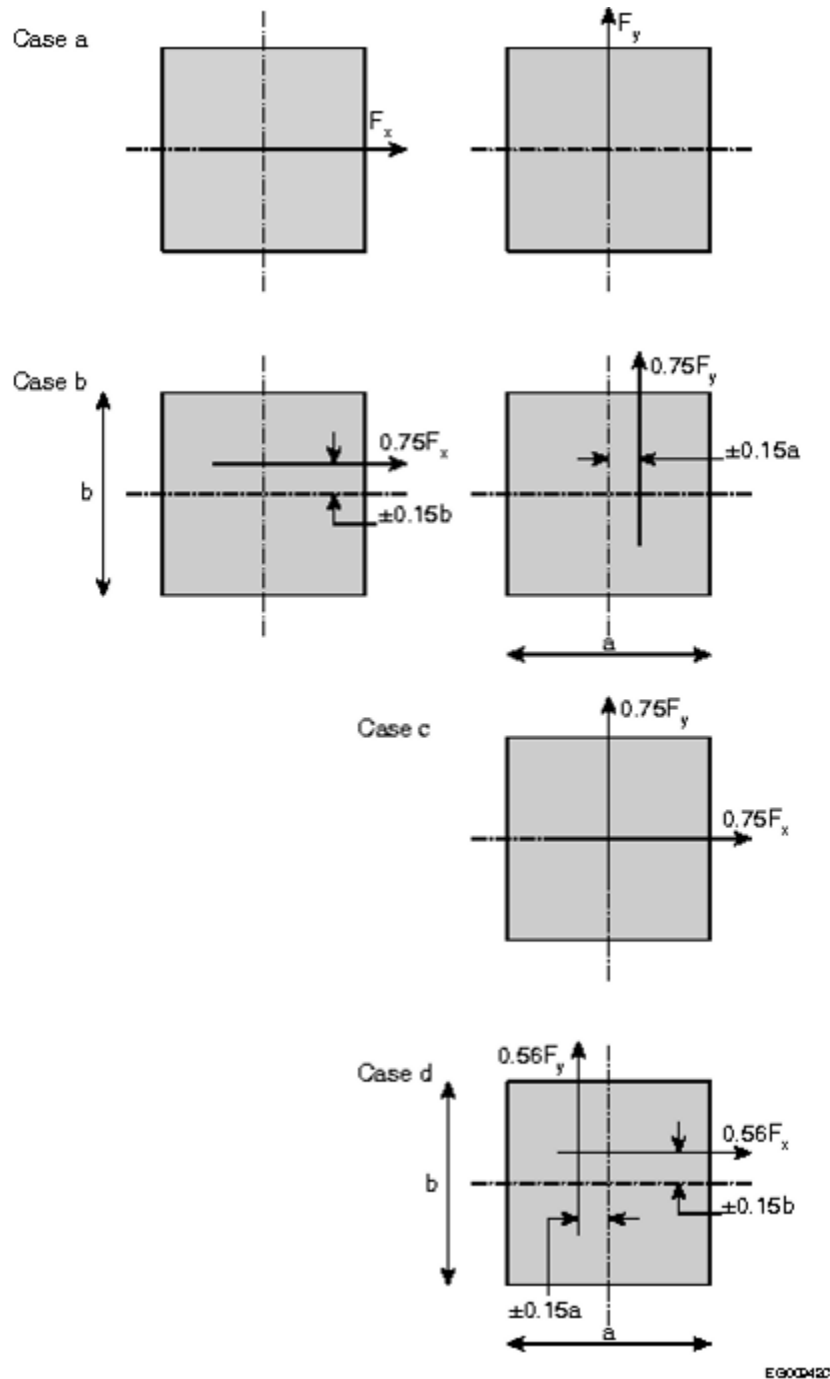


Figure A-4.1.7.9.(1)
Full and partial wind loading

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-4.1.7.12. Attached Canopies on Low Buildings ($H \leq 20$ m). An attached canopy is different from an overhang, which is an extension of the roof surface.

Figure 4.1.7.12.-A, which provides the gust pressure coefficients on the upper and lower surfaces of the canopy, is used to design the cladding for the canopy and the associated fasteners. Figure 4.1.7.12.-B,

which provides the net gust pressure coefficients on the canopy, is used to design the structure of the canopy (e.g., joists, posts, building fasteners).

In addition to the external wind pressure addressed in Article 4.1.7.12., the internal pressure addressed in Table 4.1.7.7. should also be considered, where applicable to the canopy.

A-4.1.7.13. Roof-Mounted Solar Panels on Buildings of Any Height. Article 4.1.7.13. provides procedures for calculating the wind loads on roof-mounted arrays of solar panels that satisfy particular geometrical requirements.

The area of the roof that is covered by a solar array does not need to be designed for the simultaneous application of the solar array wind loads and the roof wind loads. However, the cumulative load effect of all solar panels does need to be accounted for in accordance with Article 4.1.7.11. Furthermore, the roof needs to be designed for the case where the solar array has been removed.

Solar arrays that are mechanically fastened to the underlying roof structure can modify the load distribution on the roof. The loads from such arrays must be applied to the structural components of the roof as concentrated loads at the points of attachment.

The calculations in Article 4.1.7.13. assume that the solar panels and their mounting system are rigid. Therefore, there is no allowance for wind-induced vibration of these components. However, if the panels and their mounting system have a natural frequency less than about 10 Hz, it is possible that loads will be magnified as a result of wind-induced vibration. In such cases, it is recommended that expert opinion be sought and that the dynamic effects be investigated in more detail.

Figure A-4.1.7.13. shows an example of a roof-mounted solar array with exposed and unexposed panels. For the purpose of determining the edge factor, E , to be applied in the calculations of Article 4.1.7.13., a panel is defined as exposed if it is located within a distance of 1.5 times the panel chord length, L_p , from an exposed edge of the array. An exposed edge of the array is considered to occur where the horizontal distance, d_1 , from the panel edge to the roof edge (ignoring any rooftop equipment) is greater than $0.5h$, h being the reference height of the roof, and greater than $\max(4h_2, 1.2 \text{ m})$, h_2 being the height of the panel's highest point above the roof surface. An exposed edge is also considered to occur where the horizontal distance, d_2 , from the panel edge to the nearest edge in the next panel row (or across a gap in the same panel row) is greater than $\max(4h_2, 1.2 \text{ m})$.

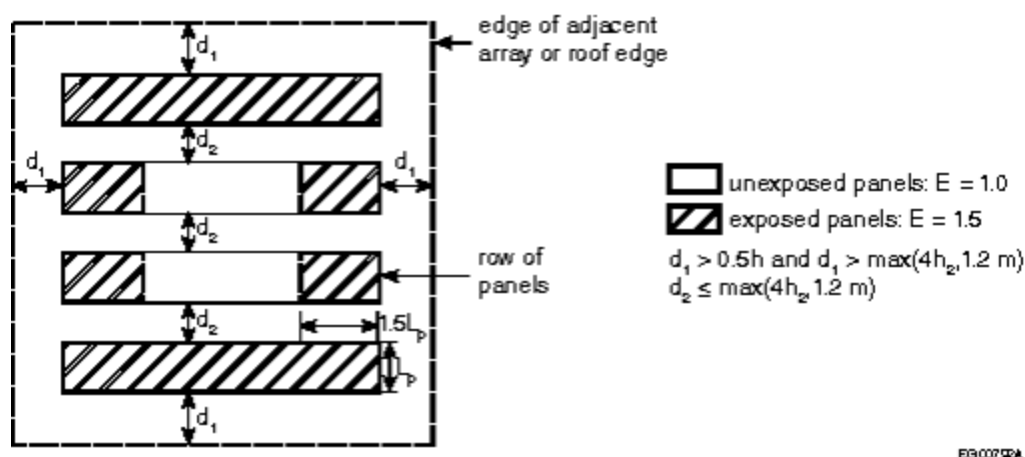


Figure A-4.1.7.13.
Plan view of a roof-mounted solar array with exposed and unexposed panels

A sample calculation of net design wind pressure for roof-mounted solar panels is provided in the Commentary entitled Wind Load and Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

The installation of solar arrays on a roof can significantly affect the distribution of snow loads on the roof. Designers should be aware that the accumulation of snow and ice around solar panels can influence the calculations described in Article 4.1.7.13. For example, accumulated snow may obstruct the ventilation areas between the roof and the underside of the panels, thereby increasing wind loads on the panels. For the design of the anchorage of a solar array to the roof and of the array itself, the pressure equalization factor, γ_a , in Sentence 4.1.7.13.(2) should be taken as 1.0, unless it can be shown that the accumulation of snow and ice will not obstruct the gaps between the panels in the array.

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 “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

Definition of W

Information on the definition of specified dead load, W , can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.3.(8) Structural Modeling. Information on structural modeling can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.4.(2) and (3) Site Designation. It is preferable to determine the site designation as X_v on the basis of the average shear wave velocity, V_{s30} , calculated from in situ measurements of shear wave velocity. This site designation will typically result in a lower seismic demand than a site designation X_s determined using the energy-corrected average standard penetration resistance, $\bar{N}_{60}$, or the average undrained shear strength, $\bar{s}_u$. Further information on site designation can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.4.(3) Site Class. The V_{s30} ranges in Table 4.1.8.4.-B are retained from the NBC 2015. Where required for the application of a standard referenced in Subsection 4.1.8., the Site Class for a particular site designation X_v can be determined from Table 4.1.8.4.-B on the basis of the value of V_{s30} . Further information on Site Class can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.4.(6) Log-Log Interpolation. The value of $S(T)$ for $T_i < T < T_j$ can be determined using log-log interpolation as follows:

$$\log(S(T)) = \log(S(T_i)) + \frac{\log(T) - \log(T_i)}{\log(T_j) - \log(T_i)} [\log(S(T_j)) - \log(S(T_i))] = A$$
$$S(T) = 10^A$$

where

$\log$ = logarithm to base 10.

A-Table 4.1.8.5.-A 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 $R_d R_o$. Information on vertical variations in $R_d R_o$ can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.9.(5) $R_d R_o$ and Equivalent Systems. Information on the $R_d R_o$ of equivalent systems can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.10.(5) and (6) Mid-rise Timber SFRSs. Information on structural irregularities in mid-rise wood construction and on how to determine the number of storeys for application in Sentences 4.1.8.10.(5) and (6) can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.10.(7) 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.(9), 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 “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.10.(9) Gravity-Induced Lateral Demand – Non-linear Dynamic Analysis. Information on Non-linear Dynamic Analysis, including ground motion time histories, target response spectra and acceptance criteria, can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.10.(10)(a) Sloped Column Irregularity. The presence of inclined vertical members in a building leads to a coupling of its horizontal and vertical vibrational modes. As a result of this coupling, horizontal accelerations of the building cause vertical accelerations of the mass supported by the inclined vertical members. Vertical ground motions cause additional vertical accelerations of the mass.

The additional earthquake forces resulting from both the coupling of horizontal and vertical vibrational modes and the vertical ground motions can be determined using the Dynamic Analysis Procedure described in Article 4.1.8.12. with $R_d R_o = 1.0$. The structural model used in the analysis must account for the vertical accelerations of all mass supported by inclined vertical members and must include the SFRS, the inclined vertical members, and all structural framing elements that transfer inertial forces generated by the vertical accelerations of the mass supported by the inclined vertical members.

The additional earthquake forces are sensitive to the degree of coupling between the vertical and horizontal vibrational modes of the building. Thus, to determine the maximum additional earthquake forces for design, the range of possible stiffness values for all structural members must be considered.

Further information on the analysis of structures with a sloped column irregularity, including a simple procedure for scaling the analysis results to avoid having to perform multiple analyses with a range of stiffness values and vertical ground motions, can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.12.(3) Ground Motion Time Histories. Information on ground motion time histories can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 $R_o R_d (\Delta_B + \Delta_D) - R_o \Delta_D$, i.e., the difference between the total storey drift including inelastic deformation effects and diaphragm deformations, $R_o R_d (\Delta_B + \Delta_D)$, 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 “Structural Commentaries (User's Guide – NBC 2020: 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 $S(0.2)/S(2.0)$

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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.15.(6) Vertical Variations in $R_d R_o$. Information on elements of the SFRS below the variation in $R_d R_o$ can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 $R_d R_o$ 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 "Structural Commentaries (User's Guide – NBC 2020: 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 "Structural Commentaries (User's Guide – NBC 2020: 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 "Structural Commentaries (User's Guide – NBC 2020: 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 "Structural Commentaries (User's Guide – NBC 2020: 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 "Structural Commentaries (User's Guide – NBC 2020: 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 "Structural Commentaries (User's Guide – NBC 2020: 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 "Structural Commentaries (User's Guide – NBC 2020: 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 CSA S832, "Seismic risk reduction of operational and functional components (OFCs) of buildings."

A-4.1.8.18.(7)(e) Post-installed Anchors. Information on the cyclic tension load testing of anchors referred to in Clause 4.1.8.18.(7)(e) can be found in International Code Council Evaluation Service (ICC-ES) Evaluation Reports. Additional information can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.18.(13) and 4.4.3.1.(1) Storage Racks. Free-standing storage racks contain materials typically loaded by forklift. Some are designed to store loaded pallets; however, in some cases, the stored material does not sit on a pallet. Information on storage racks can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.18.(14) and (15) 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 “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.18.(16) Elements of Structures, Non-structural Components and Equipment in Structures with Supplemental Energy Dissipation. Information on the requirements of Sentence 4.1.8.18.(16) can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.18.(18) Climatic Conditions. Climatic conditions leading to wetness or frost at the interface between the supporting base of the array and the roof surface may adversely affect the resistance provided by friction due to gravity loads.

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 “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.19.(4) and 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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 “Structural Commentaries (User's Guide – NBC 2020: 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, 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 “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.2.7.2.(2) Load Testing of Piles. ASTM D1143/D1143M, “Standard Test Methods for 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 3.2.2.50. and 3.2.2.58. 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, “Specification for the 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 “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.4.2.1.(1) Design Basis for Storage Garages and Repair Garages. Although the scope of CSA S413, “Parking structures,” is limited to structural steel and reinforced concrete (including prestressed and post-tensioned), the intent of Sentence 4.4.2.1.(1) is to require any type of material used in the

construction of storage garages and repair garages to conform to the performance level outlined in the standard.

See the Commentary entitled Live Loads in the “Structural Commentaries (User's Guide – NBC 2020: 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) 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 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 C-D 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.

5.1.5. Other Requirements

5.1.5.1. Requirements in Other Parts of the Code

1) Structural, fire safety and energy efficiency requirements in 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 Sentences (5) and (6), the wind uplift resistance of membrane roofing assemblies shall be determined in accordance with the requirements of CAN/CSA-A123.21, "Standard test method for the 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).)

6) The wind resistance of *vegetated roof assemblies* shall be determined in accordance with the requirements of CAN/CSA-A123.24, "Standard test method for wind resistance of vegetated roof assembly." (See Note A-5.2.2.2.(6).)

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 **water-shedding** 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

(See Note A-5.4.1.)

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 and other soil gases from the ground with an aim to controlling the indoor concentrations of these gases to an *acceptable* level, and

f) not compromise the operation of *building* services.

2) An *air barrier system* shall be designed and constructed to provide the principal resistance to air leakage to meet the requirements of Sentence (1).

3) The *air barrier system* shall incorporate air barrier assemblies that meet the appropriate Performance Class as defined in Table 5.4.1.1. (See Note A-5.4.1.1.(3).)

Table 5.4.1.1.

Maximum Air Leakage Rates for Air Barrier Assemblies

Forming Part of Sentences 5.4.1.1.(3) and (6) and 5.4.1.2.(1) and (2)

Performance Class	Maximum Air Leakage Rate, $L/(s \cdot m^2)$, at a Pressure Differential of 75 Pa
1	0.05

2	0.10
3	0.15
4	0.20
5	0.50

4) The *air barrier system* shall be designed and constructed to be continuous

- a) across construction, control and expansion joints,
- b) across junctions between different air barrier assemblies, and
- c) around penetrations through air barrier assemblies.

(See Note A-5.4.1.1.(4).)

5) The structural design of air barrier assemblies, including junctions between air barrier assemblies, subject to air pressure loads shall comply with Article 5.1.4.1. and Subsection 5.2.2.

6) The maximum air leakage rates specified in Table 5.4.1.1. are permitted to be increased where it can be shown that the higher rate will not adversely affect any of

- a) the health or safety of the *building* users,
- b) the intended use of the *building*, or
- c) the operation of *building* services.

7) An *air barrier system* is not required where it can be shown that uncontrolled air leakage 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.

(See Note A-5.4.1.1.(7).)

5.4.1.2. Air Barrier Assemblies

1) Except as provided in Sentences (2) and (3), air barrier assemblies not in contact with the ground shall

- a) conform with CAN/ULC-S742, "Standard for Air Barrier Assemblies – Specification," and
- b) meet the selected Performance Class of Table 5.4.1.1.

(See Note A-5.4.1.2.(1).)

2) Air barrier assemblies not evaluated in accordance with CAN/ULC-S742, "Standard for Air Barrier Assemblies – Specification," shall be designed and constructed

- a) to meet or exceed the selected Performance Class of Table 5.4.1.1., and
- b) with at least one air barrier material intended to provide the primary resistance to air leakage that meets the requirements of CAN/ULC-S741, "Standard for Air Barrier Materials – Specification."

(See Note A-5.4.1.2.(2).)

3) Air barrier assemblies covered in Subsections 5.9.2., 5.9.3. and 5.9.4. shall meet the air barrier performance criteria defined in those Subsections.

4) Below-grade air barrier assemblies in contact with the ground shall minimize the ingress of airborne radon and other soil gases. (See Note A-5.4.1.2.(4).)

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) Delete.

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 E96/E96M, "Standard Test Methods for 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

1) Except as required by Sentences (2) and (4), 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) A *vegetated roof assembly* shall be permitted if

- a) the *vegetated roof assembly* conforms to the requirements of Article 3.1.14.4.,
- b) gravity loads on the *building* structure are determined by ASTM E 2397/E 2397M-19 “Standard Practice for Determination of *Dead loads* and *Live loads* Associated with Vegetative (Green) Roof Systems”,
- c) the roof that supports the vegetated roof system is waterproof (see Note A-1.4.1.1. of Division A),
- d) the *vegetated roof assembly* is designed and constructed with a root barrier, or the roofing membrane is resistant to root and rhizome penetration when tested in accordance with ANSI/SPRI VR-1, “Procedure for Investigating Resistance to Root or Rhizome Penetration on Vegetative Roofs”, and
- e) the *vegetated roof assembly* is designed and constructed with water retention materials to support vegetative growth, and with drainage materials to convey water to *roof drains*. (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).)

4) A roof assembly shall resist the entry of water into the *building*, and where the roof assembly incorporates a membrane, the roof assembly shall be designed and constructed to conform to the requirements of Article 5.2.2.2.

5) Each material, component, or assembly, including electrical services, that penetrates through a roof assembly shall pass through a flashing that can be sealed against both air leakage and the weather, and which is suitable for its purpose.

6) Ballasted membrane roofs not subject to the requirements in Sentence 5.2.2.2.(4) shall be designed and constructed to resist wind loads.

5.6.2. Sealing, Drainage, Accumulation and Disposal

5.6.2.1. Sealing and 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 or, where a waterproofing roof assembly is concerned, sealed to prevent ingress of 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).)

6) Where *roof drains* connected to a *drainage system* are used to satisfy the requirements in this Section, they shall be suitable for the type of roof assembly and shall be sealed against the weather following the requirements of Article 5.6.1.2.

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, or

- 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) Construction 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 E413, "Classification for Rating Sound Insulation," using the results from measurements carried out in accordance with ASTM E90, "Standard Test Method for 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 E413, "Classification for Rating Sound Insulation," using the results from measurements carried out in accordance with ASTM E336, "Standard Test Method for 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 E90, "Standard Test Method for 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 10848-1, "Acoustics - Laboratory measurement of the flanking transmission of airborne and impact sound between adjoining rooms - Part 1: Frame document."

3) The normalized flanking level difference shall be measured in accordance with Parts 1 to 4 of ISO 10848-1, "Acoustics - Laboratory measurement of the flanking transmission of airborne and impact sound between adjoining rooms - Part 1: Frame document."

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 separating wall or floor assembly with lightweight wood or steel framing, the index shall be taken as equal to the sound transmission loss, without correction;

b) for a separating wall or floor assembly that behaves like a homogeneous panel, 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" (see Note A-5.8.1.4.(4)(b)).

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 separating wall or floor assembly with lightweight wood or steel framing and connected flanking assemblies with lightweight 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 separating wall or floor assembly that behaves like a homogeneous panel and connected flanking assemblies that behave like a homogeneous panel, 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" (see Note A-5.8.1.4.(4)(b)),

c) for a mixture of assemblies with lightweight wood or steel framing and assemblies that behave like a homogeneous panel, the index shall be determined in accordance with Clause (a) or (b) (see Note A-5.8.1.4.(4)(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 E413, "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 E336, "Standard Test Method for 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 10848-1, "Acoustics - Laboratory measurement of the flanking transmission of airborne and impact sound between adjoining rooms - Part 1: Frame document."

3) The weighted normalized flanking level difference shall be determined in accordance with ASTM E413, "Classification for Rating Sound Insulation," using the results from measurements carried out in accordance with Parts 1 to 4 of ISO 10848-1, "Acoustics - Laboratory measurement of the flanking transmission of airborne and impact sound between adjoining rooms - Part 1: Frame document."

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 separating wall or floor assembly with lightweight wood or steel framing and connected flanking assemblies with lightweight 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 separating wall or floor assembly that behaves like a homogeneous panel and connected flanking assemblies that behave like a homogeneous panel, 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" (see Note A-5.8.1.4.(4)(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 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
ANSI	A135.6	Engineered Wood Siding
ASME	B18.6.1	Wood Screws (Inch Series)
ASTM	A123/A123M	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM	A153/A153M	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM	A653/A653M	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM	C4	Standard Specification for Clay Drain Tile and Perforated Clay Drain Tile
ASTM	C73	Standard Specification for Calcium Silicate Brick (Sand-Lime Brick)
ASTM	C126	Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units
ASTM	C212	Standard Specification for Structural Clay Facing Tile
ASTM	C412M	Standard Specification for Concrete Drain Tile
ASTM	C444M	Standard Specification for Perforated Concrete Pipe
ASTM	C553	Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM	C612	Standard Specification for Mineral Fiber Block and Board Thermal Insulation
ASTM	C700	Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM	C726	Standard Specification for Mineral Wool Roof Insulation Board
ASTM	C834 ⁽¹⁾	Standard Specification for Latex Sealants
ASTM	C840	Standard Specification for Application and Finishing of Gypsum Board
ASTM	C920(1)	Standard Specification for Elastomeric Joint Sealants
ASTM	C991	Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings
ASTM	C1002	Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
ASTM	C1177/C1177M	Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
ASTM	C1178/C1178M	Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel
ASTM	C1184(1)	Standard Specification for Structural Silicone Sealants
ASTM	C1280	Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing
ASTM	C1311(1)	Standard Specification for Solvent Release Sealants

ASTM	C1330(1)	Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants
ASTM	C1396/C1396M ⁽²⁾	Standard Specification for Gypsum Board
ASTM	C1658/C1658M ⁽³⁾	Standard Specification for Glass Mat Gypsum Panels
ASTM	D1227/D1227M	Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing
ASTM	D2178/D2178M	Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
ASTM	D3019/D3019M ⁽⁴⁾	Standard Specification for Lap Cement Used with Asphalt Roll Roofing, Non-Fibred, and Fibred
ASTM	D4479/D4479M	Standard Specification for Asphalt Roof Coatings – Asbestos-Free
ASTM	D4637/D4637M	Standard Specification for EPDM Sheet Used In Single-Ply Roof Membrane
ASTM	D4811/D4811M	Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing
ASTM	D6878/D6878M	Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing
ASTM	E2190	Standard Specification for Insulating Glass Unit Performance and Evaluation
ASTM	E 2397/E 2397M	Standard Practice for Determination of Dead Loads and Live Loads Associated with Vegetative (Green) Roof Systems
BNQ	BNQ 3624-115	Polyethylene (PE) Pipe and Fittings for Soil and Foundation Drainage
CGSB	CAN/CGSB-11.3-M	Hardboard
CGSB	CAN/CGSB-12.1	Safety Glazing
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-12.9	Spandrel 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	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
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	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	A123.5	Asphalt shingles made from glass felt and surfaced with mineral granules
CSA	CAN/CSA-A123.16	Asphalt-coated glass-base sheets
CSA	A123.17	Asphalt Glass Felt Used in Roofing and Waterproofing
CSA	CAN/CSA-A123.21	Standard test method for the dynamic wind uplift resistance of membrane-roofing systems
CSA	A123.23	Product specification for polymer-modified bitumen sheet, prefabricated and reinforced
CSA	CAN/CSA-A123.24	Standard test method for wind resistance of vegetated roof assembly
CSA	A123.51	Asphalt shingle application on roof slopes 1:6 and steeper
CSA	A165.1	Concrete block masonry units
CSA	A165.2	Concrete brick masonry units
CSA	A165.3	Prefaced concrete masonry units
CSA	CAN/CSA-A179	Mortar and Grout for Unit Masonry
CSA	CAN/CSA-A220 Series	Concrete Roof Tiles
CSA	CAN/CSA-A371	Masonry Construction for Buildings
CSA	A3001	Cementitious Materials for Use in Concrete
CSA	B182.1	Plastic drain and sewer pipe and pipe fittings
CSA	G40.21	Structural quality steel
CSA	CAN/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	American National Standard for Hardwood and Decorative Plywood
SPRI	ANSI/SPRI VR-1	Procedure for Investigating Resistance to Root or Rhizome Penetration on Vegetative Roofs
ULC	CAN/ULC-S701.1	Standard for Thermal Insulation, Polystyrene Boards
ULC	CAN/ULC-S702.1	Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification

ULC	CAN/ULC-S703	Standard for Cellulose Fibre Insulation (CFI) for Buildings
ULC	CAN/ULC-S704.1	Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced
ULC	CAN/ULC-S705.1	Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Material Specification
ULC	CAN/ULC-S705.2	Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Application
ULC	CAN/ULC-S706.1	Standard for Wood Fibre Insulating Boards for Buildings
ULC	CAN/ULC-S710.1	Standard for Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification
ULC	CAN/ULC-S711.1	Standard for Bead-Applied Two Component Polyurethane Air Sealant Foam, Part 1: Material Specification
ULC	CAN/ULC-S717.1	Standard for Flat Wall Insulating Concrete Form (ICF) Units – Material Properties

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 E84 as indicated in ASTM C1396/C1396M.

⁽³⁾ The flame-spread rating of gypsum panels shall be determined in accordance with CAN/ULC-S102 in lieu of ASTM E84 as indicated in ASTM C1658/C1658M.

⁽⁴⁾ For the purpose of compliance with Part 5, ASTM D3019/D3019M shall only apply to the non-fibred and non-asbestos-fibred types of asphalt roll roofing.

5.9.2. Windows, Doors and Skylights

5.9.2.1. General

1) This Subsection applies to windows, doors and skylights, including 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 and skylights, including their components, that are required to have a *fire-protection rating* need not conform to the requirements of this Subsection. (See Note A-5.9.2.1.(3).)

5.9.2.2. Applicable Standards

(See Note A-5.9.2.2.)

1) Except as permitted in Sentences (5) and 5.9.2.3.(1), windows, doors, skylights, including their components, shall conform to the requirements in

a) AAMA/WDMA/CSA 101/IS.2/A440, “North American Fenestration Standard/Specification for windows, doors, and skylights” (Harmonized Standard), and

b) except as permitted in Sentence (4), CSA A440S1, “Canadian Supplement to AAMA/WDMA/CSA 101/IS.2/A440-, North American Fenestration Standard/Specification for windows, doors, and skylights.”

2) Performance grades for windows, doors and skylights shall be selected according to the Canadian Supplement referenced in Clause (1)(b) so as to be appropriate for the conditions and geographic location in which the window, door or skylight will be installed.

3) Windows, doors and skylights shall conform to the performance grades selected in Sentence (2) when tested in accordance with the Harmonized Standard referenced in Clause (1)(a).

4) For the purposes of conformance with Clause (1)(b), 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.(4).)

5) 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) is designed with a clear width, a clear and level space, a door-opening device and a door closer in conformance with Subsection 3.8.3. (see Article 3.8.3.6.), or

c) meets the criteria in Sentence 9.27.3.8.(3) such that flashing would not be required.

5.9.2.3. Structural and Environmental Loads, Air Leakage and Water Penetration

1) Windows, doors, skylights and their components that do not conform to Article 5.9.2.2. shall be designed and constructed in accordance with Subsection 5.1.4., Section 5.4. and Section 5.6.

(See Note A-5.9.2.3.(1).)

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. Other Fenestration Assemblies

(See Note A-5.9.3.)

5.9.3.1. General

1) For the purpose of this Subsection, the term “other fenestration assemblies” refers to curtain walls, window walls, storefronts and glazed architectural structures. (See Note A-5.9.3.1.(1).)

2) Other fenestration assemblies and their components that are required to have a *fire-protection rating* need not conform to the requirements of this Subsection. (See Note A-5.9.2.1.(3).)

5.9.3.2. Structural and Environmental Loads

1) Other fenestration assemblies and their components shall be designed and constructed in accordance with Subsection 5.1.4. (See Note A-5.9.3.2.(1).)

5.9.3.3. Heat Transfer

- 1) Other fenestration assemblies and their components shall meet the heat transfer performance requirements stated in Section 5.3. (See Note A-5.9.3.3.(1).)
- 2) Other fenestration assemblies using metal framing that separate interior conditioned space from interior unconditioned space or exterior space shall incorporate a thermal break to minimize condensation.

5.9.3.4. Air Leakage

- 1) Other fenestration assemblies and their components shall be designed and constructed in accordance with Section 5.4.
- 2) Except as provided in Sentence (3), other fenestration assemblies and their components shall have an air leakage characteristic, measured at an air pressure difference of 75 Pa, when tested in accordance with ASTM E283, "Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen," that is not greater than
 - a) 0.2 L/(s×m²) for fixed portions, including any opaque portions, and
 - b) 1.5 L/(s×m²) for operable portions.(See Note A-5.9.3.4.(2).)
- 3) The following systems need not comply with Sentence (2):
 - a) interior windows and interior doors that do not serve as environmental separators,
 - b) vehicular access doors (garage doors),
 - c) storm windows and storm doors,
 - d) commercial entrance systems,
 - e) revolving doors,
 - f) smoke and relief air vents,
 - g) site-built door systems, and
 - h) commercial steel doors.

(See Note A-5.9.3.4.(3).)

5.9.3.5. Water Penetration

- 1) Other fenestration assemblies and their components shall be designed and constructed in accordance with Section 5.6.

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, “Standard for 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 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 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)**

Provision	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),(c) [F21,F22-OS2.3]
	(b),(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]
(6)	[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),(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),(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.
(3)	[F55-OH1.1,OH1.2,OH1.3]
	[F55-OS2.3]
	[F55-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
(4)	[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.
5.4.1.2. Air Barrier Assemblies	
(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.
(2)	[F55-OH1.1,OH1.2,OH1.3]
	[F55-OS2.3]
	[F55-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
(4)	[F55-OH1.1]
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)	[F20,F55,F61-OH1.1,OH1.2,OH1.3]
	[F20,F55,F61-OS2.1,OS2.3]
(4)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(5)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(6)	[F20,F55,F61-OH1.1,OH1.2,OH1.3]
	[F20,F55,F61-OS2.1,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]
(6)	[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]
	[F20-OS2.2] [F80-OS2.3]
	[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.
5.9.4.1. 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 2025 – CITY OF VANCOUVER

SCHEDULE D

Forming Part of Sentence 5.1.2.2.(2), Division B of the Building By-law

Building Permit Number (for CoV 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. and the Association of Professional Engineers and Geoscientists of the Province of British Columbia.
- 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)

(Professional's Seal and Signature)

Date

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,

Name (Print)

Address (Print)

Address (Print) (continued)

Phone Number and Email Address

Certified Professional's Stamp and
Signature (if applicable)

for the project designed by,

Name of registered professional signing for 'Architectural' items of Schedule B letter (Print)

who is providing the Chief Building Official with a 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.

BUILDING BY-LAW 2025 – CITY OF VANCOUVER

SCHEDULE C-D

Forming Part of Sentence 5.1.2.2.(3), Division B of the Building By

Building Permit Number (for CoV Use)

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. and the Association of Professional Engineers and Geoscientists of the Province of British Columbia.
- 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)

(Professional's Seal and Signature)

Date

I have fulfilled my obligations for *Building Envelope Professional* design review and enhanced *field review* as per my previously submitted letter of COMMITMENT FOR BUILDING ENVELOPE PROFESSIONAL REVIEW. The components and assemblies of the *project* reviewed substantially comply with Article 5.1.2.2. in Part 5 of Division B, of the Building By-law, and with the plans and supporting documents, including all amendments thereto, which were *accepted* by the City of Vancouver in support of the application for the *building permit*.

Name (Print)

Address (Print)

Address (Print) (continued)

Phone Number and Email Address

Certified Professional's Stamp and
Signature (if applicable)

(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 the Province of British Columbia qualified by virtue of training or experience to provide building enclosure services.

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 but not including all Group C multi-family buildings and Artist Live/Work Studios that are more than 2 storeys in building height or more than 600 m² in building area excluding firewalls or the National Farm Building Code of Canada 1995. 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 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 "Structural Commentaries (User's Guide - NBC 2020: Part 4 of Division B)."

Resistance to deterioration may be determined based on rational analysis, such as hygrothermal modeling, field performance, accelerated testing, or compliance with guidelines provided by evaluation agencies recognized by the authority having jurisdiction. Designers of buildings covered in Part 5 can find design guidance in the NRC publication entitled "Guideline on Design for Durability of Building Envelopes," and in CSA S478, "Durability in buildings," which presents updated methodologies for analyzing resistance to deterioration that provide quantitative results to support informed design decisions.

It is noted that the effects of future climate change and their potential impact on the durability of buildings are not fully known and, as such, are still being researched and studied. How future climate change and the issues of climate resilience are incorporated in building design should be carefully

considered within the context of existing Code provisions related to structural design, fire and life safety, etc.

It is also noted that CSA S478 contains requirements for actions beyond the scope of the British Columbia Building Code, which may not be the responsibility of the designer, builder or authority having jurisdiction. These include requirements relating to quality assurance, inspection, maintenance, minimum design service lives and potential impacts of climate change, which are not addressed in the Code. The reference herein to CSA S478 is not intended to imply that the designer, builder or authority having jurisdiction adopt, apply or enforce any of these requirements.

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 (see Note A-1.4.1.1. of Division A concerning roof terminology). The tested uplift resistance and factored load should satisfy the requirements of the Commentary entitled Limit States Design in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

The test method described in CAN/CSA-A123.21, “Standard test method for the dynamic wind uplift resistance of membrane-roofing systems,” applies only to sheet membrane roofing systems whose components' resistance to wind uplift is achieved by fasteners or adhesives. It does not apply to liquid-applied membranes or to membrane roofing systems that use ballasts, such as gravel or pavers, to secure the membrane against wind uplift.

In the case of sheet 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 By-law. NRC's guide for wind design referenced above provides further guidance and examples of wind load calculations.

Wind resistance of ballasted roofs may be calculated using ANSI/SPRI RP-4, “Wind Design Standard for Ballasted Single-ply Roofing Systems”. However, its methods are based on wind speeds, not wind pressures. Conversely, wind pressures, not wind speeds, are used in Appendix C of this By-law. Therefore, a registered professional skilled in the work of Part 4 should use the ANSI/SPRI standard in conjunction with wind speeds listed in Table C-1, applying wind loads calculated in accordance with Subsection 4.1.7. of Division B (see the commentary on Wind Effects in Appendix C of Division B). Where ballast is used to resist other structural loads in a building, a registered professional is responsible to review these, particularly in replacement roofing.

Technical Bulletin Volume 40 “Design of Loose-Laid Gravel Stone Ballasted Roofs” published by the Canadian Roofing Contractors Association (CRCA) provides some guidance for using the ANSI/SPRI standard to determine ballast requirements. Note that the exposure categories are different from those used in this By-law. A registered professional may select the appropriate ballast size and weight guidelines based on roof zones and zone dimensions.

The ballast values published in CRCA Technical Bulletin Volume 40 are minimum values that will address many roof designs where the roof deck is air-impermeable. If the roof deck is air-permeable, or if flow control drains are present (these may retain water on the roof, thereby introducing added buoyancy), the design may require higher ballast weights (and correspondingly higher volumes). A registered professional should ensure that the structural design of the building can accommodate the necessary ballast weight, together with anticipated live loads including those loads imposed on the building during construction.

While gravel ballast is commonly used on protected membrane roof systems, wind scour can dislodge rocks from the roof, rendering them a public safety hazard. Consequently, a roof may need to be designed with higher parapets or with a different ballast material, such as concrete pavers. See also CRCA Technical Bulletin Volume 35 “Ballast For Protected Membrane Roofing” on ballast design requirements for protected membrane roofs.

A-5.2.2.2.(6) Vegetated Roof Assemblies. When a vegetated system is added on the top of a membrane roofing assembly, a *vegetated roof assembly* is formed. The test methods described in CAN/CSA-A123.24, “Standard test method for wind resistance of vegetated roof assembly,” determine both the wind uplift resistance and the wind flow resistance of the *vegetated roof assembly*. If the wind uplift resistance of the membrane roofing assembly used in the *vegetated roof assembly* has already been determined in accordance with the requirements of CAN/CSA-A123.21, “Standard test method for the dynamic wind uplift resistance of membrane-roofing systems,” as required by Sentence 5.2.2.2.(4), then this resistance can be used as an acceptable conservative wind uplift resistance of the *vegetated roof assembly*; in such cases, only the wind flow resistance of the *vegetated roof assembly* has to be determined in accordance with CAN/CSA-A123.24. However, if any variations in the components or methods of construction of the membrane roofing assembly used in the *vegetated roof assembly* are made after the wind uplift resistance was determined in accordance with the requirements of CAN/CSA-A123.21, then the wind uplift resistance of the *vegetated roof assembly* must be determined in accordance with CAN/CSA-A123.24.

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/IS.2/A440, “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 A440.2:19, Fenestration energy performance."

The scope of AAMA/WDMA/CSA 101/IS.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 the City of Vancouver, 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 certain areas, design conditions may be different. 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. Air Barrier Systems. An air barrier system is required in most buildings to control air movement through the environmental separator to minimize

- the condensation of airborne moisture within the environmental separator,
- discomfort from drafts,
- the infiltration of dust, soil gases, and other pollutants,
- interference in the performance of building services, such as HVAC and plumbing,
- the infiltration of exterior precipitation, and
- the loss of airborne heat energy.

The requirements for air barrier systems in Part 5 address all of these issues, except the loss of airborne heat energy, which is an energy performance issue and, as such, is addressed in the NECB. Failure to manage the issues addressed in Part 5 can lead to serious health or safety hazards.

The most significant issues are those with the potential to cause moisture-related material deterioration, such as rot and corrosion, which can lead to the failure of component connections. Where the environmental separator is subject to high moisture levels, mould can grow if spores and organic materials are present.

A-5.4.1.1. Locations Where an Air Barrier System Is Required. Where the hygrothermal environments in adjacent interior spaces are sufficiently different, an air barrier system is required to control the airflow between the spaces in order to maintain the different environments. Examples of such adjacent spaces include skating arenas adjoining swimming pools, and industrial office spaces adjoining industrial production spaces.

An air barrier system is also required in building assemblies in contact with the ground to control the ingress of radon and other soil gases, such as methane.

In addition to an air barrier system, other measures may be required in certain regions 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-5.4.1.1.(3) Air Leakage Performance Classes for Air Barrier Assemblies. The selection of a Performance Class for an air barrier assembly is intended to ensure that the air leakage performance level of the assembly is sufficient to minimize condensation and reduce the uncontrolled movement of air across the environmental separator.

The accumulation of condensation within a building assembly as a result of air leakage through the environmental separator depends on the following:

- the air leakage rate of the air barrier assembly,

- the location of the accumulation of condensation within the building assembly, and
- the drying potential of the building assembly (i.e., its ability to release moisture through vapour diffusion and surface evaporation, both inward and outward).

Critical to the rates of both drying and the accumulation of condensation is the location where moisture may occur within the building assembly. The location and amount of accumulation of condensation due to air leakage are influenced by the materials used in the building assembly and the temperatures within the assembly. The location of insulation within the building assembly is critical and can directly influence whether condensation occurs and how much moisture condensation actually accumulates.

The drying potential of the building assembly is dependent on the water vapour permeance of the various layers in the building assembly (e.g., exterior sheathing, sheathing membrane, unvented cladding, vapour barrier).

CAN/ULC-S742, “Standard for Air Barrier Assemblies – Specification,” contains requirements and test methods for air barrier assemblies used in high- and low-rise buildings. The standard classifies the air leakage performance of air barrier assemblies on the basis of air leakage rate, building height, and wind pressure loading. The approach in the standard is consistent with limit states design principles to allow for the direct incorporation of test results into the overall structural design of the building.

Unlike ASTM E2357, “Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies,” CAN/ULC-S742 measures air leakage under two temperature conditions:

- (1) at ambient temperatures with no temperature differential across the test assembly, and
- (2) with the exterior side of the test assembly at a temperature of -20°C and the interior side at a temperature of $+20^{\circ}\text{C}$ (i.e., with a temperature differential of 40°C across the test assembly).

This difference makes the testing approach in CAN/ULC-S742 more appropriate for the climate in most regions of Canada.

CAN/ULC-S742 does not address the structural transfer of air pressure loads from air barrier assemblies to adjoining air barrier assemblies or the primary structure. Nevertheless, this transfer of loads must be addressed by the designer.

The Performance Class of an air barrier assembly is selected on the basis of the following:

- the moisture loads on the building assembly due to the hygrothermal characteristics of the air,
- the ability of the materials and components of the building assembly to absorb and distribute moisture,
- the ability of the building assembly to dissipate moisture before it can lead to harm to the occupants or damage to the materials and components of the building assembly, and
- the moisture tolerance of the materials from which the building assembly is constructed.

Air barrier assemblies with lower air leakage rates are typically necessary where the drying potential of the building assembly is low and/or the moisture sensitivity of components of the building assembly is high.

Before selecting the appropriate Performance Class, the designer should consider formal study, analysis and/or modeling to establish performance criteria for each air barrier assembly. Further guidance can be found in the NRC publication entitled “Guideline on Design for Durability of Building Envelopes.” This recommendation is particularly important for buildings with

- higher than normal operating hygrothermal characteristics, e.g., museums, swimming pools and laboratories,
- building assemblies made from materials and components with lower than normal moisture tolerances, e.g., wood and other organic materials, or
- occupancies with a low tolerance for the potential health risks associated with condensation, e.g., hospitals, long-term care facilities and laboratories.

In such cases, Performance Classes with lower air leakage rates should be selected.

A-5.4.1.1.(4) Continuity of Air Barrier Systems. An air barrier system can only function properly if all the materials, components and assemblies intended to provide the air barrier functions are continuously connected and structurally capable of resisting applied loads. Historically, most failures of air barrier systems in buildings have been directly related to improper or insufficient connections between adjacent air barrier materials, components and assemblies.

A-5.4.1.1.(7) Locations Where an Air Barrier System Is Not Required. In Canada, there are few buildings intended for human occupancy where the interior space is conditioned but an air barrier system is not required. Any exemption from installing an air barrier system would depend on the level of interior conditioning provided, the ventilation level, the protection provided for the building's occupants, and the tolerance of the building's construction to the accumulation of condensation and potential precipitation ingress.

In some industrial buildings, limited conditioning (e.g., radiant heating) is provided, and ventilation levels are sufficient to reduce the relative humidity to a level at which condensation will not accumulate to an unacceptable degree. Conversely, some industrial buildings, due to the processes they contain, operate at very high temperatures and high ventilation levels. In such cases, the building envelope may be maintained at temperatures required to avoid condensation. In both of these examples, either the ventilation levels or protective means required in the work environment would protect the building's occupants from unacceptable levels of pollutants.

A-5.4.1.2.(1) Low-Sloped Membrane Roof Assemblies. For low-sloped membrane roof assemblies, CAN/ULC-S742, "Standard for Air Barrier Assemblies – Specification," provides pre-tested prescriptive solutions that have an air leakage rate not exceeding $0.2 \text{ L}/(\text{s}\cdot\text{m}^2)$. The air leakage rate of low-sloped membrane roof assemblies not identified in CAN/ULC-S742 should be determined in accordance with ASTM D8052/D8052M, "Standard Test Method for Quantification of Air Leakage in Low-Sloped Membrane Roof Assemblies."

A-5.4.1.2.(2) Air Barrier Assemblies Not Evaluated in Accordance with CAN/ULC-S742. Air barrier assemblies that have not been evaluated in accordance with CAN/ULC-S742, "Standard for Air Barrier Assemblies – Specification," must nevertheless provide the air leakage performance required for the selected Performance Class. Field testing may be required to verify their performance.

Field assessment of the air leakage characteristics of both the primary air barrier assemblies and the connections between adjacent air barrier assemblies can be a useful tool in establishing whether the acceptable minimum performance level is met.

Field testing of installed air barrier assemblies can be conducted in accordance with test standards such as

- ASTM E783, "Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors," and
- ASTM E1186, "Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems."

Even though some test standards are intended for specific types of air barrier assemblies (e.g., windows and doors), the test methodology used to assess air leakage rates may be acceptable for use with other types of air barrier assemblies. However, with this approach, it is important to establish rational acceptance criteria that reflect the test methodology and the types of air barrier assemblies being tested.

Qualitative testing can be used to identify locations in air barrier assemblies where air leakage is occurring so that field repairs can be made to improve the assembly's airtightness performance. ASTM E1186 provides guidance on a number of approaches for identifying locations of air leakage, including the following:

- infrared scanning,
- smoke tracer observation,
- airflow measurement,
- sound detection,
- tracer gas detection, and
- liquid leak detection.

Each of these techniques has benefits and limitations, as described in the standard. The most suitable approach for a particular situation is selected by the testing agency on the basis of their experience in relation to the type of construction being assessed and the weather conditions at the time of testing. Regardless of the approach selected, the testing of air barrier assemblies must be properly coordinated with the construction process so that any air leaks identified can be addressed without adversely affecting progress.

A-5.4.1.2.(4) Testing of Below-Grade Air Barrier Assemblies. To ensure that they minimize the ingress of radon and other soil gases, below-grade air barrier assemblies in contact with the ground can be tested in accordance with CAN/ULC-S742, "Standard for Air Barrier Assemblies – Specification," using the air leakage limit for Performance Class 1 or a more stringent limit. In such air barrier assemblies, as in all air barrier assemblies, penetrations and junctions are the most likely locations for air leakage. These points of weakness must be properly detailed and constructed to minimize the ingress of soil gases.

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.(7) 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 milder climates. 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 through 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 blocks, 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 water-shedding 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) Integrity and Performance of Vegetated Roof Assemblies. 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 "The NRCA Vegetative Roof Systems Manual" and in the standards published in the "Roofing Practices Manual" by the Roofing Contractors Association of British Columbia.

A vegetated roof assembly is intended to both grow and flourish, and is often used to control the rate of rainwater discharged through a storm drainage system. Maintenance of a vegetated roof assembly is

necessary. This includes removal of dead vegetation that does not compost quickly, to reduce fire risk, and regular removal of biomass from around roof drains, to prevent clogging and ponding.

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. A number of different design solutions can provide an environmental separator with the minimum performance level necessary to effectively control environmental and structural loads and their effects. An appropriate solution is selected on the basis of the applied load characteristics, the performance achieved by the solution, and its durability over the design service life. It is incumbent on the designer to balance the performance of a particular design solution against the required performance level, the risk of failure, and the consequences of failure for the building and its users.

Article 5.6.2.1. recognizes that acceptable solutions can use various strategies and single or multiple elements within the design to control precipitation. However, as indicated by research and the documentation of failures, some of these solutions are more effective than others.

One solution—a face-sealed assembly—relies on a continuous watertight surface on the outside of a building to control all precipitation over the life of the building; there is no redundancy in this design. The watertight surface can be difficult to both design and construct, and its long-term durability depends on proper preventive maintenance over its service life. This solution has a well-documented history of unsatisfactory performance in most regions of Canada.

A solution with redundancy in its design provides more effective and reliable resistance to water penetration. For example, in a rainscreen assembly, multiple water-resistive layers are combined with means to drain any water that has penetrated the outer layer and means to redirect this water to the exterior before it can affect moisture-sensitive materials within the assembly. Another solution—a mass wall assembly—accumulates and stores moisture, which is re-released to the exterior when conditions allow. Depending on the solution selected, means to facilitate the drying of materials may be incorporated in the assembly.

In selecting an acceptable solution for precipitation control, it is important to consider the structural and environmental loads that are referenced in Subsection 5.1.4. The resistance provided by the design solution must exceed these loads and their effects. The greater the intensity of the load, the higher the

performance level required to provide the necessary resistance and an acceptable level of risk. Design considerations that should be addressed include the following:

- intended building use(s),
- building exposure during service life (height, orientation and surrounding terrain),
- building exposure during construction,
- current and future local climate characteristics affecting wetting and drying, including
 - wind loads,
 - precipitation loads (including wind-driven precipitation loads),
 - relative humidity,
 - temperature variations, and
 - solar exposure,
- imposed load intensity, both in isolation and in combination (type, number, magnitude, frequency and duration),
- material types and moisture tolerances,
- resistance to the mechanisms of deterioration,
- effects of deformations, displacements and deflections of the building structure, and of materials, components and assemblies,
- constructability of materials, components and assemblies,
- expected construction tolerances,
- level of maintenance required to maintain resistance to loads and deterioration,
- intended service life of materials, components and assemblies, and
- reliability of materials, components and assemblies.

All the materials in an environmental separator must be able to resist the mechanisms of deterioration that are expected to occur over the design service life of the separator. For example, with respect to deterioration caused by moisture, a material used in a design must not be exposed to moisture in sufficient quantity and/or for sufficient length of time to reduce its ability to perform its required function(s) to a level below the required performance level. This concern is particularly important for materials that are known to be susceptible to moisture deterioration.

An environmental separator must also be designed to be suitably resistant to failure caused by

- uncertainty or variation in load intensity,
- uncertainty in the effects of loads on materials, components and assemblies,
- uncertainty in the predicted service lives of materials, components and assemblies, and
- construction deficiencies that can reasonably be anticipated.

The building structure and the environmental separator are mutually dependent in managing precipitation. The choice of materials for the building structure and the structural support/backing for

the environmental separator can influence the choice of materials, components and assemblies for the environmental separator. Materials, components and assemblies with higher performance levels may be required for the environmental separator where the building structure and the structural support/backing have lower material strengths, undergo higher in-service movements (e.g., shrinkage or deflection), or have lower resistance to deterioration.

The design and construction of details at penetrations, at joints and junctions between assemblies, and at transitions between planes are of critical importance to the long-term performance and durability of the environmental separator. Designers should provide sufficient detail on drawings to illustrate how the design solution for precipitation control is to be integrated into the building (see Subsection 2.2.5. of Division C).

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.

Refer also to Division B of Book II (Plumbing Systems), Sentence 2.4.10.4.(2). (For climate resiliency requirements see CAN/CSA-A123.26, "Performance requirements for climate resilience of low slope membrane roofing systems", together with the Standards published in the "Roofing Practices Manual" by the Roofing Contractors Association of British Columbia.)

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 authority having jurisdiction.

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 the NRC's website.

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-5.8.1.4.(4)(b) Assemblies that Behave Like Homogeneous Panels. Examples of assemblies that behave like homogeneous panels include cast-in-place concrete, precast concrete, precast hollow-core concrete, concrete block masonry, and mass timber panels. For the purpose of calculating the ASTC rating for construction using mass timber panel walls or floor assemblies in accordance with the detailed method described in Sentence 5.8.1.4.(4), a mass timber panel behaves as a homogeneous panel, notwithstanding that it has an average structural loss factor greater than 0.03. Further information on the calculation of the ASTC rating for mass timber panel assemblies can be found in the NRC publication entitled “Guide to Calculating Airborne Sound Transmission in Buildings.”

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-S702.1, “Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.”

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 C1193, “Standard Specification for Use of Joint Sealants,” and
- ASTM C1472, “Standard Guide for 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 Fenestration Assemblies 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. Manufactured Windows, Doors and Skylights.

Two Compliance Paths. It is intended that any fenestration product that conforms to this Subsection may choose to comply with either Article 5.9.2.2. or Article 5.9.2.3. Even if a product is in scope of the standards referenced in Article 5.9.2.2. (NAFS and the Canadian Supplement to NAFS), the compliance path in Article 5.9.2.3. may be used. However, it is not intended that the compliance path in Article 5.9.2.2. be used where fenestration products are not within the scope of the referenced standards.

Design Values

CSA A440S1, "Canadian Supplement to AAMA/WDMA/CSA 101/IS.2/A440, 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.

A-5.9.2.2.(4) 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-5.9.2.3.(1) Installation and Field Testing of Windows, Doors and Skylights.

Installation

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 CSA A440.4, "Window, door, and skylight installation."

Field Testing

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 E783, "Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors," and ASTM E1105, "Standard Test Method for 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 CSA A440.4, "Window, door, and skylight installation," which also includes performance requirements developed in accordance with AAMA/WDMA/CSA 101/IS.2/A440, "North American Fenestration Standard/Specification for windows, doors, and skylights," to be used when performing field testing.

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-5.9.3. Testing Standards for Other Fenestration Assemblies. Subsection 5.9.3. references ASTM test methods. The following AAMA standards can also be used to evaluate the performance characteristics of other fenestration assemblies:

- AAMA 501, "Methods of Test for Exterior Walls,"
- AAMA 501.1, "Standard Test Method for 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 Inter-Story Drifts,"
- AAMA 501.5, "Test Method for 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 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."

A-5.9.3.1.(1) Terminology for Other Fenestration Assemblies.

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/IS.2/A440, "North American Fenestration Standard/Specification for windows, doors, and skylights," are considered glazed architectural structures.

A-5.9.3.2.(1) Structural and Environmental Loads. The applicable laboratory test method for demonstrating adequate structural performance of other fenestration assemblies is ASTM E330/E330M, "Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference."

A-5.9.3.3.(1) Resistance to Condensation. Notwithstanding that other fenestration assemblies 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, "Test Method for 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.

A-5.9.3.4.(2) Air Leakage.

Air Leakage Rate and Test Pressure

A lower air leakage rate and/or higher differential test pressure can be selected for specific applications of other fenestration assemblies 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 fenestration assemblies 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.

Standard Test Methods

The applicable laboratory test method for determining the rate of air leakage is ASTM E283, "Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen." If field testing for air leakage is to be conducted, the applicable test method is ASTM E783, "Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors."

A-5.9.3.4.(3) Systems Excluded from Air Leakage Requirements. The systems listed in Sentence 5.9.3.4.(3) perform different functions than other fenestration assemblies and are therefore exempted from complying with the air leakage requirements.

A-5.9.4.1.(1) Exterior Insulation Finish Systems (EIFS). The reference to CAN/ULC-S716.1, "Standard for 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 Code. 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, "Standard for Exterior Insulation and Finish Systems (EIFS) - Installation of EIFS Components and Water Resistive Barrier," and
- CAN/ULC-S716.3, "Standard for 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 C1363, "Standard Test Method for 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 Subsection 1.3.3. of Division A.

6.1.1.2. Application

- 1) This Part applies to systems and equipment for heating, ventilating and air-conditioning services.

6.1.2. Definitions

6.1.2.1. Defined Terms

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

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 Subsection 2.2.6. of Division C.

Section 6.2. Planning

6.2.1. General

6.2.1.1. Good Engineering Practice

(See Note A-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 ACGIH manual entitled "Industrial Ventilation: A Manual of Recommended Practice for Design,"
- 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,"

i) EPA 625/R-92/016, "Radon Prevention in the Design and Construction of Schools and Other Large Buildings," and

j) ASHRAE Guideline 12, "Minimizing the Risk of Legionellosis Associated with Building Water Systems."

2) Indoor design temperatures for residential *buildings* shall be those established in Article 9.33.3.1.

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 Subsection 1.1.3. (See Note A-6.2.1.2.(1).)

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 Note A-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 Articles 6.9.4.2. and 6.3.1.4., the installation of heating and air-conditioning equipment, including mechanical refrigeration equipment, and including provisions for mounting, clearances and air supply, shall conform to the Safety Standards Act and pursuant regulations.

2) A solid-fuel burning *boiler* accepted for use under section 10 of the Safety Standards Act satisfies section 4.1 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. (See Note A-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 NFPA 82, "Standard on 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 (4), all *buildings* shall be ventilated in accordance with this Section.
- 2) Except in storage garages covered by Article 6.3.1.3., outdoor air shall be supplied to *buildings* for ventilation purposes in accordance with one of the following Sections of ANSI/ASHRAE 62, "Ventilation for Acceptable Indoor Air Quality," as a minimum:
 - a) Section 6.2, Ventilation Rate Procedure, excluding the exception stated in Section 6.2.7.1.2 and note H of Table 6.2.2.1,
 - b) Section 6.3, Indoor Air Quality Procedure, or
 - c) Section 6.4, Natural Ventilation Procedure, excluding residential occupancies.
- 3) Except in storage garages covered by Article 6.3.1.3., exhaust ventilation shall be provided in accordance with Section 6.5, Exhaust Ventilation, of ANSI/ASHRAE 62, "Ventilation for Acceptable Indoor Air Quality," as a minimum.
- 4) Self-contained heating-season mechanical ventilation systems serving only one *dwelling unit* shall comply with Subsection 9.32.3.
- 5) For *suites* in *buildings* conforming to Part 10, 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.(5).)

6.3.1.2. Crawl Spaces and Attic or Roof Spaces

- 1) Unconditioned and unoccupied crawl spaces and attic or roof spaces shall be ventilated by natural or mechanical means as required by Part 5. (See Note A-6.3.1.2.(1).)

6.3.1.3. 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 100 parts per million parts of air,
 - b) limit the concentration of nitrogen dioxide to not more than 3 parts 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 3.9 L/s for each square metre of floor area (see Article 3.3.1.21.).

(See Note A-6.3.1.3.(1).) (See also Sentence 3.3.5.4.(4).)

- 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 Note A-6.3.1.3.(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.

6.3.1.4. Heat Recovery Ventilators

1) Heat recovery ventilators with rated capacities of not less than 25 L/s and not more than 200 L/s shall be installed in accordance with Subsection 9.32.3.

6.3.1.5. Indoor Air Contaminants

(See Note A-6.3.1.5.)

1) Air contaminants of concern 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 Sentence 6.2.1.1.(1), measured using the methodology described therein.

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.

6.3.1.6. Commercial Cooking Equipment

1) Except as provided in Sentences (2) and (3), Article 3.6.3.1. and Article 3.6.3.5., systems for the ventilation of commercial cooking equipment shall be designed, constructed and installed to conform to NFPA 96, "Standard for 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 Part 9.

6.3.2.2. Drain Pans

(See Note A-6.3.2.2.)

1) HVAC systems that generate condensate or introduce liquid water into the airstream in the ducts shall be equipped with drain pans that are

a) designed in accordance with Section 5.10, 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 safely disposed of,

c) installed so that water does not stagnate and drains from the pan, and

d) designed and installed so as to be accessible for cleaning and maintenance.

2) Drain pans and associated piping shall be constructed of corrosion-resistant, non-porous materials that do not promote the proliferation of disease-causing micro-organisms.

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 Article 3.6.5.1.

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 Note A-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 Article 3.6.5.4.

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 Article 3.6.5.6.

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) and 6.3.2.10.(6), air duct systems serving storage garages shall not be directly interconnected with other parts of the *building*.

3) Exhaust ducts referred to in Sentence 6.3.2.10.(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, "Standard for 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 Note A-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 2 m 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 15 mm diam sphere.

2) Outdoor air intakes shall be located so that

a) **reserved,**

b) they are separated a minimum distance from sources of contaminants in accordance with Table 6.3.2.9.

Table 6.3.2.9.
Minimum Distances of Air Intakes from Sources of Contaminants
Forming Part of Sentence 6.3.2.9.(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, <i>street</i> , 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 heat rejection systems	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 0.3 m 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 15 mm, 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 Article 3.6.5.7.

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 a problem.

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 Note A-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 (see Note A-6.3.2.10.(6)(b)), and

c) they are designed in accordance with Sentence 6.3.2.7.(3).

(See Note A-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 Note A-6.3.2.10.(7) and (8).)

8) 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,
- 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 Note A-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 Note A-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 Article 3.6.5.8.
- 2) Where a ceiling space is used as a return-air plenum, the requirements of Article 3.6.4.3. 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 Class 2 air filter units as described in CAN/ULC-S111, "Standard Method of 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. Cleaning Devices

- 1) Ventilation required by Sentence 6.3.1.1.(1) shall be provided by a ventilation system designed to include filtration devices with a Minimum Efficiency Reporting Value (MERV) of 13, as defined by ANSI/ASHRAE 52.2, prior to introduction of outdoor air into indoor occupied spaces.

6.3.2.15. Evaporative Heat Rejection Systems

(See Article 2.2.11.6. of Division B of Book II (Plumbing Systems) of this By-law.)

- 1) Evaporative heat rejection systems shall
 - a) incorporate a drift eliminator or other means to minimize the dispersion of entrained water droplets, and
 - b) have a design discharge velocity that does not exceed the maximum discharge velocity recommended by the manufacturer.
- 2) Evaporative heat rejection systems shall be designed so that water continuously circulates through all parts of the system that are normally wetted when the system is operating.
- 3) Evaporative heat rejection systems and their components shall be constructed of corrosion-resistant, non-porous materials that do not promote the proliferation of disease-causing micro-organisms and that are compatible with disinfectants, biocides and other cleaning agents.
- 4) Evaporative heat rejection systems shall be installed such that
 - a) no discharge air bypasses the drift eliminator or other means referred to in Clause (1)(a), and
 - b) the systems are accessible for cleaning, inspection and maintenance.
- 5) Except as provided in Sentence (6), air discharged from evaporative heat rejection systems shall discharge away from the *building*, so as to not re-enter it, to a distance not less than
 - a) 2.15 m above sidewalks and driveways,
 - b) 7.6 m from outdoor air intakes,

- c) 3 m horizontally or vertically from exterior doors and operable windows, and
 - d) 3 m horizontally or vertically from occupiable outdoor spaces, excluding maintenance spaces.
- (See Note A-6.3.2.15.(5) and (6).)

6) Air discharged from evaporative heat rejection systems in health care facilities shall discharge away from the *building* in compliance with CAN/CSA-Z317.2, "Special requirements for heating, ventilation, and air-conditioning (HVAC) systems in health care facilities." (See Note A-6.3.2.15.(5) and (6).)

7) Air intakes of evaporative heat rejection systems shall incorporate protective measures to minimize the entrainment of vegetation and other organic matter.

8) Make-up water connections shall be equipped with backflow prevention devices that conform to Article 2.6.2.1. of Division B of Book II, (Plumbing Systems), of this By-law. (See Note A-6.3.2.15.(8) and (9).)

9) Water treatment systems and equipment for controlling the proliferation of disease-causing micro-organisms shall

- a) be provided in accordance with Section 8.2.4. of ASHRAE Guideline 12, "Minimizing the Risk of Legionellosis Associated with *Building* Water Systems," and

- b) include means for drainage, dilution, cleaning, and application of chemicals for the control of scale, corrosion and biological contamination.

(See Note A-6.3.2.15.(8) and (9).)

10) Drains, overflows and blow-downs shall be connected to the *building's* drainage system in accordance with Clause 2.4.2.1.(1)(e) of Division B of Book II, (Plumbing Systems), of this By-law.

11) Evaporative heat rejection systems shall be provided with access openings, service platforms, fixed ladders and fall-restraint connections to allow inspection, maintenance and testing, and a sampling port shall be installed at a point in the recirculation loop just prior to the point where treatment chemicals are injected.

6.3.2.16. Evaporative Air Coolers, Misters, Atomizers, Air Washers and Humidifiers

1) Evaporative air coolers, misters, atomizers, air washers and humidifiers shall be designed in accordance with Sections 9 and 10 of ASHRAE Guideline 12, "Minimizing the Risk of Legionellosis Associated with Building Water Systems."

2) Systems referred to in Sentence (1) shall

- a) be designed so that water continuously circulates through all parts of the system that are normally wetted when the system is operating, and

- b) incorporate a method of preventing water stagnation within the system itself and the internal plumbing when the system is not operating.

(See Note A-6.3.2.16.(2).)

3) All components of systems referred to in Sentence (1), including filters and evaporation media, shall be constructed of corrosion-resistant, non-porous materials that do not promote the proliferation of disease-causing micro-organisms.

4) Associated sumps shall

a) be constructed of corrosion-resistant, non-porous materials that do not promote the proliferation of disease-causing micro-organisms,

b) include auxiliary drains to prevent the overflow of water into ductwork, and

c) be installed so that they can be flushed, drained, cleaned and disinfected.

5) Where misters, atomizers or air washers are used in ductwork, the affected duct section shall be

a) designed to ensure drainage of unevaporated and accumulated water, and

b) constructed of corrosion-resistant, non-porous materials that do not promote the proliferation of disease-causing micro-organisms.

6) Make-up water connections shall be equipped with backflow prevention devices that conform to Article 2.6.2.1. of Division B of Book II, (Plumbing Systems), of this By-law. (See Note A-6.3.2.16.(6).)

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 Article 3.6.5.2.

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 Article 3.6.5.3.

6.3.3. Chimneys and Venting Equipment

6.3.3.1. Requirement for Venting

1) Except as provided in Articles 6.3.3.2. and 6.3.3.3., 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 Article 6.2.1.5.

2) Except as provided in Article 6.2.1.5., 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) 2.15 m above sidewalks and driveways,

b) 3 m from outdoor air intakes,

c) 3 m horizontally or vertically from doors and operable windows, and

d) 3 m horizontally or vertically from occupiable outdoor spaces, excluding maintenance spaces.

(See Note A-6.3.3.1.(2).)

6.3.3.2. Masonry or Concrete Chimneys

1) Rectangular masonry or concrete *chimneys* not more than 12 m in height shall conform to Part 9 if they serve

- a) *appliances* with a combined total rated heat output of 120 kW 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 NFPA 211, "Standard for 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 NFPA 211, "Standard for 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 2.5 m 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 Article 5.5.4.1. of Division B of the **Fire By-law**.

6.3.4.3. Enclosure Exhaust Ventilation

1) The ventilation system for a power-ventilated enclosure required by Sentence 5.5.4.2.(1) of Division B of the **Fire By-law** shall

a) conform to NFPA 91, "Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and 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 Division B 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 Section 3.6. (See also Subsection 9.10.10.)

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 Table 6.7.1.2.

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 or encapsulated mass timber construction.

2) Every steam or hot water radiator and convector shall be installed so as to conform to the clearance requirements of Table 6.7.1.2.

Section 6.5. Thermal Insulation Systems

6.5.1. Insulation

6.5.1.1. Insulation and Coverings

(See Note A-6.3.2.5.)

1) Insulation and coverings on pipes shall comply with Article 3.6.5.5.

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 52°C. (See Note A-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 Articles 3.1.5.19., 3.1.9.1., 9.10.9.6. and 9.10.9.7. 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 Table 6.7.1.2.

Table 6.7.1.2.
Clearance Between Steam or Hot Water Pipes and Combustible Material
Forming Part of Articles 6.4.2.1. and 6.7.1.2., and Sentence 6.4.3.1.(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 Note A-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 50 mm 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 Article 3.6.3.1. 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 Subsection 3.6.5.

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 Subsection 6.3.4., 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 regulations or bylaws, to good engineering practice such as that described in the publications of the National Fire Protection Association. (See Note A-6.9.1.2.(1).)

2) When indoor piping for Class I 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 Sentence 6.3.1.6.(1) using vegetable oil or animal fat shall conform to

- a) ANSI/CAN/UL/ULC 300, "Standard for 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 Article 3.1.8.10.

6.9.2.2. Smoke Detectors

1) Air handling systems shall incorporate *smoke detectors* where and as required by Article 3.2.4.12.

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 Article 3.2.6.6. 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 Article 3.6.3.4. 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 Article 3.4.4.4.

6.9.3. Carbon Monoxide Alarms

6.9.3.1. Carbon Monoxide Alarms

1) This Article applies to every *building* that contains an *assembly occupancy*, a *care occupancy* with individual *suites* or containing sleeping rooms or bed spaces not within a *suite*, a *residential occupancy*, a *business and personal services occupancy*, or a *mercantile occupancy*, and that

- a) is served by or contains a fuel-burning appliance, or
- b) contains a storage garage.

2) Carbon monoxide (CO) alarms installed in a *residential occupancy* or a *care occupancy* as required by this Article shall

- a) conform to CSA 6.19, "Residential carbon monoxide alarming devices,"
- b) be equipped with an integral alarm that satisfies the audibility requirements of 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 Note A-6.9.3.1.(2)(c)), and
- d) be installed as recommended by the manufacturer.

3) Except as permitted by Sentence (9), where a fuel-burning *appliance* is installed in a *suite* of *residential occupancy* or in a *suite* of *care occupancy*, a CO alarm shall be installed

- a) inside each sleeping room or bed space, or
- b) outside each sleeping room or bed space, within 5 m of each door serving a sleeping room or bed space, measured following corridors and doorways.

4) Except as permitted by Sentence (9), where a fuel-burning *appliance* serves a *residential occupancy* or a *care occupancy* and 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 sleeping room or bed space, or if outside, within 5 m of each door serving a sleeping room or bed space, 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) Except as permitted by Sentence (9), 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 sleeping room or bed space, or
- b) outside each sleeping room or bed space, within 5 m of each bedroom door serving a sleeping room or bed space, measured following corridors and doorways.

6) CO alarms installed in an *assembly occupancy*, a *business and personal services occupancy*, or a *mercantile occupancy* as required by this Article shall conform to

a) CAN/CSA-6.19, "Residential Carbon Monoxide Alarming Devices," notwithstanding the scope of that standard,

b) UL 2034, "Standard for Single and Multiple Station Carbon Monoxide Alarms," notwithstanding the scope of that standard, or

c) good engineering practice. (See Note A-6.9.3.1.(6).)

7) Except as permitted by Sentence (9), where a fuel-burning *appliance* serves an *assembly occupancy*, *business and personal services occupancy*, or *mercantile occupancy*, a CO alarm shall be,

a) where the fuel-burning *appliance* is part of a system that could circulate or distribute CO to a *suite* of *assembly occupancy*, *business and personal services occupancy* or *mercantile occupancy*, installed

i) on each *storey* of each *suite* that may be exposed, and

ii) in a *suite* containing an *assembly major occupancy*, each classroom and dedicated gathering room or space, and

b) installed in the room or space in which the fuel-burning *appliance* is located. (See Note A-6.9.3.1.(7).)

8) Except as permitted by Sentence (9), for each *suite* of *assembly occupancy*, *business and personal services occupancy*, or *mercantile occupancy* that shares a wall or floor/ceiling assembly with either a *storage garage* or a *service room* containing a fuel-burning *appliance*, or that is adjacent to either an attic or crawl space to which the *storage garage* or a *service room* containing a fuel-burning *appliance* is also adjacent, a CO alarm shall be installed

a) on each *storey* of the adjacent *suite*,

b) where the adjacent *suite* contains an *assembly major occupancy*, each classroom and dedicated room or space, and

c) in each *service room* containing a fuel-burning *appliance*. (See Note A-6.9.3.1.(8).)

9) CO detectors are permitted to be installed in lieu of CO alarms required by this Article provided the CO detectors

a) sound audible signals within the location they serve, as described in Sentences (3) to (5), (7) and (8),

b) are installed in conformance with CAN/ULC-S524, "Installation of Fire Alarm Systems," and

c) form part of the fire alarm system.

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 Section 9.22.

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 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 6.10.1.1. (See Note A-1.1.2.1.(1).)

Table 6.10.1.1.

**Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 6
Forming Part of Sentence 6.10.1.1.(1)**

Provision	Functional Statements and Objectives ⁽¹⁾
6.2.1.1. Good Engineering Practice	
(1)	(a) to (e) [F31,F51-OP1.1]
	(a) to (c),(e) to (i) [F40,F50,F51,F52,F54,F63-OH1.1]
	(a) to (c),(e) to (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,F50-OH1.1]
(3)	[F40,F43,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	
(2)	[F50,F41,F52,F53,F63-OH1.1]
(3)	[F40,F41,F50,F52,F53,F63-OH1.1]
(5)	[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. 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]
6.3.1.5. Indoor Air Contaminants	
(1)	[F44-OS3.4]
	[F44-OH1.1]
(2)	[F44-OH1.1]
(3)	[F52-OH1.1]
6.3.1.6. 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,F82-OH1.1]
(2)	[F40,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)	[F81-OH1.1]
	[F81,F44-OS3.4]
	[F41,F44-OH1.1]
(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)	[F52-OH1.1]
	[F01-OS1.1]
	[F01-OP1.1]
(9)	[F52-OH1.1]
(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)	[F40,F50-OH1.1]
(2)	[F40,F43,F44,F50-OH1.1]
	[F44-OS3.4]
6.3.2.15. Evaporative Heat Rejection Systems	
(1)	[F40,F41,F50-OH1.1]
(2)	[F40,F41,F50-OH1.1]
(3)	[F40,F41,F50-OH1.1]
(4)	[F40,F41,F50-OH1.1]
(5)	[F40,F41-OH1.1]
(6)	[F40,F41-OH1.1]
(7)	[F40,F41-OH1.1]
(8)	[F46-OH2.2]
(9)	[F41,F44-OH1.1]
(10)	[F46,F81-OH2.1]
(11)	[F40,F41,F50,F82-OH1.1]
	[F82-OS3.1]
6.3.2.16. Evaporative Air Coolers, Misters, Atomizers, Air Washers and Humidifiers	
(1)	[F44,F50-OH1.1]
(2)	[F40,F41,F50-OH1.1]
(3)	[F40,F41,F50-OH1.1]
(4)	[F40,F41,F50-OH1.1]
	[F40,F41,F50,F82-OH1.1]
(5)	[F40,F41,F50-OH1.1]
(6)	[F46-OH2.2]
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)	[F01-OS1.1]
	[F01-OP1.1]
	[F02-OP1.2]
	[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 <i>noncombustible</i> materials ..."
	(b) [F02-OP1.2]
	(a) [F02-OP1.2] Applies to portion of By-law text: "... be constructed of <i>noncombustible</i> 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 Table 6.10.1.1.:

⁽¹⁾ See Parts 2 and 3 of Division A.

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.

Legionella Control

HVAC designers should either develop a water management plan or complete a formal risk and hazard assessment to determine what measures are required for the control of legionella. The risk and hazard assessment should include inspections of the building and its surroundings to locate potential sources of legionella and to identify equipment or systems that could promote the growth and spread of legionella. The assessment should also evaluate the risk to building occupants that is associated with any identified equipment or systems, taking into account their design, location and operating conditions.

Further information on minimizing the growth and spread of legionella can be found in the following publications:

- ANSI/ASHRAE 188-2018, “Legionellosis: Risk Management for Building Water Systems,”
- “Developing a Water Management Program to Reduce Legionella Growth and Spread in Buildings” (U.S. Centers for Disease Control and Prevention, 2017),
- “Legionella and Legionnaires' Disease: A Policy Overview” (European Agency for Safety and Health at Work, 2011),
- “Legionella and the Prevention of Legionellosis” (World Health Organization, 2007),
- “Legionnaires' Disease: Technical Guidance: Part 1: The Control of Legionella Bacteria in Evaporative Cooling Systems, and Part 3: The Control of Legionella Bacteria in Other Risk Systems” (U.K. Health and Safety Executive, 2013), and
- “Recognition, Evaluation and Control of Legionella in Building Water Systems” (American Industrial Hygiene Association, 2020).

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.(1) 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. 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.

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 Article 6.2.1.1.

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 Appendix C for the location of the building. Part 4 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 Article 4.1.3.5., Sentence 4.1.3.3.(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.(5) 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 Part 5 pertains to unconditioned and unoccupied crawl spaces, and attic or roof spaces, which are effectively within the building envelope. That is, 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 Part 5 to crawl spaces, or attic or roof spaces. Part 5 makes reference to the need for venting environmental separators, i.e., the dissipation of heat or moisture.

Sentence 6.3.1.2.(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, such as pipes.

A-6.3.1.3.(1) Storage Garages. Car dealership showrooms are not considered as storage garages.

A-6.3.1.3.(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-6.3.1.5. 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 in or be spread by sources like drain pans, spray-water air-washers, contaminated filters, poorly maintained cooling coils, water incursion into ductwork, high humidity and stagnant water, potentially causing a wide range of adverse health effects including respiratory allergic reactions, asthma, and diseases ranging from influenza to legionellosis.

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.
- (c) HVAC systems that generate condensate or introduce liquid water into the airstream in the ducts require adequate drainage of excess water and, in some cases, a means of capturing air-entrained water droplets. These measures reduce the potential for bio-contaminants, including legionella, to proliferate in stagnant water and for water droplets containing bio-contaminants to be introduced into the airstream and contaminate the indoor environment. (See also Article 6.3.2.2.)

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. Rev. 12717 Rev. 12717 Notes to Part 6 – Heating, Ventilation and Air-conditioning Division B: Acceptable Solutions Division B Consolidated changes to January 1, 2022 Vancouver Building By-law 2019 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-6.3.2.2. Stagnant Water in Drain Pans. It is important to eliminate stagnant water as it can promote the proliferation of disease-causing micro-organisms, such as legionella.

Of particular concern is the potential for legionella bacteria in water to become airborne in water droplets or mist that can be inhaled by humans or can contaminate other water sources or systems.

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 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-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 Clause 6.3.2.10.(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. Proper cleaning 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 Article 6.2.1.1.) design guidelines can provide information on the subject. Figure A-6.3.2.10.(12)(b), which originates from ASHRAE handbooks, provides an example of factors that can be used for general applications.

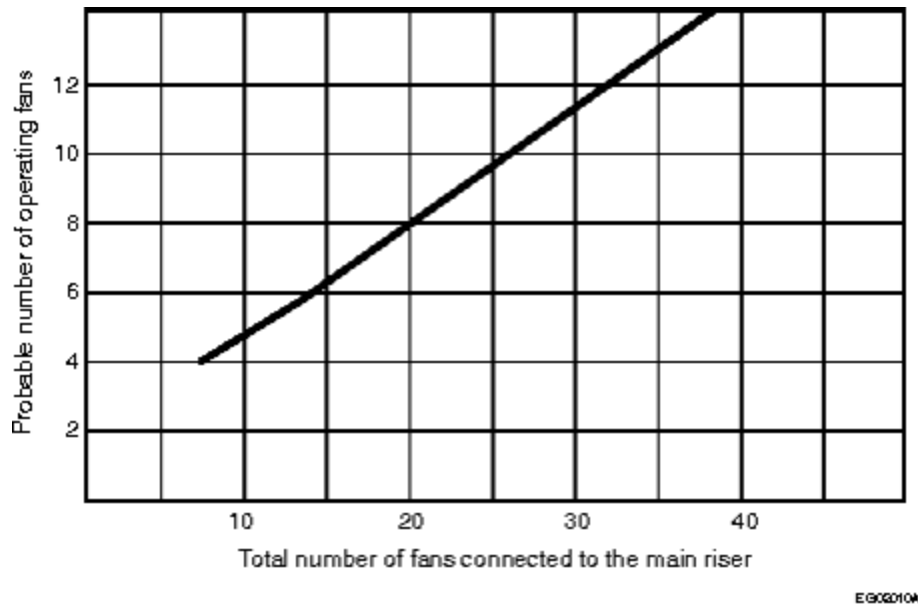


Figure A-6.3.2.10.(12)(b)

Operation diversity factor

A-6.3.2.15.(5) and (6) **Minimum Distances.** Ensuring adequate distance between the air discharge locations of evaporative heat rejection systems and certain outdoor spaces and building components minimizes the potential for contamination of the air of occupiable spaces. For example, if a building's ventilation air intake were located too close to an air discharge location of an evaporative heat rejection system, warm discharge air and associated drift, which could contain biological contaminants, could be introduced to the indoor environment through the air intake.

The minimum distances stated in Sentences 6.3.2.15.(5) and (6) may need to be increased where warranted by local conditions such as prevailing winds, adjacent structures, or special processes being carried out, any of which would make further analysis necessary. (See also Sentence 6.3.3.1.(2).)

A-6.3.2.15.(8) and (9) **Assessment of System and Make-Up Water.** The chemical characteristics of the water in the evaporative heat rejection system and of the make-up water should be assessed to select a suitable water treatment system.

A-6.3.2.16.(2) **Prevention of Water Stagnation.** Common strategies to prevent water stagnation include flushing, providing an inactivity drain, and periodic activation, even with no load.

A-6.3.2.16.(6) **Assessment of Make-Up Water.** The chemical characteristics of the make-up water should be assessed to ensure that any chemicals added to a system referred to in Sentence 6.3.2.16.(1) for precipitation control, disinfection or another purpose will not adversely affect the system.

A-6.3.3.1.(2) **Requirement for Venting.** Sentence 6.3.3.1.(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 Sentence 6.3.3.1.(2) are not meant to override similar requirements found in the installation standards referenced in Article 6.2.1.5. that address identical situations.

A-6.5.1.1.(3) Temperature of Exposed Piping. Piping carrying steam, high-temperature hot water, or another heat transfer fluid at high temperature is usually insulated to reduce heat losses as an economy measure. Above a temperature of approximately 52°C, however, a bare pipe can cause a burn to human skin coming in contact with the pipe. According to ASTM C1055, "Standard Guide for Heated System Surface Conditions that Produce Contact Burn Injuries," skin can be in contact with a surface at a temperature of 52°C for up to 60 s without experiencing irreversible damage. If pipes 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, "Code for Motor Fuel Dispensing Facilities and Repair Garages"

NFPA 32, "Standard for Drycleaning Facilities"

NFPA 33, "Standard for Spray Application Using Flammable or Combustible Materials"

NFPA 34, "Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids"

NFPA 35, "Standard for Manufacture of Organic Coatings"

NFPA 36, "Standard for Solvent Extraction Plants"

NFPA 40, "Standard for the Storage and Handling of Cellulose Nitrate Film"

NFPA 51, "Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes"

NFPA 51A, "Standard for Acetylene Cylinder Charging Plants"

NFPA 55, "Compressed Gases and Cryogenic Fluids Code"

NFPA 61, "Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities"

NFPA 68, "Standard on Explosion Protection by Deflagration Venting"

NFPA 69, "Standard on Explosion Prevention Systems"

NFPA 85, "Boiler and Combustion Systems Hazards Code"

NFPA 86, "Standard for Ovens and Furnaces"

NFPA 88A, "Standard for Parking Structures"

NFPA 91, "Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids"

NFPA 96, "Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations"

NFPA 204, "Standard for Smoke and Heat Venting"

NFPA 303, "Fire Protection Standard for Marinas and Boatyards"

NFPA 307, "Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves"

NFPA 409, "Standard on Aircraft Hangars"

NFPA 415, "Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways"

NFPA 484, "Standard for Combustible Metals"

NFPA 654, "Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids"

NFPA 655, "Standard for Prevention of Sulfur Fires and Explosions"

NFPA 664, "Standard for the 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 installed as recommended by the manufacturer.

A-6.9.3.1.(6) Carbon Monoxide Devices. Although the scope of CAN/CSA-6.19, "Residential Carbon Monoxide Alarming Devices," and UL 2034, "Standard for Single and Multiple Station Carbon Monoxide Alarms," is limited to carbon monoxide alarms for residential applications, their use may be appropriate in some other locations where they are not subject to excessive contaminants or risk of damage, such as in classrooms and meeting spaces. The designer is also given the option to follow good engineering practice. For example, some carbon monoxide devices used in storage garages may be suitable for use in other applications.

A-6.9.3.1.(7) Spaces Served by a Fuel-Burning Appliance. Where a fuel-burning appliance such as a furnace circulates or distributes air to a space there is the potential for leakage of combustion products into the duct system which could then circulate combustion products including carbon monoxide (CO) to that space, so a CO alarm is required to protect occupants of that space. Fuel-burning appliances such as a boiler do not have the same potential of the system circulating or distributing CO to the spaces served via the piping system. In both examples of a fuel-burning furnace and a fuel-burning boiler, a CO alarm is required in the service room containing the appliances.

A-6.9.3.1.(8) Adjacent Suites. Suites that share a common attic or crawl space with a storage garage or service room, as well as suites that share a common wall or floor/ceiling assembly with a storage garage or service room are considered adjacent for the application of Sentence (8).

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 the Vancouver Building By-law Book II (Plumbing Systems), that being the National Plumbing Code of Canada as amended by Subsection 7.1.5.
- 2) References to the following documents in the Vancouver Building By-law Book II (Plumbing Systems) shall be replaced as follows:
 - a) references to the National Building Code of Canada and the National Energy Code of Canada for Buildings shall be replaced with the Vancouver Building By-law, and
 - b) references to the National Fire Code of Canada shall be replaced with the Vancouver Fire By-law.
- 3) Compliance with the Vancouver Building By-law Book II (Plumbing Systems) may be achieved using alternative solutions as described in Clause 1.2.1.1.(1)(b) of Division A of this By-law, using the objectives and functional statements attributed to the applicable acceptable solutions in Division B of the Vancouver Building By-law Book II (Plumbing Systems).

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.

7.1.5. Unique to Vancouver Requirements

7.1.5.1. Division A

1) The provisions of Part 1 of Division A of the 2020 National Plumbing Code shall be amended by

a) striking out Subsection 1.2.1. and substituting:

“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) and Sentence 3.3.1.3.(1) of Division C, 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 Vancouver Building By-law.

1.2.1.2. Responsibility of Owner

(Refer to Book I (General) of this By-law.) ”,

b) adding a new Subsection 1.2.3.:

“1.2.3. Installation of Plumbing Systems

(Refer to Book I (General) of this By-law.) ”,

c) striking out Article 1.3.4.1. and substituting:

“1.3.4.1. Application of Parts 1, 2 and 3

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.) ”,

d) in Sentence 1.4.1.2.(1),

i) striking out the defined term for “*Building**” and substituting:

“*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.”, and

ii) adding the following defined terms in alphabetical order:

“*Acceptable** means acceptable to the *Chief Building Official*. ”,

“*Accredited laboratory* means a laboratory approved by the BC Provincial Health Officer for drinking water microbiology testing. ”,

“*Alert* means a bell, horn, speaker, light or text display that provides audible, tactile or visible outputs, or any combination thereof. ”,

“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 8 principal *dwelling units*, and excludes the use of rain barrels of up to a cumulative capacity of 500 L. ”,

“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. ”,

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

“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. ”,

“Cooling tower means a direct (open circuit) cooling tower, indirect (closed circuit) cooling tower, evaporative condenser, adiabatic cooler which recirculates non-evaporated water, or fluid cooler that is part of a recirculated *water system* incorporated into a *building’s* cooling, industrial process, refrigeration, or energy production system, and may comprise one or more cooling tower cells. (See Note A-1.4.1.2.(1).) ”,

“Decorative water feature means a human-made fountain, waterfall, cascade, spray or the like that uses water for architectural, decorative or aesthetic effects, is not intended for human contact, and is located indoors or outdoors, but excludes a fish pond, natural body of water, natural waterfall, a feature in or associated with a *building* used exclusively for *residential occupancy* containing no more than 8 principal *dwelling units*, or a regulated activity under the BC Pool Regulation. (See Note A-1.4.1.2.(1).) ”,

“E. coli means *Escherichia coli*. ”,

“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. ”,

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

“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. ”,

“Greywater means waste water from all sources except *blackwater* and *clear-water waste*. ”,

“Groundwater* means a free standing body of water in the ground. ”,

“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*. ”,

“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*. ”,

“**Press-connect** means a permanent mechanical joint incorporating an elastomeric seal or an elastomeric seal and corrosion resistant grip ring, with the joint made with a pressing tool and jaw or ring that complies with the manufacturer’s installation instructions. ”,

“**Public low pressure sewer system** means a public sewer in which gravity is insufficient to convey waste water and organic refuse, and pumps on private property are used to provide such force. ”,

“**Rainwater** means rainfall and other natural precipitation, and includes *storm water*. ”,

“**Residential occupancy*** (Group C) 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. ”,

“**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. ”,

“**Vegetated roof assembly*** (“green roof”) means a vegetated roof system (a functional arrangement of interacting components, inclusive of vegetation) that is combined with a roof assembly, is intended to both grow and flourish, and may be installed on a roof to control the rate of rainwater discharged through a *storm drainage system*. (See Book I, Division A, Note A-1.4.1.1.) ”, and

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

e) in Sentence 1.4.2.1.(1), adding the following abbreviations in alphabetical order:

“CFU colony forming unit(s)”,

“IDF Intensity-Duration-Frequency”,

“MPN most probable number”, and

“NTU.....nephelometric turbidity unit(s)”, and

f) in Note A-1.4.1.2.(1), adding the following in alphabetical order:

“**Cooling Tower**

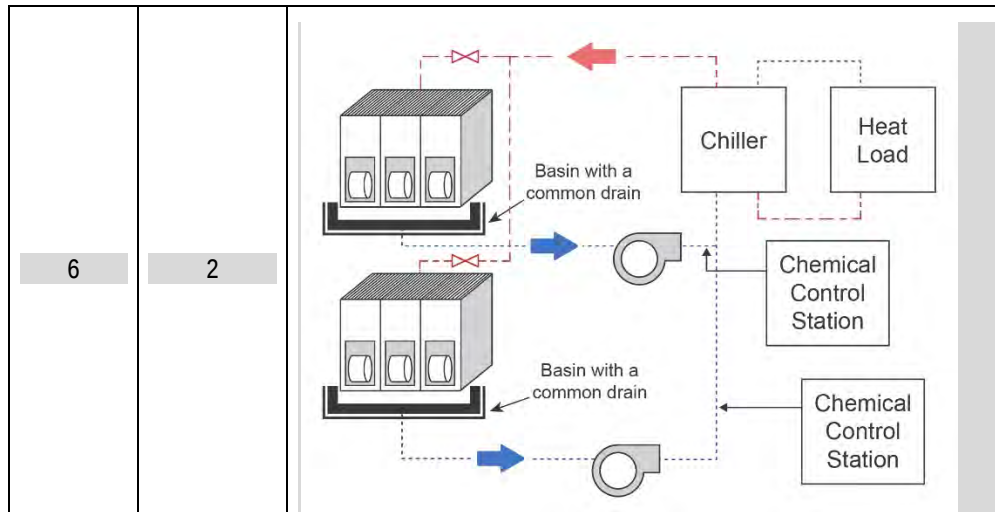
From a Legionnaires’ disease prevention perspective, the fluid flow of interest is the water sprayed, evaporated, collected and recirculated within a *cooling tower* (the so-called “external circuit”). It is this water that requires appropriate treatment to keep *Legionella pneumophila* levels controlled.

For a *cooling tower* with multiple cells, if all of the cells share the same basin and the same recirculated water, the whole unit can be considered one *cooling tower*. See sample mechanical configurations in Table A-1.4.1.2.(1). However, as a cautionary note for large systems, even with the same water flowing to all parts, it has been found by New York City’s Department of Health and Mental Hygiene that different locations within the same *cooling tower* can test positive and others can test negative for *Legionella pneumophila*.

For buildings with multiple cooling tower structures, in certain, rare configurations, and at the sole discretion of the *Chief Building Official*, it may be determined that the multiple cooling tower structures can be considered as one *cooling tower* for the purpose of this defined term. To be considered as one *cooling tower*, the recirculating water loops of the multiple cooling tower structures must share the same recirculated water and treatment and the recirculating loops must always operate together. The *Chief Building Official* must be satisfied with the equipment owner's reasoning and supporting evidence that there is a reasonable basis to presume that the water quality should be identical at all times across the multiple cooling tower structures. This assessment would consider the location, size, condition and mechanical configuration of the cooling towers, including valves and pipes; differences in exposure to sunshine, heat sources, neighbouring buildings, potential pollution sources, and mechanical equipment, such as exhaust fans; the control system and operational philosophy for the cooling towers; water quality data and compliance history; and maintenance records.

Table A-1.4.1.2.(1)
Examples of Cooling Tower Configurations and Operating Permit Requirements
Forming Part of Note A-1.4.1.2.(1)

Number of Cells	Number of Operating Permits	Mechanical and Plumbing Configuration
1	1	
3	1	



Decorative Water Feature

A living or green wall is not considered a *decorative water feature*, but should be reviewed to identify hazards and to establish procedures to reduce risks. To preclude the growth of *Legionella*, consideration should be given to including non-chemical water treatment (such as UV), maintaining water temperature below 20°C, and removing organic matter from the water. Water flow should be behind the plant material and airflow should be directed toward the living wall to minimize aerosolization into the occupied space. ”.

7.1.5.2. Division B

1) The provisions of Part 1 of Division B of the 2020 National Plumbing Code shall be amended by

a) in Sentence 1.3.1.2.(1), striking out “editions” and substituting “editions or versions”,

b) in Table 1.3.1.2., inserting the following rows in alphanumerical order:

“

ANSI/ASHRAE	188-2018	Legionellosis: Risk Management for Building Water Systems	2.2.10.6.(8)

”

,

“

ASHRAE	Guideline 12-2023	Managing the Risk of Legionellosis Associated with Building Water Systems	A-2.2.11.6.

”

,

“

ASME/CSA	A112.4.4-2022/CSA B481.5:22	Grease Removal Devices	2.2.3.2.(3)

”

,

“

ASME/CSA	A112.14.3-2022/CSA B481.1:22	Hydromechanical Grease Interceptors	2.2.3.2.(3)

”

,

"			
ASME/CSA	A112.6.9-2022/CSA B79.9:22	Siphonic Roof Drains	2.3.6.1.(6) 2.4.10.14.(1)
",			
"			
ASME	B16.51-2021	Copper and Copper Alloy Press-Connect Pressure Fittings	2.2.7.9.(1)
",			
"			
ASPE/ANSI	ASPE/ANSI 45-2018	Siphonic Roof Drainage	2.4.10.14.(1)
",			
"			
ASTM	A778/A778M-24	Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products	2.2.6.14.(1)
",			
"			
ASTM	D8429-21	Standard Test Method for <i>Legionella pneumophila</i> in Water Samples Using Legiolert	2.2.1.7.(2)
",			
"			
ASTM	F3226/F3226M-19	Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems	2.2.6.17.(1) 2.2.7.9.(1)
",			
"			
BC		Engineers and Geoscientists Act	2.7.6.1.(1)
BC		Heritage Conservation Act	A-2.4.2.5.(9)
BC	B.C. Reg. 133/2022	Contaminated Sites Regulation	A-2.4.2.5.(9)
BC	B.C. Reg. 296/2010	Pool Regulation	1.4.1.2.(1) of Division A
",			
"			
CoV		Engineering Design Manual ⁽⁴⁾	2.4.2.5.(6)
CoV		Sewer and Watercourse By-law ⁽⁴⁾	2.4.4.2.(1)
CoV		Standards of Maintenance By-law ⁽⁴⁾	A-2.4.2.4.(2)
CoV		Street and Traffic By-law ⁽⁴⁾	A-2.4.2.4.(2)
CoV		Zoning and Development By-law ⁽⁴⁾	2.4.2.5.(1) 2.4.2.5.(2) A-2.4.2.5.(1)
",			

“			
CSA	CAN/CSA-Z317.13-17	Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities	A-2.2.11.6.(9)
”			
“			
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⁾	2.6.3.1.(2) 2.6.3.2.(5) 2.6.3.4.(6) 2.7.6.2.(2)
IAPMO	ANSI/CAN/IAPMO Z1001-2021	Prefabricated Gravity Grease Interceptors	2.2.3.2.(3)
IAPMO	IAPMO/ANSI/CAN Z1117-2022	Standard for Press Connections	2.2.6.17.(1) 2.2.7.9.(1)
ISO	11731:2017	Water Quality — Enumeration of <i>Legionella</i>	2.2.1.7.(2)
ISO/IEC	17025:2017	General Requirements for the Competence of Testing and Calibration Laboratories	2.2.1.7.(2)
”			

“			
NSF	NSF/ANSI 14-2017	Plastics Piping System Components and Related Materials	2.7.2.1.(2)
NSF	NSF/ANSI 55-2022	Ultraviolet Microbiological Water Treatment Systems	2.2.11.3.(3)
NSF	NSF/ANSI 61-2023	Drinking Water System Components – Health Effects	2.2.6.10.(1) 2.2.6.11.(1) 2.2.6.12.(1) 2.2.6.13.(1) 2.2.6.14.(1) 2.2.6.16.(1) 2.2.6.17.(1)
NSF	NSF/ANSI 350-2023	Onsite Residential and Commercial Water Reuse Treatment Systems	2.7.1.2.(3)

”, and

“			
PSPC	MD 15161-2013	Control of <i>Legionella</i> in Mechanical Systems	A-2.2.11.6.(8) A-2.2.11.6.(9)

” ,

c) in Table 1.3.1.2., deleting the rows associated with

- i) ARCSA/ASPE/ANSI 63-2013,
- ii) CCBFC NRCC-CONST-56438E,
- iii) CSA CAN/CSA-B126.0-13,
- iv) CSA CAN/CSA-B126.1-13,
- v) CSA/ICC CSA B805-18/ICC 805-2018, and
- vi) NSF NSF Pro 151-8-1-95,

d) in Table 1.3.1.2., striking out the “Issuing Agency”, “Document Number” and “Title of Document” associated with the following rows:

- i) “CCBFC NRCC-CONST-56435E National Building Code of Canada 2020”, and substituting

“

CoV		Book I (General) of the By-law

”, and

- ii) “CCBFC NCC-CONST-56437E National Fire Code of Canada 2020”, and substituting

“

CoV		Fire By-law ⁽⁴⁾

” ,

e) in Table 1.3.1.2., striking out the “By-law Reference” associated with:

- i) “CSA CAN/CSA-B128.1-06 Design and Installation of Non-Potable Water System”, and substituting

“

2.7.2.1.(1)
2.7.4.1.(7)
2.7.5.2.(1)(c)
2.7.8.2.(2)

”, and

ii) “CSA CAN/CSA-B483.1-07 Drinking Water Treatment Systems”, and substituting “2.2.10.17.(4)”,

f) in Table 1.3.1.2., adding to the “Notes to Table 1.3.1.2.” the following in numerical order:

“(4) The current version in effect.”, and

g) in Sentence 1.3.2.1.(1), inserting the following in alphabetical order:

“BC Province of British Columbia (gov.bc.ca)”,

“CoV City of Vancouver (www.vancouver.ca)”,

“EPA United States Environmental Protection Agency (www.epa.gov)”,

“IEC International Electrotechnical Commission (www.iec.ch)”,

“ISO International Organization for Standardization (www.iso.org)”, and

“PSPC Public Services and Procurement Canada (www.tpsgc-pwgsc.gc.ca)”.

2) The provisions of Part 2 of Division B of the 2020 National Plumbing Code shall be amended by

a) in Section 2.2., adding a new Article 2.2.1.7., Article 2.2.1.8., and Article 2.2.1.9:

“2.2.1.7. Microbiological Testing

1) *E. coli* testing shall be conducted by an *accredited laboratory*.

2) *Legionella pneumophila* testing shall be conducted by a laboratory

a) accredited to ISO/IEC 17025, “General requirements for the competence of testing and calibration laboratories,” or equivalent,

b) using a method in accordance with Table 2.2.1.7. to identify all serogroups of *Legionella pneumophila*, and

c) enrolled in a bi-annual external proficiency testing program for recognised approval for identifying *Legionella* in environmental water samples.

Table 2.2.1.7.
Acceptable Laboratory Methods to Test for *Legionella pneumophila*
Forming Part of Sentence 2.2.1.7.(2)

Legionella pneumophila Testing Requirement	Acceptable Laboratory Method to Test for Legionella pneumophila	
	ISO 11731, “Water Quality — Enumeration of Legionella,” or equivalent	ASTM D8429, “Standard Test Method for Legionella pneumophila in Water Samples Using Legiolert”
Cooling towers		

System start-up Clause 2.2.11.6.(7)(c)	Yes, acceptable for all <i>Legionella pneumophila</i> testing requirements	No
Regular testing Clause 2.2.11.6.(7)(d)		Yes
Re-testing after an exceedance Sentence 2.2.11.6.(8)		No
<i>Decorative water features</i>		
System start-up & annual testing Clauses 2.2.11.7.(7)(c) and (d)		No
Re-testing after an exceedance Sentence 2.2.11.7.(8)		No
<i>Alternate water source systems</i>		
Commissioning Article 2.7.5.2.		No
Regular testing Article 2.7.7.1.		Yes
Re-testing after an exceedance Sentence 2.7.4.1.(5) Sentence 2.7.7.3.(1)		No

3) The owner of a *cooling tower* or *decorative water feature* shall ensure that the laboratory conducting *Legionella pneumophila* testing for the *cooling tower* or *decorative water feature* has agreed to give immediate notice to the owner, the *Chief Building Official*, and the local medical health officer if the result exceeds a standard set out in Table 2.2.11.6. or 2.2.11.7. that requires such notice to be given.

2.2.1.8. Maintenance Logs

- 1) When a maintenance log is required by Book II (Plumbing Systems) of this By-law, it shall include
 - a) the address and location of the equipment, device, apparatus, or system,
 - b) the *operating permit* number assigned to the equipment, device, apparatus, or system,
 - c) emergency contact information and the name and contact information of the owner of the equipment, device, apparatus, or system,
 - d) the location of any safety data sheets,
 - e) the location of the operating manual for the equipment, device, apparatus, or system and, as applicable, the location of the water management plan,
 - f) except when included with the operating manual, a single line schematic plan of the equipment, device, apparatus, or system, reflective of the current configuration, and including water sampling locations,
 - g) details of any changes or alterations made to the equipment, device, apparatus, or system at any time,
 - h) a record of inspections and any maintenance performed within the last 24 months,
 - i) a record of operational disruptions within the last 24 months and the corrective actions taken,
 - j) if water treatment chemicals are used, a record of the chemical treatments applied and dosages within the last 24 months,
 - k) a record of all water quality results from analyses performed within the last 24 months, and
 - l) if *Legionella pneumophila* tests are conducted, the name of the person and company collecting the sample and the name of the company conducting the laboratory test.

2) A maintenance log described in Sentence (1) shall be

- a) kept on site with the corresponding equipment, device, apparatus, or system,
- b) maintained in an electronic or paper-based format, and
- c) made available on such request to the *Chief Building Official*.

2.2.1.9. Operating Manuals

1) When an operating manual is required by Book II (Plumbing Systems) of this By-law, it shall include

- a) the address and location of the system or equipment for which the operating manual is required,
- b) contact details for the system or equipment designer,
- c) a simplified process flow diagram,
- d) a schematic of the system or equipment showing the locations of all substantial components,
- e) instructions on operating, maintaining, and inspecting the system or equipment,
- f) required frequency of maintenance and inspections,
- g) instructions on deactivating and restarting the system or equipment for repair or other purposes,
- h) safety data sheets, and

i) for *alternate water source systems*, 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.

2) The operating manual described in Sentence (1) shall be

- a) supplied to the owner or representative of the *owner*, and
- b) made available on such request to the *Chief Building Official*.”

b) in Article 2.2.3.1., adding a new Sentence (6):

“6) A *bottle trap* may be used on a laboratory sink or other *fixture* equipped with corrosion resistant fittings.”

c) in Article 2.2.3.2., striking out Sentence (3), and substituting:

“3) Grease interceptors shall be selected and installed in conformance with

- a) CSA B481.0, “Material, Design, and Construction Requirements for Grease Interceptors” and CSA B481.3, “Sizing, Selection, Location, and Installation of Grease Interceptors,”
- b) ASME A112.14.3/CSA B481.1, “Hydromechanical Grease Interceptors,”
- c) ASME A112.14.4/CSA B481.5, “Grease Removal Devices,” or
- d) ANSI/CAN/IAPMO Z1001, “Prefabricated Gravity Grease Interceptors.”

(See Note A-2.2.3.2.(3).)”,

d) in Section 2.2., striking out Articles 2.2.6.10. to 2.2.6.14., inclusive, and substituting:

“2.2.6.10. 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 Austenitic 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.

2.2.6.11. 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 A403/A403M, "Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings", and
- c) NSF/ANSI 61, "Drinking Water System Components – Health Effects."

2) Stainless steel butt weld pipe fittings shall be made of a material that matches the grade of the pipe material used.

2.2.6.12. 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 61, "Drinking Water System Components – Health Effects," and
- c) ASTM A182/A182M, "Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service," or ANSI/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.

2.2.6.13. Stainless Steel Threaded Fittings

1) Stainless steel threaded fittings shall be schedule 40s or greater conforming to NSF/ANSI 61, "Drinking Water System Components – Health Effects," and

- a) ASTM A182/A182M, "Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service," or
- b) ASTM A351/A351M, "Standard Specification for 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.

2.2.6.14. Stainless Steel Tube

1) Stainless steel tube shall conform to

- a) ASME B16.9, "Factory-Made Wrought Buttwelding Fittings,"
- b) ASTM A269/A269M, "Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service" or ASTM A778/A778M, "Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products", and
- c) NSF/ANSI 61, "Drinking Water System Components – Health Effects."

2) Only grade 304/304L or 316/316L stainless steel tube shall be used."

e) in Section 2.2., adding a new Article 2.2.6.16. and Article 2.2.6.17.:

“2.2.6.16. Welded Stainless Steel

- 1) Welded stainless steel piping assemblies shall conform to NSF/ANSI 61, “Drinking Water System Components – Health Effects.”
- 2) Welding of stainless steel pipe for *plumbing systems* shall use a gas tungsten arc welding process or a gas metal arc welding process.

2.2.6.17. Stainless Steel Press-Connect Fittings

- 1) Stainless steel *press-connect* fittings shall conform to
 - a) ASTM F3226/F3226M “Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems” or IAPMO/ANSI/CAN Z1117 “Standard for Press Connections” and
 - b) NSF/ANSI 61, “Drinking Water System Components – Health Effects.””

f) in Section 2.2., adding a new Article 2.2.7.9.:

“2.2.7.9. Press-Connect Water Fittings

- 1) Except as required by Sentence 2.2.6.17.(1), *press-connect* fittings for *water distribution systems* shall conform to
 - a) ASME B16.51 “Copper and Copper Alloy Press-Connect Pressure Fittings,”
 - b) ASTM F3226/F3226M “Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems,” or
 - c) IAPMO/ANSI/CAN Z1117 “Standard for Press Connections.””

g) in Article 2.2.10.6.:

i) striking out Sentence (2) and substituting:

“2) Except as provided in Sentence (8), 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
Lavatory supply fittings	
private	5.7
public	1.9
Kitchen supply fittings (except for pre-rinse spray valves)	
non-residential	8.3
residential	6.8 ⁽¹⁾
Pre-rinse spray valves ⁽²⁾	4.8
Shower heads ⁽³⁾	7.6

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 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. Each pre-rinse spray valve shall be equipped with an automatic shut-off.

(3) A 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.”

ii) striking out Sentence (5) and substituting:

“5) Except as provided in Sentence (8), each lavatory in a public washroom 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).)”, and

iii) adding a new Sentence (8):

“8) The requirements of Sentences (2) and (5) do not apply to

- a) any part of a *building* classified as Group B *occupancy* by Part 3 of Division B of Book I (General) of this By-law,
- b) first aid rooms,
- c) emergency eye washes or emergency showers, or
- d) a *plumbing fixture* specifically identified in a *building's* water management plan that both conforms to ANSI/ASHRAE 188, “Legionellosis: Risk Management for Building Water Systems” and is signed by a registered professional.”

h) striking out Article 2.2.10.17. and substituting:

“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 point-of-entry 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, and the owner of the point-of-entry water treatment device or apparatus shall comply with the requirements of this Sentence,
- b) the *operating permit* number assigned to a point-of-entry water treatment device or apparatus shall be posted on a sign or plate that is a minimum of 8.5 in by 11 in in size and securely fastened to the point-of-entry water treatment device or apparatus 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*, and
- d) a maintenance log conforming to Article 2.2.1.8. shall be maintained for each point-of-entry water treatment device or apparatus.

2) Except as provided in Sentence (3), an existing point-of-entry water treatment device or apparatus shall comply with Clauses (1)(a), (b), (c) and (d).

3) The requirements in Sentences (1) and (2) do not apply to a *building* used exclusively for *residential occupancy* containing no more than 8 principal *dwelling units*.

4) Point-of-use devices, including their disposable parts, used in *potable* water treatment systems shall conform to CAN/CSA-B483.1, “Drinking Water Treatment Systems.””

i) adding a new Subsection 2.2.11.:

“2.2.11. Building Appliances and Mechanical Systems

2.2.11.1. Building Appliances

1) Except when a clothes washer is supplied by an *alternate water source system*, 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 ⁽²⁾	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) Except when a clothes washer is supplied by an *alternate water source system*, 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. Reserved

2.2.11.3. Vehicle Wash Facilities

1) Except when a vehicle wash facility is supplied by an *alternate water source system*, 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) except when a vehicle wash facility is supplied by an *alternate water source system*, 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.)

3) Where a vehicle wash facility is supplied by an *alternate water source system*, disinfection of the non-*potable* water shall be provided at the vehicle wash facility at point-of-use by ultraviolet light and conform to NSF/ANSI 55, "Ultraviolet Microbiological Water Treatment Systems," Class A.

2.2.11.4. Non-recirculating Applications

1) Except as provided in Sentence (3), the *City* water system shall not be connected to

- a) *once through cooling equipment*,
- b) a venturi-type flow-through vacuum generator or aspirator in which running water is used solely for the venturi effect,
- c) 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,
- d) a non-recirculating wet-hood scrubber,
- e) machinery powered by water,
- f) a non-recirculating water feature, ornamental fountain, or swimming pool,
- g) a non-recirculating system or equipment that uses water for thermal conditioning of building surfaces or roofs, except that this does not apply to emergency fire protection of buildings, or
- h) a non-recirculating system or equipment that uses water for melting or thawing.

(See also Sentence 2.4.4.2.(2).)

2) Except as provided in Sentences (3) and (4), all equipment, machinery, appliances or fixtures listed in Clauses (1)(a) through (d) that are connected to the *City's* water system shall be disconnected.

3) *Emergency once through cooling equipment* or *maintenance once through cooling equipment* may be connected to the *City* water system or may retain an existing connection to the *City's* water system at the discretion of the *Chief Building Official* and, if permitted

- a) an *operating permit* shall be obtained, and the owner of the *once through cooling equipment* shall comply with the requirements of this Sentence,
- b) the *operating permit* number assigned to the *once through cooling equipment* shall be posted on a sign or plate that is a minimum of 8.5 in by 11 in in size and 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.(3).)

4) Where, in the opinion of the *Chief Building Official* in consultation with the *City Engineer*, the cost of disconnecting *once through cooling equipment* from the *City's* water system and replacing it with other cooling equipment is unreasonable, taking into account any relevant factors, which may include the following

- a) the current water flow rate compared to the expected reduction in water consumption if the equipment is disconnected,
- b) where the equipment is in its life cycle,
- c) the potential impact the disconnection and replacement of the equipment, including any required renovations, will have on business operations,
- d) the cost to replace the equipment relative to the expected reduction in water and sewer costs, and

e) where applicable, the cost to replace the equipment relative to the operational size, the *once through cooling equipment* may retain an existing connection to the *City's* water system at the discretion of the *Chief Building Official* until a specified expiry date and, if permitted, Clauses 2.2.11.4.(3)(a) through (c) shall apply.

2.2.11.5. Geexchange Systems

- 1) Make-up water for a closed loop geexchange (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 geexchange (geothermal) ground heat exchanger is prohibited.
- 3) Methanol shall not be used for geexchange (geothermal) applications.
- 4) An open loop geexchange (geothermal) system serving a *building* used exclusively for residential occupancy containing no more than 8 principal *dwelling units* shall not be installed.
- 5) An open loop geexchange (geothermal) system shall not discharge into the sewer.

2.2.11.6. Cooling Towers

(See Note A-2.2.11.6.)

- 1) An *operating permit* shall be obtained for the installation of a *cooling tower*, or the retention of an existing *cooling tower*, and the owner of the *cooling tower* shall comply with the requirements of this Article.
- 2) In order to obtain an *operating permit* for the installation of a *cooling tower*, a service contract must be in place with a qualified service provider to perform maintenance of the *cooling tower* for a minimum of 1 year.
- 3) The *operating permit* number assigned to the *cooling tower* shall be posted on a sign or plate that is a minimum of 8.5 in by 11 in in size and securely fastened to the cooling tower in a location that is conspicuously visible and constructed of a durable, weather resistant material.
- 4) The owner of a *cooling tower*, or their authorized representative, shall notify the *Chief Building Official*, in the form prescribed by the *Chief Building Official*,
 - a) within 5 days of any start-up or shut down of a *cooling tower*,
 - b) within 5 days of any *Legionella pneumophila* test result from a *cooling tower*, or sooner as required by Sentence (8), and
 - c) within 30 days of any changes to the information that was last provided to the *City* with regard to the *operating permit*.
- 5) A maintenance log conforming to Article 2.2.1.8. shall be maintained for each *cooling tower* and, if a laboratory result fails to meet a standard defined in Table 2.2.11.6., the maintenance log shall also include 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.
- 6) Reserved.
- 7) *Legionella pneumophila* testing shall be conducted
 - a) in accordance with Article 2.2.1.7.,
 - b) on water samples collected at a point in the recirculation loop just prior to the point where treatment chemicals are injected, or where this is not feasible, from a location representative of water in the system,
 - c) no less than 48 hours and no more than 5 days after completion of system start-up and disinfection,
 - d) at minimum, while the *cooling tower* is in operation, each calendar month of operation, with not more than 33 days between samples, and
 - e) as required by Sentence (8).

8) If a laboratory test shows that a *Legionella* result exceeds a standard set out in Table 2.2.11.6., the owner of a *cooling tower*, or their authorized representative, shall undertake the response set out in Table 2.2.11.6. (See Note A-2.2.11.6.(8).)

Table 2.2.11.6.
Required Response to Failure to Meet *Legionella* Standards for *Cooling Towers*
Forming Part of Sentence 2.2.11.6.(8)

Test Type	Test Result	Required Response
<i>Legionella pneumophila</i> ⁽¹⁾	10 or more CFU per mL and less than or equal to 1,000 CFU per mL or 10 or more MPN per mL and less than or equal to 1,000 MPN per mL	1. Within 24 hours, give notice to the <i>Chief Building Official</i> and a) shut down the <i>cooling tower</i> system and perform offline cleaning and disinfection, or b) perform online remedial treatment ⁽²⁾ and within 7 days shut down the <i>cooling tower</i> system and perform offline cleaning and disinfection; and 2. No less than 48 hours and no more than 5 days after cleaning and disinfection, perform a <i>Legionella pneumophila</i> test ⁽¹⁾ .
	Greater than 1,000 CFU per mL or Greater than 1,000 MPN per mL	1. Immediately, give notice ⁽⁴⁾ to the <i>Chief Building Official</i> , the medical health officer and the owner; 2. Immediately, the laboratory ⁽³⁾ shall also give notice ⁽⁴⁾ to the owner of the <i>cooling tower</i> , the <i>Chief Building Official</i> and the medical health officer; 3. Immediately, implement measures that will eliminate water dispersion by aerosol from the affected <i>cooling tower</i> system and then perform offline cleaning and disinfection of the system before putting the system back into service; and 4. No less than 48 hours and no more than 5 days after cleaning and disinfection, perform a <i>Legionella pneumophila</i> test ⁽¹⁾ .

Notes to Table 2.2.11.6.:

⁽¹⁾ The *Legionella pneumophila* test shall conform to the requirements of Article 2.2.1.7.

⁽²⁾ Online remedial treatment is also known as "running disinfection."

⁽³⁾ See Sentence 2.2.1.7.(3).

⁽⁴⁾ For the person giving the immediate notice to the *Chief Building Official*, the owner, and the owner of the equipment, the person shall take all reasonable steps to give notice by speaking directly to or by telephone with each person required to be notified, a person designated for this purpose by the person required to be notified, or a person answering the telephone number designated for this purpose by the person required to be notified, and follow with notice in writing to each person within 24 hours. For the person giving immediate notice to the medical health officer, the person shall provide notice in writing immediately.

9) Offline cleaning and disinfection of a *cooling tower* shall be carried out

- a) a minimum of once every calendar year,
- b) for any start-up at any time, and
- c) as required by Sentence (8). (See Note A-2.2.11.6.(9).)

10) When a *cooling tower* has been shut down for more than 3 days, it shall be drained within 5 days of being shut down, or when this is not practical during shut downs of short duration, stagnant water shall be pre-treated with an appropriate biocide regimen before start-up, allowing for proper contact time according to the supplier's recommendations.

11) If a *cooling tower* is removed or its use is permanently discontinued, it shall be safely drained, thoroughly sanitized, and the make-up water line shall be disconnected and capped.

2.2.11.7. Decorative Water Features

- 1) An *operating permit* shall be obtained for the installation of a *decorative water feature*, or the retention of an existing *decorative water feature*, and the owner of the *decorative water feature* shall comply with the requirements of this Article.
- 2) The following shall be posted in a location that is conspicuously visible:
 - a) the *operating permit* number assigned to the *decorative water feature*, on a sign or plate that is a minimum of 8.5 in by 11 in in size, constructed of a durable, weather resistant material and securely fastened to the *decorative water feature* or its associated mechanical equipment, and,
 - b) an advisory that the *decorative water feature* is not intended for human access, located around the perimeter of, or near an obvious access point to, the *decorative water feature*, using graphical symbols or words written in letters at least 100 mm high. (See Note A-2.2.11.7.(2)(b).)
- 3) The owner of a *decorative water feature*, or their authorized representative, shall notify the *Chief Building Official*, in the form prescribed by the *Chief Building Official*,
 - a) within 5 days of any start-up of a *decorative water feature* that had been shut down for 3 or more consecutive days,
 - b) within 5 days of any *decorative water feature* shut down for 3 or more consecutive days,
 - c) within 5 days of any *Legionella pneumophila* test result from a *decorative water feature*, or sooner as required by Sentence (8), and
 - d) within 30 days of any changes to the information that was last provided to the *City* with regard to the *operating permit*.
- 4) Where an outdoor *decorative water feature* is provided as an auxiliary system to a *building*, then the outdoor *decorative water feature* shall be considered part of the *building* for the purposes of this Article.
- 5) A maintenance log conforming to Article 2.2.1.8. shall be maintained for each *decorative water feature* and, if a laboratory result fails to meet a standard defined in Table 2.2.11.7., the maintenance log shall also include 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.
- 6) Reserved.
- 7) *Legionella pneumophila* testing shall be conducted
 - a) in accordance with Article 2.2.1.7.,
 - b) on water samples collected at a point representative of water that is aerosolized, or where this is not feasible or aerosolization is not obvious, from a location
 - i) prior to the point where treatment chemicals are injected in a recirculating system, or
 - ii) representative of water in the system in a non-recirculating system,
 - c) no less than 48 hours and no more than 5 days after completion of start-up and disinfection,
 - d) at minimum, once each calendar year before July 1, unless the *decorative water feature* is shut down and drained for the entirety of the period of January 1 to July 1 of that calendar year,
 - e) as required by Sentence (8).
- 8) If a laboratory test shows that a *Legionella* result exceeds a standard set out in Table 2.2.11.7., the owner of a *decorative water feature*, or their authorized representative, shall undertake the response set out in Table 2.2.11.7.

Table 2.2.11.7.
Required Response to Failure to Meet *Legionella* Standards for *Decorative Water Features*
Forming Part of Sentence 2.2.11.7.(8)

Test Type	Test Result	Required Response
<i>Legionella pneumophila</i> ⁽¹⁾	10 or more CFU per mL and less than or equal to 1,000 CFU per mL	1. Within 24 hours, give notice to the <i>Chief Building Official</i> , shut down the <i>decorative water feature</i> and perform offline cleaning and disinfection; and 2. No less than 48 hours and no more than 5 days after cleaning and disinfection, perform a <i>Legionella pneumophila</i> test ⁽¹⁾ .
	Greater than 1 000 CFU per mL	1. Immediately, give notice ⁽³⁾ to the <i>Chief Building Official</i> , the medical health officer and the owner; 2. Immediately, the laboratory ⁽²⁾ shall also give notice ⁽³⁾ to the owner of the <i>decorative water feature</i> , the <i>Chief Building Official</i> and the medical health officer; 3. Immediately, implement measures that will eliminate water dispersion by aerosol from the affected <i>decorative water feature</i> and then perform offline cleaning and disinfection of the system before putting the feature back into service; and 4. No less than 48 hours and no more than 5 days after cleaning and disinfection, perform a <i>Legionella pneumophila</i> test ⁽¹⁾ .

Notes to Table 2.2.11.7.:

⁽¹⁾ The *Legionella pneumophila* test shall conform to the requirements of Article 2.2.1.7.

⁽²⁾ See Sentence 2.2.1.7.(3).

⁽³⁾ For the person giving the immediate notice to the *Chief Building Official*, the *owner*, and the owner of the equipment, the person shall take all reasonable steps to give notice by speaking directly to or by telephone with each person required to be notified, a person designated for this purpose by the person required to be notified, or a person answering the telephone number designated for this purpose by the person required to be notified, and follow with notice in writing to each person within 24 hours. For the person giving immediate notice to the medical health officer, the person shall provide notice in writing immediately.

9) Offline cleaning and disinfection of a *decorative water feature* shall be carried out

- a) as recommended by the manufacturer, and at minimum of once every calendar year,
- b) for any start-up after having been shut down for 3 or more consecutive days, and
- c) as required by Sentence (8).

10) When a *decorative water feature* has been shut down for 3 or more consecutive days, it shall be drained within 5 days of being shut down.

11) If a *decorative water feature* is removed or its use is permanently discontinued, it shall be safely drained, thoroughly sanitized, and the make-up water line shall be disconnected and capped.”,

j) in Article 2.3.6.1., adding a new Sentence:

“6) Siphonic roof drainage systems shall be tested in accordance with ASME A112.6.9/CSA B79.9 “Siphonic Roof Drains.”,

k) adding a new Article 2.4.2.4. and Article 2.4.2.5.:

“2.4.2.4. Connections to Storm Drainage Systems

- 1) Except as provided in Sentence (2), *building* and site drainage shall connect to a *storm drainage system*.
- 2) *Building* and site drainage need not connect to a *storm drainage system* if
 - a) on-site *rainwater* management practices are employed and overflow is connected to a *storm drainage system*, and
 - b) *rainwater* does not create a hazardous condition or discharge upon or impact other lands or sites. (See Note A-2.4.2.4.(2).)

2.4.2.5. Rainwater Management

- 1) Except as provided in Sentence (2), all *buildings* shall manage *rainwater* on-site through one of the applicable compliance pathways in Table 2.4.2.5.-A, in which
 - a) “small site pathway” means Sentence (4) applies, and Sentences (5), (6), (7) and (8) do not apply, and
 - b) “engineered pathway” means Sentences (5), (6), (7) and (8) apply, and Sentence (4) does not apply.

(See Note A-2.4.2.5.(1).)

Table 2.4.2.5.-A
Compliance Pathways for On-Site Rainwater Management
Forming Part of Sentence 2.4.2.5.(1)

Site Area (m ²)	Floor Space Ratio ⁽¹⁾	Compliance Pathway
No greater than 1000	No greater than 1.0	Small site pathway
	Greater than 1.0	Engineered pathway
Greater than 1000	Any	Engineered pathway

Notes to Table 2.4.2.5.-A:

⁽¹⁾ As computed according to the Zoning and Development By-law.

- 2) The requirements of this Article do not apply to
 - a) “laneway houses” or “infill” as defined by the Zoning & Development By-law, when the site area is no greater than 1000 m²,
 - b) “accessory buildings” as defined by the Zoning & Development By-law,
 - c) *float homes*,
 - d) *marinas*,
 - e) retaining structures, or
 - f) temporary *buildings* approved according to Subsection 1.6.8. of Division C.

3) The *Chief Building Official* shall be provided with a document demonstrating that the *rainwater* management requirements of Sentence (1) have been satisfied, in the form prescribed by the *Chief Building Official*.

4) Except as provided in Sentence (9), a detention tank shall be installed with

- a) the minimum active storage capacity specified in Table 2.4.2.5.-B.,
- b) an orifice plate with the diameter specified in Table 2.4.2.5.-B.,
- c) overflow protection,
- d) one or more *cleanouts* providing access to the outlet and overflow, and
- e) for subsurface detention tanks, the capability of supporting the design depth of cover and surface loads.

(See Note A-2.4.2.5.(4).)

Table 2.4.2.5.-B
Detention Tank Specifications for the Small Site Pathway
Forming Part of Sentence 2.4.2.5.(4)

Site Area (m ²)	Minimum Active Storage Capacity (L)	Orifice Plate Diameter (mm)
No greater than 400	3,400	30
Greater than 400 to no greater than 500	3,900	35
Greater than 500 to no greater than 750	4,600	45
Greater than 750 to no greater than 1000	7,200	50

5) Except as provided in Sentences (8) and (9), the first 24 mm of *rainwater* in a 24 hour period from the site area shall be detained, and the minimum detention volume requirement

- a) shall be calculated as the volume of water that would be present if water 24 mm deep covered the entire site, and
- b) may be reduced by any combination of the retention or other practices listed in Table 2.4.2.5.-C, by the amounts in Column C of Table 2.4.2.5.-C.

Table 2.4.2.5.-C
Permitted Reductions to the Minimum Detention Volume Requirement
for the Engineered Pathway
Forming Part of Sentence 2.4.2.5.(5)

Retention or Other Practice	Reduction to the Detention Volume Requirement		
	Maximum Permitted Reduction Column A	Limit to Permitted Reduction Column B	Permitted Reduction Column C
Landscape feature ⁽¹⁾	Area of, and area routed to, the landscape feature multiplied by 24 mm	<i>Rainwater</i> capture potential, calculated as <i>rainwater</i> storage potential in the growing medium (%) multiplied by the growing medium volume, plus as applicable the storage volume within a subsurface reservoir layer and the volume infiltrated into the subgrade during a 24 hour period. ⁽³⁾	The lesser of Columns A and B
<i>Vegetated roof assembly</i> ⁽²⁾	Area of, and area routed to, the <i>vegetated roof assembly</i> multiplied by 24 mm		The lesser of Columns A and B ⁽⁴⁾
<i>Alternate water source system</i>	Area routed to the <i>alternate water source system</i> multiplied by 24 mm	Storage volume of the <i>alternate water source system</i>	The lesser of Columns A and B

Notes to Table 2.4.2.5.-C:

⁽¹⁾ Or other *acceptable* ground-level or subsurface based practice, such as permeable pavement or an infiltration tank.

⁽²⁾ Or other *acceptable* roof-top based practice. For *vegetated roof assemblies*, see Article 3.1.14.4. and Article 5.6.1.2. of Division B of Book I (General) of this By-law.

⁽³⁾ “*Rainwater* storage potential in the growing medium”, “volume infiltrated into the subgrade during a 24 hour period” and “storage volume within a subsurface reservoir layer” shall be demonstrated by *acceptable* data or references.

⁽⁴⁾ For a *vegetated roof assembly* from which the runoff is directed to an *alternate water source system*, the permitted reduction in the volume requirement shall equal Column A.

6) Except as provided by Sentences (8) and (9), the peak flow rate discharged to the *combined sewer* or *storm sewer* under post-development conditions shall not be greater than the peak flow rate discharged to the *combined sewer* or *storm sewer* under pre-development conditions, and shall be calculated using

a) the Rational Method,

b) the IDF curves in the City of Vancouver Engineering Design Manual, applying

i) for pre-development, the IDF curve prepared for pre-development estimates with a 5 year return period,

ii) for post-development, the 2100 IDF curve with a 10 year return period, and

iii) the inlet time specified in the City of Vancouver Engineering Design Manual, and

c) a composite runoff based on the percentages of different surfaces of the site area, applying the runoff coefficients from the City of Vancouver Engineering Design Manual. (See Note A-2.4.2.5.(3).)

7) An operations and maintenance manual conforming to Article 2.2.1.9. is required for each of the *rainwater* management practices employed to satisfy the requirements of Sentences (5) and (6).

8) When there is an *existing building* on the same property, the site area used in Clauses (5)(a) and (6)(c) may be reduced to be proportional to the ratio of the *buildings'* greatest horizontal area within the outside surface of exterior walls.

9) The *Chief Building Official* may relax the requirements of Sentences (4), (5) or (6) in accordance with Sentence 1.5.2.10.(2) of Division C if

a) the *owner* demonstrates to the satisfaction of the *Chief Building Official* by a *subsurface investigation* that excavation is precluded or limited by soil contamination or other factors, and

b) it is impractical, in the opinion of the *Chief Building Official*, to meet the *rainwater* management requirements of Sentences (4), (5) or (6).

(See Note A-2.4.2.5.(9).)",

l) striking out Article 2.4.3.6. and substituting:

"2.4.3.6. Drains Serving Elevator Pits

1) Where a drain is provided in an elevator pit,

a) if the elevator pit extends below the minimum elevation of the underside of a *building's* lowest floor system or the top of the *building's* lowest concrete slab, it shall be connected directly to a sump located outside the elevator pit, and

b) if the drain is subject to backflow, the drain pipe shall have a *backwater valve*.

(See Note A-2.4.3.6.(1).)",

m) striking out Article 2.4.4.2. and substituting:

"2.4.4.2. Sewer Discharge

1) Sanitary and storm discharge shall conform to the Sewer and Watercourse By-law.

2) Except within health care facilities or for medical sterilization devices, no system or equipment shall be installed that allows for the use of *potable* water to temper or dilute condensate discharged to the sewer.",

n) in Sentence 2.4.5.2.(2), striking out the term "floor drain" or "floor drains" wherever it appears and substituting "drain" or "drains," respectively,

o) striking out Article 2.4.5.3. and substituting:

"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*.",

p) in Article 2.4.6.3.:

i) striking out Sentence (1) and substituting:

"1) Except as permitted by Sentence (9), piping that is too low to drain into a *building sewer* by gravity shall be drained to a sump or receiving tank provided that

a) *fixtures* located above the public sewer connection shall drain by gravity, and

b) any overflow piping shall drain to the public sewer connection by gravity except overflow piping from an *alternate water source system*.”,

ii) striking out Sentence (6) and substituting:

“6) Where there is a *building trap*, the discharge pipe from the equipment shall be connected to the *building drain* downstream of the *trap* and *backwater valve*.”, and

iii) adding a new Sentence (9):

“9) The requirements of Sentence (1) do not apply

a) to *buildings* connected to a *public low pressure sewer system*, or

b) to any *fixture* installed after occupancy of a *building*.”,

q) striking out Article 2.4.10.8. and substituting:

“2.4.10.8. Hydraulic Loads on Sanitary Building Drains or Sewers

1) Except as permitted by Sentence (2), 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) The requirements of Sentence (1) do not apply to a *sanitary building sewer* for a *building* connected to a *public low pressure sewer system*.”,

r) adding a new Article 2.4.10.14.:

“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/CSA B79.9, “Siphonic Roof Drains.””,

s) in Article 2.5.6.3., adding a new Sentence (5):

“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.”,

t) in Article 2.6.1.1., adding two new Sentences:

“3) In a *hot water distribution system* with a recirculation loop, the temperature of the water being recirculated shall not be less than 49°C at any point of the system.

4) The recirculation loop described in Sentence (3) may be replaced by a self-regulating heat tracing system.”,

u) in Article 2.6.1.6.,

i) striking out Table 2.6.1.6. and substituting:

**“Table 2.6.1.6.
Water Usage per Flush Cycle
Forming Part of Sentence 2.6.1.6.(3)**

<i>Fixtures</i>	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.", and

ii) striking out Sentence (4) and substituting:

"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",

v) striking out Article 2.6.1.12. and substituting:

"2.6.1.12. Service Water Heaters

1) *Storage-type service water heaters* shall operate at a temperature not lower than 60°C. (See Note A-2.6.1.12.(1).)

2) Drain water heat recovery units shall only be used to supply *service water heaters*.",

w) in Article 2.6.2.1.,

i) appending to the end of Sentence (2): "(See Article 2.2.10.17.)", and

ii) adding a new Sentence (4):

"4) Residential landscape irrigation systems that apply herbicides, fungicides, insecticides, fertilizers, soil amendments or other chemicals or pesticides by means of irrigation water are prohibited.",

x) in Article 2.6.3.1., striking out Sentence (2) and substituting:

"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 Plumbing Engineering Design Handbooks, and for *dwelling units*, may be sized using the IAPMO Water Demand Calculator. (See Note A-2.6.3.1.(2).)",

y) in Article 2.6.3.2. adding a new Sentence (5):

"5) Notwithstanding the provisions of Sentences (1) through (4), the determination of hydraulic load is not a requirement for *water distribution systems* in *dwelling units* that have been designed in accordance with the IAPMO Water Demand Calculator.",

z) striking out Article 2.6.3.3. and substituting:

"2.6.3.3. Static Pressure

1) Where the static pressure at any *fixture* or supplied to a residential landscape irrigation system may exceed 550 kPa, a pressure-reducing valve shall be installed to limit the maximum static pressure at the *fixture* or for the residential landscape irrigation system to 550 kPa.",

aa) in Article 2.6.3.4.,

i) striking out Sentence (2) and substituting:

"2) Except as provided in Sentences (3) and (6), the *nominal pipe size* of a supply pipe that serves a *fixture* shall conform to Table 2.6.3.2.-A." , and

ii) adding a new Sentence (6):

“6) The *nominal pipe size* of a supply pipe that serves a *fixture* in a *dwelling unit* shall conform to

- a) the IAPMO Water Demand Calculator, or
- b) except as provided in Sentence (3), Table 2.6.3.2.-A.”,

bb) striking out Section 2.7. and substituting:

“Section 2.7. Non-Potable Water Systems

2.7.1. Connection

2.7.1.1. General

- 1) A *non-potable water system* shall not be connected to a *potable water system*.
- 2) For the purpose of this Section
 - a) all *non-potable water systems* shall comply with Subsections 2.7.1., 2.7.2. and 2.7.3.,
 - b) an *alternate water source system* installed prior to January 1, 2019 shall comply with Subsection 2.7.4., and
 - c) an *alternate water source system* installed on or after January 1, 2019 shall comply with Subsections 2.7.5., 2.7.6., 2.7.7., and 2.7.8.

2.7.1.2. Non-Potable Water Sources

- 1) Except as prohibited by Sentence (2), a *non-potable water system* shall collect only
 - a) *rainwater*,
 - b) *clear-water waste*,
 - c) *greywater* as permitted by Sentence (3), or
 - d) a combination thereof.
- 2) A *non-potable water system* shall not collect
 - a) runoff from a public road,
 - b) runoff from an area on which fertilizer is used or stored,
 - c) *groundwater*,
 - d) *perimeter drainage water*,
 - e) *greywater* not permitted by Sentence (3), or
 - f) *blackwater*.
- 3) A *non-potable water system* may collect *greywater* if it conforms to NSF/ANSI 350, “Onsite Residential and Commercial Water Reuse Treatment Systems,” Class R (single-family residential), and the treated water is used within the same *dwelling unit* from which the *greywater* is collected.

2.7.1.3. Non-Potable Water Uses

- 1) Except as provided in Sentences (2) and (5), a *non-potable water system* may use treated *non-potable water* for any of the uses set out in Columns A or B of Table 2.7.1.3.
- 2) An *alternate water source system* shall use treated *non-potable water* in lieu of *potable water* for all of the uses set out in Column A of Table 2.7.1.3.

3) Non-potable water shall not be used in lieu of *potable* water for any other uses.

Table 2.7.1.3.
Uses for Treated Non-Potable Water
Forming Part of Sentences 2.7.1.3.(1), (2) and (3)

Non-potable Water Source	Uses for Treated Non-potable Water	
	Column A	Column B
Rainwater	Water closets, urinals and trap primers	Irrigation of non-food purpose plants, clothes washers, vehicle wash facilities ⁽¹⁾ , make-up water for hydronic systems, make-up water for <i>cooling towers</i> , adiabatic cooling systems, and tempering of discharge.
Clear-water waste		
Greywater (conforming to Sentence 2.7.1.2.(3))	-	Water closets, urinals and clothes washers.
Groundwater	Not permitted	
Perimeter drainage water		
Blackwater		

Notes to Table 2.7.1.3.:

⁽¹⁾ See Article 2.2.11.3

4) Where the static pressure at any *fixture* in a non-potable water system may exceed 550 kPa, a pressure-reducing valve shall be installed to limit the maximum static pressure at the *fixture* to 550 kPa.

5) Non-potable water systems shall not be used to supply *fixtures* in healthcare facilities.

2.7.2. Identification

2.7.2.1. Piping and Outlet Identification

1) Except as required by Sentence (2), all non-potable water pipes shall be identified and marked in accordance with CAN/CSA-B128.1, "Design and Installation of Non-potable Water Systems."

2) All non-potable water distribution pipes with a *nominal pipe size* of 2 in and smaller shall be purple in colour and conform to the requirements of NSF/ANSI 14, "Plastics Piping System Components and Related Materials."

3) Non-potable water outlets shall be identified by a sign or plate in a location that is conspicuously visible and constructed of a durable, weather resistant material. (See Note A-2.7.2.1.(3).)

2.7.3. Location

2.7.3.1. Pipes

1) Non-potable water piping shall not be located directly above

a) areas where food, drink or products that are intended for human consumption are prepared, handled, dispensed or stored, or

b) a non-pressurized or 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, and the owner of the *alternate water source system* shall comply with the requirements of this Subsection.

2) The *operating permit* number assigned to the *alternate water source system* shall be posted on a sign or plate that is a minimum of 8.5 in by 11 in in size and 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 owner of an *alternate water source system*, or their authorized representative, shall undertake the response set out in Table 2.7.4.1.

Table 2.7.4.1.
Required Response to Failure to Meet Water Quality Standards for *Alternate Water Source Systems*
Installed Prior to January 1, 2019
Forming Part of Sentence 2.7.4.1.(5)

Parameter	Test Result	Required Response
<i>E. coli</i> ⁽¹⁾	100 or more CFU per 100 mL or 100 or more MPN per 100 mL	1. Immediately, supply the <i>alternate water source system</i> with <i>potable</i> water only; 2. Within 24 hours, give notice to the <i>Chief Building Official</i> and the <i>owner</i> ; and 3. Within 5 days, but no less than 48 hours after any cleaning or disinfection, perform an <i>E. coli</i> test ⁽¹⁾ and, if the water quality standard for <i>Legionella pneumophila</i> had been exceeded, a <i>Legionella pneumophila</i> test ⁽¹⁾ .
<i>Legionella pneumophila</i> ⁽¹⁾	10 or more CFU per mL or 10 or more MPN per mL	
Turbidity	> 15 NTU	
Temperature	> 25°C	

Notes to Table 2.7.4.1.:

⁽¹⁾ The *E. coli* and *Legionella pneumophila* test shall conform to the requirements of Article 2.2.1.7.

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."

8) A maintenance log shall be maintained in accordance with Sentence 2.7.8.2.(3).

9) An *alternate water source system* commissioned after January 1, 2019 shall comply with the requirements of Article 2.7.5.2.

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. Occupancy

1) Before *occupancy* of a *building* is permitted, an *alternate water source system* shall be commissioned within 8 weeks of occupancy in accordance with Article 2.7.5.2., and an *operating permit* shall be obtained in accordance with Article 2.7.5.3.

2) After an *alternate water source system* has been commissioned, the requirements of Subsections 2.7.7. and 2.7.8. shall be met.

3) An *alternate water source system* shall be considered commissioned on the date that the final water sample was collected to fulfill the requirements of Article 2.7.5.2.

2.7.5.2 Commissioning

1) In order to commission an *alternate water source system*

a) the treated non-potable water shall be tested for *E. coli*, turbidity and *Legionella pneumophila*,

i) in accordance with Article 2.2.1.7.,

ii) on water samples collected from the sampling port required by Article 2.7.6.6.,

iii) weekly for a period of 4 weeks for *E. coli* and turbidity, and

iv) once for *Legionella pneumophila*,

b) test results shall be provided to the *Chief Building Official*, and

c) a cross connection control test shall be performed as required by CAN/CSA-B128.1, "Design and Installation of Non-Potable Water Systems" and witnessed by the *Chief Building Official*.

2) Except as required by Sentence (3), if a water sample required by this Article fails to meet any of the standards set out in Table 2.7.7.1., an additional water sample for *E. coli* shall be collected no less than 48 hours and not more than 5 days after any cleaning or disinfection, tested, and reported.

3) If a *Legionella pneumophila* sample required by this Article fails to meet the standard set out in Table 2.7.7.1., an additional water sample for *Legionella pneumophila* and *E. coli* shall be collected no less than 48 hours and not more than 5 days after any cleaning or disinfection, tested, and reported.

2.7.5.3. Operating Permit

1) An *operating permit* shall be obtained, and the owner of the *alternate water source system* shall comply with the requirements of this Subsection.

2) The *operating permit* number assigned to the *alternate water source system* shall be posted on a sign or plate that is a minimum of 8.5 in by 11 in in size and 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*.

2.7.5.4. 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 person who is registered or licensed to practice as a professional engineer under the Engineers and Geoscientists Act, 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 and Backflow Prevention

- 1) A secondary water supply shall be provided.
- 2) Where a non-*potable water system* is supplied by a *potable water system*, the *potable water system* shall be protected in accordance with Article 2.6.2.1.
- 3) Where a *fixture* combines water from a non-*potable* rainwater harvesting system and *potable* water at the *fixture* supply fitting, the *potable water system* shall be protected by a *backflow preventer* as described in Sentence 2.6.2.1.(3).

2.7.6.4. Storage Tanks

(See Article 2.4.2.2. and Note A-2.7.6.4., 2.7.6.5. and 2.7.6.6.)

- 1) Provision shall be made upstream of the storage tank to remove the accumulation of particulates and impurities before they enter the storage tank.
- 2) Storage tanks 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.
- 3) Water shall be withdrawn a minimum of 0.3 m from the base of the storage tank.
- 4) Storage tanks in *alternate water source systems* shall be equipped with an overflow that directs excess rainwater to
 - a) a public *storm sewer*,
 - b) a public *combined sewer*,
 - c) a *storm water* management system, or
 - d) a designated *storm water* disposal location.
- 5) Where the storage tank outlet is located below the level of the adjoining *street*, the storage tank overflow required by Sentence (4) shall
 - a) terminate with an indirect connection that is not located within the *building*, or
 - b) be equipped with a *backwater valve*.

2.7.6.5. Water Metering

(See Note A-2.7.6.4., 2.7.6.5. and 2.7.6.6.)

- 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.

3) Water meters required by Sentences (1) and (2) shall be capable of displaying volumes in units of L or cubic m.

2.7.6.6. Water Quality Sampling and Alerts

(See Article 2.2.1.7. and Note A-2.7.6.4., 2.7.6.5. and 2.7.6.6.)

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) All monitoring devices referred to in Sentence (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.

2.7.6.7. 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 described in Sentence 2.7.1.3.(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 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- <i>potable</i> water source	Temperature	< 20°C	Continuous	Daily ⁽¹⁾
	Turbidity	< 10 NTU	Daily ⁽¹⁾ , and 1 sample tested by a laboratory every 2 calendar months with not more than 63 days between samples	Daily ⁽¹⁾ , plus all laboratory tests
	<i>E. coli</i> ⁽²⁾	< 100 CFU per 100 mL or < 100 MPN per 100 mL	1 sample tested every 2 calendar months with not more than 63 days between samples	All laboratory tests
	<i>Legionella pneumophila</i> ⁽²⁾	< 10 CFU per mL or < 10 MPN per mL	1 sample tested every 2 calendar months with not more than 63 days between samples	All laboratory tests
Rainwater from surfaces that allow the passage of vehicular traffic or where hydrocarbon-based fuels or hazardous materials are stored	Benzene	< 0.005 mg/L	1 sample tested every 2 calendar months with not more than 63 days between samples	All laboratory tests
	Toluene	< 0.024 mg/L		
	Ethylbenzene	< 0.0016 mg/L		
	Xylenes (total)	< 0.02 mg/L		
	Total suspended solids	< 20 mg/L		

Notes to Table 2.7.7.1.:

(1) For the purpose of this Table, the term “daily” shall mean once per day when the *building* is normally occupied.

(2) The *E. coli* and *Legionella pneumophila* test shall conform to the requirements of Article 2.2.1.7.

2.7.7.2. Water Quality Reporting

1) Water quality reports shall be submitted by the owner of an *alternate water source system*, or their authorized representative, to the *Chief Building Official* before the end of the second month following the issuance of an *operating permit*, and then every 2 calendar months thereafter, and shall include

a) all documentation required by Sentence 2.7.7.1.(3) and

b) except as provided in Sentence 2.7.4.2.(1), readings from the water meters required by Article 2.7.6.5.

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 owner of an *alternate water source system*, or their authorized representative, shall undertake the response set out in Table 2.7.7.3.

Table 2.7.7.3.
Required Response to Failure to Meet Water Quality Standards for *Alternate Water Source Systems*
Forming Part of Sentence 2.7.7.3.(1)

Parameter	Test Result	Required Response
Turbidity	Between 10 and 15 NTU	Take the appropriate corrective action as set out in the operating manual.
Temperature	20°C to 25°C	
Total suspended solids	Between 20 and 45 mg/L	
<i>E. coli</i> ⁽¹⁾	100 or more CFU per 100 mL or 100 or more MPN per 100 mL	1. Immediately, supply the <i>alternate water source system</i> with <i>potable water</i> only; 2. Within 24 hours, give notice to the <i>Chief Building Official</i> and the <i>owner</i> ; 3. Take the appropriate corrective action as set out in the operating manual; and 4. Within 5 days, but no less than 48 hours after any cleaning or disinfection, perform an <i>E. coli</i> test ⁽¹⁾ and, if the water quality standard for <i>Legionella pneumophila</i> had been exceeded, a <i>Legionella pneumophila</i> test ⁽¹⁾ .
<i>Legionella pneumophila</i> ⁽¹⁾	10 or more CFU per mL or 10 or more MPN per mL	
Turbidity	> 15 NTU	
Temperature	> 25°C	
Benzene	> 0.005 mg/L	1. Immediately, supply the <i>alternate water source system</i> with <i>potable water</i> only; 2. Within 24 hours, give notice to the <i>Chief Building Official</i> and the <i>owner</i> ; 3. Take the appropriate corrective action as set out in the operating manual; and 4. Within 3 days of the corrective action, perform a test for benzene, toluene, ethylbenzene and xylenes (total).
Toluene	> 0.024 mg/L	
Ethylbenzene	> 0.0016 mg/L	
Xylenes (total)	> 0.02 mg/L	
Total suspended solids	> 45 mg/L	1. Immediately, supply the <i>alternate water source system</i> with <i>potable water</i> only; 2. Within 24 hours, give notice to the <i>Chief Building Official</i> and the <i>owner</i> ; 3. Take the appropriate corrective action as set out in the operating manual; and 4. Within 3 days of the corrective action, perform a test for total suspended solids.

Notes to Table 2.7.7.3.:

⁽¹⁾ The *E. coli* and *Legionella pneumophila* test shall conform to the requirements of Article 2.2.1.7.

2.7.8. Operating Manual and Maintenance

2.7.8.1. Operating Manual

1) An operating manual conforming to Article 2.2.1.9. is required for an *alternate water source system*, and shall be sealed by a registered professional.

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 conforming to Article 2.2.1.8. shall be maintained, and shall also include

a) the documentation required by Sentence 2.7.7.1.(3), and

b) 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."

cc) in Table 2.8.1.1.:

i) adding in correct alphanumerical order the following new rows:

"

2.2.1.7. Microbiological Testing	
(1)	[F40,F41,F43,F81,F82-OS3.4,OH5]
(2)	[F40,F41,F43,F81,F82-OS3.4,OH5]
(3)	[F30,F40,F41,F43,F81,F82-OS3.1,OS3.4,OH1.1,OH2.1,OH2.3,OH5]

"

"

2.2.6.16. Welded Stainless Steel	
(1)	[F80-OH2.1,OH2.2,OH2.3]
(2)	[F80-OH2.1,OH2.2,OH2.3]
2.2.6.17. Stainless Steel Press-Connect Fittings	
(1)	[F20-OP5]

"

"

2.2.7.9. Press-Connect Water Fittings	
(1)	[F20-OP5]

"

"

2.2.11.1. Building Appliances	

(1)	[F130-OE1.2]
(2)	[F130-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]
(3)	[F40,F41,F43,F81,F82-OS3.4,OH1.1,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. Geexchange 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]
2.2.11.6. Cooling Towers	
(1)	[F40,F41,F43,F46,F81,F82-OS3.4,OH1.1,OH2.2,OH5,OP5]
(2)	[F40,F41,F43,F46,F81,F82,F130-OS3.4,OH1.1,OH2.2,OH5,OP5,OE1.2]
(4)	[F40,F41,F43,F46,F81,F82-OS3.4,OH1.1,OH2.2,OH5,OP5]
(5)	[F40,F41,F43,F46,F81,F82,F130-OS3.4,OH1.1,OH2.2,OH5,OP5,OE1.2]
(7)	[F40,F41,F43,F81,F82-OS3.4,OH1.1,OH5]
(8)	[F40,F41,F43,F81,F82-OS3.4,OH1.1,OH5]
(9)	[F40,F41,F43,F81,F82-OS3.4,OH1.1,OH5]
(10)	[F40,F41,F43,F81,F82-OS3.4,OH1.1,OH5]
(11)	[F40,F41,F43,F46,F81,F82,F130-OS3.4,OH1.1,OH2.2,OH5,OP5,OE1.2]
2.2.11.7. Decorative Water Features	
(1)	[F40,F41,F43,F46,F81,F82-OS3.4,OH1.1,OH2.2,OH5,OP5]
(2)	[F30-OS3.1,OS3.4,OH2.2,OH2.4,OH5]
(3)	[F40,F41,F43,F46,F81,F82-OS3.4,OH1.1,OH2.2,OH5,OP5]
(5)	[F40,F41,F43,F46,F81,F82,F130-OS3.4,OH1.1,OH2.2,OH5,OP5,OE1.2]
(7)	[F40,F41,F43,F81,F82-OS3.4,OH1.1,OH5]
(8)	[F40,F41,F43,F81,F82-OS3.4,OH1.1,OH5]
(9)	[F40,F41,F43,F81,F82-OS3.4,OH1.1,OH5]
(10)	[F40,F41,F43,F81,F82-OS3.4,OH1.1,OH5]
(11)	[F40,F41,F43,F46,F81,F82,F130-OS3.4,OH1.1,OH2.2,OH5,OP5,OE1.2]
“ ,	
“	
2.4.2.4. Connections to Storm Drainage Systems	
(1)	[F30,F62,F81,F82-OS3.1,OP5]
2.4.2.5. Rainwater Management	

(4)	[F40,F62,F80,F81-OP5,OE1.2]
(5)	[F40,F62,F80,F81-OP5,OE1.2]
(6)	[F40,F62,F80,F81-OP5]
(7)	[F80,F81,F82-OP5,OS3.4]

“, and

“

2.4.10.14. Design of Siphonic Roof Drainage Systems

(1)	[F81-OH2.1]

”,

ii) adding under “**2.2.3.1. Traps**” the following new row:

“

(6)	[F81-OH1.1]

”,

iii) adding under “**2.2.10.6. Valves, and Supply and Waste Fittings**” the following new row:

“

(8)	[F40,F41,F43,F46,F71,F81,F82-OS3.4,OH1.1,OH2.3,OH5]

”,

iv) striking the rows associated with “**2.2.10.17. Water Treatment Systems**” and substituting:

“

2.2.10.17. Water Treatment Systems

	[F46,F70-OH2.2]
(1)	[F30-OS3.1] [F46,F70-OS3.4]
	[F20,F30-OS2.1]
	[F40,F41,F43,F46,F70,F80,F81,F82-OS3.4,OH2.1,OH2.2,OH2.3,OH2.4,OH5,OP5,OE1.2]
	[F46,F70-OH2.2]
(2)	[F30-OS3.1] [F46,F70-OS3.4]
	[F20,F30-OS2.1]
	[F40,F41,F43,F46,F70,F80,F81,F82-OS3.4,OH2.1,OH2.2,OH2.3,OH2.4,OH5,OP5,OE1.2]
	[F46-OH2.2]
(4)	[F30-OS3.1] [F46,F70-OS3.4]
	[F20,F30-OS2.1]

”,

v) striking the rows associated with “**2.4.4.2. Cooling of Hot Water or Sewage**” and substituting:

“

2.4.4.2. Sewer Discharge

(1)	[F81-OH2.1]
(2)	[F130-OE1.2]

“

vi) striking the rows associated with “**2.4.5.3. Connection of Subsoil Drainage Pipe to a Sanitary Drainage System**” and substituting:

“

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]

“

vii) adding under “**2.4.6.4. Protection from Backflow**” the following new row:

“

(6)	[F81-OH2.1]

“

viii) adding under “**2.6.1.1. Design**” the following new rows:

“

(3)	[F40-OH1.1]
(4)	[F40-OH1.1]

“

ix) adding under “**2.6.1.12. Service Water Heaters**” the following new row:

“

(2)	[F30,F31-OS3.1,OS3.2] [F46-OH1.1,OH2.2]

“

x) adding under “**2.6.2.1. Connection of Systems**” the following new row:

“

(4)	[F40,F43,F46,F81-OS3.4,OH2.2,OH5]

“, and

xi) striking the rows associated with “**2.7.1.1. General**”, “**2.7.1.2. Identification and Marking**”, “**2.7.1.3. Location of Pipes**”, “**2.7.1.4. Location of Outlets**”, “**2.7.2.2. Permitted Applications**”, “**2.7.2.3. Roof Design**”, “**2.7.2.4. Non-Potable Rainwater Harvesting System Design**” and substituting:

“

2.7.1.1. General

(1)	[F46-OH2.2]
2.7.1.2. Non-Potable 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]
(3)	[F40,F43,F46,F81-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
2.7.1.3. Non-Potable Water Uses	
(1)	[F130-OE1.2]
(2)	[F130-OE1.2]
(3)	[F46,F70-OS3.4,OH2.2,OH2.3]
(4)	[F81-OS3.2]
(5)	[F40-OH2.2]
2.7.2.1. Piping and Outlet Identification	
(1)	[F46-OH2.2]
(2)	[F46-OH2.2]
(3)	[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. Occupancy	
(1)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
(2)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
2.7.5.2. Commissioning	
(1)	[F46,F81,F82-OS3.4,OH2.1,OH2.2,OH5]
(2)	[F46,F81,F82-OS3.4,OH2.1,OH2.2,OH5]
2.7.5.3. Operating Permit	
(1)	[F40,F41,F43,F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
(3)	[F40,F41,F43,F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
2.7.5.4. 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 and Backflow Prevention	
(1)	[F71,F72-OH2.1,OH2.3]
(2)	[F46,F81,F82-OS3.4,OH2.1,OH2.2,OH5]
(3)	[F46-OH2.2]
2.7.6.4. Storage Tanks	
(1)	[F40,F81-OH2.1,OH2.3]
(2)	[F40,F81-OH2.1,OH2.3]
(3)	[F40,F81-OH2.1,OH2.3]
(4)	[F81-OH2.2]
	[F81-OP5]
(5)	[F81-OH2.2]
	[F81-OP5]
2.7.6.5. Water Metering	
(1)	[F130-OE1.2]
2.7.6.6. Water Quality Sampling and Alerts	
(1)	[F82-OS3.4,OH2.1,OH2.3,OH5]
(2)	[F82-OS3.4,OH2.1,OH2.3,OH5]
2.7.6.7. 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]

", and

dd) in the Notes to Part 2:

i) striking out Note A-2.7.1.1., Note A-2.7.1.1.(1), Note A-2.7.2.1.(1) and A-2.7.2.4.(3) and (4) Treatment for Use, Note A-2.7.2.3.(1) Pedestrian Traffic, Note A-2.7.2.3.(2) Roofing and Conveyance Materials, and A-2.7.2.4.(1) Good Engineering Practice,

ii) inserting the following in correct alphanumerical order:

“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.



Note: Image is exaggerated for clarity

Figure A-2.2.10.4.(1)
Insufficient Key Engagement of Fitting in Roll Grooved Connection”,

“A-2.2.10.17. 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 point-of-entry 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.(3) 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-2.2.11.6. Cooling Tower Start-up and Shut-down. It is not the intention that the undefined terms “start-up” and “shut down” within Clause (4)(a), Clause (7)(c), Clause (9)(b) or Sentence (10) be interpreted to include a brief shutdown for the purposes of physical cleaning, system maintenance or inspection, or a “Standby (wet)” mode of *cooling tower* operation as defined by ASHRAE Guideline 12-2023. Operating a *cooling tower* in a “Standby (wet)” mode should include maintaining

the water treatment program and circulating water to control biological growth, as described in ASHRAE Guideline 12-2023.”,

“A-2.2.11.6.(8) Required Response to Failure to Meet Legionella Standards. This Sentence is based on Public Services and Procurement Canada’s standard MD 15161, “Control of *Legionella* in Mechanical Systems.”,

“A-2.2.11.6.(9) Offline Cleaning and Disinfection. The terms “cleaning” and “disinfection” have the meanings defined by Public Services and Procurement Canada’s standard MD 15161, “Control of *Legionella* in Mechanical Systems.”

More frequent *cooling tower* cleaning and disinfection may be necessary, especially for buildings with or near vulnerable populations. For health care facilities, refer to CAN/CSA-Z317.13, “Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities” Clause 6.4.2.”,

“A-2.2.11.7.(2)(b) Health Advisory. Examples of acceptable graphical symbols include



Figure A-2.2.11.7.(2)(b)
Examples of acceptable graphical symbols”,

“A-2.4.3.6.(1) Elevator Pit Drains. Protection from sewer gases is required in accordance with Articles 2.4.5.1. and 2.4.5.5.”,

“A-2.4.2.4.(2) Water Flow and Hazardous Conditions. Refer to the *Street and Traffic By-law* and *Standards of Maintenance By-law* for restrictions on water flow to streets, sidewalks, driveways, stairways and landings, and for prohibitions on ponding or entrance of water into a *building*.”,

“A-2.4.2.5.(1) Rainwater Management Requirements. Area-specific rainwater management requirements exist within the Zoning and Development By-law, and site-specific rainwater management requirements may apply as conditions of a rezoning approval or through a CD-1 by-law. Where such requirements differ from those of this Article, the *building’s* design must meet the more restrictive of the release rate requirement and the greater of the volumetric detention requirement.”,

“A-2.4.2.5.(4) Small Site Pathway. The detention tank “minimum active storage capacity” excludes the volume below the orifice and above the emergency overflow. The overflow must bypass the outlet flow control mechanism. The orifice flow control should have appropriate debris protection to prevent blockages. The detention tank should be inspected and cleaned regularly following the manufacturer’s instructions.”,

“A-2.4.2.5.(6) Peak Flow Rate Calculation. Pre-development means the site’s use immediately preceding development.”,

“A-2.4.2.5.(9) Relaxation to Rainwater Management Requirements. When an *owner* ascertains that site conditions preclude compliance with the rainwater management requirements of this Article, the *Chief Building Official* may relax a portion or all of the requirements of the “Engineered pathway” or the “Small site pathway.” Generally, the *Chief Building Official* may:

- consult with the *City Engineer*,

- consider evidence provided by the *owner* (Table A-2.4.2.5.(9)), and
- determine whether the *owner* has made a reasonable attempt to meet a portion or all of the rainwater management requirements by installing infrastructure above-ground or as part of the *building*.

The decision to relax requirements shall be made by the *Chief Building Official*.

Table A-2.4.2.5.(9)
Examples of Documentation That May Be Provided
By the *Owner* to the *Chief Building Official*
Forming Part of Note A-2.4.2.5.(9)

Potential Site Condition Precluding Compliance with Rainwater Management Requirements	Examples of Documentation Provided by the <i>Owner</i> Regarding a Relaxation to Rainwater Management Requirements
Archaeological resources	<i>Archaeological Impact Assessment</i> , prepared in conformance with the Heritage Conservation Act.
Artesian groundwater conditions	Hydrogeological or geotechnical engineering report.
Contamination	<i>Notification of Likely or Actual Migration</i> , prepared in conformance with the Contaminated Sites Regulation.
Geotechnical limitations	Geotechnical engineering report.

”,

“A-2.7.2.1.(3) Non-*potable* Water Outlet Identification. An example of an acceptable graphical symbol is:



Figure A-2.2.11.7.(2)(b)

Example an of acceptable graphical symbol

It is suggested that public education material also be posted to assist with risk perception and acceptance of treated non-*potable* water use.”, and

"A-2.7.6.4, 2.7.6.5. and 2.7.6.6. Non-potable Water System Design.

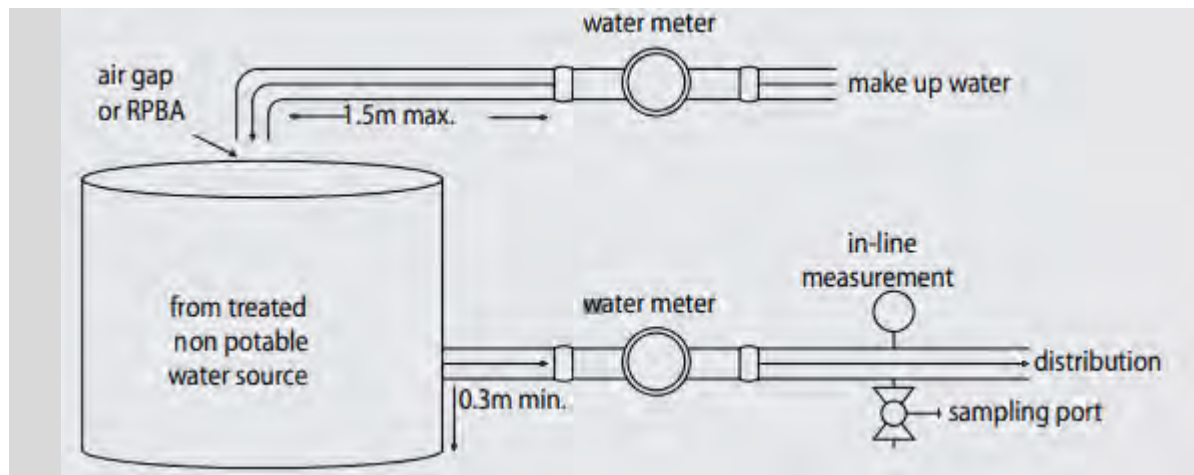


Figure A-2.7.6.4., 2.7.6.5. and 2.7.6.6.
Schematic example of a non-potable water system",

iii) striking out Note A-2.2.3.2.(3) and substituting:

"A-2.2.3.2.(3) Grease Interceptors. Metro Vancouver provides resources on-line for grease interceptor selection and sizing. CSA B481.4, "Maintenance of grease interceptors," is considered to represent good practice regarding procedures for the maintenance of grease interceptors.", and

iv) striking out Note A-2.6.1.12.(1) and substituting:

"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."

7.1.5.3. Division C

1) The provisions of Part 1 of Division C of the 2020 National Plumbing Code shall be amended by:

a) adding the following sections in alphanumeric order:

"Section 1.3. Interpretation, Intent and Prohibitions

(Refer to Book I (General) of this By-law.) ",

"Section 1.4. Obligations of the Owner and Contractor

(Refer to Book I (General) of this By-law.) ",

"Section 1.5. Authority of the Chief Building Official

(Refer to Book I (General) of this By-law.) ",

"Section 1.6. Permits, Applications and Fees

(Refer to Book I (General) of this By-law.) ",

"Section 1.7. Permission to Occupy Buildings

(Refer to Book I (General) of this By-law.) ",

"Section 1.8. Street Regulations

(Refer to Book I (General) of this By-law.) ”,

“Section 1.9. Temporary Occupancy of a Street for Construction Purposes

(Refer to Book I (General) of this By-law.) ”, and

“Section 1.10. Addressing Buildings and Parcels of Land

(Refer to Book I (General) of this By-law.) ”, and

b) adding Notes to Part 1:

“Notes to Part 1

(Refer to Book I (General) of this By-law.) ”.

2) The provisions of Part 2 of Division C of the 2020 National Plumbing Code shall be amended by:

a) striking out “Section 2.2.” and “Section 2.3.” and substituting:

“Section 2.2. Administration

(Refer to Book I (General) of this By-law.) ”,

“Section 2.3. Alternative Solutions

(Refer to Book I (General) of this By-law.) ”, and

b) striking out the Notes to Part 2 and substituting:

“Notes to Part 2

(Refer to Book I (General) of this By-law.) ”.

3) The provisions of Division C of the 2020 National Plumbing Code shall be amended by adding a new Part 3:

“Part 3

Appeals, Offences and Penalties and Transition Provisions

(Refer to Book I (General) of this By-law.) ”.

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)**

Provision	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 incomplete or abandoned *building*.
- 3) Fire safety at construction and demolition sites shall conform to Subsection 8.2.6. and Section 5.6. of Division B of the Fire By-law.

8.1.1.2. Definitions

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

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 of the Fire By-law.

8.1.2. Application

8.1.2.1. Application

- 1) Where a *building* is undergoing construction, *alteration* or demolition, measures shall be taken at the *building* site in conformance with this Code. (See Note A-8.1.2.1.(1).)

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. Fencing 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, at least 1.8 m high and complying with Sentences 8.2.1.3.(2) and (3), 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 Way Construction

1) A covered walkway 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 public way, 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 where the covered way is supported by posts on the *street* side of the sidewalk,

g) constructed with sufficient lighting to enable the public to walk safely through any walkway which, and

h) is constructed on a sidewalk which is illuminated by overhead *street* lighting at night.

8.2.1.3. Fencing, Boarding or Barricades

1) When a construction or demolition activity may constitute a hazard to the public and is located 2 m or more from a public way, a strongly constructed fence, boarding or barricade not less than 1.8 m high shall be erected between the site and the public way or open sides of a *construction* site.

2) Fencing, boarding, and barricades erected in conformance with Sentence (1) or Article 8.2.1.1.(2) shall have a reasonably smooth surface facing the public way and shall be without openings, except those required for access to the *construction* site.

3) Access openings through fencing, boarding, or barricades erected in conformance with Sentence (1) or Article 8.2.1.1.(2) 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 completion of the *construction* or demolition activity.

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, the hazardous part of the construction site shall be protected by

a) all windows, doors and other openings located within 3 m of the ground which may give access to the *building* shall be secured with boarding or barricades, or

- b) 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* or adjacent municipal infrastructure 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 site.

2) Material or equipment shall not be placed on any *street* or other public property except as authorized.

3) Except as provided in Sentence (4), where a sidewalk exists adjacent to the 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.

8.2.3.2. Overhead Activities

1) Operations such as the hoisting of major components onto a tall *building* or other overhead activities that constitute a hazard to pedestrians below from which the public cannot be protected by barricades, covered ways or similar means shall not be carried out until the *street* or other public way is closed.

8.2.3.3. Barricades

- 1) Excavations in *streets* or public property shall
 - a) be adequately barricaded, and
 - b) have warning signs or lights installed on each section of the barricades referred to in Clause (a).

8.2.3.4. Restoration and Repair

1) All sidewalks, *streets* or other public property that have been damaged shall be restored to a safe condition.

2) All obstructions on sidewalks, *streets* or other public property shall be removed when the need for such obstructions is ended.

8.2.3.5. Warning Lights

1) Warning lights shall be placed and shall be in operation during the hours of darkness 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 of the *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, overflows, 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 vehicle and pedestrian 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 path for 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 8 cm 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. of Division C.

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
- e) 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 liquids* 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 liquids* 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)

Provision	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]
8.2.1.2. Covered Walkway Construction	
(1)	(a),(b),(d) to (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]
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 Controls and Hazard Signs	
(1)	[F30-OS5.2]
8.2.4.3. Traffic 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	
(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)	[F12-OS1.2, OP3.1]
8.2.6.4. Access to Firefighting	
(1)	[F12-OS1.2, OP3.1]
8.2.6.5. Portable Extinguisher	
(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.

PART 9 – See Volume 2

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 10.2.1.4., 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. (See Note A-10.2.1.1.(5).)
- 6) A residential *building* with not more than 2 principal *dwelling units* may be provided with a gas connection serving an exterior space that is not enclosed. (See Note A-10.2.1.1.(6).)

10.2.1.2. Buildings Without Residential or Commercial Components

- 1) All *buildings* except those included in 10.2.1.3 and 10.2.1.4.,
 - a) shall be designed in compliance with Article (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) except where space heating and service water heating systems are powered only by electricity, shall be designed with a *greenhouse gas intensity* (GHGI) reduction in compliance with Table 10.2.2.5.A, or a reduction as *acceptable* to the *Chief Building Official*,

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 conformance with Article 10.2.2.10.,

f) shall comply with Article 10.2.2.15. where domestic gas-fired fireplaces are provided,

g) may provide exterior heated spaces in compliance with Article 10.2.2.19.

h) shall provide airtightness testing in compliance with Article 10.2.2.21., and

i) shall *commission* in compliance with Article 10.2.2.22.,

10.2.1.3. Residential Buildings of 4 Storeys or More, and Commercial Buildings (including Hotels and Motels)

1) All *buildings* containing Group C, D, or E *Major Occupancies*, except those included in Article 10.2.1.4.,

a) shall be designed in compliance with energy and emissions performance per Article 10.2.2.5,

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 comply with Article 10.2.2.15., where domestic gas-fired fireplaces are provided,

f) may provide exterior heated spaces in compliance with Article 10.2.2.19..

g) shall provide airtightness testing in compliance with Article 10.2.2.21., and

h) shall *commission* in compliance with Article 10.2.2.22.,

10.2.1.4. Residential Buildings of 1 to 3 Storeys, and Houses (excluding Hotels/Motels)

1) A *building* shall comply with the requirements of either the Performance Path set out in Sentence (2) or the Prescriptive Path set out in Sentence (3), where it

a) contains entirely Group C *major occupancies* except subsidiary *occupancies*,

b) is either

i) less than 4 storeys in building height, or

ii) contains not more than 2 principal *dwelling units* and their subsidiary structures with conditioned space, and

c) does not include a Hotel or Motel use.

(See Note A-10.2.1.4.(1)(a))

2) A *building* conforming with the criteria of Sentence (1) and the "Performance Path",

a) shall be designed in compliance with the energy and GHG emissions performances of Article 10.2.2.4.,

b) shall be designed in compliance with the *building* envelope thermal performance values of Article 10.2.2.6.,

c) shall be designed in compliance with the exterior closures and fenestration thermal performance values of Article 10.2.2.7.,

d) except for *residential buildings* with not more than 2 principal *dwelling units*, shall be provided with vestibules in compliance with Article 10.2.2.8.,

e) shall be provided with metering equipment in compliance with Article 10.2.2.9.,

f) shall be provided with lighting in compliance with Article 10.2.2.10.,

g) shall comply with Articles 10.2.2.11. through 10.2.2.13. where domestic boilers generate space heating or hot water,

h) shall comply with Article 10.2.2.14. where domestic heat pumps, furnaces, or make-up air units are provided,

i) shall comply with Article 10.2.2.15. where domestic gas fireplaces are provided,

j) shall comply with Article 10.2.2.16. where domestic wood fireplaces are provided,

k) shall be provided with heat recovery ventilators in compliance with Article 10.2.2.17.,

l) except for *residential buildings* with not more than 2 principal *dwelling units*, may provide exterior heated spaces in compliance with Article 10.2.2.19..

m) shall provide documentation in compliance with Article 10.2.2.20., and

n) shall provide airtightness testing in compliance with Article 10.2.2.21..

3) Except as permitted in Sentence (2), a *building* conforming with the criteria of Sentence (1) and the "Prescriptive Path",

a) shall be designed in compliance with a GHG emissions compliance option of Sentence 10.2.2.4.(5), and, where applicable, the large home emissions limit of Sentence 10.2.2.4.(6).,

b) shall be designed in compliance with the building envelope thermal performance values of Article 10.2.2.6.,

c) shall be designed in compliance with the exterior closures and fenestration with thermal performance values of Article 10.2.2.7.,

d) except for *residential buildings* with not more than 2 principal *dwelling units*, shall be provided with vestibules in compliance with Article 10.2.2.8.,

e) shall be provided with metering equipment in compliance with Article 10.2.2.9.,

f) shall be provided with lighting in compliance with Article 10.2.2.10.,

g) shall comply with Articles 10.2.2.11. through 10.2.2.13. where domestic boilers generate space heating or hot water,

h) shall comply with Sentence 10.2.2.14. where domestic heat pumps, furnaces, or make-up air units are provided,

i) shall comply with Article 10.2.2.15. where domestic gas fireplaces are provided

j) shall comply with Article 10.2.2.16. where domestic wood fireplaces are provided,

k) shall be provided with heat recovery ventilators in compliance with Article 10.2.2.17.,

l) except for *residential buildings* with not more than 2 principal *dwelling units*, may provide exterior heated spaces in compliance with Article 10.2.2.19.

m) shall provide documentation in compliance with Article 10.2.2.20., and

n) shall 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".

2) A *building* designed in accordance with Sentence (1), shall be designed, as applicable, with

a) ASHRAE 90.1, Exception to 4.2.1.3. (*alteration* for Historical buildings), being replaced by "In a *building* where components have been formally recognized by a federal, provincial, territorial, or municipal *authority having jurisdiction*, as having either Heritage or Character value, the alteration of these components need not comply with these requirements.",

b) a climate zone of 4,

c) no requirement for *commissioning* per ASHRAE 90.1, Section 4.2.5.2,

d) no requirement to comply with whole building air leakage testing of ASHRAE 90.1, Section 5.4.3.1.1.,

e) no requirement to comply with vestibules provision of ASHRAE 90.1, Section 5.4.3.3.,

f) no requirement to comply with the Fenestration Orientation provisions of ASHRAE 90.1, Section 5.5.4.5.,

g) ventilation in conformance with ASHRAE 62-2001 (except addendum n), or if applicable, 6.3.1.1.(3)(b) of the Building By-law,

h) no requirement to comply with Service Water-Heating System Controls, per ASHRAE 90.1, Article 7.4.4. (See Article 2.6.1.12. of Division B of Book II (Plumbing Systems) of this By-law.), (See Note A-10.2.2.2.(2)(h).)

- i) no requirement to comply with Automatic Receptacle Control, per ASHRAE 90.1, Section 8.4.2,
- j) no requirement to comply with Electrical Energy Monitoring provision of ASHRAE 90.1, Section 8.4.3.1.
- k) ASHRAE 90.1, Section 9.1.2. (lighting alterations) and Exception 9.1.2. being replaced by:

“9.1.2 Lighting Alterations.

For the *alteration* of any *lighting system* in an interior *space* or exterior area, that *space* or area shall comply with the entirety of Chapter 9, as applicable to that *space* or area.

Exceptions to 9.1.2:

1. Interior lighting *alterations* where the total new wattage of all *replaced luminaires* on a project is 2,000 watts or less, the total wattage of *replaced luminaires* of a *lighting system* within a *space* shall be at least 50% below the total wattage of all *removed luminaires* of that *lighting system*, unless the *space* is at or below the LPD allowance of Table 9.6.1 or Section 9.6.2 as applicable.

Controls shall comply with the requirement of either Section 9.4.1.1(h) or Section 9.4.1.1(i).

2. Exterior lighting *alterations* where the total number of *replaced luminaires* on a project is 10 or less, the total wattage of *replaced luminaires* shall be at least 50% below the total wattage of all *removed luminaires*, unless each altered area is at or below the LPD allowances of Table 9.4.2-2.

Controls shall comply with the requirement of Section 9.4.1.4(a).

3. The replacement of a failed *lamp* or *ballast/driver* in an individual *luminaire* or the replacement of any failed lighting control.

4. The removal or relocation of interior or exterior *luminaires* as part of, or independent of, exceptions 1, 2, or 3.”

l) ASHRAE 90.1, Section 9.6.1.d. (lighting Space by Space Method application), being replaced by “The *interior lighting power allowance* is the sum of lighting power allowances of all *spaces* and *subspaces*. Trade-offs among *spaces* and *subspaces* are not permitted.”

(See Note A-10.2.2.2.(2)(l).),

m) the 5% in Table 11.5.1, Item 5 Building Envelope, Exception a., being replaced by 2%, if designed in compliance with ASHRAE 90.1, Section 11, and

n) the 5% in Table G3.1, Item 5.a. Building Envelope, Exception 1., being replaced by 2%, if designed in compliance with ASHRAE 90.1, Appendix G.”

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, as applicable, with

- a) a climate zone of 4,
- b) ventilation in conformance with ASHRAE 62-2001 (except addendum n) or if applicable, 6.3.1.1.(3)(b) of the Building By-law,
- 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 3% for skylights,
- e) a vertical glazing Solar Heat Gain Coefficient which does not exceed an assembly maximum of 0.36, and
- 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%,
- g) no requirement to comply with whole building air leakage testing of NECB, Article 3.2.4.2.,
- h) lighting exclusions 4.2.1.4.(4)(a) and 4.2.1.4.(4)(b) applicable to exclude “display” lighting for retail merchandise,

- i) NECB, Section 4.3. (lighting Trade-off Path application), shall be permitted using whole building application only. Trade-offs among spaces and subspaces are not permitted with the application of the Space by Space Method, (See Note A-10.2.2.2.(2)(l).),
- j) no requirement to comply with Hot Service Water requirements, per NECB Subsection 6.2.6. (See Article 2.6.1.12. of Division B of Book II (Plumbing Systems) of this By-law.). (See Note A-10.2.2.2.(3)(j).), and
- k) no requirement to comply with Monitoring provision of NECB, Article 7.2.1.1..

10.2.2.4. Energy and Emissions Performance (for Buildings subject to Article 10.2.1.4.)

- 1) *Buildings* and major occupancies designed and constructed to conform to the certification criteria for 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.(1).)
- 2) Except as permitted by Sentence (1), for a *building* required to comply with this Article, any energy modelling shall conform to:
 - a) the EnerGuide Rating System (version 15 or newer) and the City of Vancouver 1 to 3 Storey Residential Energy Modelling Guidelines, or
 - b) the applicable requirements of Part 8 of the NECB, and the City of Vancouver Energy Modelling Guidelines
- 3) Except as permitted by Sentence (1), a *building* required to comply with this Article shall demonstrate modelling compliance with the following performance metrics:
 - a) the applicable mechanical energy use intensity (MEUI) target in Table 10.2.2.4.A., and
 - b) except as permitted in Sentence (4), a thermal energy demand intensity (TEDI) $\leq 20 \text{ kWh}/(\text{m}^2 \cdot \text{year})$

Table 10.2.2.4.A Mechanical Energy Use Intensity Forming part of Clause 10.2.2.4.(3)(a)	
Conditioned Floor Area	MEUI (kWh/m ² a)
$\leq 50 \text{ m}^2$	125
$\leq 75 \text{ m}^2$	108
$\leq 120 \text{ m}^2$	78
$\leq 165 \text{ m}^2$	58
$\leq 210 \text{ m}^2$	48
$> 210 \text{ m}^2$	45

- 4) The thermal energy demand intensity requirements may be calculated using the 'Adjusted TEDI' formula: (See Note A-10.2.2.4.(4).)

$$\text{TEDI}_{\text{adjusted}} = \text{TEDI}_{20} + (\text{TEDI}_{\text{higher}} - \text{TEDI}_{\text{step}})(\text{HDD}_{\text{actual}} - \text{HDD}_{\text{lowest}})/500$$

- 5) Except as permitted by Sentence (1), a *building* required to comply with this Article shall be designed and constructed to one of the following GHG emissions compliance options in Table 10.2.2.4.B:

Table 10.2.2.4.B Greenhouse Gas Emissions Compliance Options Forming part of Sentence 10.2.2.4.(5)				
	or	Maximum GHG Emissions ⁽¹⁾ ⁽²⁾ ⁽³⁾	or	

Maximum GHG Emissions (kgCO _{2e} / a) ⁽¹⁾⁽²⁾		Maximum GHGI Emissions (kgCO _{2e} /m ² a)	Maximum GHG Emissions (kgCO _{2e} /a)		Reduction of GHG Emissions by Energy Source of <i>Building</i> Systems
265		1.5	500		Energy sources supplying all <i>building</i> systems, including <i>equipment</i> and <i>appliances</i> , shall be electricity

Notes to Table 10.2.2.4.(B):

⁽¹⁾ GHG and GHGI values shall be calculated for each 'house' which consists of a principal dwelling unit, with or without ancillary dwelling units

⁽²⁾ Refer to the City of Vancouver Energy Modelling Guidelines for 1 to 3 Storey Residential Buildings for guidance on modelling GHG and GHGI metrics

⁽³⁾ Compliance with this option is demonstrated by meeting both the GHGI and the GHG emission requirements for each house.

6) A *building* required to comply with this Article that contains more than 325 m² of *conditioned space*, and does not consist of more than *one principal dwelling unit*, shall provide a calculation to demonstrate that the proposed home, including all exterior gas equipment, has a maximum greenhouse gas (GHG) limit of 2,000 kgCO_{2e}/year. (See Note A-10.2.2.4.(6).)

10.2.2.5. (ZEBP) Building Energy and Emissions Performance (for Buildings subject to Article 10.2.1.3.)

1) *Buildings* and major occupancies designed and constructed to conform to the certification criteria for Passive House Standard are deemed to comply with this Article provided the design's energy model is:

- version 9 or newer of the Passive House Planning Package, and
 - prepared by a Certified Passive House Designer, or Certified Passive House Consultant,
- (See Note A-10.2.2.5.(1).)

2) Except as permitted by Sentence (1), for a *building* required to comply with this Article, any energy modelling shall comply with the applicable requirements of Part 8 of the NECB, and the City of Vancouver Energy Modelling Guidelines.

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) Except as permitted in Sentences (1), (3), or (5), 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.

5) Compliance with the TEUI and TEDI limits in Table 10.2.2.5.A is not required where a building is connected to a *Low Carbon Energy System*, and can demonstrate the performance values of the proposed building comply with the limits in Table 10.2.2.5.C.

Table 10.2.2.5.A Maximum Energy Use and Emissions Intensities Forming part of Sentence 10.2.2.5.(4)			
Occupancy Classification ⁽¹⁾	Total Energy Use Intensity (kWh/m ² a)	Thermal Energy Demand Intensity (kWh/m ² a)	Greenhouse Gas Intensity (kgCO _{2e} /m ² a)
Group C occupancies in buildings up to 6 Storeys, except Hotel and Motel	110	25	3.0
Group C occupancies in buildings over 6 Storeys, except Hotel and Motel	120	30	3.0
Hotel and Motel occupancies	140	20	4.0
Group D and E occupancies, except Office	120	20	3.0

Office <i>occupancies</i>	100	20	3.0
All other <i>occupancies</i>	(1)		50% lower than GHGI of the reference building modelled using only fossil-fuel systems

Notes to Table 10.2.2.5.A:

⁽¹⁾ For *buildings* containing multiple *occupancies*, refer to the procedures on mixed-use *buildings* in Section 5 of the City of Vancouver Energy Modelling Guidelines.

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 ² a)	Thermal Energy Demand Intensity (kWh/m ² a)	Greenhouse Gas Intensity (kgCO _{2e} /m ² a)
Group C <i>occupancies</i>	100	15	NA

Table 10.2.2.5.C Maximum Energy Use and Emissions Intensities Forming part of Sentence 10.2.2.5.(5)			
Occupancy Classification	Total Energy Use Intensity (kWh/m ² a)	Thermal Energy Demand Intensity (kWh/m ² a)	Greenhouse Gas Intensity (kgCO _{2e} /m ² a)
Group C <i>occupancies</i> in <i>buildings</i> up to 6 Storeys, except Hotel and Motel	110	25	3.0
Group C <i>occupancies</i> in <i>buildings</i> over 6 Storeys, except Hotel and Motel	130	40	3.0
Hotel and Motel <i>occupancies</i>	170	30	4.0
Business and Personal Services or Mercantile <i>occupancies</i> , except Office	170	30	3.0
Office <i>occupancies</i>	130	30	3.0

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 comply with the performance values in Table 10.2.2.6., between

- heated space and unheated space,
- heated space and exterior air,
- heated space and exterior *soil*,
- heating floor assemblies and heated space,
- heating floor assemblies and unheated space,
- heating floor assemblies and exterior air, and
- heating floor assemblies and exterior *soil*.

Table 10.2.2.6. Minimum Effective Thermal Resistance of Assemblies Forming part of Sentence 10.2.2.6.(1)		
Building Assembly	Assembly Minimum Thermal Resistance (RSI - m ² K/W)	
	Performance Path	Prescriptive Path

	(per Sentence 10.2.1.4.(2))	(per Sentence 10.2.1.4.(3))
Roof Assemblies	4.30	7.04
Decks ⁽¹⁾		
Area > 10.0 m ²	4.30	7.04
Area ≤ 10.0 m ²	4.30	
Attic Space ⁽²⁾	8.50	
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)	4.22	
Suspended Floors (concrete slab)	4.22	
Concrete Slabs on Ground at, above, or below grade (insulation under all slab area and around edge of slab)	2.45	
Radiant Heating Suspended Floor Assembly Over Heated Area (insulation between heated floor and heated area below) ⁽⁴⁾	2.45	
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 term "Decks" shall represent flat roof assemblies, intended for pedestrian access, installed over living spaces.

⁽²⁾ Refer to Notes for Part 10: Figure A-10.2.2.6.-B for permitted reduction in insulation value for attic insulation near an exterior wall

⁽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.

⁽⁴⁾ 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.

2) The effective total "RSI" value of the opaque envelope area, the non-opaque envelope area, and the overall envelope area, calculated by a design professional, shall be submitted as part of an application for a permit.

(See Note A-10.2.2.6.)

3) In a residential *building* containing more than two principal *dwelling units*, low-sloped roofs (< 2:12) shall use light coloured and high albedo materials with a minimum initial solar reflectance index range (SRI) of 73 to 78, when tested in accordance with ASTM E908, and a minimum emissivity of 0.85 (in the 8-13 micron band), when tested in accordance with ASTM E408. (See Note A-10.2.2.6.(3).)

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 Thermal Transmittance USI Value ⁽²⁾ (W/(m ² K))	
	Performance Path (per Sentence 10.2.1.4.(2))	Prescriptive Path (per Sentence 10.2.1.4.(3))
Windows, sliding, and folding doors with glazing		

Window-to-wall ratio $\geq 30\%$, and One Family Dwelling with conditioned space $\geq 325 \text{ m}^2$	1.44	Average of 1.04 or lower and no individual window can be above U1.22
All Other	1.44	1.22
Curtainwall and Window Wall Assemblies		
Window-to-wall ratio $\geq 30\%$, and One Family Dwelling with conditioned space $\geq 325 \text{ m}^2$	1.44	Average of 1.04 or lower and no individual window can be above U1.22
All Other	1.44	1.22
Other Types of Closures		
Storefront curtainwall, window, and door assemblies	2.27	
Doors with or without glazing ⁽¹⁾	1.80	
Doors with a required fire resistance rating	Exempt	
Roof access hatches	2.94	
Skylights (not larger than 1220 mm in both directions), roof windows and sloped glazing systems	2.44	
Skylights larger than 1220 mm in both directions	2.95	
Tubular daylight devices	2.64	

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⁾ See note A-10.2.2.7.(3)

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-assembled fenestration 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 fenestration products that are site-assembled, imported, or otherwise 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 provided in Sentence (3), a door that separates conditioned space from the exterior shall be protected with an enclosed vestibule whose doors opening into and out of the vestibule are equipped with self-closing devices.

2) Except for doors equipped with power operators in barrier-free entrances, vestibules required in Sentence (1) shall be designed so that the interior and exterior doors of the vestibule shall be separated by no less than 2.1 m when closed and users passing through the vestibule are not required to open the interior and exterior doors at the same time.

3) A vestibule is not required for an exterior door that

- a) is a revolving door,
- b) is used primarily to facilitate vehicular movement or material handling,
- c) is intended to be used as a service, emergency exit, or stairwell exit door only,
- d) is intended to be used as a seasonal use door, such as a door leading to a patio,
- e) opens directly from a dwelling unit,
- f) opens directly from a building or space less than 278.7 m^2 in area.

10.2.2.9. Building Services Submetering

1) Every *building* shall be equipped with metering equipment capable of collecting and reporting *building* energy performance data for each energy source to the *building* and for every portion of the *building* which supports a separate use or *occupancy*.
(See Note A-10.2.2.9.(1).)

2) *Buildings* shall be designed to facilitate the installation of the means to monitor energy usage of:
(See Note A-10.2.2.9.(2).)

- a) central HVAC systems, including boilers, chillers, pumps, heat pumps, fans and other equipment used to provide space heating, space cooling, dehumidification, and ventilation to the building, but not including energy that serves process loads or water heating; and
- b) central service water heating systems, and water heating systems for 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 controls all non high efficiency lighting fixtures within the *suite*, except lights serving corridors, stairs, washrooms, and rooms with no exterior window.

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 Hot Water Heaters

1) In a *building* required to comply with this Article, water heating appliances shall

- a) be powered only by electricity, except as permitted by Sentence (2), and
- b) comply with the following standards:
 - i) CSA C191, "Performance of electric storage tank water heaters for domestic hot water service", or
 - ii) CAN/CSA-C745 "Energy Efficiency of Electric Storage Tank Water Heaters and Heat Pump Water Heaters, or
 - iii) CAN/CSA-P.9 Combined space- and water-heating systems

2) *Buildings* complying with the Performance Path option of Sentence 10.2.1.4.(2) may provide gas-fired appliances providing domestic hot water, and shall have a uniform energy factor of not less than 0.92 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) CAN/CSA-P.9 Combined space- and water-heating systems,
- d) CSA C191, "Performance of electric storage tank water heaters for domestic hot water service", or
- e) 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 Boilers

1) Except as permitted by Sentence (2), in a *building* required to comply with this Article, domestic boilers providing heat, or heat and domestic hot water, shall be powered only by electricity and be tested using CAN/CSA-C22.2 No 165, "Testing Method for Electric Boilers",

2) *Buildings* complying with the Performance Path option of Sentence 10.2.1.4.(2) may provide gas-fired appliances that have an Annual Fuel Utilization Efficiency (AFUE) rating of not less than 92%, and must be 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 Heat Pumps, Furnaces or Make-up Air Units

1) In a *building* required to comply with this Article, except as permitted by Sentence (5), domestic *heat pumps*, furnaces or make-up air units shall be powered only by electricity and be tested using CAN/CSA-C22.2 No. 236 "Heating and Cooling Equipment".

2) *Heat pumps* equipped with supplementary heaters shall incorporate controls to prevent supplementary heater operation when the heating load can be met by the *heat pump* alone, except during defrost cycles,

3) *Heat pumps* with a programmable thermostat shall be equipped with setback controls that will temporarily suppress electrical back-up or adaptive anticipation of the recovery point, in order to prevent the activation of supplementary heat during the *heat pump's* recovery.

4) *Heat pumps* shall conform to the performance requirements of Table 10.2.2.14..

Table 10.2.2.14
Heat Pump Equipment Performance Requirements
Forming part of Sentence 10.2.2.14.(4)

Component or Equipment	Heating or Cooling Capacity (kW)	Standard	Minimum Performance (no units)
Air Cooled Unitary Air Conditioners and Heat Pumps – Electrically Operated			
Split Systems	≤ 19	CSA C656	SEER = 14.5 EER = 11.5 HSPF = 7.1
Single Package System	≤ 19	CSA C656 (Including General Instruction No 2)	SEER = 14 EER = 11 HSPF = 7.0
All Systems	> 19	CAN/CSA-C746	See Level 2 in standard
Water Cooled Unitary Air Conditioners and Heat Pumps – Electrically Operated			
Ground Source Closed Loop			COP _h ≥ 3.91
Water loop <i>heat pumps</i>		CAN/CSA-C13256-1	COP _h ≥ 3.91

Direct Expansion Ground Source Heat Pumps – Electrically Operated			
Direct Expansion Ground Source Heat Pumps	≥ 21	CSA C748	COP _h ≥ 3.1

Notes to Table 10.2.2.14

The symbols and abbreviations that appear in this column have the following meanings:

COP = coefficient of performance, in W/W (COP_c = in cooling mode and COP_h = in heating mode)

EER = energy efficiency ratio, in (Btu/h)/W (no metric equivalent)

HSPF = heating season performance factor, in watt-hours

SEER = seasonal energy efficiency ratio, in (Btu/h)/W (no metric equivalent)

5) *Buildings* complying with the Performance Path option of Sentence 10.2.1.4.(2) may provide domestic gas-fired furnaces or make-up air units that shall have an Annual Fuel Utilization Efficiency (AFUE) rating of not less than 92%, as tested using CSA 2.6/ANSI Z83.8, "Gas unit heaters, gas packaged heaters, gas utility heaters and gas-fired duct furnaces".

6) *Heat pumps* used to provide space heating shall be of the variable or multi stage compressor type.

7) *Heat pumps* providing space heating shall not provide for domestic hot water production, except where the heat pump only provides pre-heated water to a separate and independent electric domestic hot water system.

8) In a *building* containing not more than two principal *dwelling units*, *heat pumps* that provide space cooling must also be able to provide space heating.

9) *Heat pumps*, furnaces and make-up air units shall be readily accessible for maintenance, and capable of being reached quickly for operation, renewal or inspection, without requiring those to whom ready access is a requisite to climb over or remove obstacles.

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 a) shall be equipped with

- i) intermittent pilot ignition (IPI) systems,
- ii) on-demand ignition systems that automatically shut off within 7 days of appliance non-use in a single detached house or duplex *building*, or 6 hours of appliance non-use in a multifamily dwelling,
- iii) match ignition, and
- iv) a timer, and

b) shall be direct vented.

2) Where exterior gas fireplaces are provided as 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.

3) In a *building* required to comply with this Article, the total rated input of all gas-fired fireplaces installed shall not exceed 17.59 kW (60,000 Btu per hour).

4) In a *building* required to comply with this Article, gas-fired fireplaces are not permitted as the primary heating *appliance*.

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 domestic wood 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 (HRV) or energy recovery ventilator (ERV) located in

- a) each dwelling unit, including *ancillary dwelling units*, or
- b) a commonly accessible location if serving multiple *dwelling units*.

2) In a *building* required to comply with this Article, an HRV or ERV shall

a) be sized to run at its rated speed for continuous operation while achieving the performance requirements of Table 10.2.2.17 as designed and tested in conformance with CAN/CSA-C439:

Table 10.2.2.17
Heat Recovery / Energy Recovery Ventilator Performance Requirements
Forming part of sentence 10.2.2.17.(2)

Compliance Path	Sensible Heat Recovery Efficiency (SRE) at 0° Celsius ⁽¹⁾
Performance Path (complying with Sentence 10.2.1.4.(2))	65%
Prescriptive Path (complying with Sentence 10.2.1.4.(3))	75%

Notes to Table 10.2.2.17

⁽¹⁾ See Note A-10.2.2.17 for guidance on determining efficiency ratings

- b) 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,
- c) not be connected to kitchen and bathroom exhaust fans,
- d) have balanced HRV or ERV supply and exhaust air flows within plus or minus 10% of the actual normal operating exhaust capacity, and
- e) be labelled with tested supply and exhaust air flows for high and low settings, measured in CFM.

3) In a *building* required to comply with this Article, the HRV or ERV system contractor or installer shall provide a completed Mechanical Ventilation Checklist to the *Chief Building Official*.

10.2.2.18. [UTV Reserved]

10.2.2.19. System Requirements for Heating within Exterior Spaces

(See Note A-10.2.2.19.)

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 (3), the design of exterior space heating or occupant heating systems shall comply with Table 10.2.2.19, as applicable,

Table 10.2.2.19.

Exterior Space or Occupant Heating System Design Requirements

Forming a part of 10.2.2.19.

System Type	Maximum output	Control type	Management Requirements
In-slab or in-floor radiant heat	15 W/ft ²	Zone-based controls interconnected with centralized automatic control system	Independent zone management
Electric radiant heat	18 W/ft ²	Unit-based or zone-based controls interconnected with centralized automatic control system	Independent unit or zone management
Heated seating	20 W per seat	Zone-based controls, interconnected with i) individual seat shutoff, or ii) a centralized automatic control system	Individual seat heater shutoff and independent zone management
Non-electric and non-fossil fuel radiant heat	18 W/ft ²	Unit-based controls interconnected with 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.

10.2.2.20. Energy and Emissions Compliance Documentation Requirements

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 compliance documentation, in the form of

- a) a PHPP file from a Certified Passive House Consultant or Designer,
- b) an EnerGuide Rating System Audit, or
- c) equivalent documentation, *acceptable* to the Chief Building Official.

2) In a *building* subject to Sentence 10.2.1.4.(1), energy compliance reports shall provide:

- a) a “Pre-construction Energy Checklist” at the time of permit application that demonstrates compliance with Article 10.2.1. 4. energy requirements,
- b) a “Mid-construction Energy Checklist” to the *building official* at the time of mid-construction that:

- i) demonstrates the energy components are consistent with the specified requirements at *permit* application, and
- ii) includes a completed blower door test in which the airtightness meets or exceeds the specified value in Table 10.2.2.21.A, or is otherwise *acceptable* to the *Chief Building Official*, and
- c) a final construction (as-built) report at project completion that:
 - i) demonstrates the energy components are consistent with the specified requirements at initial permit application, and
 - ii) includes a completed blower door test in which the airtightness meets or exceeds the specified value in Table 10.2.2.21.A, or is otherwise *acceptable* to the *Chief Building Official*.

10.2.2.21. Building and Dwelling Unit Airtightness Testing

(See Note A-10.2.2.21)

- 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,
 - c) airtightness protocol recognized by Natural Resources Canada for use in homes and buildings labeled under the EnerGuide for New Homes program, or
 - d) ASTM E3158, “Standard Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building.”
- 2) A *building* required to comply with this Article shall have, at time of final inspection, maximum tested air leakage rates in conformance with:
 - a) Table 10.2.2.21.A, for buildings subject to Article 10.2.1.4.,
 - b) Table 10.2.2.21.B, for buildings subject to Article 10.2.1.2. or Article 10.2.1.3., or
 - c) be sealed to the satisfaction of the *Chief Building Official*.

Table 10.2.2.21.A
Maximum Tested Air Leakage Rates for Buildings complying with Article 10.2.1.5.
Forming part of Clause 10.2.2.21.(2)(a)

Airtightness Levels	ACH ₅₀	NLA ₁₀ (cm ² /m ²)	NLR ₅₀ (L/s-m ²)
All buildings	2.5	1.20	0.89

Table 10.2.2.21.B
Maximum Tested Air Leakage Rates for Buildings complying with Article 10.2.1.2 or 10.2.1.3
Forming part of Clause 10.2.2.21.(2)(b)

Building Classification	Maximum Tested Air Leakage Rate
Whole Building	1.5 L/s/m ² at 75 pascals
Suites in multi-family buildings	1.23 L/s/m ² at 50 pascals

10.2.2.22. Building Equipment and Systems Commissioning

- 1) In a *building* required to comply with this Article, *building* services (e.g. heating, ventilation, and air-conditioning, lighting, service water heating) and associated equipment, controls, meters, submeters shall be commissioned using a *commissioning* process carried out by a *Commissioning Provider* in accordance with: (See Note A-10.2.2.22.(1).)
 - a) ASHRAE Standard 202-2024, or
 - b) CSA Z320-11 (R2021) and CSA Z5000-18, with
 - i) no requirement to install metering or submetering equipment to monitor, record or display energy consumption, water consumption or end-use data,
 - ii) no requirement for post-occupancy monitoring-based commissioning, or continuous tracking and analysis for energy or water consumption data on an on-going basis, or user surveys, or post-occupancy energy model calibration. (See also Division C, Subsection 2.2.8.)

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 an *electric vehicle energy management system* is implemented, the *Chief Building Official* may specify a minimum performance standard to ensure a sufficient rate of electric vehicle charging.

Section 10.4. Low Carbon Materials and Construction

10.4.1. Low Carbon Materials and Construction

10.4.1.1. Application

1) This Section applies to new *buildings* and *additions* described in Sentence 1.3.3.2.(1) of Division A, except those (See Note A-10.2.2.22.(1).)

- a) subject to Article 10.2.1.5. and any *storage garage* attached to them, or
- b) with gross *floor area* not exceeding 1,800 m².

10.4.1.2. Low Carbon Materials and Construction

1) A *building* shall be designed and constructed to achieve whole-building embodied carbon impacts of not more than double an *acceptable* benchmark as determined in compliance with the “National Whole-Building Life Cycle Assessment Practitioner’s Guide” and the associated City of Vancouver Addendum, or as *acceptable* to the *Chief Building Official*.

Section 10.5. Objectives and Functional Statements

10.5.1. Objectives and Functional Statements

10.5.1.1. 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 10.5.1.1. (See Note A-1.1.1.2.(1) of Division A.)

Table 10.5.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 10
Forming part of Sentence 10.5.1.1.(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]
(6)	[F86-OE1]
(7)	[F95,F96-OE1]
(8)	[F95,F96-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)	[F41-OE1]
10.4.1.2. Low Carbon Materials and Construction	
(1)	[F101-OE2.2]

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-10.2.1.1.(5) Balcony. The intention is to apply the requirements to exterior spaces regardless of designation such as balcony, patio, porch, veranda, or other name whether located on the side or the roof of a building.

A-10.2.1.1.(6) Gas Connection for Small Residential Buildings. In line with the original intention, this note is to clarify the total limit of one gas connection, and not one gas connection for each exterior space, where an exterior space can include, but is not limited to, a balcony, patio, deck or lawn.

A-10.2.1.2.(1)(a) Designing to Passive House. 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-10.2.1.4.(1)(b) 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-10.2.2.2.(2)(h) and A-10.2.2.3.(1)(j) SWH Temperature and Flow Rate Control Systems – Modelling. The intention is to prioritize health and safety over energy and emissions reductions, from the threat of *Legionellae* development and exposure, however, performance models can continue to account for energy and emissions savings through the incorporation of phantom low flow rates in the proposed model.

A-10.2.2.2.(2)(l) Lighting Trade-off Limited to Whole Building. The intention of this limitation is to prevent LPD results, through the application of trade-offs over numerous renovations, that could otherwise not be achieved as a regular new construction project. Allowing under-lit spaces to be renovated to their maximum allowance without considering the existing over-lit spaces (through previous trade-off applications) can result in total building/tenancy LPD limits being exceeded by excessive amounts.

A-10.2.2.4.(4) Adjusted Thermal Energy Demand Intensity (TEDI). Refer to the latest BC Energy Step Code documentation and guidance for calculating the Adjusted TEDI

A-10.2.2.4.(6) Modelling Guidelines for Large Homes. For a building required to comply with the greenhouse gas (GHG) limit, the total annual GHG footprint shall be calculated using approved modelling software and modelling criteria provided in the "Modelling Guidelines for Large Homes."

A-10.2.2.5.(1) 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.

Calculating the Effective Thermal Resistance of an Assembly with Continuous Insulation:
Isothermal-Planes Method

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”:

$$RSI_{\text{parallel}} = \frac{100}{\frac{\% \text{ area of framing}}{RSI_F} + \frac{\% \text{ area of cavity}}{RSI_C}}$$

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.

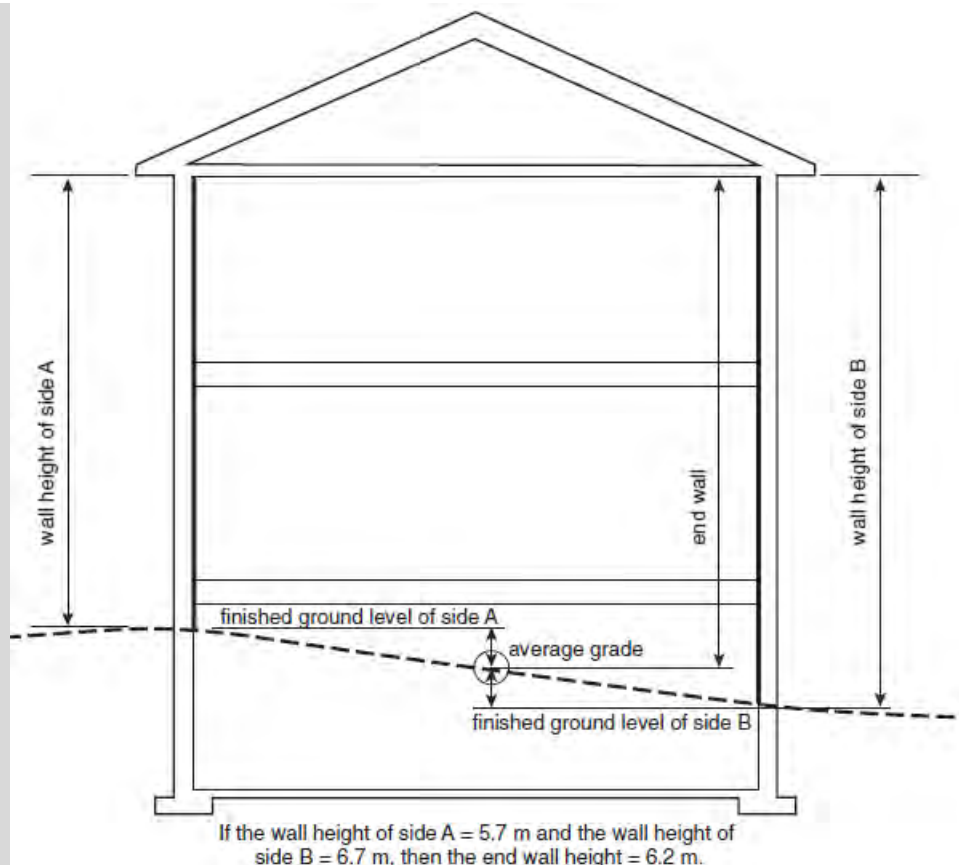


Figure A-10.2.2.6.-A

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.

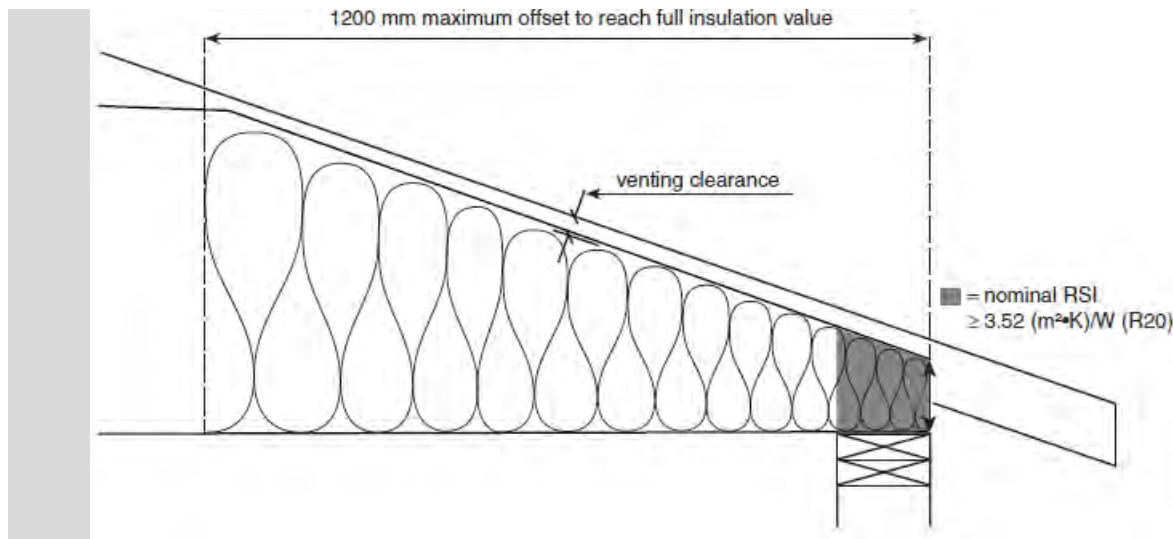


Figure A-10.2.2.6.-B
Area of ceiling assemblies in attics permitted to have reduced thermal resistance

A-10.2.2.6.(3) Roof Albedo and Emissivity. The intention is to reduce the radiative effect from solar heated roofs on top floor residence(s). The emissivity target is to incorporate the micron band to maximize the cooling effect. The overall emissivity value may be determined either directly or through a weighted average of the applicable roofs and their respective areas. Only exposed membraned areas apply, while calculations are to exclude skylights, parapets and equipment. The SRI range is meant to allow tan roofs (SRI 73) where reflection is more likely to be a nuisance to adjacent buildings.

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-Assembled Fenestration 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 demonstrate compliance, the U-value must meet or be below code stipulated values; for example: a USI-value of U 1.23 would not meet requirements where USI 1.22 is required.

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 address(es) 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-assembled fenestration products at the manufacturing location in which each individual fenestration product has a compliant U-value. Compliance is achieved if each product meets the U-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 U-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 U-value, compliance may be demonstrated by calculating the overall average U-value by means of a tabulated U-value x A reporting format. In such a table, the U-values for the standard size of each product are to be multiplied by the area of the product to determine the average area weighted U-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.

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-assembled windows, doors,
- imported windows and doors not previously tested in Canada,
- curtainwalls and sloped glazing assemblies, and
- factory-assembled 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.

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 1 foot 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.

The use of "space" within Clause 10.2.2.8.(3)(f) is intended to refer to an entire tenancy space, such as a commercial retail unit for example, and not simply a reception area or lobby.

A-10.2.2.9.(1) Building Services Submetering. Meters provided by the utility service provider that collect and report energy usage typically already meet this requirement. Energy sources include electricity, gas, liquid fuel, and district system-provided steam, hot or chilled water. Note that for buildings with certain occupancies and gross floor areas, energy and carbon reporting requirements may apply after building occupancy. Refer to the City of Vancouver Annual Greenhouse Gas and Energy Limits By-law No. 13472 for applicability and details.

A-10.2.2.9.(2) Building Services Submetering. Monitoring energy consumption is considered essential to energy management. However, this Article does not require the installation of monitoring equipment, but requires the provision of the necessary access and hardware to permit the eventual installation and use of monitoring equipment, if desired. For electrical energy, this might include, for example, the installation of a meter socket or the provision of access to the load side of the service box or main distribution panel to allow for the measurement of energy consumption for electrical energy. For other sources of energy such as gas or district system supplied steam, hot or chilled water, etc., this might include installation of measurement ports or shut-off valves that allow future installation of meters.

Where design loads from Clauses 10.2.2.9.(2)(a) to 10.2.2.9.(2)(b) are less than 10% of the whole-building load, these categories may be combined with other categories.

A-10.2.2.10 Exterior Lighting in Residential Buildings.

10.2.2.10.(1)(b) Master Switch Except for residences containing only high efficiency light fixtures (LED etc) excluding pot lights, 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 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.

10.2.2.15.(1)(b) Direct Venting. Naturally Aspirating Fuel-Fired Appliances (NAFFVA) are not permitted.

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 SRE (%) rating at continuous rated speed typically corresponds to the rating at the middle speed of three standard test fan speeds. For systems with a different number of tested speeds, linear interpolation is permitted to obtain the efficiency rating.

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

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 unit 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-10.2.2.19 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 Article 10.2.2.19 is limited to business-licensed establishments where the primary use is the consumption of food or beverages while seated.

The intention of Article 10.2.2.19 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 10.2.2.19.(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 10.2.2.19.(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), and 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/ft² this would equate to 266 ft² per zone, however less energy intensive systems would be allowed to cover a larger area, for example, a 15 W/ft² system would allow 320 ft² per zone.

For multi-system design scenarios, Sentence 10.2.2.19.(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/ft², a combined system of in-slab heating with an overhead radiant system cannot be designed to exceed a combined total operation of 18 W/ft². This scenario allows in-slab heating at 8 W/ft² while limiting the overhead heating to 10 W/ft², or the possibility of 5 W/ft² and 13 W/ft² 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-10.2.2.21. 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.

Air Barrier Assembly Testing

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.

Air Barrier System Approaches

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.(1) Building Systems Commissioning. Projects that are required to follow the commissioning requirements of the BC Housing Building Commissioning Guidelines are deemed equivalent to 10.2.2.22 requirements.

The Commissioning Provider (also known as a Commissioning Authority or CxP) is an individual with the following qualifications and is independent of the design and construction teams:

- A minimum of 10 years of demonstrable experience in commissioning with a minimum of 5 projects of a similar scale or scope, or
- A minimum of 4 years of demonstrable experience in commissioning with a commissioning designation provided by an organization with an accredited commissioning training program (e.g. ASHRAE, Association of Energy Engineers, Building Commissioning Certification Board), 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 commissioning services across building systems.

The Commissioning Authority may be supported by a Commissioning Provider Team (CxP Team) which consists of a team of specialists and related support staff who are responsible for the management of actions and the generation of deliverables by the Commissioning Authority. The Commissioning Provider Team may consist of several companies, including subcontractors to the Commissioning Authority who act as the contact to the Owner.

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.

A-10.4.1.1.(1)(a) Embodied Carbon. The intention of this wording is to exempt smaller buildings, including stacked townhomes and their shared underground parkades, from Low Carbon Materials and Construction requirements. Where uncertainty exists, applicants should consult with building officials to confirm the applicability of embodied carbon requirements.

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.

2) Where *construction* of an *existing building* occurred before the effective date of this By-law, reconstruction or *alteration* of an *existing building* is not a requirement of this By-law, except as required by Subsection 11.1.4.

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

2) The following additional words and terms shall have the following meanings for this Part.
(see Note A-11.1.2.1.(2))

Change of *Major occupancy* means a change of *major occupancy* within a *building*, a *suite*, or its constituent *floor areas*.

Restricted Change of *Major occupancy* means a change of *major occupancy* restricted to a specific set of uses as set out in Sentence 11.5.4.1.(2) that are limited both in hazard and scope such that it does not increase the overall level of risk.

Small *Suite* Change of *Major occupancy* means a change of *major occupancy* within a *suite* with an *occupant load* not exceeding 60 persons and limited to Group A2, Group D, Group E, Group F2 (limited to wholesale showroom use), or Group F3 *major occupancies*.

Horizontal Addition means any new *floor area* beyond the extents of the existing *floor area*.

Major Horizontal Addition means a horizontal *addition* which exceeds the limits permitted by a *Minor Horizontal Addition*.

Minor Horizontal Addition means a horizontal *addition* to the existing *floor area* in which it is located, and which ~~that~~ does not exceed 25 per cent of the *existing building area*, 500 m² in aggregate *floor area*, or *both*.

Renovation means a *project* whose scope of work includes *construction* limited to the improvement, renovation, reconfiguration, or refurbishment.

Major Renovation means a renovation whose scope of work includes multiple *suites* in a *building*, or work not falling into other subcategories of renovation.

Minor Renovation means a renovation of a single *suite* contained within a single tenant space and those demising walls shared with the adjoining *suites*, but which does not include the public or common *floor areas* of the *building*.

Small *Suite* Renovation means a renovation whose scope of work includes a *suite* that is limited to Group A2, Group D, Group E, Group F2 (limited to wholesale showroom use), or Group F3 major occupancies, and has an *occupant load* of

- up to 60 persons as determined by Division B, or
- up to 100 persons if egress is directly to the adjoining ground level.

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.

Repair means work pertaining to a limited scope of interior or exterior renovation work to replace *existing building* components with functionally equivalent components.

Vertical Addition means the addition of any new *floor area* that in-fills existing unoccupied roof or deck area or is superimposed over *existing building* structure or *floor area*.

Major Vertical Addition means a Vertical Addition which exceeds the limits permitted by a *Minor Vertical Addition*.

Minor Vertical Addition means a Vertical Addition with an aggregate *floor area* increase that does not exceed 25 per cent of the *building area*, 500 m² in aggregate *floor area*, or *both*.

Voluntary Building By-Law Upgrades means upgrades limited to *alterations* that directly contribute to the improvement of *building* systems for fire and life safety, accessibility, health, seismic force resistance, *building* envelope, and energy or water efficiency systems in an *existing building*, and which do not arise as a consequence of other new work or improvements.

11.1.3. Objectives

11.1.3.1. 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) 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* (see Note 11.1.3.1.(1)(e)), and

f) the level of life safety and *building* performance shall not be decreased below the existing level.

2) An *alteration* to an *existing building* shall not trigger upgrading of the *existing building* to meet the rainwater management requirements described in Article 2.4.2.5. of Division B of Book II (Plumbing Systems) of this By-law.

11.1.4. Compliance

11.1.4.1. Upgrading of Existing buildings

1) Except as otherwise permitted in this Subsection, where an *alteration* is made to an *existing building*, the *alteration* shall comply with the upgrade objectives of this By-law and the *existing building* shall be

- a) provided with *acceptable* upgrades satisfying the upgrade levels required by the *existing building* Upgrade Mechanism in Section 11.5.,
 - b) upgraded to the satisfaction of the *Chief Building Official* through Alternative Compliance Measures that demonstrate equivalent improvement where specific characteristics of the *building* are intended to be retained, or
 - c) upgraded to the satisfaction of the *Chief Building Official* where the *owner* demonstrates that the design levels, as determined by the Upgrade Mechanism, present a hardship for the *owner*.
- (See Note 11.1.4.1.(1))

2) 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.

11.1.4.2. Exceptions to Upgrade Requirements

- 1) 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 May 1, 2007,
 - b) all new work is in compliance with this By-law, and
 - c) all unsafe conditions are corrected to the satisfaction of the *Chief Building Official*.
- 2) Where a voluntary Building By-law upgrade 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.
- 3) Existing construction complying with Alternative Compliance Measures in accordance with Sections 11.2. to 11.4. need not be further upgraded (see Note A-11.1.4.2.(3)).
- 4) Where the scope of a renovation is limited to minor or major renovation, and no *alterations* are proposed to existing *fire separations*, the applicable structural and non-structural upgrades may be limited to the renovated *suites* provided that measures are taken to limit the risk that a failure of connected elements outside the renovated *suites* will cause a failure of structural or non-structural elements within the subject *suite*.
- 5) Where the scope of a renovation project is limited to a minor or major renovation and the value of project is less than \$255,000, structural or non-structural upgrading need not be provided (see Note A-11.1.4.3.(6), 11.2.3.1., 11.5.3.1.(2)&(4), and 11.5.4.2.(4)).
- 6) Where an *alteration* to a *building* is a self-contained volumetric space that is separated from the remainder of the *building* by a *noncombustible 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 *floor area* of the self-contained volumetric space is not larger than 10% of the *existing building area*,
 - d) a *noncombustible vertical fire separation* with a 2 h *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*.

11.1.4.3. Additional Upgrade Requirements

- 1) 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.

2) Where property lines are relocated closer to a *building*, the *building* shall be upgraded to conform to the spatial separation 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.

3) 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 11.1.4.1.

4) 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 the upgrade triggers of Article 11.1.4.1

5) 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*.

6) Where the total construction value of an *alteration* to a *marina* exceeds 50% of the replacement value of the *marina* as determined at the application stage for *alteration*, then the *marina* shall comply with Subsection 12.2.1.

11.1.5. Alternative Compliance Measures

11.1.5.1. Conditions for Using Alternative Compliance Measures

1) Where a *building* or a portion of a *building* is required to be upgraded, the Alternative Compliance Measures provided in Section 11.2. or 11.4. may be applied as alternatives to those requirements contained elsewhere in this By-law, under the conditions specified in this Article, and Sections 11.2. through 11.4.

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 11.3.3. may be applied as an alternative provided all of the requirements of that Article have been met.

3) Except for *additions* and new *construction*, where the spatial separation and exposure protection requirements of Subsection 3.2.3. or 9.10.14. require that the exterior wall construction of a *building* to be *noncombustible*, Subsection 11.3.4. may be applied.

Section 11.2. Alternative Compliance Measures for the Conversion of Existing Buildings

11.2.1. Application

11.2.1.1. 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) The requirements of this section may be applied in lieu of the upgrades required by 11.5 Upgrade Mechanism. 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 measures in Section 11.4 may be applied to existing conditions for conversions.

11.2.2. Conversion of an Existing Residential Building Containing Not More Than Two Principal Dwelling units into a Community Care Facility, Group Residence or Daycare Facility for Children

11.2.2.1. 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 daycare facility for *children* 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 daycare facility for *children*,

b) the *community care facility* or *group residence* is

- i) separated from the residential portions of the *building* containing not more than one principal *dwelling unit* by a *fire separation* with a *fire-resistance rating* of 1 h,
- ii) separated from the residential portions of the *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 daycare facility for *children* conforms with Article 3.1.2.8.,

d) firefighter access conforms with this By-law,

e) the *building area* is no more than 300 m²,

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.

11.2.2.2. 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 daycare facility for *children*.

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., 9.10.14. or 9.10.15. to have exposure protection, existing openings need only conform to Article 11.3.4.

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* shall 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 cm² 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 cm² 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 3.2.4.7.

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.

11.2.3. Conversion of a Portion of a Suite into an Ancillary Residential Unit

11.2.3.1. 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 unit*, the *existing building* shall conform to the requirements of Part 9, except as permitted by Table 11.2.3.1., provided the *building* was constructed under a *building permit* issued prior to June 22, 2004. (See Note A-11.2.3.1.(1).)

2) 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 of Division B.

3) Where the *alteration* in Sentence (1) includes an *addition*, the *addition* shall conform to the requirements of this By-law.

- 4) Notwithstanding the requirements of Sentence 9.34.1.1.(1), circuits and receptacles in the *ancillary residential unit* 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 residential unit*,
 - b) any electrical range and equipment loads provided for the *ancillary residential unit* 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 unit*.

Table 11.2.3.1.
Fire Safety Requirements for *Ancillary residential unit* Conversions
Forming Part of Article 11.2.3.1.

Item	Item Details	Alternative Compliance Measure(s)
Spatial Separation	Existing windows and doors	Original unaltered windows, doors, or other openings may remain.
	New windows in existing openings	Where windows are provided in existing openings to be protected by Subsections 3.2.3. or 9.10.14. Existing openings may be protected in conformance with Article 11.3.4.4.
Fire Containment within a Principal Dwelling unit	Separation between a principal <i>dwelling unit</i> and its contained <i>ancillary residential units</i>	Existing lath and plaster in good condition or 12.7 mm gypsum wall board on wood studs at maximum 450 mm on centre may be used where the interior wall finish is in place prior to the <i>construction</i> of an <i>ancillary residential unit</i> . Except where existing conditions create unreasonable hardship, new walls are to be constructed with • 15.9 mm (5/8") type 'X' GWB or 12.7 mm (½") Type 'C' GWB on wood or steel studs at maximum 600 mm on centre. The stud cavity is to be filled with minimum 89 mm (3 ½") mineral wool insulation. • Caulked joints where floor and ceiling assemblies intersect. • Resilient acoustic channels on at least one side of the wall assembly.
	Ducts common to both units through <i>suite</i> separations	<i>Fire dampers</i> not required if sheet metal ducting extends a minimum of 1 800 mm (6'-0") beyond the <i>suite</i> separation and the opening is firecaulked. Acoustic insulation is to be used inside the common duct extending a minimum of 1 500 mm (60") from either side of the <i>suite</i> separation.
	Plumbing and sprinkler plastic piping that penetrate <i>fire separations</i>	Shall be tightly fitted, cast in place, or caulked as per product listing.

	Suite entry doors between the principal <i>dwelling unit</i> and its contained <i>ancillary residential unit</i>	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.
Resistance to Forced Entry	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 <i>ancillary residential unit</i> .
Exits	Egress from each <i>dwelling unit</i>	In combination with the egress window requirements of Sentence 9.9.10.1., at least one conforming <i>exit</i> is required from the principal <i>dwelling unit</i> and one from the <i>ancillary residential unit</i> .
	Windows and doors adjacent to exits	No requirements where the <i>suite</i> is <i>sprinklered</i> , provided with a closure or provided with intervening construction extending out by at least 600 mm.
Fire Department Access	Access Path	Existing path designated for fire department is permitted to be minimum 860 mm.
Flame Spread Rating	Exits	Not more than 150
	Remainder of <i>building</i>	No requirement
Sprinklers		Sprinklers are not required where the construction value of the <i>alteration</i> does not exceed \$255,000 or 50% of the replacement ⁽¹⁾ value of the <i>existing building</i> .
Heating Systems	Furnace room enclosure	No separation required but provide proper combustion air and required clearances from all equipment. ⁽²⁾
Smoke Alarms	Entire <i>building</i>	Interconnected <i>smoke alarms</i> to be installed on each <i>storey</i> including basements, in each sleeping room and in a location between the sleeping room and the remainder of the <i>storey</i> and if the sleeping room is served by a hallway, the <i>smoke alarm</i> to be located in the hallway. 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 <i>building</i>	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 <i>unsafe condition</i> as determined by the <i>Chief Building Official</i> . All existing stairs to have at least one handrail in conformance with Subsection 9.8.7.
Guardrail Protection	Entire <i>building</i>	Existing guards may be retained provided they are structurally sound, non-climbable and are at least 900 mm high.
Sprinklers		Sprinklers are not required provided the construction value of the <i>alteration</i> is less than or equal to 50% of the replacement ⁽¹⁾ value of the <i>existing building</i> .

Heating Systems	Furnace room enclosure	No separation required but provide proper combustion air and required clearances from all equipment. ⁽²⁾
Smoke Alarms	Entire <i>building</i>	Interconnected smoke alarms to be installed on each <i>storey</i> including basements, in each sleeping room and in a location between the sleeping room and the remainder of the <i>storey</i> and if the sleeping room is served by a hallway, the <i>smoke alarm</i> to be located in the hallway. 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 <i>building</i>	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 <i>unsafe condition</i> as determined by the <i>Chief Building Official</i> . All existing stairs to have at least one handrail in conformance with Subsection 9.8.7.
Guardrail Protection	Entire <i>building</i>	Existing guards may be retained provided they are structurally sound, non-climbable and ≥ 900 mm high.
Existing Headroom	Entire <i>building</i>	May be reduced to 1950 mm over 80% of the <i>suite</i> area and all egress routes. The minimum clear height under the remaining <i>suite floor area</i> shall be not less than 1 850 mm, except <i>public corridors</i> and <i>exits</i> which shall be not less than 2 000 mm.
	Doorway opening sizes	Doorway openings within an ancillary residential unit may be reduced to not less than 1 890 mm high. Except for <i>exit doors</i> , and doors serving <i>public corridors</i> and <i>exit corridors</i> that serve principle <i>dwelling units</i> in a <i>building</i> containing an <i>ancillary residential unit</i> , doorway openings shall be designed to accommodate swing-type and folding doors not less than 1 980 mm high.
Sound Separation	Between the principal <i>dwelling unit</i> and its contained <i>ancillary residential units</i>	Not required where the interior wall finish is in place prior to the construction of an <i>ancillary residential unit</i> . Fill cavity spaces of <i>suite</i> separation with mineral wool in walls and floor assemblies of new construction.
Unsafe Conditions	Entire <i>building</i>	Any condition within or around the <i>building</i> which could cause undue hazard or risk to persons to be corrected as directed by the <i>Chief Building Official</i> .

Notes to Table 11.2.3.1.:

(1) See Note A-11.2.3.1.

(2) The Gas Code places restrictions on locating gas furnaces adjacent to sleeping rooms or bathrooms.

(3) See Note A-11.2.3.1.(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 *building height* may be considered as 3 *storeys* in *building height* where the *project* is limited to the creation of a new *ancillary residential unit*.

11.2.4. Enclosure of an Exterior Open Balcony in an Existing Residential Building

11.2.4.1. 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 this By-law,
 - 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 in Section 11.5.

11.2.5. Conversion of Space in an Existing Group F Division 2 Building into Artist Live/Work Studios

11.2.5.1. Alternative Compliance Measures

- 1) *Artist live/work studios* are permitted in an *existing building* classified as a Group F, Division 2 *major 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* not more than 3 *storeys* in *building height*,
 - c) the *exit* systems conform to Section 3.4., except as permitted in Subsections 11.3.6. and 11.3.7.,
 - d) all *public corridors* conform to Article 3.3.1.4., except as permitted in Subsections 11.3.5. and 11.3.7.,
 - 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 entire *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 in Section 11.5,
 - k) a studio complies with the sound transmission requirements of Section 5.8.,
 - 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 in Section 11.5.

2) For the purpose of determining *major occupancy* classification, *artist live/work studios* shall be considered to have a *major occupancy* classification as defined in Articles 3.1.3.3. and 3.1.3.4.

11.2.6. Conversion of an Existing Hotel to Single Room Accommodation

11.3.6.1. 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 not more than 3 storeys in *building height*,
- b) the *exit* systems conform to Section 3.4., except as permitted in Subsections 11.3.6. and 11.3.7.,
- c) all *public corridors* conform to Article 3.3.1.4., except as permitted in Subsections 11.3.5. and 11.3.7.,
- 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 in Section 11.5.,
- 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 5.8, and
- j) the *building* is upgraded to an *acceptable* level as defined in the upgrade mechanism in Section 11.5.

11.2.7. Conversion of an Existing Non-Strata Building to a Strata Property

11.2.7.1. 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, and A4 as detailed in the upgrade mechanism in Section 11.5., 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., 9.10.14. or 9.10.15. as applicable,
- 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.,
- c) upgraded to design upgrade levels S4 and N4, as detailed in the upgrade mechanism in Section 11.5., and
- d) fully *sprinklered*.

(See Note A-11.2.7.1.(2).)

Section 11.3. Alternative Compliance Measures for Existing Conditions to Assist Renovation

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 Subsection 11.3.3. shall not apply to newly *constructed buildings* or portions of a *building*, which shall conform to the requirements for new *construction* in this By-law.

2) Where the *building* is a *heritage building*, the alternative compliance measures in Section 11.4 may be applied to existing *construction*.

3) The alternative compliance measures provided in Subsection 11.3.2. may be applied to existing conditions or existing *construction* required to be modified to support new *construction*.

11.3.2. Energy Retrofit Design Building Classification

11.3.2.1. Application to Existing buildings

- 1) Except as permitted by Sentences (2) and (8), *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 Article 11.3.2.2., or as deemed *acceptable* to the *Chief Building Official*.
- 3) Except as permitted in Sentence (5) and Articles 11.3.2.2. through 11.3.2.4., *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 Sentence 10.2.2.2.(2), or
 - b) the "*Alteration* Language Supporting NECB 2020" (See Note A-11.3.2.1.(3)(b).).
- 4) Where a *building* contains one or more major occupancies that conform to Article 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-11.3.2.1.(5).)
- 6) The design requirements of Subsection 10.2.2. shall form an integral part of this Subsection, except where otherwise indicated.
- 7) Compliance with the requirements of this Subsection does not exempt upgrades that are otherwise required by this Part.
- 8) In a *building* where components have been formally recognized by a federal, provincial, territorial, or municipal *authority having jurisdiction*, as having either Heritage or Character value, the alteration of these components need not comply with this subsection.

11.3.2.2. Buildings without Residential or Commercial Components

- 1) *Alterations* to energy systems or components of a *building*, except those included in Articles 11.3.2.3. and 11.3.2.4., shall comply with
 - a) the *alteration* requirements of
 - i) Clause 11.3.2.1.(3)(a) except as required by Clause (ii), or
 - ii) Clause 11.3.2.1.(3)(b) where the *building* was designed or upgraded to NECB, and
 - b) Articles 10.2.2.8. through 10.2.2.20. as applicable,
 - c) the airtightness performance requirements of Article 10.2.2.21. for reconstruction projects, and
 - d) the *commissioning* requirements of Article 10.2.2.22 for new equipment and new systems including controls, meters, submeters. (See Note A-11.3.2.2.(1)(d).

11.3.2.3. (ZEBP) Residential Buildings of 4 Storeys or More, and Commercial Buildings (including Hotels and Motels)

- 1) *Alterations* to energy systems or components of a *building* containing Group C, D, or E Major Occupancies, except those included in Articles 11.3.2.4. shall comply with
 - a) the *alteration* requirements of Clause 11.3.2.1.(3)(b),
 - b) Articles 10.2.2.8. through 10.2.2.20. as applicable,
 - c) the airtightness performance of Article 10.2.2.21. for reconstruction projects, and

d) the *commissioning* requirements of Article 10.2.2.22 for new equipment and new systems including controls, meters, submeters. (See Note A-11.3.2.2.(1)(d).)

11.3.2.4. Residential Buildings of 1 to 3 Storeys

- 1) Except as otherwise required by Sentence 11.3.2.1.(7), Table 11.5.3.1.(2), or in this Subsection, *alterations* to energy systems or components of a *building*, described in Sentence 10.2.1.4.(1), shall comply with
 - a) the *building* envelope opaque elements with thermal performance requirements of Article 10.2.2.6., except:
 - i) for albedo (SRI) and emissivity requirements of Sentence 10.2.2.6.(3), and
 - ii) as permitted by Sentence (2),
 - b) the exterior closures and fenestration performance requirements of Article 10.2.2.7., except as permitted by Sentence (2),
 - c) Articles 10.2.2.8 through 10.2.2.11. as applicable,
 - d) domestic hot water requirements of Article 10.2.2.12. except the system may be gas-fired with a uniform energy factor of not less than 0.78 or a thermal efficiency of not less than 90%;
 - e) space-heating appliance performance requirements of Articles 10.2.2.13. and 10.2.2.14, except a system may be gas-fired with an Annual Fuel Utilization Efficiency (AFUE) rating of not less than 92% as tested using CSA 2.6/ANSI Z83.8, "Gas unit heaters, gas packaged heaters, gas utility heaters and gas-fired duct furnaces"
 - f) the domestic fireplace performance requirements of Articles 10.2.2.15. and 10.2.2.16.,
 - g) the heat recovery ventilator requirements of Article 10.2.2.17., except that *projects* may provide continuous exhaust ventilation in accordance with Section 9.32.,
 - h) Article 10.2.2.19. as applicable, and
 - i) documentation *acceptable* to the *Chief Building Official*.
- 2) Where it is deemed prohibitive by the *Chief Building Official*, an *alteration* or upgrade to a *building* may
 - a) achieve the applicable standard of performance in Table 11.3.2.4. or as otherwise permitted by the *Chief Building Official*, and
 - b) trade-off the remaining emissions-reduction outcomes with other *building* systems or components, *acceptable* to the *Chief Building Official*.

Table 11.3.2.4.
Permitted minimum standards (with equivalent emissions reduction trade-offs selected and approved)
Forming part of 11.3.2.4.(2)(a)

10.2.2.6. Wall Assemblies	Shall achieve a minimum nominal RSI of 2.5 m ² K/W in the affected assemblies with heat transfer, air leakage and condensation control per Section 9.25.
10.2.2.6. Roof Assemblies	Shall achieve a minimum nominal RSI of 3.8 m ² K/W in the affected assemblies with heat transfer, air leakage and condensation control per Section 9.25.
10.2.2.7. Windows, Curtain wall, Sliding or folding doors with glazing	Shall achieve a maximum USI of 1.44 W/m ² K

- 3) *Alterations* designated as reconstruction (see Note A-11.5.1.), shall comply with
 - a) the energy and emissions requirements in either the Performance Path in Sentence 10.2.1.4.(2) or the Prescriptive Path in Sentence 10.2.1.4.(3), and
 - b) the applicable airtightness requirements of Article 10.2.2.21. except an airtightness performance of 3.5 ACH may be achieved.

11.3.3. Construction and Building Safety Alternatives

11.3.3.1. General

- 1) Except for additions and new construction, where the *building* is required to be of *noncombustible* construction, the provisions of this Subsection may be applied as an alternative to the Construction requirements of Subsection 3.2.2.
- 2) A *building* applying the provision of Articles 11.3.3.2. to 11.3.3.10 shall
 - a) be structurally upgraded to the design upgrade level S3 as defined in Article 11.5.1.2.,
 - b) except as permitted in Subsections 11.3.5. and 11.3.7., be upgraded to comply with the fire containment requirements within a *floor area* conforming to this By-law, and
 - c) except as permitted in Subsections 11.3.6. and 11.3.7. and as required by Clause (d), be upgraded to provide *exit* systems conforming to Section 3.4.

11.3.3.2. 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.,
 - 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*, and
 - d) except as permitted in Subsection 11.3.4., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.

11.3.3.3. 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*, and
- d) except as permitted in Subsection 11.3.4. and Table 11.3.1.1., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.

11.3.3.3. 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* or the *building area* does not exceed 400 m² 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 Sentences 11.3.3.4.(2) and (3).

11.3.3.4. 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., and
 - c) except as permitted in Subsection 11.3.4., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.

11.3.3.5. Group B2 Ambulatory Occupants

- 1) A Group B, Division 2 occupancy containing only occupants that are capable of walking up or down stairs 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 m² regardless of the occupant load,
- b) be provided with lighting and emergency power systems conforming to Subsection 3.2.7., and
- c) except as permitted in Subsection 11.3.4., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.

11.3.3.6. 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., and
- c) except as permitted in Subsection 11.3.4., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.

11.3.3.7. 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., and
- c) except as permitted in Subsection 11.3.4., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.

11.3.3.8. 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 11.3.3.8.(3)

Table 11.3.3.8.(3)
Maximum *Building area*, Group D, up to 6 Storeys
Forming part of Sentence 11.3.3.8.(3)

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	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., and

c) except as permitted in Subsection 11.3.4., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.

11.3.3.9. 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 m² 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 m² 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 11.3.3.9.(3), is permitted to be of *noncombustible* construction, 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.

Table 11.3.3.9.(3)
Maximum *Building area*, Group E, Existing Building
Forming part of Sentence 11.3.3.9.(3)

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

4) A *building* referred to in Sentence (1), is permitted to retain existing *combustible* 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., and

c) except as permitted in Subsection 11.3.4., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.

11.3.3.10. 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 m² 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 11.3.3.10.(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 be

i) *noncombustible* construction,

ii) *combustible* construction with a *fire-resistance rating* of no less than 45 min in *buildings* with a *building area* no greater than 4800 m², or

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*.

Table 11.3.3.10.(2)

Maximum *Building area*, Group F, Division 2 or 3, Existing Building

Forming part of Sentence 11.3.3.10.(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

- 3) 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 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 retain existing *combustible* 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., and
 - c) be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3., except as permitted in Subsection 11.3.4.

11.3.3.11. *Combustible* Construction for Minor Repairs

(See Article 1.5.2.9. of Division C.)

11.3.3.12. Open Air Repair and Storage Garages

- 1) Open-air storeys of a storage garage or repair garage located below *grade* need not be *sprinklered*.

11.3.3.13. Daycare Facilities for Children

- 1) Sprinklers required by Table 3.1.2.8. need not be provided for an *existing building* containing a daycare facility for children where
 - a) in a Group A, Division 2 or a Group C major occupancy, at least two *means of egress* are provided by means of doors located so that at least one *means of egress* could provide egress from the daycare facility for children if the other *means of egress* becomes inaccessible to the occupants due to a fire, that
 - i) discharge directly to exterior at the adjacent ground level, or
 - ii) discharge into an *exit* stair enclosure with a *fire-resistance rating* at least equal to that required by the fire separation in Table 3.1.2.8., where it is not required to travel up or down more than 1 storey to reach the adjacent ground level, and
 - b) in a Group A, Division 2 major occupancy, the occupant load of the daycare facility for children shall not exceed Table 3.1.2.8.(3)

Table 11.3.3.13.
Fire Safety Requirements for Omission of Sprinkler in Daycare Facilities for Children
Forming part of Sentence 11.3.3.13.

	Maximum number of Children
Total number of Children	30 ⁽¹⁾
Children under 30 months	8

Notes to Table 11.3.3.13.:

- ⁽¹⁾ Maximum number of children, inclusive of children of age 30 months and under.

11.3.4. Spatial Separation Alternatives

11.3.4.1. 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.

11.3.4.2. 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.

11.3.4.3. 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-11.3.4.3.(1)(b).) and
- c) all exterior windows contain wired or safety glass in steel frames.

11.3.4.4. Existing Unprotected and Relocated Openings

1) Where the *limiting distance* is less than 900 mm, existing *unprotected openings* may be retained, provided

a) the openings are constructed with non-operable closures 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)., or

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, 3.2.3.1.E or 9.10.14.4.A, may be retained, provided

- a) the openings are constructed of glass blocks or wired glass in fixed frames, or
- b) the *building* is to be *sprinklered* using 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 *project* consists of 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-11.3.4.4.(4).)

5) A new *unprotected opening* in an existing exterior wall need not comply with the requirements of Article 9.10.15.4.(1) provided

- a) an equivalent area of existing *unprotected openings* within the same *fire compartment* or *storey* are removed, and
- b) the *limiting distance* of the new *unprotected opening* is greater than 2 m.

11.3.5. Alternatives for Fire Containment and Separation

11.3.5.1. 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*.

11.3.5.2. 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*.

11.3.5.3. 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.

11.3.6. Alternatives for Exits and Means of Egress

11.3.6.1. General

1) Except as permitted in Articles 11.3.6.2. through 11.3.6.4. and in Subsection 11.3.7., every *floor area* or other space shall be served with *exits* in conformance with Section 3.4.

11.3.6.2. 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.

11.3.6.3. 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 m²,
 - 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.

11.3.6.4. Existing Stairs in a Means of Egress

- 1) Existing stairs with rectangular treads in straight flights in an *exit* or a *means of egress*, other than those serving seating areas, may be retained provided that

- a) existing tread and riser dimensions within a flight comply with Table 11.3.6.4.(1),

Table 11.3.6.4.(1)
Dimensions of Existing Stairs
Forming Part of Sentence 11.3.6.4.(1)

	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 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 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 Sprinklered Buildings

11.3.7.1. General

- 1) The alternative compliance measures in Articles 11.3.7.2. to 11.3.7.9. 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.

11.3.7.2. 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).

11.3.7.3. 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.

11.3.7.4. 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.

11.3.7.5. 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 m² in cross-sectional area.

11.3.7.6. 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.

11.3.7.7. 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 service shafts in adjacent *fire compartments*.

11.3.7.8. 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 11.3.7.9., 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* or mezzanine, 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.

11.3.7.9. 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 ground 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.

11.3.8. Alternatives for Accessibility

11.3.8.1. 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 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-11.2.8.1.(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 m² 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).

11.3.9. Alternatives for Building Systems

11.3.9.1. 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 side discharge configuration that terminates vertically only in a manner that minimizes condensation on adjacent surfaces.

Section 11.4. Alternative Compliance Measures for Heritage Buildings

11.4.1. Application

11.4.1.1. Alternative Compliance Measures

- 1) This Subsection provides alternative compliance measures for the restoration and renovation of heritage *buildings*.
- 2) The alternative compliance measures provided in Table 11.4.1.1. 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 11.1.4.3.(2), relocation of a heritage *building* may conform to the upgrade requirements for spatial separation outlined in Table 11.4.1.1.
- 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 5.9.2.2. provided the replica
 - a) complies with Clause 9.7.5.1.(3)(a) or (b) as applicable,
 - b) does not create an unsafe condition, and
 - c) is *acceptable* to the *Chief Building Official*.

Table 11.4.1.1.
Alternative Compliance Measures for Heritage Buildings
 Forming part of Sentence 11.4.1.1.(2)

No.	By-law Requirement	Alternative Compliance Measures
1	Fire separations Sentence 3.1.3.1.(1) and Table 3.1.3.1.; Subsection 9.10.9. 2 h <i>fire separation</i> required between some major occupancies	Except for F1 occupancies, 1 h <i>fire separation</i> is <i>acceptable</i> , if the <i>building</i> is <i>sprinklered</i> .
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 <i>fire separation</i> is <i>acceptable</i> , if the <i>building</i> is <i>sprinklered</i> .
3	Noncombustible Construction Subsection 3.1.5. and Article 9.10.6.1. All materials used in <i>noncombustible</i> construction must be <i>noncombustible</i> unless otherwise permitted.	1. Roofs may be of <i>combustible</i> construction provided the <i>building</i> is <i>sprinklered</i> . 2. Up to 10% gross <i>floor area</i> to a maximum of 10% of any one <i>floor area</i> may be of <i>combustible</i> construction provided the <i>building</i> is <i>sprinklered</i> .
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 <i>fire-</i>	A <i>fire-resistance rating</i> may also be used based on: 1. HUD No. 8 Guideline on Fire Ratings of Archaic Materials and Assemblies.

No.	By-law Requirement	Alternative Compliance Measures
	<i>resistance rating</i> it shall be tested in accordance with CAN/ULC-S101.	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 <i>building</i> : (a) is <i>sprinklered</i> , and (b) does not exceed 6 <i>storeys</i> in <i>building height</i> .
6	Continuity of Fire separations Sentence 3.1.8.3.(1) and 3.1.8.3.(2); Article 9.10.9.2. <i>Fire separations</i> are required to be continuous above the ceiling space.	<i>Fire separations</i> are not required to be continuous above the ceiling space where: (a) the ceiling space is non-combustible construction, (b) both <i>fire compartments</i> are <i>sprinklered</i> , or (c) the ceiling has a minimum rating of 30 minutes.
7	Wired Glass Sentences 3.1.8.5.(1) and 3.1.8.16; Articles 9.10.13.1. and 9.10.13.5. 6 mm wired glass in steel frame required in <i>fire separations</i> .	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 <i>fire separation</i> .
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 as <i>storey</i> in <i>building height</i> .	Enclosed mezzanines may be up to 40% of the <i>storey</i> in which they occur and not be considered a <i>storey</i> in <i>building height</i> if the <i>building</i> is <i>sprinklered</i> .
9	Building height Articles 3.2.2.20. to 3.2.2.90. <i>Noncombustible</i> construction required for <i>buildings</i> over 3 <i>storeys</i> in <i>building height</i> .	<i>Buildings</i> may be of <i>combustible</i> construction up to 6 <i>storeys</i> provided: (a) the <i>building</i> is <i>sprinklered</i> (b) the <i>building</i> contains Group C, D, E, F2 or F3 occupancies, and (c) floor assemblies not required to exceed 1 h <i>fire separation</i> requirements may be of heavy timber construction.
10	Spatial Separation Subsection 3.2.3.	The area of existing <i>unprotected opening</i> is not limited provided: (a) the <i>limiting distance</i> is a minimum 1 m,

No.	By-law Requirement	Alternative Compliance Measures
	The area of <i>unprotected opening</i> shall not exceed the limits in Tables 3.2.3.1.A to 3.2.3.1.E	(b) the <i>building</i> has a supervised sprinkler system in conformance with Article 3.2.4.9., and (c) the sprinkler system is designed to notify the fire department in conformance with Article 3.2.4.7.
	Spatial Separation Subsection 9.10.14.; Subsection 9.10.15. The area of <i>unprotected opening</i> in an <i>unsprinklered building</i> shall not exceed the limits in Tables 9.10.14.4.-A or 9.10.15.4.	The area of existing <i>unprotected opening</i> on a <i>building</i> face is not limited provided the existing <i>unprotected openings</i> on that face are protected with close spaced sprinklers per Clause 3.2.3.13.(5)
11	Construction of Exposing building face Article 3.2.3.7.; Article 9.10.14.5. The <i>exposing building face</i> is required to have a <i>fire-resistance rating</i> and/or be of <i>noncombustible</i> construction.	<i>Exposing building face</i> is not required to have a fire resistance rating if the <i>building</i> is <i>sprinklered</i> . Also, the <i>exposing building face</i> is not required to be of <i>noncombustible</i> 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 3.2.4.20.(7) and 3.2.4.20.(9); Sentence 9.10.19.1.(2) Smoke alarms are required to be connected to an electric circuit.	Smoke alarms may be battery operated in a residential <i>building</i> containing not more than one principal <i>dwelling unit</i> .
14	Interconnected Floor Space Subsection 3.2.8.; Sentence 9.10.1.3.(6)	1. Open stairs in <i>buildings</i> of not more than 4 <i>storeys</i> in <i>building height</i> need not comply with Subsection 3.2.8. provided: (a) the <i>building</i> contains a Group C or D occupancy, (b) the <i>building</i> is <i>sprinklered</i> with fast-response sprinklers, (c) corridors opening into the interconnected floor space are separated from the interconnected floor space by a <i>fire separation</i> 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 <i>buildings</i> of maximum 3 <i>storeys</i> in <i>building height</i> , or the first 2 <i>storeys</i> and basement, need not comply with Subsection 3.2.8. provided: (a) the <i>building</i> contains a Group C or D occupancy,

No.	By-law Requirement	Alternative Compliance Measures
		(b) the <i>building</i> is <i>sprinklered</i> 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 <i>means of egress</i> 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. <i>Suites</i> are required to be separated from adjoining <i>suites</i> by 3/4 h or 1 h rated <i>fire separations</i> .	Existing <i>fire separations</i> of 30 min, such as wood lath and plaster in good condition, are <i>acceptable</i> in <i>sprinklered buildings</i> not exceeding 6 storeys in <i>building height</i> .
16	Corridor Fire separation Article 3.3.1.4.; Article 9.10.9.15. <i>Public corridors</i> are required to be separated from the remainder of the <i>building</i> by a <i>fire separation</i> having a fire resistance rating of at least 3/4 h.	Existing corridors with 30 min <i>fire-resistance ratings</i> , such as wood lath and plaster in good condition, are <i>acceptable</i> in residential occupancies provided the <i>building</i> : (a) does not exceed 6 storeys in <i>building height</i> , and (b) is fully <i>sprinklered</i> with fast-response sprinklers.
17	Corridor Width Articles 3.3.1.9. and Subsection 3.4.3.; Article 9.9.3.3. <i>Public corridors</i> and <i>exit corridors</i> are required to have a minimum width of 1 100 mm.	<i>Public corridors</i> and <i>exit corridors</i> are required with a minimum width of 800 mm provided: (a) the occupant load of the <i>building</i> is maximum 20 people, and (b) the <i>building</i> does not exceed 3 storeys in <i>building height</i> .
18	Door Swing Articles 3.3.1.11. and 3.4.6.12. Doors required to swing in the direction of <i>exit</i> travel.	Second egress door from a room is not required to swing in the direction of <i>exit</i> travel provided: (a) the <i>building</i> is <i>sprinklered</i> and the system is supervised in conformance with Sentence 3.2.4.9.(3), and (b) the occupant load of the <i>building</i> 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., Article 3.4.6.2. through Article 3.4.6.9.; Section 9.8.	Existing conditions that do not comply fully with the requirements are permitted if they are <i>acceptable</i> to the <i>Chief Building Official</i> .
20	Transparent Doors and Panels Article 3.3.1.19.; Article 9.6.1.4.	Existing glass or transparent panels that do not comply fully with the requirements are permitted if sufficiently discernible or guards are provided in unsafe conditions.

No.	By-law Requirement	Alternative Compliance Measures
	Glass in doors and sidelights are required to be protected by guards and to be safety glass.	
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 <i>building</i> is <i>sprinklered</i> 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 <i>building</i> is <i>sprinklered</i> 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. <i>Floor areas</i> shall be served by not fewer than 2 <i>exits</i> except as permitted by Sentence 3.4.2.1.(2)	<i>Floor areas</i> may be served by a single <i>exit</i> within the limits of Sentence 3.4.2.1.(2).(b) provided: (a) the <i>building</i> does not exceed 3 <i>storeys</i> in <i>building height</i> , (b) the <i>building</i> is <i>sprinklered</i> with fast-response sprinklers, and (c) all <i>floor areas</i> 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 <i>exit</i> stairs and landings to less than 750 mm.	Existing swinging doors in their swing are permitted to reduce the effective width of <i>exit</i> stairs and landings to a minimum of 550 mm provided: (a) they serve Group C or D occupancies, (b) the <i>building</i> does not exceed 4 <i>storeys</i> in <i>building height</i> , and (c) the <i>building</i> is <i>sprinklered</i> .
24	Fire separation of Exits Article 3.4.4.1.; Subsection 9.9.4. Article 3.4.4.1.; Subsection 9.9.4. <i>Exits</i> are required to be separated from the remainder of the <i>floor area</i> by a <i>fire separation</i> having a <i>fire-resistance rating</i> of not less than 3/4 h.	1. <i>Buildings</i> of 3 <i>storeys</i> or less may have <i>exits</i> that are separated by a <i>fire separation</i> that does not have a <i>fire-resistance rating</i> provided: (a) the <i>building</i> is <i>sprinklered</i> with fast-response sprinklers, and (b) the sprinkler system is supervised in accordance with Sentence 3.2.4.9.(2). 2. <i>Buildings</i> not exceeding 6 <i>storeys</i> in <i>building height</i> may have <i>exits</i> that are separated by a 45 min <i>fire separation</i> provided the <i>building</i> is <i>sprinklered</i> .
25	Exits Through Lobbies Article 3.4.4.2.; Article 9.9.8.5.	Rooms adjacent to the lobby are not required to be separated by a <i>fire separation</i> provided:

No.	By-law Requirement	Alternative Compliance Measures
	Rooms adjacent to the lobby are required to be separated by a <i>fire separation</i> .	(a) the <i>floor area</i> is <i>sprinklered</i> 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 <i>exit</i> .	Service rooms and ancillary rooms may open directly into an <i>exit</i> provided: (a) the rooms are <i>sprinklered</i> 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.(3) to 9.9.11.3.(4) <i>Exit</i> signs are required to be illuminated continuously while the <i>building</i> is occupied.	Where <i>exit</i> signage may compromise historic appearances, or authenticity of displays, <i>exit</i> 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 <i>exit</i> door.	Except as permitted in Sentences 3.4.6.11.(3) or 9.9.6.6.(2), existing <i>exit</i> 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 <i>acceptable</i> provided: (a) the fire escapes are <i>acceptable</i> , and (b) the <i>building</i> is <i>sprinklered</i> .
30	Fire Escape Construction 3.4.7.2.; Sentence 9.9.2.1.(2)	Existing <i>combustible</i> fire escapes are permitted if the <i>building</i> is permitted to be of <i>combustible</i> 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 <i>building</i> is <i>sprinklered</i> , 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 <i>floor area</i> by a rated <i>fire separation</i> .	Existing vertical service spaces that do not completely conform to the rated <i>fire separation</i> requirements are <i>acceptable</i> provided the vertical service spaces are <i>sprinklered</i> .

No.	By-law Requirement	Alternative Compliance Measures
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 requirements.	Existing rooms are not required to comply to the minimum dimension requirements of Subsection 3.7.1. or Subsection 9.5.3. provided it is <i>acceptable</i> to the <i>Chief Building Official</i> .
34	Washroom Requirements Subsection 3.7.2.; Section 9.31. <i>Buildings</i> 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 <i>acceptable</i> to the <i>Chief Building Official</i> .
35	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) <i>acceptable</i> means of protection is provided, or (b) there is no exposure to the public.
36	Mechanical Systems Part 6 and Part 7	Existing mechanical systems in <i>buildings</i> 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 <i>acceptable</i> to the <i>Chief Building Official</i> .
37	Mechanical and Plumbing Systems Parts 9, 10 and 11	Existing mechanical systems in <i>buildings</i> 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 <i>acceptable</i> to the <i>Chief Building Official</i> .
38	Energy and Water Efficiency Parts 9, 10 and 11.	The existing level of energy and water efficiency in a <i>building</i> is not required to comply with the requirements of Parts 9, 10 or 11 provided the level of energy efficiency is <i>acceptable</i> to the <i>Chief Building Official</i> .

11.5. Upgrade Mechanism

11.5.1. General

(See Note A-11.5.1.)

11.5.1.1. Application

- 1) The *acceptable* level of upgrade required for a *building* shall be determined on the basis of the Upgrade Triggers Mechanism of Subsection 11.5.2., except as otherwise required or permitted by this Part.
- 2) For a single detached house or duplex, the *acceptable* level of upgrade required shall be determined on the basis of Subsection 11.5.3.
- 3) The Hazard Index may be determined by the Hazard Index Table or other methodology as deemed *acceptable* to the *Chief Building Official* (see Note A-11.5.1.1.(3)).

11.5.1.2. Required Upgrade Levels

- 1) The required Upgrade Levels determined by this Part are as follows (see Note A-11.5.1.2.(1)):

Fire

- F1 - *Exiting* to be reviewed to ensure that the *exits* do not present an unsafe condition.
- F2 - *Existing building* to meet the fire & life safety requirements of this By-law within the project area and have conforming *exits* leading from the project area to an *acceptable* open space.
- F3 - *Existing building* to meet fire, life and health safety requirements within the *project* area. *Existing building* to meet fire, life and health safety requirements within the public areas.
- F4 - Entire *building* to substantially meet the intent of health, fire and life safety requirements of this By-law as well as provide protection to adjacent property.

Structural

- S1 - Proposed work must not have an adverse effect on the structural capacity of the existing structure.
- S2 - Limited structural upgrade required in order to provide minimum protection to *building* occupants during a seismic event within the *project* area.
- 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.
- S4 - The entire *building* structure shall be brought up to an *acceptable* level in order to meet seismic requirements of this By-law.

Nonstructural

- N1 - *Project* area to be reviewed to ensure safety from overhead falling hazards.
- N2 - *Project* area and *means of egress* to be reviewed to ensure safety from overhead falling hazards.
- N3 - *Building exits* and to *acceptable* open space to be reviewed to ensure safety from overhead falling hazards.
- N4 - Entire *building* and to *acceptable* open space to be reviewed to ensure safety from overhead falling hazards.

Accessibility

A1 - The proposed work must not adversely affect the existing *accessibility* level of the *building*.

A2 - A limited level of upgrade shall be provided within the *project* area to ensure access for persons with disabilities.

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*.

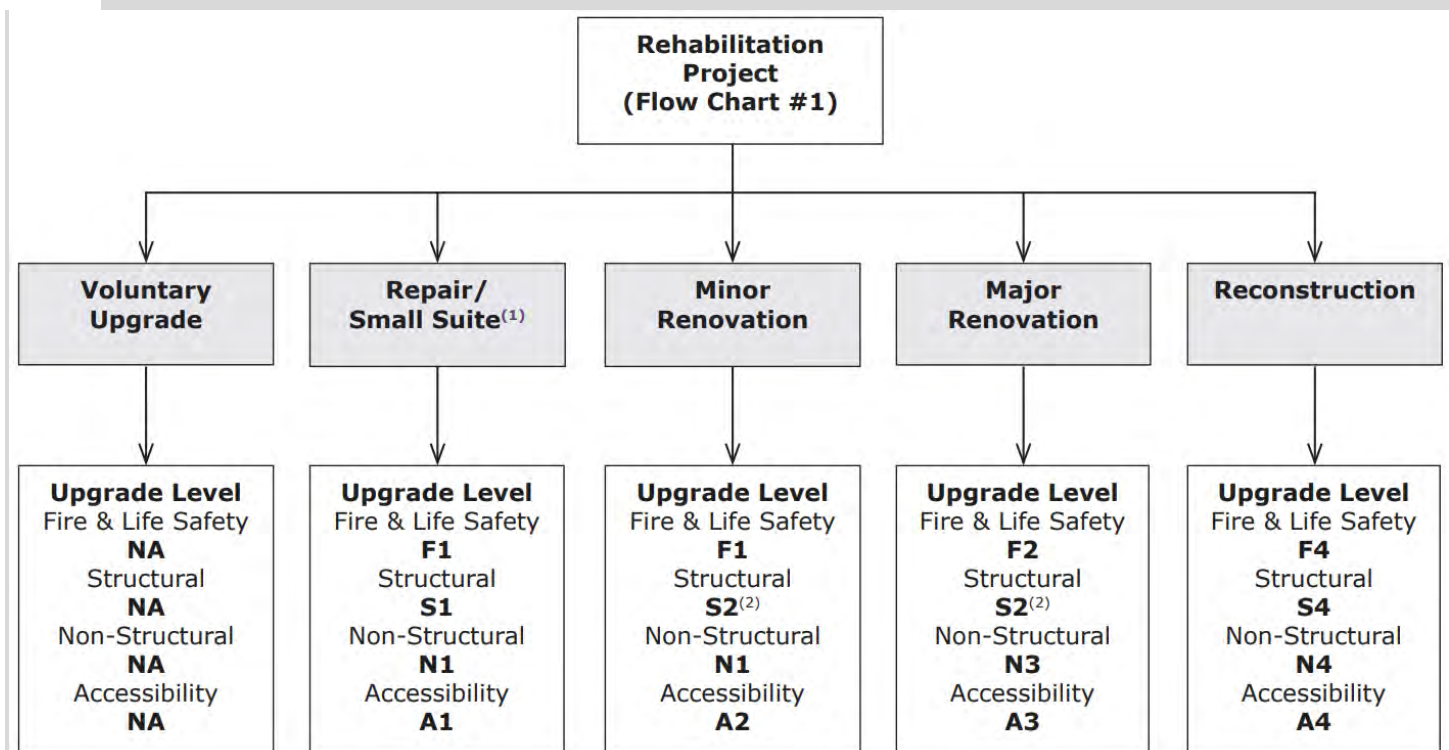
A4 - The *existing building* shall be upgraded in order to provide the minimum *accessibility* requirements of this By-law.

11.5.2. General Upgrade Requirements

11.5.2.1. Upgrade Trigger Mechanism

1) Except as otherwise required or permitted by this Part, the *acceptable* level of upgrade for an *existing building* shall be determined in accordance with Flow Chart 11.5.2.1.-A, -B, and -C for each type of project.

RENOVATION PROJECT TYPE (Flow Chart No. 1)

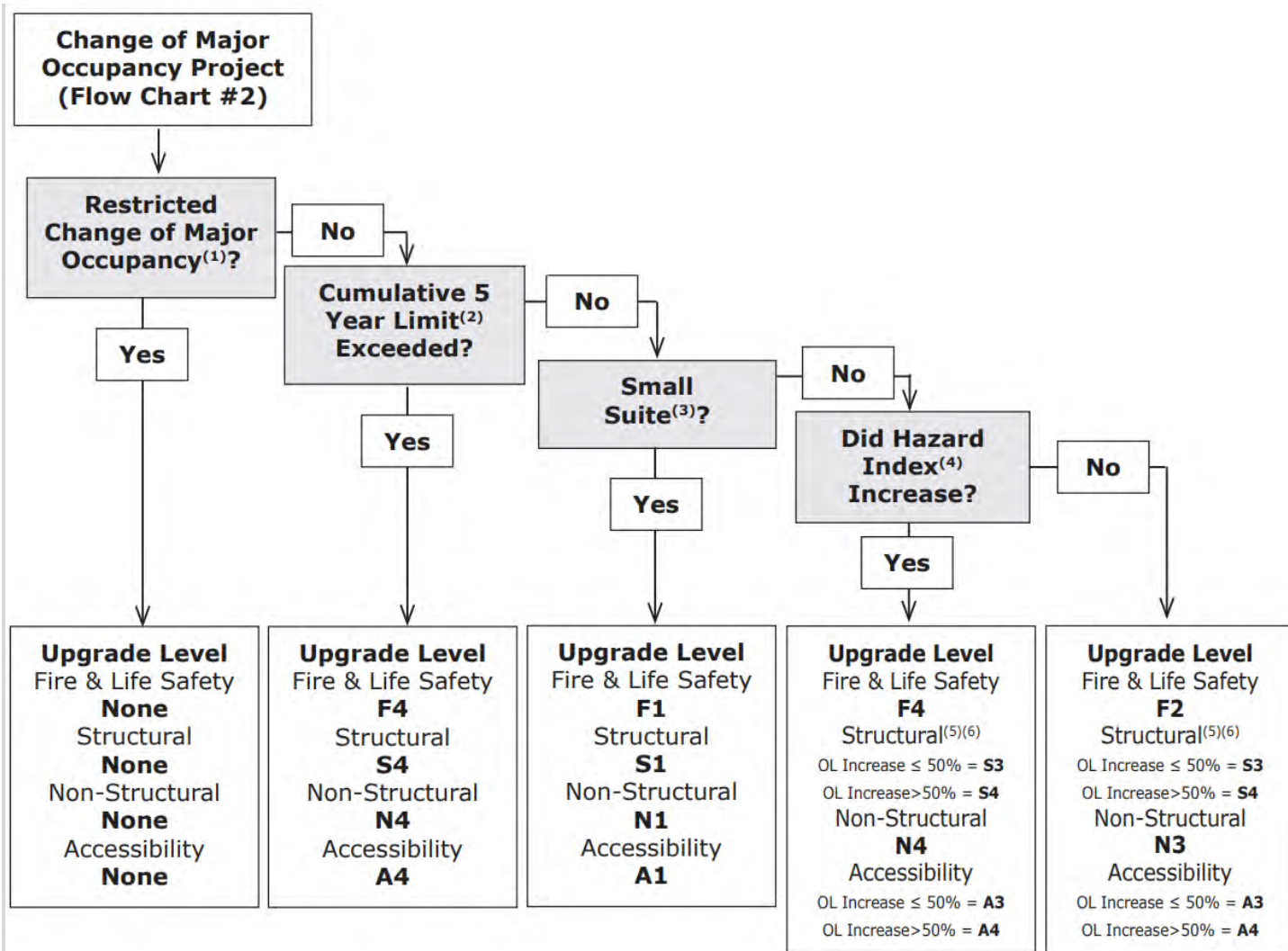


Notes to Flow Chart No. 1:

(1) 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) as required by Sentence 11.5.1.1.(5).

(2) Notwithstanding the upgrade levels in Flow Chart #1, where a minor or major renovation involves an entire *building* and the renovation includes the removal of the majority interior wall cladding then the structural seismic upgrade level shall be S3.

CHANGE OF MAJOR OCCUPANCY CLASSIFICATION PROJECTS (Flow Chart No. 2)



Notes to Flow Chart No. 2:

⁽¹⁾ Restricted Change of *Major occupancy* (see Article 11.5.3.1.(2))

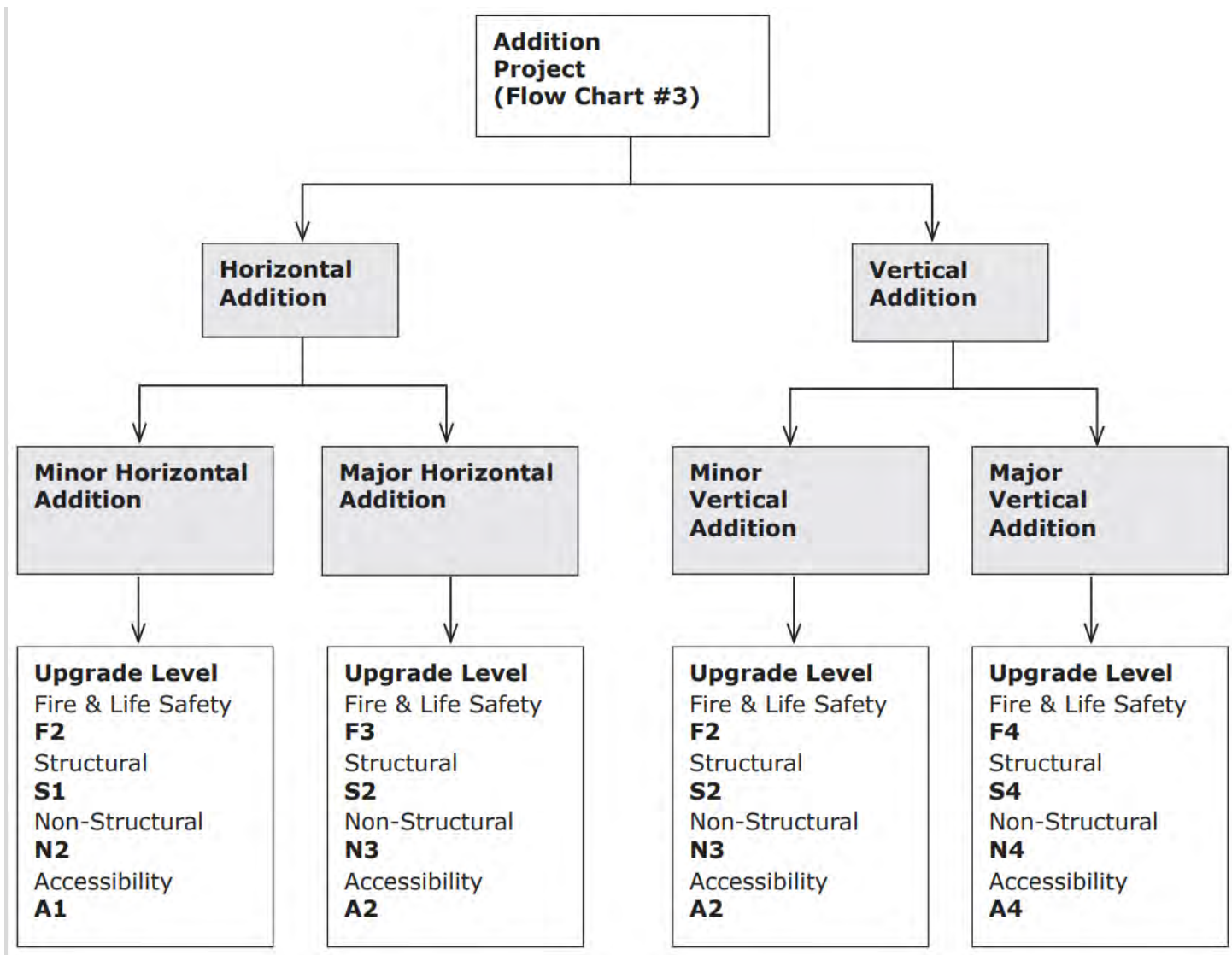
⁽²⁾ The cumulative 5 year limit is triggered when there is a change of *major occupancy* in an *existing building* and the aggregate area of the change in *major occupancy* including the current work within any 5 year period is greater than 50% of the *building area* (as defined in Article 1.4.1.2. of 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*.

⁽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) as required by Sentence 11.5.1.1.(5).

⁽⁴⁾ 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.

⁽⁵⁾ 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.

ADDITION PROJECTS (Flow Chart No. 3)



2) Where a project scope includes multiple categories of work the highest upgrade level in each category shall apply and include the requirements of all lower upgrade levels.

3) Where a *suite* is altered as a small *suite* renovation or small *suite* change of *major occupancy*, and the existing framed ceiling/floor and wall assemblies separating the *suite* from adjacent spaces in the *building* are not constructed with at least 2 layer of 13 mm thick gypsum board on the interior side, the *suite* separation shall be upgraded to include at least 2 layers of 13 mm thick gypsum wall board.

11.5.3. Upgrade Requirements for Single Detached House and Duplex Building

11.5.3.1. Upgrade Requirement

1) An *alteration* or addition to a single detached house or duplex *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 11.5.3.1.(1)-A, 11.5.3.1.(1)-B, and 11.5.3.1.(1)-C.

Table 11.5.3.1.(1)-A
Fire and Life Safety Upgrade requirements for Residential Buildings containing not more than Two Principal Dwelling units
Forming part of Sentence 11.5.3.1.(1)

Scope of Work	Smoke Alarms ⁽¹⁾	CO Alarms ⁽²⁾	Guards ⁽³⁾	Spatial Separation ⁽⁴⁾	Structural ⁽⁵⁾
Renovation	Y	Y	Y	N	N
Relocation or Reconstruction	Y	Y	Y	Y	Y
Horizontal Addition <i>Floor area</i>					
up to 25% ⁽⁶⁾	Y	Y	Y	N	N
over 25% ⁽⁷⁾	Y	Y	Y	Y	Y
Vertical Addition <i>Floor area</i>					
up to 25% ⁽⁶⁾	Y	Y	Y	N	Y
over 25% ⁽⁷⁾	Y	Y	Y	Y	Y

Notes to Table 11.5.3.1.(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 6.9.3. 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., 9.10.14. or 9.10.15. as applicable; or as permitted by Section 11.3.
(5) All existing wood frame walls to be anchored to existing concrete foundation walls for seismic resistance.
(6) Aggregate increase in *floor area* less than 25% of the *building area* (see flow chart #3 of Note A-11.2.1.2).
(7) Aggregate increase in *floor area* greater than 25% of the *building area*.

Table 11.5.3.1.(1)-B
Egress and Exit Upgrade requirements for Residential Buildings containing not more than Two Principal Dwelling units
Forming part of Sentence 11.5.3.1.(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 or Reconstruction	Y	Y	Y	Y	Y	Y
Horizontal Addition <i>Floor area</i>						
up to 25% ⁽⁷⁾	Y	N	N	N	N	Y
over 25% ⁽⁸⁾	Y	Y	Y	Y	Y	Y
Vertical Addition <i>Floor area</i>						
up to 25% ⁽⁷⁾	Y	Y	N	N	N	Y

over 25% ⁽⁸⁾	Y	Y	Y	Y	Y	Y

Notes to Table 11.5.3.1.(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.

(7) Aggregate increase in *floor area* less than 25% of the *building area* (see flow chart #3 of Note A-11.5.2.1).

(8) Aggregate increase in *floor area* greater than 25% of the *building area*.

Table 11.5.3.1.(1)-C

Floor area Upgrade Requirements for Residential Buildings containing not more than Two Principal Dwelling units
Forming part of Sentence 11.5.3.1.(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 or Reconstruction	Y	Y	Y	Y	Y
Horizontal Addition <i>Floor area</i>					
up to 25% ⁽⁶⁾	N	N	N	N	N
over 25% ⁽⁷⁾	Y	Y	Y	Y	Y
Vertical Addition <i>Floor area</i>					
up to 25% ⁽⁶⁾	N	N	N	Y	N
over 25% ⁽⁷⁾	Y	Y	Y	Y	Y

Notes to Table 11.5.3.1.(1)-C:

⁽¹⁾ Flame Spread Rating: 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.

⁽⁶⁾ Aggregate increase in *floor area* less than 25% of the *building area* (see flow chart #3 of Note A-11.5.2.1).

⁽⁷⁾ Aggregate increase in *floor area* greater than 25% of the *building area*.

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 the *building* shall be upgraded to an *acceptable* level in conformance with Table 11.5.3.1.(2).

Table 11.5.3.1.(2)

Energy Efficiency Upgrade Requirements for Residential Buildings containing not more than Two Principal Dwelling units
Forming part of Sentence 11.5.3.1.(2)

<i>Alteration construction value</i> ⁽¹⁾	EnerGuide Assessment ⁽²⁾	Air tightness upgrades ⁽³⁾	Attic and Sloped Roof Insulation ⁽⁴⁾	Hot Water Heating	Electric Space Heating

\$0.00 to \$142,999	N	N	N	N	N
\$153,000 to \$254,999	N	N	N	Y ⁽⁵⁾	N
≥\$255,000	Y	Y	Y	Y	Y

Notes to Table 11.5.2.1.(2):

⁽¹⁾ "Construction Value" - see note A-11.1.4.3.(6), 11.2.3.1.,11.5.3.1.(2)&(4), and 11.5.4.2.(4).

⁽²⁾ An EnerGuide Assessment completed within the last 4 years must be submitted, a post-construction assessment must also be completed.

⁽³⁾ Where EGH>5 air changes per hour, air sealing is required.

⁽⁴⁾ 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).

⁽⁵⁾ Domestic hot water equipment must be replaced in compliance with the domestic hot water requirements of Article 10.2.2.12. or a uniform energy factor of not less than 1.0, except the system may be gas-fired with a uniform energy factor of not less than 0.78 or a thermal efficiency of not less than 90% where

- the *building* mechanical room, storage or service spaces have insufficient space to accommodate the footprint, height, or manufacturer-specified space requirements of the new equipment;
- the existing electrical panel has insufficient circuit or amperage capacity to accommodate the new equipment;
- the existing domestic hot water system is part of a combined system that also provides space-heating;
- the existing domestic hot water equipment was installed with a valid permit within the previous five years; or
- equivalent emissions reduction measures are completed as *acceptable* to the *Chief Building Official*."

3) Where an *alteration* is made to an existing residential *building* containing not more than two principal residential *dwelling units*, a sprinkler system shall be installed

- a) throughout the *building*, where more than one *dwelling unit* is created, reconstructed, or both,
- 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* increases the existing *building floor area* by more than 50%.

4) A *building* need not be *sprinklered* in accordance with Sentence (3), if the construction value of the *alteration* does not exceed \$255,000 (see Note A-11.1.4.3.(6), 11.2.3.1.,11.5.3.1.(2)&(4), and 11.5.4.2.(4)).

11.5.4. Special Cases

11.5.4.1. General

1) 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 and A4 as detailed in the Upgrade Trigger Mechanism except where

- a) the change in *major occupancy* is to a single *suite* of not more than 100 m², and the work does not exceed 5% of the *building area*, or
- b) such upgrades are in conflict with an approved heritage retention plan.

2) Where there is a change of *major occupancy* in a *building*, the upgrade requirements of Flow Chart #2 of the Upgrade Trigger Mechanism need not be provided where

- a) the change in *major occupancy* is to a single *suite*,
- b) the aggregate *suite area* does not exceed the lesser of 50% of the *building area* or 300 m²,
- c) the *major occupancy* of the *suite* is Group D or Group E, and
- d) the use and aggregate *suite area* complies with Table 11.5.4.1.(2)

Table 11.5.4.1.(2)
Maximum Aggregate *Suite Area*

Forming part of Sentence 11.5.4.1.(2)			
Major occupancy	Suite Use	Aggregate Suite Area	
		≤200 m ²	201 to 300 m ²
Group D	Administrative & Business Offices	Y	Y
	Barber and Hairdressing Shop	Y	Y
	Beauty Salon	Y	Y
	Health Care Offices (non-surgical, non-sedation)	Y	Y ⁽¹⁾
Group E	General Retail (Non-hazardous materials)	Y ⁽¹⁾	N ⁽²⁾

Notes to Table 11.5.4.1.(2).:

(1) Provided the Hazard Index of the space is not increased (see Table A-11.5.4.1.C)

(2) Except as acceptable to the Chief Building Official

3) Where a *building* is altered and is 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 and A4 as detailed in the Upgrade Trigger Mechanism.

4) Except as permitted by Article 11.5.3.1., 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 and A4, as determined by the Upgrade Trigger Mechanism.

11.5.4.2. Sprinkler Installation Requirements for the Addition of One or More *Dwelling units* (See Note A-11.5.4.2.)

1) Where an *alteration* to an *existing building* creates or adds one or more *dwelling units*, the *building* shall be *sprinklered* in conformance with Table 11.5.4.2.(1), except as permitted by Sentence (4) and Sentence 11.5.3.1.(3).

Table 11.5.4.2.(1)
Sprinkler Installation Determination Where *Dwelling units* are Added
Forming part of Sentence 11.5.4.2.(1)

Existing <i>Dwelling units</i>	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 11.5.4.2.(1)

(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.

2) Where the *alteration* in Sentence (1) involves the addition of existing *floor area* 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 11.5.4.2.(1)

3) Sprinklers required by Table 11.5.4.2.(1) shall be installed throughout the *storey* on which the new *dwelling unit* is to be located and all *storeys* below the new *dwelling unit*.

4) A *building* need not be *sprinklered* in accordance with Sentence (1) if the construction value of the *alteration* does not exceed \$255,000 (see Note A-11.1.4.3.(6), 11.2.3.1., 11.5.3.1.(2) & (4), and 11.5.4.2.(4)).

Notes to Part 11

Existing buildings

A-11.1.2.1.(2) Project Scopes in Part 11

For the purposes of Part 11, and establishing acceptable upgrade requirements, Sentence 11.1.2.1.(2) establishes several project scopes used to classify work involving existing construction. A project may fall under one or more project categories, and as a result, it will be subject to the most restrictive set of requirements applicable to all of the project categories that it falls under.

Change of Major occupancy refers to a project scope that includes a change of use or introduces a new use within a suite, storey, or its constituent floor areas, that exceeds the last permitted major occupancy (as last legally authorized) of that suite, storey, or constituent floor areas.

More limited scopes of Change of Major occupancy include:

Restricted Change of Major Occupancy which refers to changes of major occupancy within a limited set of uses as set out in Clause 11.5.1.3.(9)(c) that are limited by both hazard and scope such that it does not increase the overall risk.

Small Suite Change of Major Occupancy which means a change of major occupancy within a suite of limited occupant load and lower hazard use. This categorization is contingent upon the provision of a separation incorporating additional gypsum board on the suite side from adjacent spaces in the building (including vertically).

Horizontal Additions are construction that creates new floor area beyond the extents of the existing floor area but which does not impose new vertical loads on existing construction. This could include the construction of a new addition to a building supported on *grade*.

Minor Horizontal Additions are horizontal additions, of limited size, the extents of which may not exceed the lesser of 25 per cent of the existing total building area, or 500 m² of floor area increase aggregated over all of a building's storeys.

Renovation projects include alterations to existing construction for the purpose of improvement, renovation, reconfiguration, or refurbishment of existing floor spaces.

There are several subcategories of Renovations including the following:

Major Renovation is the broadest category of renovation work, and includes all renovations to existing construction which do not fall into other subcategories

Minor Renovation is renovation work within a single suite (or a space occupied by a single tenant space) and those demising walls shared with the adjoining suites, but which does not include the public or common floor areas of the building. Minor renovation may also include the subdivision of a single suite of not more than one storey into smaller constituent suites.

Minor Renovation 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,
- Subdivision of an existing suite of not more than one storey into one or more suites which do not include floor area outside of the subdivided suite
- Renovation in adjacent suites to the extent necessary to support the relocation of shared demising walls, or
- 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.

Small Suite Renovation means renovations pertaining to a suite of limited occupant load and lower hazard use. This is contingent upon the provision of a separation incorporating additional gypsum board on the suite side from adjacent spaces in the building (including vertically),

Small Suite renovations 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.

Reconstruction means the extensive removal of the major 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 to be considered a reconstruction and would be considered a repair, minor renovation or a major renovation as defined in this By-law.

Repair focuses on interior or exterior renovations where existing building components are being replaced with components that do not change the essential characteristics of the original building components. This is not the same as a restoration, but a repair 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.

Vertical Additions are the addition of any new floor area superimposed over an existing building structure or floor area which imparts an additional structural load. Structural loads include not only gravity loads, but could include implications from uplift, wind, or changes in rain or snow loads.

In addition to storeys, vertical additions may also include mezzanines, decks, or other roof areas intended for occupancy which in-fill existing unoccupied spaces, but which do not necessarily add to the floor or building areas.

Major Vertical Addition are those vertical additions which exceeds the limits permitted by a Minor Vertical Addition.

Minor Vertical Addition is an addition of new floor area that does not result in an increase to the aggregate floor area by more than 25 per cent of the building area, 500 m² in aggregate floor area, or both.

Voluntary Building By-Law Upgrades are alterations to the building that directly contribute to the improvement of existing building systems and that are aligned with the fundamental objectives of the Building By-law, and exceed the minimum expectations for the code compliance of other planned improvements. These improvements may include improvements in the fire alarm system, sprinkler system, *exit*, accessibility, seismic, building envelope, and energy or water efficiency systems in an existing building. However, this does not generally apply to improvements to these systems where this is already a requirement needed to achieve code compliance for other planned new construction or renovation (e.g. one would not typically consider the addition of sprinklers to be a voluntary improvement, where an existing major occupancy was changed to a different major occupancy that would be required to be sprinklered).

A-11.1.3.1.(1)(e) Limitation of Upgrades to Suites. The objective described in Clause 11.1.3.1.(1)(e) is to limit the potential scope of upgrades to suite areas outside a renovated suite (i.e. to other suites, but not common areas) unless the effects of the renovation also have direct or significant impacts to another suite.

For example an increase to occupant loads to a suite, has direct impacts on the subject suite and the commonly accessed *means of egress* from the subject suite, which may lead to upgrades of those spaces, but the egress within another suite would likely not be affected until you left that other suite, and therefore upgrade would not be required.

However, judgement needs to be applied in this regards, as it may not be immediately obvious to what extent building systems shared by more than one suite might be affected. In the above example, a significant enough increase in the occupant load in a

suite could have structural implications that affect all suites on a floor, in which case additional upgrades within suites not directly affected may be required.

A-11.1.4.1.(1) **Upgrading of Existing buildings.** Article 11.1.3.1. of the Building By-law identifies that existing buildings are required to be upgraded, and identifies three mechanism by which an appropriate level of upgrade may be determined. In most cases, this is achieved by use of the upgrade triggers mechanism described in Section 11.5.

However, the scope of projects vary considerably as do the state of existing building construction, and therefore upgrades in accordance with Clauses 11.1.4.1.(b) and (c) provide alternative means to establish acceptable upgrades to retained existing construction.

Clause (b) address upgrades via Alternative Compliance Measures, which include:

- Construction to achieve modified code requirements, to facilitate conversions of existing buildings, in Section 11.2.;
- Alternative acceptable construction providing an alternative set of improvement for specific existing components or systems of a building which are deemed to comply with the upgrades that would otherwise be required by the upgrade triggers mechanisms, in Section 11.3; and
- Measures intended to facilitate the alteration of existing heritage construction, in Section 11.4.

The figure below provides a general flowchart illustrating how the acceptable upgrade to an existing building is determined.

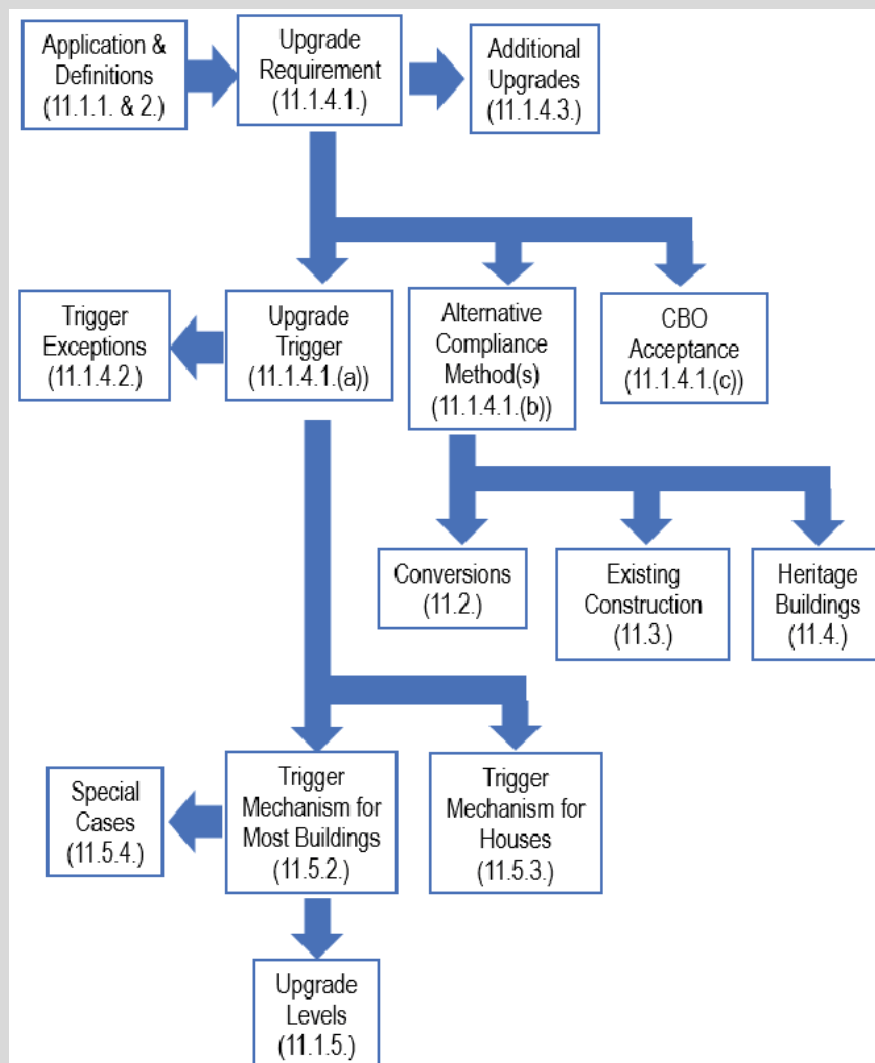


Figure 11.1.4.1.(1): Building Upgrade Overview

A-11.1.4.2.(2) 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.

A-11.1.4.2.(3) Alternative Compliance Measure. Where Alternative Compliance Measures are implemented to address specific retained characteristics of a building, the retained construction is deemed to be compliant for the purposes of establishing the building upgrades as determined by the Upgrade Trigger Mechanism.

A-11.1.4.2.(6) Self-contained Separated Spaces. The self-contained space provisions of Article 11.5.1.6. 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 constitute a hardship. 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-11.1.4.3.(6), 11.2.3.1., 11.5.3.1.(2) & (4), and 11.5.4.2.(4) Project Value. The term “construction value” refers to the value of the proposed work stated on the application for the permit established by Division C, Article 1.6.2.3. This includes the 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, including all components of the building, and 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.

A-11.2.3.1. and 11.1.4.3.(6) Replacement Value. The term “replacement value” is used as a baseline for determining the applicability of specific upgrade requirements. The term refers to the cost to replace the structure in its current state or serve the function of a previous structure. This is similar to the insurable value – the cost to replace the destructible improvements of a property (as applied to a building or part thereof). 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 a reproduction of the original or redeveloped as new construction.

A-11.5.1.2.(1) Upgrade Levels. The required upgrading of an existing building are assigned Levels 1 through 4, where 4 represents the highest level of upgrade in each of the areas associated with the upgrade objectives of the Building By-law.

If an alteration includes more than one category of work or project type, then the most restrictive upgrade levels from each category of work will be applied. The individual upgrade levels are cumulative, so the higher level upgrade levels include all of the preceding lower upgrade level requirements. For example, where the design upgrade level is F3, then all of the upgrade requirements under F2 and F1 also apply.

The acceptable solutions indicated in these notes and associated with upgrade levels are examples of possible upgrade plans that are deemed to satisfy the prescribed upgrade levels. Code users are not necessarily required to provide upgrades that are comply exactly with the acceptable solutions.

It is expected that owner may choose to adopt specific upgrades that better align with the planned work. Analysis by the building designer may be required to demonstrate that the proposed set of upgrades will achieve the performance of the required upgrade level.

Acceptable Solutions for Upgrade Levels

Fire

F1 Project Area – Exits to be upgraded with respect to number, capacity, and fire separations only.

F2 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.

F3 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.

F4 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.

Structural

S1 Entire Building – Proposed work must not reduce the structural integrity of the existing building.

S2 Project Area – Non-structural elements and falling hazards must be restrained to resist lateral loads due to earthquakes within the project area.

S3 Entire Building – Building to be upgraded to resist 50 per cent 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.

S4 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.

Nonstructural

N1 Project Area – Restrain all ceiling supporting frames, T-bars assemblies, ceiling gypsum wall boards, all overhead mechanical ducts, sprinklers, equipment, sprinkler system, overhead electrical conduits and lights.

N2 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, sprinklers, equipment, sprinkler system, overhead electrical conduits and lights. Restrain cladding veneer, parapets, canopies and ornaments over *exit* and extended to 5 m on either side of *exit*.

N3 Entire Building *Exits* – Restrain interior partition walls. Restrain ceiling supporting frames, T-bars assemblies, ceiling gypsum wall boards, overhead mechanical equipment and services, sprinklers, sprinkler system, 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*.

N4 Entire Building – Restrain all interior partition walls. Restrain all ceiling supporting frames, T-bars assemblies, ceiling gypsum wall boards, overhead mechanical equipment and services, sprinklers, sprinkler systems, 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.

Accessibility

A1 Project Area – Existing level of accessibility must be maintained throughout the project area. No additional accessibility enhancements are required.

A2 Project Area – door clearances, door hardware, and areas of refuge.

A3 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.

A4 Entire Building – Building to meet accessibility provisions of the current VBBL.

Note: that where there is one or more upgrade level(s) within the same category preceding the design upgrade level in Article 11.5.1.2., 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. (see also 11.5.2.1.(2).)

A-11.2.3.1.(1) **Interconnected Smoke Alarms and Carbon Monoxide Detectors.** Concern has been expressed regarding the interconnection requirements of smoke alarms served by different electrical panels if the panels do not share a common ground as a current could be generated through the interconnecting wires and resulting in potential false alarms. Interconnected smoke alarms must be powered off the same (main) electrical panel so that a common ground and reliable operation is achieved.

A-11.2.7.1.(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' and sprinklering 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-11.3.1.1. **Application of Alternative Measures for Existing Conditions.** This Article is not intended to be applied to new construction. In general, it is the purpose of Sections 11.2 to 11.4 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-11.3.2.1.(3)(b) **Alteration Language Supporting NECB 2020.** The term "alteration language" is used in Subsection 11.2.2. 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.

● ACKNOWLEDGEMENT

The City of Vancouver would like to acknowledge the permission granted by ASHRAE for use of their alteration language, from the ASHRAE 90.1-2019 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 90.1-2019 standard.

With the implementation of NECB 2020 within Vancouver's Building Bylaw in 2025, this document provides the minimum requirements for alterations to existing buildings designed and constructed to NECB 2011/2015 and those buildings subject to this document through Subsection 11.3.2. (formerly 11.7) of Division B.

● SCOPE

This document pertains to the application of existing buildings, specifically buildings:

- designed to NECB 2011,
- designed to NECB 2015,
- designed to ZEBP (10.2.2.5), or
- subject to 11.3.2.1.(3)(b) requirements (formerly 11.7.1.1.(3)(b) requirements).

● APPLICATION

This document applies to the alteration of all building components with prescriptive requirements listed within NECB 2020, 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 space heating, space cooling, ventilation, humidification, dehumidification, electric power, lighting, transportation, refrigeration, cooking, or *service water heating*, 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 heating*, or lighting.

0 1.1 General

1.1.1 Instructions

This document shall be read in conjunction with NECB 2020. Words that appear in italics are defined in this document unless already defined within NECB 2020. All references to Parts are referring to the Parts within NECB 2020.

1.1.1.1 Additions to Existing Buildings. *Additions to existing buildings* 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 heating*, 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.

0 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.

0 Exception: In a *building* where components have been formally recognized by a federal, provincial, territorial, or municipal *authority having jurisdiction*, as having either Heritage or Character value, the alteration of these components need not comply with these requirements.

2.1 Building Components and Systems

0 2.1.1 Building Envelope (supports Part 3 of the NECB 2020)

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 Article 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:

- 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.
- 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.
- 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.

O 2.1.2 Lighting (supports Part 4 of the NECB 2020)

2.1.2.1 Lighting Alterations. For the *alteration* of any lighting *system* in an interior *space*, that *space* shall comply with the entirety of Part 4 as applicable to that *space* or area.

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. Interior lighting *alterations* where the total new wattage of all *replaced luminaires* on a project is 2,000 watts or less, the total wattage of *replaced luminaires* of a *lighting system* within a *space* shall be at least 50% below the total wattage of all *removed luminaires* of that *lighting system*, unless the *space* is at or below the LPD allowances of Part 4. Controls shall comply with the requirement of 4.2.2.1.(20).
- b. Exterior lighting *alterations* where the total number of *replaced luminaires* on a project is 10 or less, the total wattage of *replaced luminaires* shall be at least 50% below the total wattage of all *removed luminaires*, unless each altered area is at or below the LPD allowances of Part 4. Controls shall comply with the requirement of 4.2.4.
- c. The replacement of a failed lamp or *ballast/driver* in an individual *luminaire* or the replacement of any failed lighting control.
- d. The removal or relocation of interior or exterior *luminaires* as part of, or independent of, exceptions 1, 2, or 3.

2.1.3 HVAC (supports Part 5 of the NECB 2020)

2.1.3.1 Additions to Existing Buildings. Mechanical *equipment* and *systems* serving the heating, cooling, ventilating or refrigeration needs of additions to *existing buildings* shall comply with the requirements of Part 5.

Exception: When HVACR to an addition is provided by existing HVACR *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 HVACR *equipment* as a direct replacement of existing HVACR *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;
- c. for a refrigerant change of existing *equipment*;
- d. for the relocation of existing *equipment*; or
- e. for ducts and piping where there is insufficient *space* or access to meet these requirements.

O 2.1.4 Service Water Heating Systems (supports Part 6 of the NECB 2020)

2.1.4.1 Additions to Existing Buildings. Service water heating *systems* and *equipment* shall comply with the requirements of Part 6.

Exception: When the service water heating *system* to an addition is provided by existing service water heating *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 heating *systems equipment* installed as a direct replacement for *existing building* service water heating *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.

O 2.1.5 Power (supports Part 7 of the NECB 2020)

2.1.5.1 Addition to Existing Buildings. *Equipment* installed in addition to *existing buildings* shall comply with the requirements of Part 7.

O 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-11.3.2.1.(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.

A-11.3.2.2.(1)(d) Commissioning (Cx) Requirements and Scope. These new commissioning requirements are not meant to include the Re-commissioning or Retro-commissioning of existing equipment or existing systems unless they are part of a new system, or dependent upon or interlocked with, the operation of new equipment.

A-11.3.4.3.(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-11.3.4.4.(4) Window Replacement. The provisions of Sentence 11.2.4.4.(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-11.3.8.1.(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 11.2.8.1.(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 11.2.8.1.(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-11.5.1. 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 required upgrades to an existing building were based primarily on construction values. The Upgrade Mechanism determines the required “acceptable” level of upgrade for an existing building using the concept of defined “Categories of Work” falling with the broad project types of Rehabilitation, Additions, and Change of Major occupancy.

The intent of the Upgrade Mechanism 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 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 11.5.2.1. of Division B.

A-11.5.1.1.(3) Hazard Index. 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. The Hazard Index for various building uses are indicated in Table A-11.5.1.1.(4), and are used to determine 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.

For the purposes of a Restricted Change of Occupancy, the Hazard Index may be established based on the aggregate area of the suite, to provided indices that can be compared to establish a relative level of risk between the proposed and current uses of different sizes. Where a suite is subdivided as part of change in major occupancy, the relative risk is established based on the index number of the final aggregate size of the suite as compared to the original size of the suite (see Note A-11.5.3.1.(1)).

Table A-11.5.1.1.(3) Hazard Index Table		
Group A, Division 1		
Building Use	Hazard Index ⁽¹⁾	
	≤200 m ²	>200 m ²
Dinner Theatres	4	5
Live Theatres	4	5
Motion Picture Theatres	4	5
Opera Houses	4	5
Television Studios (With Audience)	4	5
Group A, Division 2		
Building Use	Hazard Index	
	≤200 m ²	>200 m ²
Art Galleries	3	4
Auditoria	3	4
Billiard Halls, Amusement Arcades	3	4
Bowling Alleys	3	4

Table A-11.5.1.1.(3) Hazard Index Table		
Churches	3	4
Clubs, Lodges (Non-Residential)	3	4
Community Halls	3	4
Concert Halls	3	4
Court Rooms	3	4
Dance Halls	3	4
Daycare Centres	3	4
Exhibition Halls (Without Sales)	3	4
Exhibition Halls (With Sales)	See Group E	
Gymnasias (Multi-Purpose)	3	4
Gymnasias (Athletic)	3	4
Lecture Halls	3	4
Libraries	3	4
Licensed Beverage Establishments	3	4
Licensed Clubs, Lodges	3	4
Museums	3	4
Passenger Stations/Depots	3	4
Recreational Piers	3	4
Restaurants (Seating Over 17)	3	4
Schools, Colleges	3	4
Undertaking Premises	3	4
Group A Division 3		
Building Use	Hazard Index ⁽¹⁾	
	≤200 m ²	>200 m ²
Arenas (No Occupancy On Activity Surface)	3	4
Armouries (No Occupancy On Activity Surface)	3	4
Enclosed Stadia or Grandstand	3	4
Ice Rinks (No Occupancy On Activity Surface)	3	4

Table A-11.5.1.1.(3) Hazard Index Table		
Indoor Swimming Pools	3	4
Group A Division 4		
Building Use	Hazard Index ⁽¹⁾	
	≤200 m ²	>200 m ²
Amusement Park Structures	2	3
Bleachers	1	3
Grandstands (Open)	1	3
Reviewing Stands	1	3
Stadia (Open)	1	3
Group B, Division 1		
Building Use	Hazard Index	
	≤200 m ²	>200 m ²
Detention Facilities (Minimum Security)	4	5
Detention Facilities (All other types of security)	6	6
Police Station with Detention (not meeting Article 3.1.2.4.)	3	4
Group B, Division 2		
Building Use	Hazard Index	
	≤200 m ²	>200 m ²
Hospital, Nursing Home, Geriatric, Sanitarium (Immobile)	4	5
Hospital, Nursing Home, Geriatric, Sanitarium (Non-Ambulatory)	4	5
Psychiatric Hospitals (Maximum Confinement)	4	5
Psychiatric Hospitals (Minimum Confinement)	3	4
Police Station with Detention (Meeting Article 3.1.2.4.)	3	3
Group B, Division 3		
Building Use	Hazard Index	
	≤200 m ²	>200 m ²
Residential Care Facilities (Ambulatory)	3	4
Residential Care Facilities (Non-Ambulatory)	4	5
Children Custodial Homes	3	4

Table A-11.5.1.1.(3) Hazard Index Table		
Convalescent Homes (Ambulatory)	3	4
Convalescent Homes (Non-Ambulatory)	4	5
Group Homes for Adult Residents with Developmental Disabilities (Minimum Confinement)	3	4
Group Homes for Adult Residents with Developmental Disabilities (Maximum Confinement)	4	5
Group C		
Building Use	Hazard Index	
	≤200 m ²	>200 m ²
Apartments	3	4
Clubs, Residential	3	4
Colleges Residential	3	4
Congregate Care Housing for Seniors	3	5
Convents	3	4
Dormitories/Hotels	3	4
Hotels	3	5
Detached Houses (1 or 2 Family)	2	2
Live/work units	3	5
Monasteries	3	4
Retirement Homes	3	4
Schools, Residential	3	4
Group D		
Building Use	Hazard Index	
	≤200 m ²	>200 m ²
Advertising and Sales Offices	3	3
Automatic Bank Deposit	3	4
Barber/Hairdresser Shops	3	4
Beauty Parlours	3	4
Branch Banks	3	4
Car Rental Premises	3	3

Table A-11.5.1.1.(3) Hazard Index Table		
Chiropractic Offices	3	4
Communications Offices (Telephone Exchange)	3	4
Communications Offices (Telex)	3	4
Communications Offices (Courier)	3	3
Computer Centres	3	4
Construction Offices	3	3
Costume Rental Premises	3	4
Dental Offices (Denture Clinic)	3	4
Dental Offices (General)	3	4
Dental Offices (Surgical/Anaesthesia)	4	5
Dry Cleaning Depots	3	4
Dry Cleaning Premises (Self-Serve)	4	4
Health/Fitness Clubs	3	4
Laundries (Self-Serve)	4	4
Massage Parlours	3	4
Medical Offices (Examination)	3	4
Medical Offices (Surgical Anaesthesia)	4	5
Offices (Business)	3	3
Offices (Charitable)	3	3
Offices (Legal/Accounting)	3	3
Offices (Design)	3	4
Pharmacy Offices	3	4
Photographic Studios	3	4
Physiotherapy Offices	3	4
Police Stations (No Detention)	3	4
Printing and Duplicating	4	5
Public Saunas	3	4
Radio Stations (No Audience)	3	4
Small Tool Rental Premises	3	4

Table A-11.5.1.1.(3) Hazard Index Table		
Suntan Parlours	3	4
Veterinary Offices	3	4
Group E		
Building Use	Hazard Index	
	≤200 m ²	>200 m ²
Automotive/Hardware Department Store	4	5
China Shops	3	4
Department Stores	4	5
Electrical Stores (Fixtures)	3	3
Exhibition Halls (With Sales)	4	5
"Fast Food" Outlets	3	4
Feed and Seed Stores	4	5
Flea Markets	3	5
Flower Shops	3	4
"Food" and Vegetable Markets	3	4
Garden Shops	3	4
"Gas" Bars	4	5
Gift Shops	3	4
Home Improvement Stores	4	5
Kitchen/Bathroom Cupboards Stores	3	4
Plumbing Stores (Fixtures/Accessories)	3	3
"Pop" Shops	3	4
Restaurants (Not More Than 30 Persons)	3	4
Shopping Malls	4	5
Stationery/Office Supply Stores	3	4
Stores (Art)	3	4
Stores (Baked Goods)	3	4
Stores (Beer)	3	4
Stores (Book)	3	4

Table A-11.5.1.1.(3) Hazard Index Table		
Stores (Camera)	3	4
Stores (Candy)	3	4
Stores (Clothing)	3	4
Stores (Drugs)	4	4
Stores (Electronic)	3	4
Stores (Floor Coverings)	4	5
Stores (Food)	3	3
Stores (Furniture/Appliances)	3	4
Stores (Hardware)	4	5
Stores (Health)	4	4
Stores (Hobby)	3	4
Stores (Jewellery)	3	3
Stores (Paint/Wallpaper)	4	5
Stores (Pet)	3	4
Stores (Records/Tapes)	3	4
Stores (Spirits)	4	5
Stores (Toys)	4	5
Stores (Variety)	4	4
Stores (Video Sales/Rental)	3	4
Supermarket	3	4
Group F, Division 1		
Building Use	Hazard Index	
	≤200 m ²	>200 m ²
All Uses	6	6
Group F, Division 2		
Building Use	Hazard Index	
	≤200 m ²	>200 m ²
Aircraft Hangars	3	5
Abattoirs	3	4

Table A-11.5.1.1.(3) Hazard Index Table		
Bakeries	3	5
Body Shop	3	5
Candy Plants	3	4
Cold Storage Plants with Flammable Refrigerant	3	5
Cold Storage Plants with Non-flammable Refrigerant and	3	4
Dry Cleaning Establishments (non-flammable or non-explosive)	3	4
Electrical Substations	3	4
Factories (High Fire Load)	3	5
Freight Depots (High Fire Load)	3	5
Laboratories (High Fire Load)	3	5
Laundries (not self-serve)	3	4
Manufacturer Sales (High Fire Load)	3	5
Mattress Factories	3	4
Meat Packing Plants	3	4
Packaging Manufacturers (Cellulose)	3	4
Packaging Manufacturers (Noncombustible)	3	3
Packaging Manufacturers (Plastics)	3	5
Paper Processing Plants (Wet)	3	5
Planing Mills	3	5
Printing Plants	3	4
Public Heritage Buildings	3	3
Repair Garages	3	5
Sample Display Rooms (High Fire Load)	3	5
Self Service Storage Buildings	3	4
Service Stations (no spray painting)	3	5
Storage Rooms (High Fire Load)	3	5
Television Studios (no audience)	3	4
Tire Storage	3	5
Warehouse (High Fire Load)	3	5

Table A-11.5.1.1.(3) Hazard Index Table		
Welding Shops	3	5
Wholesale Rooms (High Fire Load)	3	5
Wood Working Factories	3	5
Workshops (High Fire Load)	3	5
Group F, Division 3		
Building Use	Hazard Index	
	≤200 m ²	>200 m ²
Creameries	2	2
Factories (Low Fire Load)	2	3
Freight Depots (Low Fire Load)	2	3
Laboratories (Low Fire Load)	2	3
Manufacturers Sales (Low Fire Load)	2	3
Power Plants	3	4
Public Heritage Buildings	3	3
Sample Display Rooms (Low Fire Load)	2	3
Storage Garages	2	3
Storage Rooms (Low Fire Load)	2	3
Warehouse (Low Fire Load)	2	3
Wholesale Rooms (Low Fire Load)	2	3
Workshops (Low Fire Load)	2	3

Notes to Table A-11.5.1.1.(3):

⁽¹⁾ For the purposes of a Restricted Change of Occupancy, the Hazard Index may be established based on the aggregate area of the suite provided the suite changing occupancy is fully contained in the original suite area.

A-11.5.2.1.(1) Procedure for Using the Upgrade Trigger Mechanism. The following steps outline a recommended procedure for using the Upgrade Trigger Mechanism.

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 Trigger Mechanism 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.

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; and accessibility for persons with disabilities are to be determined using each of the applicable project type flow charts and the related category of work

For Renovation Type Projects use Flow Chart No. 1 in Article 11.5.2.1.

For Change of Major occupancy Type Projects use Flow Chart No. 2 in Article 11.5.2.1.

For Addition Type Projects use Flow Chart No. 3 in Article 11.5.2.1.

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; and accessibility for persons with disabilities. The most restrictive upgrade levels are the design upgrade levels that are to be applied to the existing building.

A-11.5.2.1.(2) Incremental Upgrade.

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); and accessibility (A). For each of the upgrade levels, there is a corresponding acceptable solution that is deemed to meet the intended upgrade objectives of the applicable upgrade level. The upgrade objectives and acceptable solution for each F, S, N and A upgrade level provided in A 11.5.1.2 and its associated notes.

If an alteration includes more than one category of work or project type, then the most restrictive upgrade levels from each category of work will be applied. The individual upgrade levels are cumulative, so the higher level upgrade levels include all of the preceding lower upgrade level requirements. For example, where the design upgrade level is F3, then all of the upgrade requirements under F2 and F1 also apply.

A-11.5.3.1.(1) Upgrade Requirements for Detached Houses and Duplexes. The upgrades applicable to Detached house and Duplexes are determined by Article 11.5.3.1. through a simplified and more prescriptive process. This is intended to reflect the simpler nature of these projects, and the absence of many of the usual design features of such projects.

A-11.5.4.1.(1) Restricted Change of Major Occupancy. The term “restricted change of major occupancy” refers to a change in major occupancy restricted to a specific set of uses that are limited both in scope and risk such that it does not increase the overall hazard.

While it is intended that designers and owners seeking to apply this requirement refer to the hazard index Table A-11.5.1.1.(3), for the purposes of the uses specified in Sentence 11.5.3.1.(2) – they may substitute the aggregate suite area of the suite in lieu of the building area where the change of major occupancy is wholly contained within the original suite.

For example: a suite of 300 m² is being repartitioned and converted from a “business office” use (Group D) to a suite of “retail toystore” use (Group E) of 150 m² and second suite of “health care office” use which are fully contained within the original 300 m² suite area. The aggregate suite area is therefore permitted to be used for the purposes of determining the appropriate hazard index which is then established as follows:

- Business Office (300 m²) – 4 (original)
- Retail Toystore (150 m²) – 4 (new)
- Health Care Office (150 m²) – 3 (new)

By comparison, a larger toystore, such as the conversion of the original 300 m² suite area into a toystore, would result in a hazard index of ‘5’ which would not meet the requirements of Article 11.5.1.3. for a “restricted change of major occupancy” as it represents an increase in hazard.

While the hazard index table is a useful tool for assessment, it is also important to understand that no table can address all possible combinations of uses. Designers and owners should exercise caution when making judgments of relative hazards in this regard.

A-11.5.4.1.(2) Sprinkler Installation Determination Where Dwelling units Are Added. Table 11.5.4.1.(2) 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.

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

12.2.1. Float Homes and Marinas

12.2.1.1. 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-12.2.1.1.(1).)

2) A *float home* shall be designed and constructed in accordance with the British Columbia Float Home Standard. (See Note A-12.2.1.1.(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*.

12.2.1.2. 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.

12.2.1.3. 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.

12.2.1.4. Lighting for Marinas

1) All areas throughout a *marina* shall be illuminated to a minimum average level of 50 lx at the level of all *marina walkways*, at angles and intersections, and 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.

12.2.1.5. 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*.

12.2.1.6. 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.

12.2.1.7. 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.

12.2.1.8. 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-12.2.1.1.(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-12.2.1.1.(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.

Part 13 Temporary Buildings and Temporary Uses

Section 13.1. General

13.1.1. General

13.1.1.1. Scope

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

13.1.1.2. Application

- 1) This Section applies to
 - a) temporary *buildings*, including special event facilities and emergency shelters in temporary buildings,
 - b) tents, and
 - c) temporary uses in *existing buildings* designed to support a different *major occupancy*, including arts and culture events, temporary special events, emergency shelters, retail, and day care for children.

13.1.1.3. Alternative Compliance Measures

- 1) The alternative compliance measures provided in this Part apply to temporary *buildings* and *existing buildings* temporarily used for other uses and occupancies and do not apply to new work, which must conform to the requirements for new *construction* in other Parts of this By-law.
- 2) The alternative compliance measures in Section 11.3. may be applied to existing conditions, except as otherwise required by this Part.
- 3) The alternative compliance measures in Section 11.5. may be applied to existing conditions in a *heritage building*, except as otherwise required by this Part.

13.1.1.4. Definitions

- 1) Words that appear in italics are defined in Article 1.4.1.2. of Division A.
- 2) The following additional words and terms shall have the following meanings for this Part:

Arts and culture 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*.

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*.

13.1.1.5. Use of Term Temporary

- 1) For the purposes of this Part, the term “temporary building” shall refer to a *building* that is not intended for, or not constructed to a standard to support, continuous ongoing *occupancy* on a permanent basis, that is used

- a) for a time period exceeding 12 consecutive months, or
- b) for a fixed term of *occupancy* that is *acceptable* to the *Chief Building Official* which does not exceed 3 years.

2) For the purposes of this Part, the term “temporary use” shall refer to the interim or provisional occupancy of a portion of an *existing building* designed to support a different *major occupancy* over a fixed time period, as permitted by this Part or as *acceptable* to the *Chief Building Official*.

13.2. Temporary Buildings

13.2.1. Temporary Buildings

13.2.1.1. Alternative Compliance Measures

1) The alternative compliance measures of Table 13.3.1.1. may be applied to temporary *buildings*.

Table 13.2.1.1. Alternative Compliance Measures for Temporary Buildings, including Temporary Special Events and Emergency Shelters Forming part of Sentence 13.2.1.1.(1)		
No.	By-law Requirement Division B	Alternative Compliance Measures
1	Handrails 3.4.6.5.	Handrail extensions for temporary <i>buildings</i> may extend vertically downward not less than 300 mm beyond the top and bottom of the stairway.
2	Guards 3.4.6.6.	Openings greater than 100 mm may be permitted in <i>guards</i> 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 <i>guard</i>, 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 <i>guard</i> may be permitted where a) the <i>guard</i> 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.
3	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.
4	Direction of Door Swing 3.4.6.12. Door Release Hardware 3.4.6.16.	Temporary sliding gates may be used as <i>exit</i> doors provided a) gates are left open during normal operating hours and always manned by <i>supervisory staff</i>, b) gates are closed during non-operating hours, and locked c) operational procedures are in place to ensure that the gates are unlocked during operating hours, and d) <i>supervisory staff</i> are trained for emergency evacuation procedures.

Table 13.2.1.1.
Alternative Compliance Measures for Temporary Buildings, including Temporary Special Events and
Emergency Shelters
Forming part of Sentence 13.2.1.1.(1)

No.	By-law Requirement Division B	Alternative Compliance Measures
5	Environment Separation Part 5	Part 5 does not apply.
68	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.
79	Faucets and Shower Head Efficiency Book II, Division B, 2.2.10.6.	No restriction required.
8	Water Closet Efficiency Book II, Division B, 2.6.1.6.	No restriction required.
9	Urinal Efficiency Book II, Division B, 2.6.1.6.	All urinals shall conform to CSA B45 "Plumbing Fixtures" and shall have an average water consumption not exceeding 3.8 litres per flush cycle.
10	Sanitary Connection 2.4.2.1. Book II	Portable water closets that form part of a temporary facility need not be connected to the <i>sanitary drainage system</i> .
11	Storm Drainage Connection Book II, Division B, 2.4.2.1.	Roofs and paved areas need not be connected to the storm drainage system

2) An emergency shelter in a temporary building shall also comply with the requirements of Subsection 13.4.4.

13.3. Tents

13.3.1. Tents

13.3.1.1. General

1) Except as permitted by this Subsection, a tent shall comply with the requirements of 3.1.18., and Sections 3.3. and 3.4.

2) Tents use for temporary purpose may also apply the alternative compliance measures of Section 13.2.

13.3.1.2. Clusters of Tents

1) A cluster of tents, may be considered a single tent for the purposes of spatial separation under Article 3.1.18.3., where

- a) the cluster of tents have an aggregate area of not more than 60 m², and
- b) each tent in the cluster is located no more than 3 m away that any other tent in that cluster.

2) 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.

3) *Exit* doors for a tent, 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) *supervisory staff* are trained for emergency evacuation procedures, and remain in the vicinity of the *exit* at all times.

13.4. Temporary Uses in Existing Buildings

13.4.1. Temporary Uses

13.4.1.1. Alternative Compliance Measures for Temporary Uses

1) The alternative compliance measures of this Section, may be applied to the

- a) temporary use of a *building* or part of a *building* designed to support a different *major occupancy*, and
- b) temporary use of a tent designed to support a different *major occupancy*.

2) A *building* supporting a temporary use through the application of alternative compliance measures in this Part, shall have a valid *occupancy permit*.

13.4.2. Temporary Special Event

13.4.2.1. Alternative Compliance Measures for Temporary Special Event

1) A *fire separation* between adjacent *occupancies* 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.

13.4.3. Art and Culture Event

13.4.3.1. Alternative Compliance Measures for Temporary Art and Culture Event

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 classified as a temporary Group A Division 2 major occupancy for an arts and culture event where

- a) the *arts and culture event* is located in the *first storey* or the *storey* below the *first storey*,
- b) the *floor area* containing the *arts and culture event* complies with the fire and life safety requirements of Sentences (2) and (3), and
- c) an *Occupant Load* plan acceptable to the *Fire Chief* is obtained where an *arts and culture event* has an *occupant load* of more than 60 persons or where alcohol is served in connection with a Special Occasion Liquor License issued by the Province, or
- d) an approved Security Assessment by the Vancouver Police Department is obtained where an *Arts and culture event* is a public event with an *occupant load* of more than 60 persons or where alcohol is served in connection with a Special Occasion Liquor License issued by the Province

2) *Floor area* used for an *arts and culture event* shall

- a) be constructed of concrete supported by solid ground without suspended slab, or certified by a *registered professional*, to be suitable for *assembly occupancy* and designed to a minimum specified uniformly distributed *live load* of 4.8 kPa,
- b) include at least one *accessible* entrance conforming with Subsection 11.3.7.1.(1)(d) or (e),
- c) be sprinklered in a basement used for an *arts and culture event*,
- d) except as required by Clause 11.6.2.1(4)(b), be provided with a fire alarm or at least one designated *supervisory staff* posted at each required egress door, but in no case shall there be fewer than two *supervisory staff* for an *arts and culture event*, and
- e) include emergency lighting
 - 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 event* to the *street* as described in Sentence 3.2.7.3.(1).

3) *Means of egress* from *floor areas* used for an *arts and culture event* shall include

- a) *exits* in compliance with the requirements of Section 3.4. with respect to size, travel distance, and number, as applicable to a Group A, Division 2 *major occupancy*, except that not less than
 - i) one *exit* is permitted where the *occupant load* does not exceed 60 persons, or
 - ii) two *exits* are permitted where the *occupant load* does not exceed 250 persons, and
- b) *exit signs* installed over or adjacent to exits and in common paths of travel where the *occupant load* exceeds 60 persons.

4) *Floor area* used for an *arts and culture event* which occurs more than 3 days per month or occurs with any other arts and culture event more than 3 days per month, shall

- a) include a fire separation to adjacent occupancies or uses
- b) be served by a permanent or temporary fire alarm system, and
- c) except where the floor area is *sprinklered*, draperies, fabrics or combustible hangings shall be flame retardant and other combustible finishes shall be of *fire-retardant-treated wood* or have a Flame-spread rating of not more than 150 (see Note A-11.6.2.1.(4)).

5) An *arts and culture event* shall include portable fire extinguishers installed in accordance with the Fire By-law, with

a) at least one extinguisher at the main entrance and at each egress door leading from the *arts and culture event floor area*, and

b) the approved fire emergency procedures and security plan with approved maximum occupant load posted beside each portable extinguisher at the main entrance and at each egress door leading from the *arts and culture event*.

6) Cooking which generates grease-laden vapour is not permitted at an *arts and culture event*, unless commercial cooking and ventilation equipment, installed under *permit* and conforming with Article 6.3.1.7., is used.

13.4.4. Emergency Shelter

13.4.4.1. Alternative Compliance Measures for Temporary Emergency Shelter

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 m² of *floor area* or, if bunk beds are provided, no more than two shelter beds for every 3.7 m² 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.

2) A fixed term transitional housing or emergency shelter complying with the requirements of this Sentence is permitted to remain for not more than 3 years provided

a) the *building* is constructed as a

i) temporary emergency shelter complying with the requirements of Sentence (1), or

ii) factory constructed *building* complying with CSA Z240 MH except as required by 1.1.1.1.(2)(g) of Division A,

b) the *building* is *sprinklered* with quick response or residential sprinklers,

c) the *building* is provided with a single stage fire alarm system, and

d) the owner provides an operating agreement stating the intended fixed term of occupancy, maximum occupant load, and minimum operating staff level, as acceptable to the *Chief Building Official*.

13.4.5. Temporary Retail Use

13.4.5.1. Alternative Compliance Measures for Temporary Retail Use

1) Notwithstanding the provisions of this By-law, a temporary use for retail is permitted in an *existing building floor area* of Group A Division 2, Group D, Group F, Division 2 or Group F Division 3 major occupancy, where

- a) the *temporary use* for retail is located on the *first storey* or the adjacent grade level, but not both,
- b) the *building* is provided with a *fire alarm system*, and the
- c) *floor area* containing the *arts and culture event* complies with the fire and life safety requirements of Sentences (2) and (3).

2) *Floor area* used for temporary use for retail shall

a) be constructed of concrete supported by solid ground without suspended slab, or certified by a *registered professional*, to be suitable for *assembly occupancy* and designed to a minimum specified uniformly distributed *live load* of 4.8 kPa,

b) be separated from other all other *major occupancies* by a *fire separation* with a *fire resistance rating* of at least 2 h,

c) be sprinklered in accordance with NFPA 13,

d) have washroom facilities complying with Subsection 3.7.2.,

e) have emergency lighting

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 common paths of egress travel to the exits as described in Sentence 3.2.7.3.(1), and

f) include at least one *accessible* entrance conforming with Subsection 11.3.7.1.(1)(d) or (e).

3) *Means of egress* from a temporary use for retail shall include

a) *exits* in compliance with the requirements of Section 3.4. with respect to size, travel distance, and number, as applicable to a Group A, Division 2 *major occupancy*, except that not less than

i) one *exit* is permitted where the *occupant load* does not exceed 60 persons, or

ii) two *exits* are permitted where the *occupant load* does not exceed 250 persons, and

b) *exit* signs installed over or adjacent to exits and in common paths of travel where the *occupant load* exceeds 60 persons.

4) The *temporary use* shall be provided with

a) portable fire extinguishers installed in accordance with the Fire By-law, with at least one extinguisher at the main entrance and at each egress door,

b) a safety plan, outlining procedures for supervisory personnel with no less than one staff member for each interval of up to 50 occupants, and training in first aid and emergency evacuations, and

c) *smoke detectors* installed in accordance to Article 3.2.4.20. are installed throughout the *temporary use*,

5) *Floor area* use for the *temporary use* of retail may not include cooking.

13.4.6. Temporary Day Care for Children

13.4.6.1. Alternative Compliance Measures for Temporary Day Care for Children

1) Notwithstanding the provisions of this By-law, a temporary daycare facility for children is permitted in an *existing building*, where it

a) has a fixed term of occupancy of not more than 3 years, or otherwise acceptable to the *Chief Building Official*, and

b) complies with the requirements of this Article.

2) The temporary daycare facility for children shall be located in a *floor area* of Group A, Division 2 major occupancy, where

a) the temporary daycare facility for children does not exceed 30 *children*,

b) the temporary daycare facility for children is separated from other all other major occupancies by a *fire separation* with a *fire resistance rating* of at least 1 h,

c) the *storey* containing the temporary daycare facility for children and all *storeys* below are fully *sprinklered*, except where

i) *means of egress* are provided directly to the exterior,

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

iii) at least two *means of egress* are located so that one *means of egress* could provide egress, if any other *means of egress* becomes inaccessible due to fire,

d) the temporary daycare facility for children is equipped with emergency lights in accordance with articles 3.2.7.3. and 3.2.7.4.,

e) firefighter access conforms with Part 3 of this By-law,

f) A fire alarm system with heat and smoke detection in accordance with Articles 3.2.4.10. and 3.2.4.11.,

g) nonstructural elements and other falling hazards in the temporary daycare facility for children are restrained to resist lateral loads due to earthquakes,

h) interior partition walls and ceiling, and their support frames and overhead lights and services are restrained, and

i) all *unsafe conditions* are corrected to the satisfaction of the *Chief Building Official*.

Notes to Part 13

Temporary Buildings and Temporary Uses

A-13.4.3.1.(4) **Combustible Finishes.** Combustible finishes have been associated with the rapid propagation of fire within assembly occupancies. Such materials will often be affixed to wall and ceiling surface, or loose hanging materials will be provided so as to improve the appearance of a space or reduce hard surface that reflect sound.

Sentence 11.6.2.1.(4) is intended to limit the type of built-in combustible wall and ceiling finishes and hanging materials (such as draperies or fabrics) to reduce the risk to occupants where the space is not protected by fire sprinklers, which can respond to a fire before rapid fire propagation occurs.

Loose fabric materials should be flame retardant, which is commonly demonstrable through a product listing identifying that it meets the requirements of CAN/ULC-S109. Built-in combustible finishes must demonstrate a flame-spread rating of not more than 150 which is readily demonstrable by listings confirming the product meets the requirement of CAN/ULC-S102, or they may be constructed with fire retardant-treated wood.

A-13.4.4.1.(2) **Fixed Term Transitional Housing or Emergency Shelter.** The requirements for fixed term transitional housing or emergency shelters described in Sentence 11.6.3.2.(2) are intended to accommodate temporary, but longer term housing that may be deployed for a fixed duration to address ongoing housing concerns.

Fixed term housing or shelters may consist of temporarily repurposed buildings, or may be constructed as modular factory built structures in accordance with CSA Z240 MH to the extent permitted by Division A (See also Note A-1.1.1.1.(3) of Division A) or other regulatory requirements.

The requirements of Sentence 11.6.3.2.(2) and Division C Sentence 1.6.8.1.(1) require that the term of occupancy be limited. This reflects the potential risk that the form of construction may not be appropriate for permanent use, either as a consequence of the inability to maintain the building due to ongoing use, or due to reduced durability. However, this term may be extended once by the Chief Building Official in accordance with Article 1.6.8.8., provided that it can be shown that the building will be able to support extended use.

BOOK I (GENERAL) - DIVISION C

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 6 months 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 compliance method 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 compliance method 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, Mechanical and Sprinkler Systems

1) The *Chief Building Official* may issue a *permit* for a plumbing system, mechanical system or *sprinkler system* in accordance with the provisions of Subsection 1.6.3.

2) The *Chief Building Official* may relax the rainwater management requirements of Division B, Sentences 2.4.2.5.(4), (5) and (6) of Book II (Plumbing Systems) of this By-law as provided in Division B, Sentence 2.4.2.5.(9) of Book II (Plumbing Systems) of this By-law.

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 2.2.10.5.

3) The *Chief Building Official* may relax the *flood construction level requirements* or the setback requirements in this By-law as provided in Article 2.2.10.6.

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 or Mechanical 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 have 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.

3) The *Chief Building Official*, if of the opinion that the *mechanical system*, or any part of it, in any *building* is defective or inadequate, may notify the *owner* or occupant thereof of such condition and may order such *mechanical system*, or part thereof, be placed in a proper, safe and working condition.

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*, double the fee set out in the Fee Schedule to a maximum of \$20,000, but in no case less than \$500.

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

(See Note A-1.6.2.3.)

1) The value of the proposed work for new construction stated on the application for the permit shall be determined as

- a) the net floor area in square meters (m²) multiplied by \$2691.25 (\$250/ft²) for a single detached house or duplex,
- b) the net floor area in square meters (m²) multiplied by \$2691.25 (\$250/ft²) for an *ancillary residential building*, or
- c) the total current monetary worth of all proposed materials, construction and work related to the building for all other cases.

2) The value of the proposed work for an *alteration* to an *existing building* stated on the application for the permit shall be determined as

- a) the renovated *floor area* in square meters (m²) multiplied by \$1937.69 (180/ft²) for a single detached house, duplex, or *ancillary residential building*,
- b) the new or renovated vertical wall area in square meters (m²) where only the walls are being altered or added, multiplied by \$968.85 (\$90/ft²) for a single detached house, duplex or *ancillary residential building*, or
- c) the total current monetary worth of all proposed materials, construction and work related to the building for all other cases.

3) The value of the proposed work established in Clause (1)(c) and (2)(c) 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*.

4) The total current monetary worth referred to in Clauses (1)(c) and (2)(c), and Sentence (3) 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.

5) The total current monetary worth referred to in Clause (1)(a) and Sentence (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, and may

substitute a different value for the proposed work, based on a cost estimate prepared by a registered quantity surveyor using an *acceptable* valuation method.

1.6.2.5. Fee Schedule

1) Except as permitted by Sentence (2), *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.

2) The *Chief Building Official* may reduce *permit* fees in accordance with Part A, Section 4 of the Fee Schedule at the end of this Part for a *building* considered Social Housing, as defined in the Zoning and Development By-law.

1.6.2.6. No Refund

1) Except as permitted in Article 1.6.2.7., 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 1.5.3.5. or Article 1.5.3.6.

2) Where fees have been submitted to the *City* as part of an application for an alternative solution or an *operating permit*, and the *Chief Building Official* approves, the Director of Finance may refund a portion of the fees related to the application, after deduction of the administrative fee set out in the Schedule of Fees at the end of this Part.

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, Mechanical and Sprinkler Permits

1.6.3.1. Application Requirements

1) The *Chief Building Official* may issue a *permit* for a *plumbing system*, *mechanical 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 Mechanical System

1) The *Chief Building Official* shall only issue a *permit* to construct, extend, alter, renew or repair a *mechanical system* to a *plumbing contractor*, licensed *electrical contractor* or a *gas contractor*.

2) The *Chief Building Official* shall only issue a *permit* to install a *mechanical system* that includes a *heat pump* to a *plumbing contractor*, a *licensed electrical contractor* or a *gas contractor* who holds a *Municipal Heat Pump Certification*.

1.6.3.4. 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*.

1.6.3.5. 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*.

1.6.3.6. 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*.

1.6.3.7. No Permit for Minor Repairs to Plumbing, Mechanical or Sprinkler System

1) Despite the provisions of Article 1.6.3.1., no *permit* is required to repair or replace a valve, sprinkler head, 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.

1.6.3.8. Requirement for Inspection

1) A *plumbing system*, *mechanical system* or *sprinkler system* shall be inspected by the *Chief Building Official*, unless the *Chief Building Official* determines that an inspection is not necessary.

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*.

1.6.5. 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*, 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*, provided that, in the meantime, no applicable amendments have been made to this By-law.

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 12 consecutive months or a fixed term of occupancy not to exceed 3 years where *acceptable*.

1.6.8.2. Compliance with By-law

1) Except as otherwise provided in this Subsection or in Part 13, Division B, Book I, 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*,

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 and Structures

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*, 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 for New Operating Permits and Renewals

1) To obtain or renew an *operating permit*, the owner of the equipment, device, apparatus, or system, or their authorized representative, shall file an application in writing in the form prescribed by the *Chief Building Official*.

2) The application for a new *operating permit* or the renewal of 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.

3) Except as provided in Sentences (4) and (5), *operating permits* are valid for a one year period, and shall be renewed on an annual basis.

4) *Operating permits* for *emergency once through cooling equipment* and *maintenance once through cooling equipment* will be valid for a period deemed appropriate by the *Chief Building Official*, and if valid for a period of

a) less than one year, may not be renewed, or

b) one year, shall be renewed on an annual basis.

5) *Operating permits* for *once through cooling equipment* permitted to retain an existing connection to the City's water system under Sentence 2.2.11.4.(4) of Division B of Book II (Plumbing Systems) of this By-law shall be valid for a one year period and renewed on an annual basis until the expiry date established by the *Chief Building Official*.

1.6.9.4. Owner Must be Certified

1) The owner of the equipment, device, apparatus, or system, or their authorized representative, must be certified under the Environmental Operators Certification Program, except that this requirement does not apply to *once through cooling equipment*. (See Note A-1.6.9.4.(1).)

1.6.9.5. Conditions on Operating Permits

- 1) The *Chief Building Official* may impose conditions on *operating 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 of the equipment, device, apparatus, or system, the *constructor*, the *registered professional* and the *certified professional*,
 - j) compliance with this By-law and other enactments,
 - k) use and *occupancy*, and
 - l) temporary *buildings* and *occupancies*.

1.6.9.6. 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 1.8.11., 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. [UTV Deleted]

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) 500 mm for a solar shading device located between 2.75 and 5.2m above the *street*,

- b) 915 mm for a solar shading device located between 5.2m and 7.62m above the street, and
 - c) 1370 mm 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 Sentences (2) and (3), 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.

3) Not more than one laneway house may be assigned a *suite* number that is subordinate to the principal residential *building* in accordance with Article 1.10.1.4., provided

a) that the laneway house along with the principal residential *building* shall consist of a single real-estate entity that is not subdivided into separate strata lots pursuant to the “Strata Property Act”,

b) *suite* numbers are assigned between the affected *buildings* in a simple and logical manner that makes the location and relationship of each *suite* self-evident as if the laneway house formed a part of the principal residential *building*, and

c) sufficient and clear signage is provided and visible on approach so as to make clear the sequence of suite number assignment.

SCHEDULE E-1

Note: To be submitted with the application for a Building Permit

• BUILDING BY-LAW "OWNER'S UNDERTAKING"

The Chief Building Official
City of Vancouver
453 West 12th Avenue
Vancouver, B.C.
V5Y 1V4

Date (Month Day Year)

Dear Sir:

RE: Property Address _____

Building Permit Application No. _____

In consideration of the City accepting and processing the above application for a building permit, and as required by the Building Bylaw, the following representations, warranties and indemnities are given to the City.

1. (a) If an individual is the owner:
() That I am the owner of the above property, or

(b) If a corporation is the owner of the property,
() That _____ 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 bylaws of the City of Vancouver and other statutes and regulations in force in the City of Vancouver relating to the development, work, undertaking or permission in respect of which this application is made.
3. The owner fully understands the requirements herein, and acknowledges full responsibility for carrying out the work, or gives assurance that the work will be carried out, in accordance with all bylaws 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 bylaw has been complied with and the owner remains responsible at all times to assure 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 Bylaw which are set out on the reverse side hereof.
4. The owner hereby agrees to indemnify and save harmless the City of Vancouver 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 bylaws, statutes and regulations relating to any work or undertaking in respect of which this application is made.
5. Where used herein the words "work" or "undertaking" in respect of which this application is made, the owner understands this to include all electrical, plumbing, mechanical, gas and other works necessary to complete the contemplated construction.

Owner's Undertaking (continued) Property Address _____

Building Permit Application No. _____

6. I am authorized to give these representations, warranties, assurances and indemnities to the City of Vancouver. This Owner's Undertaking is executed by the Owner this _____ day of _____, _____.
(Day) (Month) (Year)

1. Where owner is an individual:

Signed and delivered in the presence of:

Owner's Signature _____

Witness's Signature _____

Owner's Name _____
(PRINT)

Witness's Name _____
(PRINT)

Witness's Address _____

2. Where owner is a corporation:

Signed, sealed and delivered in the presence of:

Name of Corporation _____

Witness's Signature _____

Per: Authorized Signatory _____

Witness's Name _____

Name _____
(PRINT)

(PRINT)
Witness's Address _____

Building Bylaw, 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.

SCHEDULE E-2

Note: To be submitted with the application for a Building Permit

BUILDING BY-LAW “OWNER’S UNDERTAKING FOR TENANT IMPROVEMENTS”

The Chief Building Official
City of Vancouver
453 West 12th Avenue
Vancouver, B.C.
V5Y 1V4

Date (Month Day Year)

Dear Sir:

RE: Property Address _____

Building Permit Application No. _____

In consideration of the City accepting and processing the above application for a building permit from _____ (the “Tenant”), a tenant of the above-mentioned property, and as required by the Building By-law, the following representations, warranties and indemnities are given to the City.

1. (a) If an individual is the owner:
() That I am the owner of the above property, or

(b) If a corporation is the owner of the property,
() That _____ is the owner of the above property.
(Name of Corporation)
2. The owner will use its reasonable efforts to require the tenant to comply with, and cause those employed for this project to comply with all applicable by-laws of the City of Vancouver and other statutes and regulations in force in the City of Vancouver relating to the development, work, undertaking or permission in respect of which this application is made.
3. 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 the owner remains responsible at all times to use its reasonable efforts to require compliance by the tenant. 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 on the reverse side hereof.
4. The owner hereby agrees to use its reasonable efforts to require that the tenant does indemnify and save harmless the City of Vancouver 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 application is made.
5. Where used herein the words “work” or “undertaking” in respect of which this application is made, the owner understands this to include all electrical, plumbing, mechanical, gas and other works necessary to complete the contemplated construction

Owner's Undertaking (continued)
(Tenant Improvements)

Property Address _____

Building Permit Application No. _____

6. I am authorized to give these representations, warranties, assurances and indemnities to the City of Vancouver. This Owners' Undertaking is executed by the owner this _____ day of _____, _____.
(Day) (Month) (Year)

1. Where owner is an individual:

Signed and delivered in the presence of:

Owner's Signature _____

Witness's Signature _____

Owner's Name _____
(PRINT)

Witness's Name _____
(PRINT)

Witness's Address _____

2. Where owner is a corporation:

Signed, sealed and delivered in the presence of:

Name of Corporation _____

Witness's Signature _____

Per: Authorized Signatory _____

Witness's Name _____

Name _____
(PRINT)

(PRINT)
Witness's Address _____

Building Bylaw, 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.

SCHEDULE E-3

Note: To be submitted with the application for a Building Permit

• BUILDING BY-LAW "LESSEE'S UNDERTAKING FOR TENANT IMPROVEMENTS"

The Chief Building Official
City of Vancouver
453 West 12th Avenue
Vancouver, B.C.
V5Y 1V4

Date (Month Day Year)

Dear Sir:

RE: Property Address _____

Building Permit Application No. _____

In consideration of the City accepting and processing the above application for a building permit, and as required by the Building Bylaw, the following representations, warranties and indemnities are given to the City.

1. (a) If an individual is the lessee:
() That I am the lessee of the above property, or

(b) If a corporation is the lessee of the property,
() That _____ is the lessee of the above property.
(Name of Corporation)
2. The lessee will comply with, and cause those employed for this project to comply with all applicable bylaws of the City of Vancouver and other statutes and regulations in force in the City of Vancouver relating to the development, work, undertaking or permission in respect of which this application is made.
3. The lessee fully understands the requirements herein, and acknowledges full responsibility for carrying out the work, or gives assurance that the work be carried out, in accordance with all bylaws governing the construction of the building. The lessee 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 bylaw has been complied with and the Lessee remains responsible at all times to assure compliance. The lessee 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 Bylaw which are set out on the reverse side hereof.
4. The lessee hereby agrees to indemnify and save harmless the City of Vancouver 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 bylaws, statutes and regulations relating to any work or undertaking in respect of which this application is made.
5. Where used herein the words "work" or "undertaking" in respect of which this application is made, the lessee understands this to include all electrical, plumbing, mechanical, gas and other works necessary to complete the contemplated construction.

Lessee's Undertaking (continued) Property Address _____

Building Permit Application No. _____

6. I am authorized to give these representations, warranties, assurances and indemnities to the City of Vancouver. This Lessee's Undertaking is executed by the Lessee this _____ day of _____, _____.
(Day) (Month) (Year)

1. Where lessee is an individual:

Signed and delivered in the presence of:

Lessee's Signature _____

Witness's Signature _____

Lessee's Name _____
(PRINT)

Witness's Name _____
(PRINT)

Witness's Address _____

2. Where lessee is a corporation:

Signed, sealed and delivered in the presence of:

Name of Corporation _____

Witness's Signature _____

Per: Authorized Signatory _____

Witness's Name _____
(PRINT)

Name _____
(PRINT)

Witness's Address _____

Building Bylaw, 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.

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) and Section 4 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.\$208.00

For each \$1,000, or part thereof, by which the estimated cost of the work exceeds \$5,000 but does not exceed \$50,000. \$13.30

For each \$1,000, or part thereof, by which the estimated cost of the work exceeds \$50,000. \$6.74

(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..... \$132.00

(c) For an OCCUPANCY PERMIT not required by this By-law but requested. \$300.00

(d) For the demolition of a BUILDING, not including a SINGLE DETACHED HOUSE, which has at any time since November 1, 1986 provided RESIDENTIAL OCCUPANCY, subject to Section 3:

For each DWELLING UNIT..... \$1,500.00

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..... \$1,500.00

(e) For the demolition of a SINGLE DETACHED HOUSE, which has at any time since November 1, 1986 provided RESIDENTIAL OCCUPANCY, subject to Section 3.\$1,500.00

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..... \$409.00

(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..... \$409.00

(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..... \$270.00

(d) For each REINSPECTION made necessary due to faulty work or materials or incomplete work requested to be inspected. \$270.00

(e) For each inspection of a drainage tile system:

For a single detached house or duplex..... \$278.00

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. \$544.00

When the estimated cost of the work exceeds \$500,000 but does not exceed \$1,000,000.\$1090.00

When the estimated cost of the work exceeds \$1,000,000.\$1,370.00

(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*.\$348.00

For all other BUILDINGS. \$698.00

(g) To access plans (electronic or on microfilm) or documents for viewing or copying.....\$59.30

(h) For each microfilm image or electronic file copied. \$16.40

(i) For a request to renumber a BUILDING. \$1,280.00

(j) For the extension of a BUILDING PERMIT where requested in writing by an applicant pursuant to

Article 1.6.7.2. of Book I, Division C and Book II, Division C.....50% of the original BUILDING PERMIT fee to a maximum of \$499.00

(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..... \$3,270.00

(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 Subsection 1.6.6. of Book I, Division C and Book II, Division C

where the PERMIT relates to a SINGLE DETACHED HOUSE or a SECONDARY SUITE..... \$270.00

plus for each hour, or part thereof, exceeding one hour..... \$270.00

where the PERMIT relates to any other BUILDING..... \$819.00

plus for each hour, or part thereof, exceeding one hour..... \$409.00

(m) For each RE-OCCUPANCY PERMIT after rectification of an UNSAFE CONDITION and related By-law violations..... \$497.00

(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 I, Division C

for each application..... \$1,140.00

(o) For an evaluation of plans, specifications, building materials, procedures or design methods for the purpose of acceptance of existing conditions for each application..... \$653.00

(p) For review by the Alternative Solution Review Panel..... \$3,670.00

(q) For the evaluation of a resubmission or revised submission made under Clauses (n) or (o) of this Section 2..... \$409.00

(r) For each refund issued pursuant to Sentence 1.6.2.7.(2) of Book I, Division C, and Book II, Division C the administrative fee to be deducted..... \$92.80

3. Upon written application of the payor and on the advice of the 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 (d) and (e) 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.

4. Upon written application by the payor and on the advice of the Director of Planning, the *Chief Building Official* shall reduce the fees paid pursuant to Clause (a) of Section 1 by percentage for that part of a building designated as Social Housing.....20%

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. \$270.00

Each additional FIXTURE. \$84.90

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..... \$397.00

For each 30 m of piping or part thereof, exceeding the first 30 m. \$110.00

Connection of the City water supply to any hydraulic equipment. \$149.00

2. INSPECTIONS OF FIRELINE SYSTEMS:

Hydrant & Sprinkler System:

First two inspections for each 30 m of water supply pipe or part thereof.....	\$397.00
Each additional inspection for each 30 m of water supply pipe or part thereof.....	\$164.00
Sprinklers:	
First head, single detached house or duplex.	\$451.00
First head, all other buildings.	\$961.00
First head, renovations to existing sprinkler systems.	\$279.00
Each additional head, all buildings (no limit on number).....	\$4.94
Firelines:	
Hose Cabinets.	\$52.20
Hose Outlets.	\$52.20
Wet & Dry Standpipes.	\$52.20
Standpipes.	\$52.20
Dual Check Valve In-flow Through Devices.....	\$52.20
Backflow Preventer.	\$270.00
Wet & Dry Line Outlets:	
Each connection	\$52.20
NOTE: A Siamese connection shall be considered as two dry line outlets.	
Each Fire Pump	\$422.00
Each Fire Hydrant	\$130.00

3. REINSPECTIONS

For each REINSPECTION made necessary due to faulty work or materials or incomplete work requested to be inspected.....	\$270.00

4. SPECIAL INSPECTIONS

Each inspection to establish fitness of any existing fixture for each hour or part thereof	\$270.00
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.....	\$409.00

5. BUILDING SEWER INSPECTIONS

First two inspections for each 30 m of BUILDING SEWER or part thereof.....	\$397.00
Each additional inspection for each 30 m of BUILDING SEWER or part thereof	\$164.00

PART C – OPERATING PERMITS

Every applicant for an OPERATING PERMIT shall, at the time of application for a new OPERATING PERMIT or renewal of an OPERATING PERMIT, pay to the City the fees set out hereunder:

For each OPERATING PERMIT relating to equipment or systems in a BUILDING	\$207.00
For not renewing an OPERATING PERMIT on or before the renewal date	
The OPERATING PERMIT renewal fee plus.....	117.00
For each reinspection made necessary due to non-compliance with this By- law	\$258.00
For each change of permit holder on an OPERATING PERMIT	\$117.00

PART D – MECHANICAL PERMITS

Every applicant for a MECHANICAL PERMIT shall, at the time of application, pay to the City the fees set out hereunder:

For a MECHANICAL PERMIT for a single private residential deck, patio, or balcony in a DWELLING UNIT.	\$252.00
For a MECHANICAL PERMIT in a 1-3 storey BUILDING.....	\$413.00 + \$14.60 per 1kW
For a MECHANICAL PERMIT in a BUILDING of 4 storeys and above	\$943.00
plus \$117 for each electric heat pump installation above 6 total heat pump units to a maximum of	\$2,500.00

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-1.5.2.1. Power of Entry. Since these requirements apply to both new construction and existing buildings, the Chief Building Official (i.e., the designated official) has the power to enter any existing buildings as well as new construction, but only for the purpose of administering or enforcing these requirements.

In other words, if there is reason to believe that unauthorized alterations or a change of occupancy has occurred or an unsafe condition exists in respect of fire, structural safety or health, an inspection may be made. The designated official should be informed of any unsafe conditions found in the course of fire inspections.

A-1.5.2.6. Permit with Incomplete Application. A permit may be issued if additional information required is of secondary importance and the foundation or structure is not dependent on it. Information of this type might pertain to building services, such as heating, ventilating, air-conditioning, electrical or plumbing or to partitioning which may not be determined until leases have been arranged.

A-1.5.2.12. Permit for Staged Construction. If the Chief Building Official issues a permit for a foundation before submission of the plans of the complete building, there is no assurance that a permit will be issued for the superstructure when the plans are submitted later. Such issuance will depend upon, among other things, the adequacy of the foundation.

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-1.6.2.3.(1)(b) and (c) Value of Proposed Work. The value of proposed work is a reference construction value used for the purposes of determining the applicable permit fees for a given project.

For new detached homes, duplexes, and ancillary residential building such as laneway houses, this may be determined through a simplified process based on the net floor area. This refers to the total aggregate floor space within the building and any associated accessory structures supporting human occupancy or storage. The area so established is to be considered the sum of all horizontal floor area located within the outermost extents of the exterior walls on each floor level, inclusive of all normally occupied space. This is intended to include service rooms or ancillary uses to support normal building operation and maintenance.

The total area to be used in the determination of the value of proposed work is to be determined to the first decimal place. This is multiplied by the factor identified in Sentences 1.6.2.3.(1) or (2) as applicable in order to establish the value of the proposed work.

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-1.6.8.3.(2) Permits for Temporary Decks, Patios, Tents, and Stages. Smaller temporary structures such as decks, patios, tents, or stages may be exempt from the requirement for a building permit provided that they meet the requirements of Sentence 1.6.8.3.(2). However, this does not relieve the owner or operator of the temporary structure from compliance with the requirements of the Building By-law.

It remains the responsibility of the owner to demonstrate that temporary structure complies with the structural, fire and life safety requirements of the Building By-law, and to obtain all necessary permissions and authorizations from the relevant authorities.

An owner may, by retaining appropriate registered professionals, submit a Schedule B (Structural) as evidence of suitable structural capacity and a Schedule B (Architectural) as evidence of compliance with fire and life safety requirements.

Regardless of the provision of this By-law, an owner may still be required by the Architect's Regulations of the Professional Governance Act, be obligated to engage the services of a registered architect.

A-1.6.9.4.(1) Owner Must be Certified. The Environmental Operators Certification Program (EOCP) Building Water Systems (BWS) certification is the required minimum certification level, except that for non-potable water systems accepted by the Chief Building Official as an alternative solution, a more advanced water or wastewater certification may be required. Certification under the ASSE/IAPMO/ANSI 12080 Standard "Professional Qualifications Standard for Legionella Water Safety and Management Personnel" is an acceptable equivalent to the EOCP Building Water Systems certification.

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, and Section 199.01 with respect to fees.

2.2.1.2. Structural Design

1) Except as required in Sentence (2), for 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*.
- i) Deleted.

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 By-law, 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, Mechanical 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 source of information for *encapsulation ratings* of mass timber elements of construction (to be indicated on large-scale sections),
 - f) the location of *exits*, and
 - g) 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.

2.2.3.4. Information Required on Mechanical Drawings and Related Documents

1) If the *Chief Building Official* requires an application for a *permit* in respect of a *mechanical system*, mechanical drawings and related documents submitted with the application shall show

- a) the location and *size* of all mechanical *appliances*,
- b) the *size* of all major pipes and components,
- c) the *heat loss calculation*, and
- d) the full *mechanical system* being installed, drawn to an indicated scale.

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,
- e) all effects and loads, other than dead loads, used for the design *and construction* of the structural members and exterior cladding, *including the roof assembly*, and
- f) the Importance Category of the *building*.

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,
- 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. Owner 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 enactments respecting safety, 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,
 - b) if a *building* permit is required, deliver to the *Chief Building Official* letters in the forms set out in Schedules A and B-
(See the end of Division C and Note A-2.2.7.2.(1)(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 the *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 the *Chief Building Official* 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 their professional seal or stamp on the plans submitted by them 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.

2.2.8. Commissioning Plan and Preliminary Commissioning Report

(See Note A-2.2.8.)

2.2.8.1. Application

1) The requirements of this Subsection apply to a *building* within the scope of Part 3 of Division B.

2.2.8.2. Responsibilities

1) Prior to the issuance of a *building permit*, the owner shall submit an *acceptable commissioning plan* prepared by a *commissioning provider*.

2) Prior to the *occupancy* of a *building*, the owner shall submit an *acceptable preliminary commissioning report* prepared by a *commissioning provider*.

2.2.8.3. Information Required in a Commissioning Plan and Preliminary Commissioning Report

1) The *commissioning plan* and *preliminary commissioning report* required by Article 2.2.8.2. shall comply with Article 10.2.2.22 of Division B. (See Note A-2.2.8.3.)

2.2.9. Deleted

2.2.10. Buildings on Designated Flood Plains

2.2.10.1. 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.

2.2.10.2. 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.)

2.2.10.3. 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*.

2.2.10.4. 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.

2.2.10.5. Increase of Flood Construction Level and Setback Requirements on Designated Flood Plains

1) The *Chief Building Official*, in consultation with the *City Engineer*, 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.

2.2.10.6. Relaxation of Flood Construction Level and Setback Requirements on Designated Flood Plains

1) The *Chief Building Official*, in consultation with the *City Engineer*, 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*, in consultation with the *City Engineer*, 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 *authority having jurisdiction* shall accept a measure as an alternate solution to an acceptable solution for the *building* if satisfied that

- a) except as permitted by Sentence 3.3.1.3.(1), 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) Except as permitted by Sentence 3.3.1.3.(2), 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 building 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

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*.

2.3.3.2. Independent Review by Third Party

- 1) Where *acceptable* to the *Chief Building Official*, an applicant may, during the course of the *Chief Building Official's* review of an alternative solution, supplement the application with a report by an *acceptable* third party that provides a technical overview to the *Chief Building Official* with respect to
 - a) the scope, assumptions and assessment of consequence,
 - b) the suitability and applicability of the chosen methodology,
 - c) the accuracy, relevance and strength of the technical analysis, and
 - d) sufficiency of documentation and performance measurements.
- 2) The third party shall be an individual *acceptable* to the *Chief Building Official* that
 - a) is a *registered professional* in good standing with their professional association, and
 - b) has relevant and recognized experience, expertise or credentials with respect to the application of the Building By-law, local construction codes and subject matter related to the proposed alternative solution.
- 3) The third party shall provide a declaration that they have not been involved in the preparation of the alternative solution or otherwise employed by the *owner* or applicant, and have no real or apparent interest,
 - a) in the completion or financial outcome of the subject construction project, or
 - b) from business or contractual interests with the *owner* or alternative solution proponent, which would influence the outcome of the independent review.
- 4) The *owner* shall bear the costs of retaining the third party, and provide a written confirmation that the terms of engagement of the third party are not contingent or otherwise dependant upon the outcome of their review or of the determination of the *Chief Building Official*.
- 5) The review of an alternative solution as referred to in Sentence (1), is not binding on the *Chief Building Official*.

SCHEDULE A

Forming Part of Sentence 2.2.7.2.(1), Division C of the Building By-law

Building Permit Number (for CoV 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. and the Association of Professional Engineers and Geoscientists of the Province of British Columbia.
 - 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

Name of Project (Print)

Address of Project (Print)

Re:

(Professional's Seal and Signature)

Date

The undersigned has retained _____ as a *coordinating registered professional* to coordinate the design work and *field reviews* of the *registered professionals of record* required¹ 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.

¹It 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*.

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SCHEDULE A - continued

Building Permit Number (for CoV 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

Owner

Coordinating Registered Professional's Name (Print)

Owner's Name (Print)

Address (Print)

Address (Print)

Address (Print) (continued)

Address (Print) (continued)

Phone Number and Email Address

Name Agent of Signing Officer (Print)

Date

Certified Professional's Stamp and
Signature (if applicable)

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)

Phone Number and Email Address

Date

(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: 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 as an Architect with the Architectural Institute of British Columbia under the Professional Governance Act, or
- b) a person who is registered as a professional engineer or professional licensee engineering with the Association of Professional Engineers and Geoscientists of the Province of British Columbia under the Professional Governance Act.

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SCHEDULE B

Forming Part of Sentence 2.2.7.2.(1), Division C of the Building By-law

Building Permit Number (for CoV Use)

ASSURANCE OF PROFESSIONAL DESIGN
AND COMMITMENT FOR FIELD REVIEW

Discipline

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. and the Association of Professional Engineers and Geoscientists of the Province of British Columbia.
- 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)

(Professional's Seal and Signature)

Date

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

Certified Professional's Stamp and
Signature (if applicable)

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.

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SCHEDULE B - continued

Building Permit Number (for CoV 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.

Name (Print)

Address (Print)

Address (Print) (continued)

Phone Number and Email Address

(Professional's Seal and Signature)

Date

(If the Registered Professional of Record 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 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 as an Architect with the Architectural Institute of British Columbia under the Professional Governance Act, or
- b) a person who is registered as a professional engineer or professional licensee engineering with the Association of Professional Engineers and Geoscientists of the Province of British Columbia under the Professional Governance Act.

Certified Professional's Stamp and
Signature (if applicable)

SCHEDULE B - continued

Building Permit Number (for CoV 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)
- 1.25 Building envelope, testing, confirmation or both as per Part 10 requirements

(Professional's Seal and Signature)

Date

Certified Professional's Stamp and
Signature (if applicable)

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
- 2.5 Independent review of structural designs

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)
- 3.9 Mechanical systems, testing, confirmation or both as per Part 10 requirements

SCHEDULE B - continued

(Initial applicable discipline below and cross out and initial only those items not applicable to the project.)

Building Permit Number (for CoV Use)

PLUMBING

- 4.1 Roof drainage systems
- 4.2 Site and foundation drainage systems
- 4.3 Plumbing systems and devices
- 4.4 Continuity of fire separations at plumbing penetrations
- 4.5 Functional testing of plumbing related fire emergency systems and devices
- 4.6 Maintenance manuals for plumbing systems
- 4.7 Structural capacity of plumbing components, including anchorage and seismic restraint
- 4.8 Review of all applicable shop drawings
- 4.9 Plumbing systems, Part 10 requirements (ASHRAE, NECB, ZEBP, etc)
- 4.10 Plumbing systems, testing, confirmation or both as per Part 10 requirements

Project Address

Discipline

FIRE SUPPRESSION SYSTEMS

- 5.1 Suppression system classification for type of occupancy
- 5.2 Design coverage, including concealed or special areas
- 5.3 Compatibility and location of electrical supervision, ancillary alarm and control devices
- 5.4 Evaluation of the capacity of city (municipal) water supply versus system demands and domestic demand, including pumping devices where necessary
- 5.5 Qualification of welder, quality of welds and material
- 5.6 Review of all applicable shop drawings
- 5.7 Acceptance testing for "Contractor's Material and Test Certificate" as per NFPA Standards
- 5.8 Maintenance program and manual for suppression systems
- 5.9 Structural capacity of sprinkler components, including anchorage and seismic restraint
- 5.10 For partial systems — confirm sprinklers are installed in all areas where required
- 5.11 Fire Department connections and hydrant locations
- 5.12 Fire hose standpipes
- 5.13 Freeze protection measures for fire suppression systems
- 5.14 Functional testing of fire suppression systems and devices

ELECTRICAL

- 6.1 Electrical systems and devices, including high building requirements where applicable
- 6.2 Continuity of fire separations at electrical penetrations
- 6.3 Functional testing of electrical related fire emergency systems and devices
- 6.4 Electrical systems and devices maintenance manuals
- 6.5 Structural capacity of electrical components, including anchorage and seismic restraint
- 6.6 Clearances from buildings of all electrical utility equipment
- 6.7 Fire protection of wiring for emergency systems
- 6.8 Review of all applicable shop drawings
- 6.9 Electrical systems, Part 10 requirements (ASHRAE, NECB, ZEBP, etc)
- 6.10 Electrical systems, testing, confirmation
- 6.11 Radio Antenna Systems

(Professional's Seal and Signature)

Date

GEOTECHNICAL — Temporary

- 7.1 Excavation
- 7.2 Shoring
- 7.3 Underpinning
- 7.4 Temporary construction dewatering

GEOTECHNICAL — Permanent

- 8.1 Bearing capacity of the soil
- 8.2 Geotechnical aspects of deep foundations
- 8.3 Compaction of engineered fill
- 8.4 Structural considerations of soil, including slope stability and seismic loading
- 8.5 Backfill
- 8.6 Permanent dewatering
- 8.7 Permanent underpinning

Certified Professional's Stamp and
Signature (if applicable)

SCHEDULE C-A

Forming Part of Sentence 2.2.7., Division C of the Building By-L

Building Permit Number (for CoV Use)

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. and the Association of Professional Engineers and Geoscientists of the Province of British Columbia
- 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 *coordinating registered professional* shall complete the following:)

Coordinating Registered Professional's Name (Print)

Address (Print)

Address (Print) (continued)

Phone Number and Email Address

(Professional's Seal and Signature)

Date

Certified Professional's Stamp and
Signature (if applicable)

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 have coordinated the field reviews to ascertain that the project substantially complies in all material respects with
 - i) the applicable requirements of Part 10, and
 - ii) the plans and supporting documents submitted in support of the application for the *building permit*,
- d) I am a *registered professional* as defined in the Building By-law.

(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: 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 as an Architect with the Architectural Institute of British Columbia under the Professional Governance Act, or
- b) a person who is registered as a professional engineer or professional licensee engineering with the Association of Professional Engineers and Geoscientists of the Province of British Columbia under the Professional Governance Act.

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SCHEDULE C-B

Forming Part of Sentence 2.2.7., Division C of the Building By

Building Permit Number (for CoV Use)

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. and the Association of Professional Engineers and Geoscientists of the Province of British Columbia.
- 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)

(Professional's Seal and Signature)

(Each registered professional shall complete the following:)

Date

Name (Print)

Address (Print)

Address (Print) (continued)

Phone Number and Email Address

Certified Professional's Stamp and
Signature (if applicable)

I hereby give assurance that

- a) I have fulfilled my obligations for coordination of *field reviews* as outlined in Subsection 2.2.7.2., 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) those components of project opposite my initials in Schedule B substantially comply in all materials 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 of record* as defined in the Building By-law

(If the registered professional of record 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 Bylaw defines a *registered professional* to mean

- a) a person who is registered as an Architect with the Architectural Institute of British Columbia under the Professional Governance Act, or
- b) a person who is registered as a professional engineer or professional licensee engineering with the Association of Professional Engineers and Geoscientists of the Province of British Columbia under the Professional Governance Act.

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 professional who is qualified to perform such design. Sentence 2.2.1.2.(1) is not intended to imply that a professional may not also be required in the application of requirements in other Parts of the **Vancouver 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, and building enclosure assemblies 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,
- (o) the heat lost calculations for heating and cooling of the building, and
- (p) the dimensions of the edge, field and corner zones of the roof, and load values for each affected area of a wall and roof assembly (see Figures 4.1.7.6.-A through 4.1.7.6.-C in Article 4.1.7.6. of Division B).

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 Province of British Columbia, Union of BC Municipalities, Building Officials' Association of British Columbia, Architectural Institute of British Columbia, Association of Professional Engineers and Geoscientists of 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 authority having jurisdiction, 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 Code 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 authority having jurisdiction, 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 Authority Having Jurisdiction (AHJ) 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

- fire alarm system zoning
- location of fire alarm 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 fire alarm 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 AHJ in a complete package at least 24 hours prior to the Coordinated Final AHJ 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 AHJ.

- Organize the "Coordinated Final Consultant Review" at least one week prior to "Coordinated AHJ 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 AHJ.
- Organize the "Coordinated AHJ Final Review."
- Record any deficiencies identified at the "Coordinated AHJ 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

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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

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CONTRACTOR DEMONSTRATION – CONSTRUCTION COMPLETE

Contractor & Subtrades

(Mechanical, Electrical, Elevator, Sprinkler, Fire Alarm, etc.) as appropriate

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COORDINATED FINAL CONSULTANT REVIEW DEMONSTRATION/WITNESSING CRP/RPRs

(Architect, Mechanical Engineer, Electrical Engineer, Sprinkler Engineer, Equivalency Consultant, etc.) as appropriate

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OCCUPANCY SUBMISSION DOCUMENTS

CRP to collect all submission documents, including Schedule Cs from RPRs, and submit to AHJ in a complete package

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COORDINATED FINAL AHJ REVIEW DEMONSTRATION/WITNESSING

Contractor, Subtrades, CRP/RPRs demonstrate to AHJ

(Building, Fire, Mechanical, Electrical and Sprinkler)

A-2.2.8.3. Commissioning Plan and Preliminary Commissioning Report for New Equipment in New and Existing Buildings

Commissioning Plans

The Commissioning Plan must provide organization, documentation, requirements, and tools to evaluate and document that the design, construction, and operation of the new components and systems in new and existing buildings.

The following is an example of the details required within a Commissioning Plan for new components and systems in new and existing buildings.

1. Overview of the Cx activities developed specifically for the project;
2. Roles and responsibilities for the project team throughout the project;
3. Declaration of whether the CxP is affiliated with the design or construction team. If the CxP is affiliated with the design or construction team, include a conflict-of-interest management plan disclosing the relationship between the CxP and other design and construction team members, and clarify how the CxP will remain independent and able to objectively inform the owner of issues uncovered during the commissioning process;
4. Documentation of general communication channels, including the distribution of the Cx Plan during the design and construction process;
5. Detailed description of Cx Activities and a schedule of activities;
6. Project design documentation evaluation procedures;
7. General description of Cx activities that will occur during design, construction, and occupancy and operations;
8. Guidelines and format that will be used to develop the Cx documentation, including Systems Manual and training plans;
9. Listing and format for Design Review, checklists and testing forms, issues and resolution log, and Cx Progress Reports that will be used during the project to communicate and track critical Cx Activities information;
10. List of project's commissioned systems and assemblies, and description of evaluation procedures; and,
11. The framework for procedures to follow whenever Cx evaluation does not meet the owner's project requirements.

Preliminary Commissioning Reports

The Preliminary Commissioning Report must clearly indicate all essential details to demonstrate the proper, integrated operation of commissioned components and systems prior to occupancy.

The following is an example of the details required within a Preliminary Commissioning Report for new components and systems in new and existing buildings.

1. Executive summary identifying the systems and assemblies commissioned;
2. Copy of the final Cx Plans;
3. Copy of Cx design and submittals review reports;
4. Completed copy of the approved supplier, contractor, and CxP evaluations, and Cx start-up and test forms, including those used during the occupancy and operations activity;
5. Location of record drawings of commissioned systems;
6. Location of warranties for commissioned systems;
7. Copy of all Cx Progress Reports;
8. Copy of all issues and resolution logs, including the descriptions of the issues and the measures taken to correct them, and a discussion of systems or assemblies that do not perform in accordance with the owner's project requirements;
9. For all incomplete issues, delayed or seasonal tests, include a resolution plan with recommended timelines for completion and identify who is responsible for resolution. This section is to be accepted and approved by the Owner; and
10. Listing of incomplete deliverable and open issues for resolution during the project closeout phase.

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 authority having jurisdiction and for the authority having jurisdiction 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 the NRC's website.

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 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 September 15, 2025, a *building* may be constructed in accordance with By-law No. 12511 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.

3.3.1.3. Rainwater Management Regulation Transition

1) An alternative solution accepted by the *Chief Building Official* under Section 2.3 may achieve less than the minimum level of performance required by Division B, Article 2.4.2.5. of Book II (Plumbing Systems) of the Building By-law in the areas defined by the objectives and functional statements attributed to the applicable acceptable solutions.

2) A person requesting an alternative solution under Sentence (1) shall file an application in the form prescribed by the *Chief Building Official*.

3) The application referred to in Sentence (2) shall include

- a) documentation that the *owner* applied to the *City*, prior to January 1, 2024, for rezoning or a development permit pertaining to the *building*,
- b) documentation that the *owner* has not been required to provide rainwater management for the development, or that the *City* has agreed to other rainwater management requirements for the development, and
- c) information about the qualifications, experience and background of the person or persons taking responsibility for the design.

4) For a *building* to which Part 9 applies as described in Sentence 1.3.3.3.(1) of Division A or for a *building* used exclusively for *residential occupancy* containing no more than 8 principal *dwelling units*, where an *owner* has applied to the *City* prior to January 1, 2025 for a development permit, the requirements of Division B, Article 2.4.2.5. of Book II (Plumbing Systems) of this By-law do not apply if the *owner* has applied for a *permit* prior to January 1, 2026.

3.3.1.4. Seismic Regulation Transition

1) A *building* required to meet the seismic design provisions of Subsection 4.1.8., Section 9.23, and Appendix C of Division B of this By-law may, as an alternative, meet the seismic design provisions of Subsection 4.1.8., Section 9.23, and Appendix C of Division B of the 2019 Building By-law where

- a) a substantially complete application for a *building permit* is submitted on or after the effective date of this By-law but before September 15, 2026,
- b) a *building permit* is required and the *owner* submits a substantially complete application for a *building permit* on or after the effective date of this By-law but before March 08, 2027, and
 - i) a substantially complete development permit application has been submitted to the *City* in relation to the *building* before the effective date of this By-law, or
 - ii) a rezoning application has been submitted to the *City* in relation to the *building* before the effective date of this By-law, or
- c) a *building permit* is not required, and the *construction* or *alteration* of the *building* substantially starts after the effective date of this By-law but before March 08, 2027.

2) An *owner* obtaining a *permit* and exercising the alternative seismic requirements permitted by Sentence (1) shall commence the work authorized by the *permit* within 6 months of the date of issuance of the *permit* and continue work to completion without interruption, other than work stoppages considered reasonable in the building industry, or the *Chief Building Official* may require that the *owner* apply for a revision to the *permit*.

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Part 9

Housing and Small Buildings

Section 9.1. General

9.1.1. Application

9.1.1.1. 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, Part 11 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, 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 C260, "Standard Specification for Air-Entraining Admixtures for Concrete," or ASTM C494/C494M, "Standard Specification for 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 2017, “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 (<i>loadbearing</i> members)	—	—	—	Stud, Standard, No. 2
Stud wall framing (<i>non-loadbearing</i> members)	—	—	—	Stud, Utility, No. 3
Plank frame construction (<i>loadbearing</i> members)	No. 3 Common	—	No. 3 Common	No. 2
Plank frame construction (<i>non-loadbearing</i> 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

- the manufacturer of the material,
- the standard to which it is produced, and
- 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 A653/A653M, "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process," or
 - b) ASTM A792/A792M, "Standard Specification for 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. and Article 2.2.7.6. of Division C.)

- 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 the CWC, "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 design parameter, 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

(See Note A-9.4.2.1. and 9.4.2.2.)

- 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 m², and
 - f) for flat roofs, there are no significant obstructions on the roof, such as parapet walls, spaced closer than the distance calculated by

$$D_o = 10(H_o - 0.8S_s/\gamma)$$

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 taken as 4.0 kN/m³ or 0.43 S_s + 2.2 kN/m³, whichever is lesser.

9.4.2.2. Specified Snow Loads

(See Note A-9.4.2.1. and 9.4.2.2.)

- 1) Except as provided in Sentences (2) to (4), 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.

4) Where the height of a roof step at the intersection of an upper level roof and a lower level roof is greater than 2 m, and the upper level roof has a slope less than 1 in 6 and an area greater than 600 m², the specified snow load on the lower level roof shall be

a) for distances from the roof step that are less than or equal to the drift length, x_d , calculated in accordance with Sentence (5), not less than 1.5 times the specified snow load, S , calculated using the formula in Sentence (1) with C_b equal to 0.55, and

b) for distances from the roof step that are greater than the drift length, x_d , calculated in accordance with Sentence (5), as specified in Sentence (1).

- 5) For the purposes of Sentence (4), the drift length, x_d , in m, shall be calculated as follows:

$$x_d = 5 \left(h - \frac{0.55 S_s}{\gamma} \right)$$

where

h = height of the roof step, in m, and

γ = specific weight of snow as specified in Clause 9.4.2.1.(1)(f).

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).)

9.4.2.5. Seismic Design Parameter

(See Note A-9.4.2.5.)

1) Except as provided in Sentence (2) and unless otherwise indicated, the value of the seismic design parameter, S_{max} , at a location listed in Table C-3 of Appendix C shall be taken as S_{max} for unknown Site Class.

2) Where the Site Class is determined in accordance with Sentence 4.1.8.4.(3), the value of the seismic design parameter, S_{max} , at a location listed in Table C-3 of Appendix C, is permitted to be taken as S_{max} for the value for the determined Site Class. (See Note A-9.4.2.5.(2).)

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 <i>dwelling unit</i>	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 <i>Soil or Rock</i>	Maximum Allowable Bearing Pressure, kPa
Dense or compact sand or gravel ^(a)	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 9.15.1.1.)

1) Except where constructed in accordance with Section 9.15., walls supporting drained earth shall be designed

a) for a pressure equivalent to that exerted by a fluid that has a density of not less than 480 kg/m³ and a depth equal to 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 m² 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. Accessible Design

9.5.2.1. General

1) Except as provided in Articles 9.5.2.3. and 3.8.2.1., every *building* shall be designed in conformance with Section 3.8.

9.5.2.2. Protection on Floor Areas with an Accessible Path of Travel

1) Where an *accessible* path of travel required in Article 9.5.2.1. is provided to any *storey* above the *first storey*, the requirements in Article 3.3.1.7. shall apply.

9.5.2.3. Apartment Buildings

1) Except as provided in Sentence (2), in a *building* of *residential occupancy* that contains multiple *dwelling units* and common interior space served by a common *building* entrance, *access* described in Section 3.8. shall be provided from the entrances, required by Sentence 3.2.1.1.(1) to be *accessible*, throughout all common spaces of entrance *storeys* and within all other common spaces including rooftop *occupancies* serving *adaptable dwelling units*.

2) Access required by Sentence (1) need not be provided on a floor level that

a) is not served by a ramp, passenger elevator, a platform-equipped passenger-elevating device, an escalator or an inclined moving walk,

b) is not a *building* entrance level, and

c) does not contain common facilities that are not also provided on an *accessible* level.

9.5.2.4. Visible Signal Devices

1) Visible signal devices shall be installed in conformance with Articles 3.2.4.19. and 3.2.4.20.

9.5.2.5. Lighting

1) Notwithstanding the requirements of Subsection 9.34.2., illumination shall be provided in accordance with Article 3.2.7.1.

9.5.3. Ceiling Heights

9.5.3.1. Ceiling Heights of Rooms or Spaces

1) Except as provided in Sentences (2) and (3), 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. or Sentence (2) or (3) 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	2.0	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 m ²
Other bedroom or sleeping space	2.1		Lesser of area of the space or 3.5 m ²
Unfinished <i>basement</i> including laundry area therein			Clear height under beams and in any location that would normally be used for passage
Bathroom, water-closet room or laundry area above <i>grade</i>	2.1		Lesser of area of the space or 2.2 m ²

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* and within a *principal dwelling unit* with an *ancillary residential unit* including their common spaces 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
<i>Dwelling unit</i> or <i>principal dwelling unit</i> with an <i>ancillary residential unit</i> including common spaces (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 <i>basement</i>		
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.(1).)

9.6.1.2. Material Standards for Glass

- 1) Glass shall conform to
 - a) CAN/CGSB-12.1, "Safety Glazing,"
 - 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-12.9, "Spandrel glass,"
 - g) CAN/CGSB-12.10-M, "Glass, Light and Heat Reflecting,"
 - h) CAN/CGSB-12.11-M, "Wired Safety Glass," or
 - i) ASTM E2190, "Standard Specification for 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 E1300, "Standard Practice for Determining Load Resistance of Glass in Buildings." (See also Article 4.3.6.1.)
- 2) Reserved.
- 3) Individual panes of glass conforming to Table 9.6.1.3. that are used in doors need not comply with Sentence (1).

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 Glazing and Protection of Glazing

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

- safety glazing of the tempered or laminated type conforming to CAN/CGSB-12.1, "Safety Glazing," or
- 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 units* and in public areas, other than the entrance doors described in Sentence (1), shall be safety glazing or wired glass of the type described in Sentence (1) where the glass area exceeds 0.5 m² and extends to less than 900 mm from the bottom of the door.

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) Glazing used for a shower or bathtub enclosure shall conform to Class A of CAN/CGSB-12.1, "Safety Glazing."

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

- This Section applies to
 - windows, doors and skylights separating *conditioned space* from unconditioned space or the exterior, and
 - entrance doors to *dwelling units*.
- For the purpose of this Section, the term "skylight" refers to unit skylights, roof windows and tubular daylighting devices.
- 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

- 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) Reserved.
- 2) Skylights and their components shall be designed, constructed and installed so that they resist snow loads.
- 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 are installed as
 - a) reserved,
 - b) are installed as storm windows and doors, or
 - c) are required to have a *fire-protection rating*.
- 3) 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.)
- 4) Reserved.

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, "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/A440-17, 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) is designed with a clear width, a clear and level space, a door-opening device and a door closer in conformance with Subsection 3.8.3. (see Article 3.8.3.6.), or
- c) meets the criteria in Sentence 9.27.3.8.(3) such that flashing would not be required.

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 101/1.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 101/1.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 ancillary to a *dwelling unit*.

(See Note A-9.7.5.2.(1).)

2) Doors, frames and hardware that conform to a security level of at least Grade 10 as described in the Annex to ASTM F476, “Standard Test Methods for Security of Swinging Door Assemblies,” are not required to conform to Sentences (3) to (7). (See Note A-9.7.5.2.(2).)

- 3) Except as permitted in Sentence (2), wood doors as described in Sentence (1) 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) Except as permitted in Sentence (2), 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) Except as permitted in Sentence (2), 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) Except as permitted in Sentence (2), 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 5.3.6 of AAMA/WDMA/CSA 101/1.S.2/ A440, "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, Landings, 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* or a principal *dwelling unit* with an *ancillary residential unit* including their common spaces, 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.

9.8.1.5. Tactile Walking Surface Indicators

- 1) Tactile attention indicators shall be installed in conformance with Article 3.3.1.19.

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* or a **single detached** house including their common spaces 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. and Note A-9.5.3.1.)
- 2) Except as provided in Sentences (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* or a **single detached** house shall not be less than 1 950 mm.
- 4) Reserved.

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* other than *dwelling units* and **single detached** houses, shall consist of
 - a) straight *flights*, or
 - b) except as provided in Sentence (4), curved *flights*.
- 2) Stairs within *dwelling units* and **single detached** houses , 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, Tapered Treads and Winders

Forming Part of Sentence 9.8.4.1.(1)

Stair Type	Rectangular Treads, <i>Tapered Treads</i> and 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

- (a) single *dwelling units*,
- (b) single detached houses, or
- (c) garages that serve *dwelling units* described in Clause a) or b).

⁽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	
	<i>Run</i> , 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

- (a) single *dwelling units*,
- (b) single detached houses, or
- (c) garages that serve *dwelling units* described in Clause a) or b).

⁽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.

9.8.4.9. Open Risers

1) Except as provided in Sentence (2), stairs shall have no open risers.

2) Open risers are permitted in

- a) interior and exterior stairs that serve a single *dwelling unit* or a single detached house,
- b) fire escape stairs,
- c) stairs that are principally used for maintenance,
- d) stairs that serve *service rooms*, and
- e) stairs that serve *industrial occupancies* other than *storage garages*.

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 Article 3.8.3.5.

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* or a *single detached* house shall be not less than 860 mm wide.

9.8.5.3. Height over Ramps

- 1) Except as permitted by Sentence (2), the clear height over *ramps* shall be not less than 2 050 mm.
- 2) The clear height over *ramps* serving a single *dwelling unit* or a *single detached* house shall be not less than 1 950 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*.

9.8.6. 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 Article 3.8.3.5.
- 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. (See Note A-9.8.6.2.(2).)
- 3) A landing may be omitted at the top of an exterior *flight* serving a secondary entrance to a single *dwelling unit* or a *single detached* house-, 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* or a *single detached*, and
 - b) 1 100 mm for stairs or *ramps* not described in Clause (a).

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* or a **single detached** house shall be not less than 1 950 mm.

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 <i>dwelling unit</i> , single detached house or an <i>ancillary residential unit</i>	1	1	1	1	2
All other locations	1	2	2	2	2

- 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* or a **single detached** house, 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* or a *single detached* house.

5) Except for stairs with winders, where a *flight* of stairs within a *dwelling unit* or a *single detached* consists of *tapered treads*, or a mix of *tapered treads* and rectangular 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* or a *single detached* house, 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.(11).)

3) For stairs or *ramps* serving a single *dwelling unit* or a *single detached* house, 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* or a *single detached*, 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 1 070 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* or a single detached house 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) and except at the leading edge at the top of a *flight*, 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 the difference in elevation is more than 600 mm between the walking surface and the adjacent surface within 1.2 m.

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 that can only be released with the use of tools or special knowledge to control the free swinging or sliding operation 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.

(See Note A-9.8.8.1.(4).)

5) Windows need not be protected in accordance with Sentence (4), where the bottom edge of the openable portion of the window is located

- a) more than 900 mm above the finished floor, or
- b) 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* and *single detached* houses, 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 1.5 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), (3) and (5), *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 <i>Guard</i>	Minimum Specified Loads		
	Horizontal Load Applied Inward or Outward at any Point at the Minimum Required Height of the <i>Guard</i>	Horizontal Load Applied Outward on Elements Within the <i>Guard</i> , Including Solid Panels and Balusters	Evenly Distributed Vertical Load Applied at the Top of the <i>Guard</i>
<i>Guards</i> within <i>dwelling units</i> and exterior <i>guards</i> serving not more than two <i>dwelling units</i>	0.5 kN/m OR concentrated load of 1.0 kN applied at any point ⁽¹⁾	0.5 kN applied over a maximum width of 300 mm and a height of 300 mm ⁽²⁾	1.5 kN/m
<i>Guards</i> 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 <i>guards</i>	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 (3).

2) The size of the opening between any two adjacent vertical elements within a *guard* shall not exceed the limits required by Sentence 9.8.8.5.(1) 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.

3) For *guards* within *dwelling units* and within *principal dwelling units with an ancillary residential unit* including their common spaces and for exterior *guards* serving not more than two *dwelling units*, where the width and spacing of balusters are such that three balusters can be engaged by a load imposed over a 300 mm width, the load shall be imposed so as to engage three balusters.

4) None of the loads specified in Table 9.8.8.2. need be considered to act simultaneously.

5) For *guards* within *dwelling units* and within *single detached* houses and for exterior *guards* serving not more than two *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) and (3), all *guards* shall be not less than 1 070 mm high.

2) All *guards* within *dwelling units* or within *single detached* houses shall be not less than 900 mm high.

3) Exterior *guards* serving not more than one *dwelling unit* or a *single detached* house 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) 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 (3) and (4), 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 (3).)

2) Except for *guards* that serve *industrial occupancies*, the triangular openings formed by stair risers, stair treads and the bottom element of a required *guard* shall be of a size that prevents the passage of a 150 mm diam sphere.

3) 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 (3).)

4) 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.(4).)

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 glazing of the laminated or tempered type conforming to CAN/CGSB-12.1, "Safety Glazing," 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* or a *single detached* house, 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* or a *single detached* house, and 600 mm o.c. in other stairs.
- 2) For stairs serving not more than one *dwelling unit* or a *single detached* house, 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 OSB within *dwelling units* shall be not less than 25 mm actual thickness, except that, where open risers are permitted 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* or within houses with a *secondary suite* including their common spaces, 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* or a *single detached* house including their common spaces, 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) Except as required by Sentences 9.9.3.3.(2) and 9.9.3.4.(3), this Subsection applies to every *means of egress* except

a) *exits* that serve not more than one *dwelling unit* or a *single detached* house, and

b) *access to exits* within *dwelling units* and within single *detached* houses.

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.)

2) The width of *public corridors* and *exit* corridors that serve a single detached house shall be not less than 860 mm.

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.

3) The clear height in *public corridors* and *exit* corridors that serve a *single detached house* 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 9.10.9.12.), 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) Where an *exit* is located in a **single detached house**, the *exit* shall be separated from adjacent *floor areas* with a *fire separation*

- a) having a *fire-resistance rating* not less than 15 min where all *smoke alarms* within the house are of photo-electric type and interconnected as described in Clause 9.10.19.5.(2)(a),
- b) having a *fire-resistance rating* not less than 30 min where additional *smoke alarms* of photo-electric type are installed and interconnected as described in Clause 9.10.19.5.(2)(b),
- c) having a *fire-resistance rating* not less than 45 min when *smoke alarms* are not installed and interconnected as described in Clauses (a) or (b), or
- d) that is not required to have a *fire-resistance rating* if the *building* is *sprinklered*.

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 Sentences (1) and (2) 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. Protection of Exit Facilities

(See Note A-3.1.8.19.(1).)

1) This Article applies to

a) 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*, and

b) opening protection required by Articles 9.9.4.4. through 9.9.4.6.

2) Except as provided in Sentence (3), the combined area of glazing in doors and sidelights **referred to in Clause (1)(a)** shall not exceed 0.8 m².

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 **Clause (1)(a)** need not be limited as required in Sentence (2).

4) Exterior exposing openings requiring protection by Articles 9.9.4.4. through 9.9.4.6. shall be protected with

a) wired glass in fixed steel frames or glass block conforming to Articles 9.10.13.5. and 9.10.13.7.,

b) a closure conforming with Article 9.10.13.1., or

c) a dedicated sprinkler water curtain in accordance with Article 3.2.3.13.(5).

9.9.4.4. Openings Near Unenclosed Exterior Exit Stairs and Ramps

1) Except as permitted by Sentence (2), **unprotected** openings in exterior walls of the *building* shall be protected in accordance with Sentence 9.9.4.3.(4) 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*, ancillary space or common space in a **single detached house**, 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*.

2) A *sprinklered* single detached house or duplex with not more than two *dwelling units* and provided with more than one path of travel from each *dwelling unit* conforming to the dimensional requirements of Article 9.10.20.3., need not be provided with the opening protection referred to in Sentence (1).

9.9.4.5. Openings in Exterior Walls of Exits

1) Except as permitted by Sentence (2), either openings in exterior walls of an *exit* or openings in adjacent exterior walls of the *building* the *exit* serves shall be protected in accordance with Sentence 9.9.4.3.(4) 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) In a *sprinklered* single detached house with not more than 2 *dwelling units*, the opening protection referred to in Sentence (1) need only be provided where a single confined path of travel provides the sole means of egress.

9.9.4.6. Openings Near Exit Doors

1) Except as permitted by Sentence (2), 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 in accordance with Sentence 9.9.4.3.(4)

2) A *sprinklered* single detached house or duplex with not more than 2 *dwelling units* and provided with more than one path of travel from each *dwelling unit* conforming to the dimensional requirements of Article 9.10.20.3., need not be provided with the opening protection referred to in Sentence (1).

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 m² 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-3.3.1.8.(2) and (3).)

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 only a single *dwelling unit* or *single detached house* need not comply with Sentences (1) and (2). (See also Article 9.5.5.1.)

4) Except as permitted by Sentence (3), the clear opening height of doorways described in Sentence (1) serving a *single detached house* shall be not less than 1 980 mm high.

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 850 mm wide where there is only one door leaf,

b) not less than 850 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 850 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* or *ancillary residential unit* including their common spaces, 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 Sentence (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 28 m² in gross area that are in warehousing *buildings* of not more than one *storey*, and

ii) open directly to the exterior at ground level.

6) Garage doors intended for vehicular access shall not be used a *means of egress* from a storage garage except where acceptable to the *Chief Building Official* and

a) designed to swing on a vertical axis in the direction of egress travel, and

b) comply with the requirements of Articles 9.9.6.7. and 9.9.6.8.

(See Note A-9.9.6.4.(6))

9.9.6.5. Direction of Door Swing

- 1) Except for doors serving a single *dwelling unit* or *ancillary residential unit* including their common spaces, *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* or *ancillary residential unit* including their common spaces, 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.(5).
- 2) Except for doors serving a single *dwelling unit* or a single detached house, 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 900 mm to 1 100 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* or a single detached house, 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) Except as required by Sentences (2) and (4) 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* at the roof level, designed in conformance with the requirements for *exits* and located remote from each other, shall be provided.

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.

4) Except as required by Sentence (2), *means of egress* at the roof level, designed in conformance with the requirements for *exits* shall be provided from an *occupancy* on a roof serving more than a single *dwelling unit*.

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.

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)

<i>Occupancy of Room, Suite or Floor Area</i>	<i>Maximum Area of Room, Suite or Floor Area, m²</i>	<i>Maximum Distance to Egress Door, m</i>
Group C (except <i>dwelling units</i>)	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) One of the *means of egress* from a *mezzanine* that is not required to terminate at a *fire separation*, as permitted by Sentence 9.10.12.1.(2), and that exceeds the limits of Sentence (2) 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 Clause (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 not more than 1.5 m above adjacent 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 (2) and 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*.

2) For *dwelling units* in a *single detached* house, it need not be possible to go in more than one direction to an *exit* from the location where the egress door opens into a *public corridor* or exterior passageway if the *building* is *sprinklered* or if each *dwelling unit* has separate and direct access from each *storey* to

- a) a balcony, or
- b) an openable window conforming to Clauses 9.9.9.1.(2)(a) and (b).

9.9.9.3. Shared Egress Facilities

1) Except as provided in Sentences (2) and (3), 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) Where a *dwelling unit* is located above another *dwelling unit* or common space in a **single detached** house, the upper *dwelling unit* shall be provided with a second and separate *means of egress* where an egress door from that *dwelling unit* opens onto an exterior passageway that

- a) has a floor assembly with a *fire-resistance rating* less than 45 min,
- b) is served by a single *exit* stairway or *ramp*, and
- c) is located more than 1.5 m above adjacent ground level.

3) For *dwelling units* in a **single detached** house where an egress door from either *dwelling unit* opens onto a shared egress facility served by a single *exit* stairway or *ramp*, other than as described in Sentence (2), a second and separate *means of egress* need not be provided if the *building* is *sprinklered* or if the *dwelling units* have separate and direct access from each *storey* to

- a) a balcony, or
- b) an openable window conforming to Clauses 9.9.9.1.(2)(a) and (b).

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 m² 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* or a **single detached** house.

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 providing visual information 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 providing visual information 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,
- ii) E002 emergency exit right,
- iii) E005 90-degree directional arrow, and
- iv) E006 45-degree directional arrow.

3) Internally illuminated *exit* signs shall be continuously illuminated and

a) where illumination of the sign is powered by an electrical circuit, be constructed in conformance with CSA C22.2 No. 141, "Emergency lighting equipment," or

b) where illumination of the sign is not powered by an electrical circuit, be constructed in conformance with CAN/ULC-S572, "Standard for Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems."

4) Externally illuminated *exit* signs shall be continuously illuminated and be constructed in conformance with CAN/ULC-S572, "Standard for 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.

7) *Exit* signs with tactile information shall be provided in accordance with Article 3.4.5.2.

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-9.9.11.5.(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* or a *single detached house*.

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*,
- e) *public corridors*,
- f) public washrooms that are equipped to serve more than one person at a time,
- g) locations where doors are equipped with an electromagnetic lock as described in Clauses 3.4.6.16.(5)(k) and (6)(g), and
- h) universal washrooms, universal shower rooms and *accessible change spaces* required by Article 3.8.2.8.

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/m² 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, "Standard for 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 m² 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 6.3.1.6. (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 <i>Major Occupancies</i> ⁽¹⁾
C	—	<i>Residential occupancies</i>
D	—	<i>Business and personal services occupancies</i>
E	—	<i>Mercantile occupancies</i>
F	2	<i>Medium-hazard industrial occupancies</i>
F	3	<i>Low-hazard industrial occupancies</i> (Does not include <i>storage garages</i> serving individual <i>dwelling units</i>)

Notes to Table 9.10.2.1.:

⁽¹⁾ See Note A-3.1.2.1.(1).

- 2) A *storage garage* or carport that serves one or more residential *buildings*, may be considered an ancillary use to a Group C *major occupancy* provided that
 - a) it serves *buildings* of only *residential occupancy*,
 - b) the *storage garage* or carport contains no other *major occupancy*, and
 - c) the *storage garage* or carport is on the same property as the *buildings* to which it is deemed ancillary.

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* (Group C).
- 2) Reserved.

- 3) Reserved.
- 4) Reserved.
- 5) Reserved.

6) 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. 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*.

9.10.2.4. 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*.

9.10.2.5. 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 3.1.2.7. 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-3.1.2.7.)

9.10.3. Ratings

9.10.3.1. Fire-Resistance and Fire-Protection Ratings

1) Except as permitted in Sentences (2) and (3), 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. (See Note A-9.10.3.1.(1)(c).)

2) In a **single detached** house, where a minimum *fire-resistance rating* of 15 min is permitted, the construction described in Clause 9.11.1.1.(2)(a) is permitted to be used.

3) In a **single detached** house, where a minimum *fire-resistance rating* of 30 min is permitted, it is permitted to use construction having

- a) walls and floor/ceiling assemblies framed with wood studs,
- b) joist spaces filled with
 - i) preformed insulation of rock or slag fibres conforming to CAN/ULC-S702, "Mineral Fibre Thermal Insulation for Buildings," having a mass per unit area of not less than 1.22 kg/m² of floor surface, or
 - ii) wet-blown cellulose fibres conforming to CAN/ULC-S703, "Cellulose Fibre Insulation for Buildings," having a density of not less than 50 kg/m³ to a minimum depth of 90 mm on the underside of the subfloor and the sides of the structural members,
- c) stud spaces of

i) *non-loadbearing* assemblies filled with preformed insulation of glass fibres conforming to CAN/ULC-S702.1, “Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification,” having a mass per unit area of not less than 0.6 kg/m² of wall surface, and

ii) *loadbearing* assemblies filled with preformed insulation of rock or slag fibres conforming to CAN/ULC-S702.1, “Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification,” having a mass per unit area of not less than 1.22 kg/m² of wall surface, or filled with insulation of cellulose fibres conforming to CAN/ULC-S703, “Standard for Cellulose Fibre Insulation (CFI) for Buildings,” having a density of not less than 50 kg/m³,

d) resilient channel on one side of the *fire separation* spaced 400 or 600 mm o.c., and

e) not less than 12.7 mm thick gypsum board on ceilings and on both sides of walls. (See also Clause 9.11.1.1.(2)(a).)

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* 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 40% of the open area of the room in which they are located (see Note A-3.2.1.1.(3)(a)), and

b) except as permitted in Sentence (3), the space above the *mezzanine* floor is used as an open area without *partitions* or subdividing walls higher than 1 070 mm above the *mezzanine* floor.

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.

9.10.4.4. Rooftop Enclosures

1) A rooftop enclosure shall not be considered as a *storey* in calculating the *building height* if the rooftop enclosure is provided for

a) elevator machinery,

b) a *service room*,

c) a stairway used for no purpose other than for access or egress,

d) an elevator lobby used for no purpose other than for access or egress, or

e) a combination thereof.

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 (3), 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 and the penetrations conform to Article 9.10.9.8.

3) 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 Floors and Roofs

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) Light-frame walls, columns, arches and beams as well as *loadbearing* steel elements that support floors between *dwelling units* in a single detached house shall be protected by not less than 12.7 mm thick gypsum board. (See Note A-9.10.8.3.(2).)

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) reserved,
- b) a single *dwelling unit* where no *suite* is located above or below the *dwelling unit* (see also Sentence 9.9.9.3.(2)).

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) single detached houses, 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 and Smoke-tight Barriers between Rooms and Spaces within Buildings

9.10.9.1. Application

- 1) This Subsection applies to
 - a) *fire separations* required between rooms and spaces in *buildings*, except between rooms and spaces within a *dwelling unit*, and
 - b) reserved.

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) Except as provided in Sentence (6), the continuity of a *fire separation* where it abuts another *fire separation*, a floor, a ceiling, or a roof shall be maintained by a *firestop* that, when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," has an FT rating not less than the *fire-resistance rating* for the abutting *fire separation*. (See Note A-3.1.8.3.(2).)

4) Except as provided in Sentence (6), joints located in a horizontal plane between a floor and an exterior wall shall be sealed by a *firestop* that, when subjected to the fire test method in ASTM E2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-storey Test Apparatus," has an F rating not less than the *fire-resistance rating* for the horizontal *fire separation*.

5) Except as provided in Sentence (6), all gypsum board joints in the assemblies described in Sentence (1) shall conform to CSA A82.31-M, "Gypsum Board Application," to maintain the integrity of the smoke-tight barrier over the entire surface.

6) Joints between ceilings and walls, between floors and walls, and between walls at corners need not comply with Sentences (3) to (5) where such joints consist of gypsum board that is attached to framing members and arranged so as to restrict the passage of flame and smoke through the joints. (See Note A-3.1.8.3.(5).)

9.10.9.3. Openings to be Protected with Closures

1) Except as permitted in Articles 9.10.9.5. to 9.10.9.8., openings in required *fire separations* shall be protected with *closures* conforming to Subsection 9.10.13.

2) Doors in a *fire separation* with a required *fire-resistance rating* of 15 min, but not greater than 45 min, need not have a *fire-protection rating* provided they

- a) are at least 45 mm thick solid core wood doors, and

- b) have a self-closing device.

(See Subsection 9.10.13. and Note A-9.10.9.3.(2).)

3) Doors in a partition conforming with Sentence 9.10.9.16.(5) between a principal *dwelling unit* and its *subordinate ancillary residential unit*, shall be protected with a closure with a minimum *fire-protection rating* of 20 minute conforming to Article 9.10.13.2.

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* and within houses with a *secondary suite* 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. General Requirements for Penetrations of Fire Separations

(See Note A-3.1.9.)

- 1) Except as required by Sentence (2) and Articles 9.10.9.7. and 9.10.9.8. and as permitted by Article 9.10.9.9., penetrations of a required *fire separation* or a membrane forming part of an assembly required to be a *fire separation* shall be
 - a) sealed by a *firestop* that, when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," has an F rating not less than the required *fire-resistance rating* for the *fire separation*,
 - b) tightly fitted or cast in place, provided the penetrating item is made of steel, ferrous, copper, concrete or masonry, or
 - c) sealed to maintain the integrity of the *fire separation*.

(See Note A-9.10.9.6.(1).)

- 2) Penetrations of a *firewall* shall be sealed at the penetration by a *firestop* that, when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," has an FT rating not less than the *fire-resistance rating* for the *fire separation*.

9.10.9.7. Piping Penetrations

(See Note A-3.1.9.)

- 1) Except as provided in Sentences (2) and (5), piping for drain, waste, vent and central vacuum systems that is 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 penetration is protected in accordance with Clause 9.10.9.6.(1)(a) or (b).
- 2) Drain piping leading directly from a water closet through a concrete floor slab 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
 - a) the piping is *noncombustible* and the penetration is protected in accordance with Sentence 9.10.9.6.(1), or
 - b) the piping is *combustible* and the penetration is sealed by a *firestop* conforming to Clause 9.10.9.6.(1)(a).
- 3) *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.
- 4) In *buildings* containing two *dwelling units* only, *combustible* drain, waste and vent piping is permitted on one side of a horizontal *fire separation*.

5) Water distribution piping is permitted to partly or wholly penetrate a *fire separation* required to have a *fire-resistance rating*, provided

- a) the piping is *noncombustible* and the penetration is protected in accordance with Sentence 9.10.9.6.(1), or
- b) the piping is *combustible* and is not located in a vertical shaft, and the penetration is sealed by a *firestop* conforming to Clause 9.10.9.6.(1)(a).

9.10.9.8. Penetrations by Outlet Boxes or Service Equipment in Concealed Spaces

1) Except as provided in Sentences (2) to (5), 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 *firestop* that, when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," has an FT rating not less than the *fire-resistance rating* of the *fire separation*. (See Note A-9.10.9.8.(1).)

2) Except as provided in Sentence 9.10.9.6.(2), *noncombustible* outlet boxes that penetrate a *fire separation* or a membrane forming part of an assembly required to have a *fire-resistance rating* need not conform to Sentence (1), provided

- a) they do not exceed
 - i) 0.016 m² in area, and
 - ii) an aggregate area of 0.065 m² in any 9.3 m² of surface area, and
- b) the annular space between the membrane and the *noncombustible* outlet boxes does not exceed 3 mm.

3) Except as provided in Sentence 9.10.9.6.(2), *combustible* outlet boxes that penetrate a *fire separation* or a membrane forming part of an assembly required to have a *fire-resistance rating* need not conform to Sentence (1), provided

- a) the outlet boxes are
 - i) separated from the remainder of the space within the assembly by an enclosure of not more than 0.3 m² in area made of *fire block* material conforming to Article 9.10.16.3. (see Note A-9.10.9.8.(3)(a)(i)), or
 - ii) located in a space within the assembly that is filled with preformed fibre insulation processed from rock or slag conforming to CAN/ULC-S702.1, "Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification," and having a mass per unit area of not less than 1.22 kg/m² of wall surface such that the exposed sides and back of the outlet box are encapsulated by the *noncombustible* insulation, and
- b) the outlet boxes do not exceed an aggregate area of 0.016 m² in any individual enclosure as described in Subclause (a)(i) or any individual insulated space as described in Subclause (a)(ii).

4) *Noncombustible* outlet boxes conforming to Sentence (2) are permitted to be located on opposite sides of a vertical *fire separation* having a *fire-resistance rating* and need not conform to Sentence (1), provided they are

- a) separated from each other by a horizontal distance of not less than 600 mm,
- b) separated from each other and the remainder of the wall space by an enclosure conforming to Subclause (3)(a)(i), or
- c) located in an insulated wall space in accordance with Subclause (3)(a)(ii).

5) *Combustible* outlet boxes conforming to Sentence (3) are permitted to be located on opposite sides of a vertical *fire separation* having a *fire-resistance rating* and need not conform to Sentence (1).

6) Service equipment is permitted to penetrate a horizontal *fire separation* conforming to Sentence 9.10.9.12.(2), provided the penetration is sealed by

- a) a *firestop* that, when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," has an FT rating not less than the required *fire-resistance rating* for the *fire separation*,
- b) a *firestop* conforming to Clause 9.10.9.6.(1)(a), where the service equipment is located entirely within the cavity of a wall assembly above and below the horizontal *fire separation* having a required *fire-resistance rating*, or
- c) a *firestop* conforming to Clause 9.10.9.6.(1)(a), where the penetration is
 - i) contained within the concealed space of a floor or ceiling assembly having a *fire-resistance rating*,

- ii) located above a ceiling membrane providing a horizontal *fire separation*, or
- iii) contained within a *horizontal service space* conforming to Sentence 9.10.9.12.(2) that is directly above or below a floor or ceiling.

9.10.9.9. Penetrations by Raceways, Sprinklers and Fire Dampers

- 1) *Combustible* totally enclosed raceways that are embedded in a concrete floor slab are permitted in an assembly required to have a *fire-resistance rating*, provided the concrete cover between the raceway and the bottom of the slab is not less than 50 mm.
- 2) Totally enclosed raceways are permitted to penetrate a *fire separation*, provided they are sealed at the penetration by a *firestop* conforming to Clause 9.10.9.6.(1)(a).
- 3) Sprinkler piping is permitted to penetrate a *fire separation*, provided the *fire compartments* on each side of the *fire separation* are *sprinklered*.
- 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 *firestop* requirements of Article 9.10.9.6. and Clause 9.10.9.8.(6)(a), provided the annular space created by the penetration of a fire sprinkler is covered by a metal escutcheon plate in accordance with NFPA 13, "Standard for the Installation of Sprinkler Systems."
- 5) *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 *firestop* requirements of Sentence 9.10.9.6.(1), provided the *fire damper* is
 - a) installed in conformance with NFPA 80, "Standard for Fire Doors and Other Opening Protectives,"
 - b) specifically designed with a *firestop*, or
 - c) provided in conformance with Sentence 9.10.5.1.(3).(See also Note A-3.1.9.2.(1).)

6) In a **single detached house**, ducts penetrating *fire separations* need not be equipped with *fire dampers* in conformance with Article 3.1.8.10. provided they are *noncombustible* with all openings in the duct system serving only one *fire compartment*.

9.10.9.10. 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*.

9.10.9.11. Reduction in Thickness of Fire Separation by Beams and Joists

- 1) Where pockets for the support of beams or joists are formed in a 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. of Appendix D for the required *fire-resistance rating*.

9.10.9.12. 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.

9.10.9.13. 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 two *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*.

9.10.9.14. 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*.

9.10.9.15. Separation of Suites

1) Except as required in Article 9.10.9.16. and as permitted by Sentence (2), each *suite* in other than *business and personal services occupancies* 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*.

9.10.9.16. Separation of Residential Suites

1) Except as provided in Sentences (2) to (5) 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) Except as provided in Sentences (4) and (5), *dwelling units* that contain 2 or more *storeys* including *basements* as well as *principal dwelling units* including subordinate ancillary residential units and common spaces 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) Except as permitted in Sentence (5), in a single detached house, *dwelling units* shall be separated from each other and from ancillary spaces and common spaces with a *fire separation*

a) having a *fire-resistance rating* not less than 15 min when all *smoke alarms* within the single detached house are of photo-electric type and interconnected as described in Clause 9.10.19.5.(2)(a) (see also Sentence 9.10.3.1.(2)),

b) having a *fire-resistance rating* not less than 30 min when additional *smoke alarms* of photo-electric type are installed and interconnected as described in Clause 9.10.19.5.(2)(b) (see also Sentence 9.10.3.1.(3)),

c) having a *fire-resistance rating* not less than 45 min when *smoke alarms* are not installed and interconnected as described in Clauses (a) or (b), or

d) that is not required to have a *fire-resistance rating* if the *building* is *sprinklered*.

5) The *fire separation* required by Sentence (4), between the principal *dwelling unit* and a subordinate *ancillary residential unit*, in a *sprinklered building* may be constructed as

a) wall or partition assembly 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.

9.10.9.17. Separation of Public Corridors

1) Except as otherwise required by this Part and as provided in Sentences (2) to (5), *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) A *public corridor* located in a **single detached** house shall be separated from the remainder of the spaces in the house with a *fire separation*

- a) having a *fire-resistance rating* not less than 15 min when all *smoke alarms* within the house are of photo-electric type and interconnected as described in Clause 9.10.19.5.(2)(a) (see also Sentence 9.10.3.1.(2)),
- b) having a *fire-resistance rating* not less than 30 min when additional *smoke alarms* of photo-electric type are installed and interconnected as described in Clause 9.10.19.5.(2)(b) (see also Sentence 9.10.3.1.(3)),
- c) having a *fire-resistance rating* not less than 45 min when *smoke alarms* are not installed and interconnected as described in Clauses (a) or (b), or
- d) that is not required to have a *fire-resistance rating* if the *building* is *sprinklered*.

5) No *fire separation* is required in a *sprinklered floor area* between a *public corridor* and a space containing plumbing fixtures required by Article 3.7.2.2. and Section 9.31., provided

- a) 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*, and
- b) the plumbing fixtures are not located within a *dwelling unit* or *suite*.

9.10.9.18. 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-9.10.9.18.(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.

9.10.9.19. 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-9.10.9.18.(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.

9.10.9.20. 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*.

9.10.9.21. Central Vacuum Systems

1) A central vacuum system shall serve not more than one *suite*.

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),

- a) where the *appliances* serve
 - i) not more than one room or *suite*, or
 - ii) a *building* with a *building area* of not more than 400 m² and a *building height* of not more than 2 *storeys*, or
- b) where the *appliances*
 - i) serve a *single detached* house, and

ii) are located in a *service room* separated from the *dwelling units* or their common spaces by a *fire separation* having a *fire-resistance rating* not less than the *fire-resistance rating* required for the *fire separation* between the *dwelling units* or common spaces.

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, "Standard on 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 and materials for recycling 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 *fire separation* with a *fire-resistance rating* of not less than 45 min is permitted where

a) the *fire-resistance rating* of the floor assembly is not required to exceed 45 min, or

b) the room is *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) A *party wall* on a property line of a *building* of *residential occupancy* need not be constructed as a *firewall*, provided it is constructed as a *fire separation* having not less than a 1 h *fire-resistance rating*, where the *party wall* separates

a) two *principal dwelling units* where there is no *principal dwelling unit* above another,

b) ~~deleted~~, or

c) *principal dwelling units* and common spaces in a duplex.

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 *fire compartment* that is not *sprinklered* 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*, ancillary spaces or common spaces in a **single detached** house.

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, or

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, “Standard for 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 ¹	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, “Standard Specification for 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 m² 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 m².

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, “Standard Specification for 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 m², 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 m², 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), 9.10.5.1.(3) and 9.10.9.9.(5), 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 cm², 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 9.10.9.20.

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 6.3.1.6.)

9.10.13.14. Fire Stop Flaps

1) *Fire stop flaps* in ceiling membranes referred to in Sentence 9.10.5.1.(3) shall

a) conform to CAN/ULC-S112.2, "Standard Method of 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.

2) This Subsection does not apply to detached carports conforming to Section 9.35. that serve not more than one *principal dwelling unit*.

9.10.14.2. Area and Location of Exposing Building Face

1) Except as permitted by Sentence (4), 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, or

ii) the area for each *fire compartment*, where a *building* is divided into *fire compartments* by *fire separations* with *fire-resistance ratings* not less than 45 min.

2) 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).)

3) 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).)

4) 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.

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 <i>Unprotected Openings</i> , % 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	
<i>Residential, business and personal services, and low-hazard industrial</i>	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	—	
<i>Mercantile and medium-hazard industrial</i>	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:

(1) 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

$$\text{Area} = 0.24(2 \times \text{LD} - 1.2)^2$$

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 <i>Unprotected Openings</i> , m ²
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
- 2 m horizontally of another *unprotected opening* that is on the same *exposing building face* and serves the single room or space, or
 - 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
- 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
 - 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* is permitted to be up to twice the area determined according to Sentence (1), where the *unprotected openings* are glazed with
- wired glass in steel frames, as described in Article 9.10.13.5., or
 - glass blocks, as described in Article 9.10.13.7.
- 7) Where the *building* is *sprinklered*, the maximum aggregate area of *unprotected openings* is permitted to be up to 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
- all *storeys* are constructed as *open-air storeys*, and
 - 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 *buildings* 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
- the detached garage or accessory *building* serves only one *dwelling unit*,
 - the detached garage or accessory *building* is located on the same property as that *dwelling unit*, and
 - 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
- the windows are glazed with tempered, wired or laminated glass, or glass block, and
 - the *exposing building face* is constructed according to Article 9.10.14.5.
- 13) The *exposing building face* of an attached carport or open-air *storage garage* serving not more than 5 motor vehicles is permitted to have 100% *unprotected openings*, where
- it is in a *building* of only *residential occupancy* with not more than 8 *dwelling units*, and
 - it complies with requirements of Clauses 9.10.15.4.(11)(a) through (d).

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	Maximum Area of <i>Unprotected</i>	Minimum Required	Type of Construction	Type of Cladding

Classification of Building or Fire Compartment	Openings Permitted, % of Exposing Building Face Area	Fire-Resistance Rating	Required	Required
<i>Residential, business and personal services, and low-hazard industrial</i>	0 to 10	1 h	<i>Noncombustible</i>	<i>Noncombustible</i>
	> 10 to 25	1 h	<i>Combustible or noncombustible</i>	<i>Noncombustible</i>
	>25 to 50	45 min	<i>Combustible or noncombustible</i>	<i>Noncombustible</i>
	> 50 to < 100	45 min	<i>Combustible or noncombustible</i>	<i>Combustible or noncombustible</i>
<i>Mercantile and medium-hazard industrial</i>	0 to 10	2 h	<i>Noncombustible</i>	<i>Noncombustible</i>
	>10 to 25	2 h	<i>Combustible or noncombustible</i>	<i>Noncombustible</i>
	> 25 to 50	1 h	<i>Combustible or noncombustible</i>	<i>Noncombustible</i>
	> 50 to < 100	1 h	<i>Combustible or noncombustible</i>	<i>Combustible or noncombustible</i>

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, “Standard Method of 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 Subsection 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 D2898, “Standard Practice for 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 <i>Exposing Building Face</i>	Maximum Area of <i>Exposing Building Face</i> , m ²
1:1	88
2:1	102
3:1	129
4:1	161
5:1	195

4) Except as provided in Sentence (5), where a garage or accessory *building* serves one *dwelling unit* only and is detached from any *building*, or if a detached garage serves both units of a duplex with a continuous internal *fire separation*, with a *fire resistance rating* of at least 45 minutes, 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 and type of construction 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 *single detached house or duplex*, 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.

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 one or two *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).)

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 *public way*. (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 *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).)

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 Houses

(See Note A-9.10.15.)

9.10.15.1. Application

- 1) This Subsection applies to
 - a) *residential buildings* that contain not more than two *dwelling units* and have no *principal dwelling unit* above another *principal dwelling unit*, and
 - b) single detached houses with an *ancillary residential unit* including their common spaces.

(See Note A-9.10.15.1.(1).)

9.10.15.2. Area and Location of Exposing Building Face

- 1) Except as permitted by Sentence (5) 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 (2), where Table 9.10.15.4. is used to determine the maximum aggregate area of *unprotected openings*, the area of any number of individual portions of the *exposing building face*. (See Note A-9.10.15.4.(2).)

2) 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).)

3) For the purpose of using Table 9.10.15.4. 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) 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).)

5) 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.

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) to (11), the maximum aggregate area of *unprotected openings* in an *exposing building face* shall

a) conform to Table 9.10.15.4.,

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 the *limiting distance* squared.

2) Where the limits on the area of *unprotected openings* are determined for individual portions of the *exposing building face*, as described in Subclause 9.10.15.2.(1)(b)(iii), the maximum aggregate area of *unprotected openings* for any portion shall be determined using the values in Table 9.10.15.4. corresponding to

a) the maximum total area of *exposing building face*, which is equal to the sum of all portions of the *exposing building face*, and

b) the *limiting distance* of each portion.

(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 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* or a group of *unprotected openings* in an *exposing building face* shall not exceed 50% of the maximum allowable aggregate area of *unprotected openings* determined in Sentence (1).

4) The spacing between individual *unprotected openings* or a group of *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 *dwelling unit* facing a detached garage or accessory *building*, 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.

7) The maximum aggregate area of *unprotected openings* in an *exposing building face* is permitted to be up to twice the area determined in accordance with Sentence (1), where

a) the *unprotected openings* consist of glass blocks, as described in Article 9.10.13.7., or

b) the *building* is *sprinklered*, provided all rooms, including closets, bathrooms and attached garages, 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.

Table 9.10.15.4.

Maximum Area of Glazed Openings in Exterior Walls of Houses

Forming Part of Subclause 9.10.15.2.(1)(b)(iii) and Sentences 9.10.15.4.(1) and (2)

Maximum Total Area of Exposing Building Face, m ²	Maximum Aggregate Area of Glazed 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	—

8) If a *building* is *sprinklered* and the *limiting distance* is less than 1.2 m but not less than 1 m, the maximum centage 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.(14).

9) 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.

10) 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*.

11) The *exposing building face* of an attached carport or open-air *storage garage* serving not more than 5 motor vehicles is permitted to have 100% *unprotected openings* where

a) the carport or *storage garage* is ancillary to a *building* of only *residential occupancy* and has a *limiting distance* of at least 1.2 m,

b) the perimeter walls of the carport or *storage garage* are substantially open on at least 3 sides, with not less than 25% of the total area of the exterior perimeter walls open to the exterior in a manner that will provide cross ventilation,

c) A *fire separation* is provided between the carport or *storage garage* and all adjacent spaces in the building with a minimum 1 h *fire-resistance rating*,

d) The carport or *storage garage* is provided with a smooth flat ceiling, and is *sprinklered* in accordance with the applicable sprinkler design standard and notwithstanding the provision of that standard, provided with

i) quick response sprinklers, and

ii) a minimum design density of 0.15 USgpm/sq.ft.

(see Note A-9.10.15.4.(11))

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, "Standard Method of 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., Subsection 9.27.11. or Section 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 D2898, "Standard Practice for 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, "Standard Method of 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 one or two *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 *public way*. (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) Where not *sprinklered*, 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 m² 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, "Standard Method of 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) two layers of lumber, each not less than 19 mm thick, 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/m³,
- 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.(8).)

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. (See also Note A-3.1.11.7.(7).)

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 ceiling that is not *sprinklered* 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 *public corridor* that is not *sprinklered* 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 ratings* 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 m² 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.,
- b) provided the *building* does not contain a Group C *major occupancy*, by sheet metal that
 - i) is mechanically fastened to the supporting assembly independent of the insulation,
 - ii) is not less than 0.38 mm thick, and
 - iii) 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) to (5), a fire alarm system shall be installed in *buildings* in which a sprinkler system is installed.
- 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
<i>Residential</i>	10 (sleeping accommodation)
<i>Business and personal services, Mercantile</i>	150 above or below the <i>first storey</i>
<i>Low- or medium-hazard industrial</i>	75 above or below the <i>first storey</i>

3) In *buildings* in which a sprinkler system has been installed in accordance with NFPA 13D, "Standard for the 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 hoistways, chutes and dumbwaiter shafts, and
- f) laundry rooms in *buildings* of *residential occupancy*, but not those within *dwelling units*.

3) Except as required by 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 3.2.2.92. 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*,
- b) each sleeping room not within a *dwelling unit*, and
- c) ancillary spaces and common spaces not in *dwelling units* in a *single detached* house.

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.

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*.

9.10.19.3. 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, "Standard for the 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.(9)(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 with a sound pressure level between 75 dBA and 110 dBA within the individual *suites* (see also Note A-3.2.4.18.(4)),

b) except as permitted in Sentence (4), are installed in conformance with CAN/ULC-S524, "Standard for Installation of Fire Alarm Systems," and

c) form part of the fire alarm system.

(See Note A-3.2.4.20.(10).)

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 interconnected so that the actuation of any one alarm causes all alarms within the *dwelling unit* to sound.

2) Except as provided in Sentence (3), in a *principal dwelling unit*

a) all *smoke alarms* shall be of photo-electric type and interconnected so that the actuation of any one *smoke alarm* causes all *smoke alarms* within the *principal dwelling unit* and subordinate *ancillary residential unit* including their common spaces to sound when the *fire separations* described in Articles 9.9.4.2., 9.10.9.16. and 9.10.9.17. have a *fire-resistance rating* not less than 15 min (see also Sentence 9.10.3.1.(2)), or

b) an additional *smoke alarm* of photo-electric type shall be installed in each *dwelling unit* and common space and be interconnected so that the actuation of one *smoke alarm* will cause the additional *smoke alarms* in the other *dwelling unit*, *dwelling units* or common spaces to sound when the *fire separations* described in Articles 9.9.4.2., 9.10.9.16. and 9.10.9.17. have a *fire-resistance rating* not less than 30 min (see also Sentence 9.10.3.1.(3)).

3) Deleted.

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, "Standard for 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, "Standard for 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) *single detached houses*.

9.10.20.2. Access to Basements

1) Except for *basements* in houses with a *secondary suite* or *basements* serving not more than one *dwelling unit*, each *basement* that is not *sprinklered* that exceeds 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) Except as permitted by Sentence (8), access for fire department vehicles and firefighters path of travel 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 the provisions of 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* or provided with a strobe light connected to an internal *smoke alarm* within the *dwelling unit* that identifies the location of the principal entrance.

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* or provided with a strobe light connected to an internal *smoke alarm* within the *dwelling unit* that identifies the location of the principal entrance.

7) Where acceptable to the *Chief Building Official*, 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 or is designed to contain 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).

8) In a single detached house or duplex within the scope of Division A, Article 1.3.3.3., access routes are permitted to be located so that the path of travel for firefighters to the principal entrance of each *dwelling unit* or *ancillary floor area* is not more than

- a) 45 m where
 - i) there are at least two paths of travel by which an occupant may reach a *street*, *lane*, or public thoroughfare, or
 - ii) the path of travel by which an occupant may reach a *street*, *lane*, or public thoroughfare is protected from fire exposure from *unprotected openings* in accordance with Article 9.9.4.4.,
- b) 65 m where
 - i) there are at least two paths of travel by which an occupant may reach a *street*, *lane*, or public thoroughfare,
 - ii) the *building* is provided with *sprinklers* hydraulically designed with a 25% increase in the required discharge,
 - iii) the *sprinkler system* is connected to internal smoke alarms within the *dwelling unit*, provided with an exterior audible alarm, and
 - iv) 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*, or
- c) 90 m where
 - i) the requirements of Subclauses (b)(i) to (b)(iv) have been satisfied,
 - ii) no principal *dwelling unit* or its *ancillary residential unit* is located above another *dwelling unit*,
 - iii) an access path of at least 1.2 m wide is provided from each principal *dwelling unit* entry to the *street*, and
 - vi) lighting is provided along the path of travel for firefighters with a minimum illumination level of 1 lx at ground level (also see Article 10. 2.2.10.) along the path.

9.10.20.4. Portable Extinguishers

1) Portable extinguishers shall be installed in all *buildings*, except within *dwelling units*, in conformance with the appropriate provincial or territorial regulations or municipal bylaws or, in the absence of such regulations or bylaws, the NFC.

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 appropriate provincial or territorial regulations or municipal bylaws or, in the absence of such regulations or bylaws, in conformance with the NFC.

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 applicable provincial or territorial regulations or municipal bylaws or, in the absence of such regulations or bylaws, with CSA B149.1, "Natural gas and propane installation code." (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 that projects 125 mm 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

a) gypsum board not less than 9.5 mm thick, or

b) any material providing a *fire-resistance rating* of not less than 10 min and a *flame-spread rating* of not more than 25.

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 Sentences (2) and (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) In a single detached house each *dwelling unit* shall be separated from every other space in the house in which noise may be transmitted by

a) construction having

i) joist spaces are filled with sound-absorbing material of not less than 150 mm nominal thickness,

ii) stud spaces are filled with sound-absorbing material,

iii) resilient channel on one side of the separation spaced 400 or 600 mm o.c., and

iv) not less than 12.7 mm thick gypsum board on ceilings and on both sides of walls,

b) construction providing an STC rating of not less than 43, or

c) a separating assembly and adjoining constructions, which together provide an ASTC rating of not less than 40.

(See also Sentence 9.10.3.1.(2) and Note A-9.11.1.1.(2).)

3) Construction separating a *dwelling unit* from an elevator shaft or refuse chute shall have an STC rating of not less than 55.

4) A dwelling unit in a building containing not more than 1 or 2 primary dwelling units, need not be separated from an adjoining storage garage containing not more than five stalls, provided that the adjoining separating assemblies are provided with exterior sheathing and at least 89 mm of insulation.

9.11.1.2. Determination of Sound Transmission Ratings

1) The STC ratings shall be determined in accordance with ASTM E413, "Classification for Rating Sound Insulation," using the results from measurements carried out in accordance with ASTM E90, "Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements."

2) The *ASTC* ratings shall be

a) determined in accordance with ASTM E413, "Classification for Rating Sound Insulation," using the results from measurements carried out in accordance with ASTM E336, "Standard Test Method for 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/m², 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/m², 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/m², 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 <i>STC</i> ≥ 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)	• wood strip flooring not less than 16 mm thick aligned parallel to separating wall, or

studs)	• 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/m²⁽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/m²⁽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/m²⁽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/m²⁽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.

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 <i>Soil</i>	Minimum Depth of <i>Foundation</i> Containing Heated <i>Basement</i> or <i>Crawl Space</i> ⁽¹⁾		Minimum Depth of <i>Foundation</i> Containing No Heated <i>Space</i> ⁽²⁾	
	Good <i>Soil</i> Drainage	Poor <i>Soil</i> Drainage	Good <i>Soil</i> Drainage	Poor <i>Soil</i> Drainage
<i>Rock</i>	No limit	No limit	No limit	No limit
Coarse grained <i>soils</i>	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 m² 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 m² 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 watermain 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 D1227/D1227M, "Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing," Type III, Class I,

ii) ASTM D4479/D4479M, "Standard Specification for 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 $43 \text{ ng}/(\text{Pa}\cdot\text{s}\cdot\text{m}^2)$ when tested in accordance with Procedure A (wet cup) of ASTM E96/E96M, "Standard Test Methods for 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. covered 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 $170 \text{ ng}/(\text{Pa}\times\text{s}\times\text{m}^2)$ 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, and
- 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 D1227/D1227M, "Standard Specification for 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 D3019/D3019M, "Standard Specification for Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, and Fibered," where non-fibered and non-asbestos-fibered (Types I and III) asphalt roll roofing are permitted,

- c) ASTM D4479/D4479M, "Standard Specification for 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 D4637/D4637M, "Standard Specification for EPDM Sheet Used In Single-Ply Roof Membrane,"
- e) ASTM D4811/D4811M, "Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing,"
- f) ASTM D6878/D6878M, "Standard Specification for 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. covered 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) a *conditioned space* that has a wall, roof or floor assembly, or part thereof, that is in contact with the ground, and
 - b) the protection of the *conditioned space* described in Clause (a).
- 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, or parts thereof, separating *conditioned space* from the ground shall be protected by an *air barrier system* conforming to Subsection 9.25.3.
- 2) 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, *buildings* shall
 - a) be provided with the rough-in for a subfloor depressurization system conforming to Article 9.13.4.3., or
 - b) conform to Parts 5 and 6 for the protection from radon ingress and the means to address high radon concentrations in the future (see Articles 5.4.1.1. and 6.2.1.1.).

9.13.4.3. Rough-in for a Subfloor Depressurization System

(See Note A-9.13.4.3.)

- 1) Floors-on-ground shall accommodate the future installation of a subfloor depressurization system by installing a radon vent pipe, and a contiguous gas-permeable layer between the *air barrier system* and the ground consisting of
 - a) a material or materials that allow effective depressurization of that space (see Sentence 9.16.2.1.(1)), or
 - b) not less than 100 mm of coarse clean granular material containing not more than 10% of material that would pass a 4 mm sieve.
- 2) The radon vent pipe required by Sentence (1) shall
 - a) be sealed to maintain the integrity of the *air barrier system*, with no perforations along the pipe above the *air barrier system*,
 - b) have one or more inlets that allow for the effective depressurization of the gas-permeable layer (see Note A-9.13.4.3.(2)(b) and (3)(b)), and
 - c) permit connection to depressurization equipment,
 - d) where it passes through *conditioned space*, be completely surrounded by *conditioned space*,
 - e) consist of pipe and fittings in accordance with 7.1.3 of CAN/CGSB-149.11, "Radon control options for new construction in low-rise residential buildings,"
 - f) terminate outside the *building* in a manner that does not constitute a hazard,
 - g) be installed to prevent the accumulation of moisture and away from locations where snow and ice accumulate, and
 - h) be clearly labeled every 1.8 m and at every change in direction to indicate that it is intended only for the future removal of radon from below the floor-on-ground.
- 3) A radon vent pipe shall be deemed to comply with
 - a) Clause (2)(b) where its inlet or inlets below the *air barrier system* are located at or near the centre of the floor-on-ground with gas-permeable material extending not less than 100 mm beyond any inlet, and

b) Clause (2)(f) where it terminates outside the *building*, not less than 1.8 m from a property line, and located in accordance with either 7.2.4.6 or 7.3.4 of CAN/CGSB-149.11, "Radon control options for new construction in low-rise residential buildings," with the opening of the pipe fitted with a corrosion-resistant screen or grille with a mesh opening size of 10 mm to 12.5 mm or a product of equivalent air flow performance.

Section 9.14. Drainage

(See Article 2.4.2.5. of Division B of Book II (Plumbing Systems) of this By-law.)

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 C4, "Standard Specification for Clay Drain Tile and Perforated Clay Drain Tile,"

b) ASTM C412M, "Standard Specification for Concrete Drain Tile,"

c) ASTM C444M, "Standard Specification for Perforated Concrete Pipe,"

d) ASTM C700, "Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated,"

e) BNQ 3624-115, "Polyethylene (PE) Pipe and Fittings for Soil and Foundation Drainage,"

f) CSA B182.1, "Plastic drain and sewer pipe and pipe fittings," or

g) CAN/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 m² 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* (See Note A-9.14.5.3.(2)).

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.
- 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 installation of buildings."

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 CAN/CSA-A179, "Mortar and Grout for Unit Masonry,"

- b) grout shall be coarse, conforming to CAN/CSA-A179, "Mortar and Grout for Unit Masonry," and
- c) placement of grout shall conform to CAN/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, "Specification of 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, strip footing widths shall be determined according to

- a) Section 4.2., or
- b) the following formula

$$W = w \times [\Sigma s_j s] / (storeys \times 4.9)$$

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.,

$\Sigma s_j s$ = sum of the supported joist spans on each *storey* bearing on an exterior wall whose load is transferred to the footing, or sum of half of the supported joist spans on each *storey* bearing on both sides of an interior wall 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
- 100 mm, or
 - the width of the projection of the footing beyond the supported element.

9.15.3.9. Step Footings

- 1) Where step footings are used,
- the vertical rise between horizontal portions shall not exceed 600 mm, and
 - the horizontal distance between risers shall not be less than 600 mm.

9.15.4. Foundation Walls

9.15.4.1. Flat Wall Insulating Concrete Form Units

1) Flat wall insulating concrete form units shall conform to CAN/ULC-S717.1, "Standard for Flat Wall Insulating Concrete Form (ICF) Units – Material Properties."

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, concrete core in flat wall insulating concrete forms 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 concrete core in flat insulating concrete form *foundation* walls shall be not less than the greater of
- 150 mm, or
 - the thickness of the concrete in the wall above.

Table 9.15.4.2.-A

Thickness of Solid Concrete, Concrete Core in Flat Wall Insulating Concrete Form and Unreinforced Concrete Block Foundation Walls

Forming Part of Sentence 9.15.4.2.(1)

Type of <i>Foundation</i> Wall	Minimum Thickness of Concrete or Concrete Block, mm	Maximum Height of Finished Ground Above <i>Basement</i> Floor or Crawl Space Ground Cover, m			
		Height of <i>Foundation</i> Wall Laterally Unsupported at the Top ⁽¹⁾⁽²⁾	Height of <i>Foundation</i> 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 and concrete core in flat wall insulating concrete forms, ⁽³⁾ 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 and concrete core in flat wall insulating concrete forms, ⁽³⁾ 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	⁽⁴⁾	⁽⁴⁾
	240	1.2	1.8	⁽⁴⁾	⁽⁴⁾

	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 Note A-Table 9.15.4.2.-A.

⁽⁴⁾ See Table 9.15.4.2.-B.

3) 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 (4) to (7), 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.

4) 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.

5) 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.(3)

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		
	<i>Foundation</i> Wall Height			<i>Foundation</i> 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.

6) In concrete block walls required to be reinforced, all vertical bar reinforcement shall be installed along the centre line of the wall.

7) 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 or flat insulating concrete form wall,

b) the floor joists are embedded in the top of the *foundation* walls,

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, or

d) they extend from the footing to no more than 300 mm above the finished ground level and are backfilled on both sides such that the difference in elevation between the finished ground levels on either side of the wall is no more than 150 mm.

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

i) 15M bars spaced not more than 1.2 m o.c., or

ii) 10M bars spaced not more than 600 mm 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 150 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 150 mm Flat Insulating Concrete Form Foundation Walls

Forming Part of Sentence 9.15.4.5.(2)

Max. Height of Finished Ground Above Finished <i>Basement</i> Floor, m	Minimum Vertical Reinforcement		
	Maximum Unsupported <i>Basement</i> 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 <i>Basement</i> Floor, m	Minimum Vertical Reinforcement		
	Maximum Unsupported <i>Basement</i> 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	Minimum Vertical Reinforcement

Above Finished <i>Basement</i> Floor, m	Maximum Unsupported <i>Basement</i> 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), not less than 100 mm of coarse clean granular material containing not more than 10% of material that will pass a 4 mm sieve shall be placed 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) Granular material need not be installed under
 - 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 clean coarse aggregate 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 trowelled 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, "Specification of 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 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 m² of unobstructed vent area for every 50 m² 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 m² 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 m² 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
 - iii) are erected in locations where the seismic design parameter, S_{max} , for Site Class C is not greater than 0.27 (see also Article 9.4.2.5.).

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 also Article 9.4.2.5.)

1) In locations where the seismic design parameter, S_{max} , for Site Class C is greater than 0.37, *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 seismic design parameter, S_{max} , for Site Class C is greater than 0.23 but not greater than 0.37, *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 C73, "Standard Specification for Calcium Silicate Brick (Sand-Lime Brick),"
 - b) ASTM C126, "Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units,"
 - c) ASTM C212, "Standard Specification for 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 durable.

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 <i>loadbearing</i> cellular blocks	Not permitted	5
Solid non- <i>loadbearing</i> cellular blocks	Not permitted	2

9.20.3. Mortar

9.20.3.1. Mortar Materials

- 1) Cementitious materials and aggregates for mortar and grout shall comply with CAN/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 CAN/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. 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
- under the starting course,
 - in all courses of columns, and
 - 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
- conform to Table 9.20.5.2., and
 - 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 *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 mm², 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,
- e) pre-bent during manufacture to a right angle within 6 mm of the fastener hole,
- f) fastened with
 - i) corrosion-resistant wood screws conforming to Sentence 9.23.3.1.(3) that have a minimum diameter of 4.16 mm (No. 8) and a wood penetration of not less than 38 mm, or
 - ii) corrosion-resistant common spiral nails conforming to Sentence 9.23.3.1.(1) that are not less than 76 mm long and have a wood penetration of not less than 63 mm, and
- g) 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) Where hot-dipped, zinc-coated straps are used to meet the requirements of Sentence (1), they shall be pre-bent and pre-drilled or pre-punched prior to hot-dip, zinc-coated galvanizing.

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 CAN/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 A153/A153M	Class B2 or 458 g/m ²
Hardware and bolts	ASTM A153/A153M	See ASTM A153/A153M
Strip, plate, bars and rolled sections (not less than 3.18 mm thick)	ASTM A123/A123M	610 g/m ²
Sheet (less than 3.18 mm thick)	ASTM A123/A123M	460 g/m ² on material 0.76 mm thick ⁽¹⁾

Notes to Table 9.20.16.1.:

⁽¹⁾ ASTM A123/A123M does not apply to metal less than 0.76 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 territorial regulations or municipal bylaws 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, m²	Forming Part of Sentence 6.2.2.10(1)							
	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 C27, "Standard Classification of 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, "Standard for 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, "Standard for Factory-Built Fireplace Systems."

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, "Standard for 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.)

1) Subject to the application limitations defined elsewhere in this Part, 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. Connections to Preservative-Treated Wood

1) Except as provided in Sentence (3), connectors in contact with preservative-treated wood shall be made of

a) hot-dipped, zinc-coated galvanized steel with a coating weight not less than Z550 conforming to ASTM A653/A653M, "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process,"

b) a material that provides an equivalent level of corrosion protection to that provided by the material described in Clause (a), or

c) stainless steel.

2) Fasteners used to attach the connectors referred to in Sentence (1) shall be made of

a) galvanized steel coated with zinc in accordance with ASTM A153/A153M, "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware," or

b) a material that provides an equivalent level of performance and is compatible with the connector.

3) Connectors and fasteners that are in contact with wood that has been treated with a disodium octaborate tetrahydrate (SBX (DOT)) or zinc borate preservative and is installed in a dry interior environment are permitted to be made of uncoated carbon steel. (See Note A-9.23.2.4.(3).)

9.23.2.5. Lumber

1) Lumber shall conform to Subsection 9.3.2.

9.23.3. Fasteners and Connectors

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 F1667, "Standard Specification for 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. and 9.23.3.5.-A to 9.23.3.5.-C 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	Minimum Diameter of Nails, mm
45	2.64
51	2.84
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 Sentences 9.23.3.4.(1) and 9.23.14.4.(2)

Construction Detail	Minimum Length of Nails, mm	Minimum Number or Maximum Spacing of Nails ⁽¹⁾
Floor joist or blocking perpendicular to sill plate or top wall plate below – toe nail	82	2 per floor joist or blocking
<i>Rim joist</i> , trimmer joist or blocking – supporting walls with required <i>braced wall panels</i> – 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
Blocking to stud or 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 studs at openings, within walls, or abutting studs at wall intersections and corners – in required <i>braced wall panels</i>	76	300 mm o.c.
Doubled top wall plates ⁽¹⁾	76	600 mm o.c.
Bottom wall plate or sole plate to floor joists, <i>rim joists</i> or blocking (exterior walls) ⁽²⁾	82	400 mm o.c.
Bottom wall plate or sole plate – in required <i>braced wall panels</i> – to floor joists, <i>rim joists</i> or blocking (exterior walls) ⁽²⁾	82	150 mm o.c.
Interior walls to framing or subflooring	82	600 mm o.c.
Required <i>braced wall panels</i> – 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 <i>loadbearing</i> 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.
End-joist or end-rafter to built-up wall stud ⁽⁴⁾	76	5 or 8 ⁽⁵⁾

Notes to Table 9.23.3.4.:

⁽¹⁾ See Note A-9.23.3.1.(2).

⁽²⁾ See Article 9.23.11.4. for requirements on the nailing of top plates splices in *braced wall bands*.

⁽³⁾ See Sentence 9.23.3.4.(2).

⁽⁴⁾ See Sentence 9.23.3.4.(3).

⁽⁵⁾ Where heavyweight construction is used in the roof of the space, at least 8 nails are required (see Note A-9.23.13.2.(3)).

3) Where the 1-in-50-year 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) Fastening of the following shall conform to Table 9.23.3.5.-A:

- a) subflooring,
- b) wall sheathing not in a required *braced wall panel*, and
- c) roof sheathing where the 1-in-50-year hourly wind pressure (HWP) is not greater than 0.6 kPa and the seismic design parameter, S_{max} , for Site Class C is not greater than 0.47.

Table 9.23.3.5.-A
Fastening of Subflooring, Wall Sheathing Not in a Required Braced Wall Panel, and Roof Sheathing Where
HWP $\leq$ 0.6 kPa and S_{max} for Site Class C $\leq$ 0.47
Forming Part of Sentence 9.23.3.5.(1)

Element	Minimum Length of Fasteners, mm				Minimum Number or Maximum Spacing of Fasteners ⁽¹⁾
	Common or Spiral Nails	Ring Thread 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	

Note to Table 9.23.3.5.-A:

⁽¹⁾ See Note A-9.23.3.1.(2).

2) Except as provided in Sentence (4), fastening of roof sheathing shall conform to Table 9.23.3.5.-B, where

- a) the 1-in-50-year hourly wind pressure (HWP) is greater than 0.6 kPa but not greater than 1.2 kPa, or
- b) the seismic design parameter, S_{max} , for Site Class C is greater than 0.47 but S_{max} is not greater than 2.6.

Table 9.23.3.5.-B
Fastening of Roof Sheathing Where 0.6 kPa < HWP $\leq$ 1.2 kPa or Where S_{max} for Site Class C > 0.47 and S_{max}
 $\leq$ 2.6
Forming Part of Sentence 9.23.3.5.(2)

HWP and S_{max} ⁽¹⁾ Limits	Element	Minimum Length of Fasteners, mm			Minimum Number or Maximum Spacing of Fasteners ⁽²⁾
		Common, Spiral or Ring Thread Nails	Screws	14-Gauge Staples	
0.6 kPa < HWP $\leq$ 0.8 kPa and $S_{max} \leq$ 0.6 or S_{max} for Site Class C > 0.47, $S_{max} \leq$ 0.6 and HWP $\leq$ 0.8 kPa	Board lumber 184 mm or less wide ⁽³⁾	63	51	63	2 per support
	Board lumber more than 184 mm wide ⁽³⁾	63	51	63	3 per support
	Plywood, OSB or waferboard up to 20 mm thick	63	51	63	150 mm o.c. along the edges of sheathing panels and 300 mm o.c. along intermediate supports
	Plywood, OSB or waferboard over 20 mm and up to 25 mm thick	63	57	n/a	
0.8 kPa < HWP $\leq$ 1.2 kPa and $S_{max} \leq$ 2.6 or S_{max} for Site Class C > 0.47, 0.6 < $S_{max} \leq$ 2.6 and HWP $\leq$ 1.2 kPa	Plywood, OSB or waferboard up to 20 mm thick	63	51	n/a	75 mm o.c. along the edges of sheathing panels, 300 mm o.c. along intermediate supports, and where 0.8 kPa
	Plywood, OSB or waferboard over	63	57	n/a	

	20 mm and up to 25 mm thick				< HWP ≤ 1.2 kPa, 50 mm o.c. within 1 m of the edges of the roof

Notes to Table 9.23.3.5.-B:

⁽¹⁾ See Article 9.4.2.5.

⁽²⁾ See Note A-9.23.3.1.(2).

⁽³⁾ See Article 9.23.16.5.

3) Except as provided in Sentence (4), fastening of wall sheathing in required *braced wall panels* shall conform to the reference framing types specified in Table 9.23.3.5.-C.

Table 9.23.3.5.-C
Fastening of Wall Sheathing in Required Braced Wall Panels Where $HWP \leq 1.2\text{kPa}$ and $S_{\max} \leq 2.6$
Forming Part of Sentence 9.23.3.5.(3)

Reference framing type ⁽¹⁾	Minimum Sheathing Element ⁽²⁾ and Maximum Stud Spacing	Minimum Specifications for Fasteners		Minimum Number or Maximum Spacing of Fasteners ⁽³⁾⁽⁴⁾ along Panel Edges Fastened to Framing
		Common, Spiral or Ring Thread Nails	Screws	
GWB-O (interior side of WSP and DWB framing types)	12.5 mm gypsum board for 600 mm stud spacing	2.48 mm diameter ring thread with 20 mm penetration into support framing ⁽⁵⁾	3.45 mm shank diameter, Type W, with 20 mm penetration into support framing ⁽⁶⁾	200 mm o.c. for nails or 300 mm o.c. for screws
GWB-A	12.5 mm gypsum board for 600 mm stud spacing			200 mm o.c. for nails or 300 mm o.c. for screws
GWB-B	12.5 mm gypsum board for 400 mm stud spacing			200 mm o.c.
GWB-C	12.5 mm gypsum board for 400 mm stud spacing or 12.5 mm gypsum board, blocked, ⁽⁷⁾ for 600 mm stud spacing			150 mm o.c. or 200 mm o.c. for blocked
GWB-D	12.5 mm gypsum board for 400 mm stud spacing			100 mm o.c.
WSP-A	9.5 mm plywood, OSB or waferboard for 400 mm stud spacing	2.84 mm x 51 mm ⁽⁸⁾	NP ⁽⁸⁾	150 mm o.c.
WSP-B	11 mm plywood, OSB or waferboard, blocked, ⁽⁷⁾ for 600 mm stud spacing	3.25 mm x 63 mm ⁽⁸⁾		150 mm o.c.
WSP-C	11 mm plywood, OSB or waferboard, blocked, ⁽⁷⁾ for 600 mm stud spacing	3.25 mm x 63 mm ⁽⁸⁾		100 mm o.c.
WSP-D	11 mm plywood, OSB or waferboard, blocked, ⁽⁷⁾ for 600 mm stud spacing	3.25 mm x 63 mm ⁽⁸⁾		75 mm o.c.
WSP-E	15.5 mm plywood, OSB or waferboard, blocked, ⁽⁷⁾ for 600 mm stud spacing	3.66 mm x 76 mm ⁽⁸⁾		75 mm o.c.
DWB	19 mm diagonal lumber board	3.25 mm x 63 mm ⁽⁸⁾	3.25 mm x 51 mm	2 per support framing where lumber width ≤ 184 mm or 3 per support framing where lumber width > 184 mm

Notes to Table 9.23.3.5.-C:

⁽¹⁾ See Note A-Table 9.23.3.5.-C.

⁽²⁾ Plywood, OSB, waferboard and board lumber shall conform to the material standards specified in Subsection 9.23.17. Wood-based panels may be installed vertically or horizontally. Gypsum sheathing shall conform to the requirements of gypsum board in Subsection 9.29.5.

⁽³⁾ See Note A-9.23.3.1.(2).

⁽⁴⁾ For plywood, OSB, or waferboard panel sheathing, the maximum fastener spacing along intermediate supports shall be 300 mm o.c. For gypsum sheathing, the maximum spacing along intermediate supports shall conform to Sentence 9.29.5.8.(4) for nails and Sentence 9.29.5.9.(4) for screws.

⁽⁵⁾ Nails for GWB framing types shall conform to Article 9.29.5.6.

⁽⁶⁾ Screws for GWB framing types shall conform to Article 9.29.5.7.

⁽⁷⁾ Where blocking is required, horizontal joints of panel sheathing shall occur over blocking consisting of not less than 38 mm x 89 mm lumber oriented either edgewise or flatwise, and the panel sheathing shall be fastened to the blocking.

⁽⁸⁾ Nails for WSP and DWB framing types shall conform to Article 9.23.3.1.

⁽⁹⁾ NP = Not permitted

- 4) Fastening of wall sheathing in required *braced wall panels* and roof sheathing shall conform to Part 4, where
 - a) the 1-in-50-year hourly wind pressure (HWP) is greater than 1.2 kPa,
 - b) the seismic design parameter, S_{max} , is greater than 2.6, or
 - c) the seismic design parameter, S_{max} , for Site Class C is greater than 0.47, for *buildings of 3 storeys in building height* and
 - i) of heavy weight construction,
 - ii) clad at full height with masonry veneer, or
 - iii) clad at full height with stone veneer.

(See Sentence 9.23.13.2.(3).)

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.

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 9.26., 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 that considers wind and earthquake loads and lateral earth pressures shows that 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) Except as provided in Sentence (6), where the seismic design parameter, *S*_{max}, for Site Class C is greater than 0.47, anchorage of *braced wall panel* shall be provided by fastening the sill plate to the *foundation* with anchor bolts, such that

- a) there are not less than two anchor bolts per *braced wall panel*, located at opposite ends of the *braced wall panel* within 0.5 m of the *foundation* end or within 0.3 m of the end of the *braced wall panel*, and
- b) anchor bolts spaced in accordance with Table 9.23.6.1. (See Note A-9.23.6.1.(3).)

Table 9.23.6.1.-A

Anchor Bolt Spacing within Braced Wall Panels Where HWP ≤ 1.2 kPa, *S*_{max} for Site Class C > 0.47 and *S*_{max} ≤ 2.6

Forming Part of Sentence 9.23.6.1.(3)

	Maximum Spacing of Anchor Bolts within <i>Braced Wall Panels</i> , m

Reference Framing Type	Anchor Bolt Diameter	
	12.7 mm	15.9 mm
GWB-A	2.4	2.4
GWB-B	2.4	2.4
GWB-C	1.8	2.4
GWB-D	1.4	2.1
WSP-A	1.4	2.1
WSP-B	0.8	1.2
WSP-C	0.7	1.0
WSP-D	0.6	0.9
WSP-E	0.5	0.8
DWB	0.8	1.2

- 5) Anchor bolts referred to in Sentences (2) and (3) 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) Anchorage shall be designed according to Part 4, where
 - a) the 1-in-50-year hourly wind pressure (HWP) is greater than 1.2 kPa,
 - b) the seismic design parameter, S_{max} , is greater than 2.6, or
 - c) the seismic design parameter, S_{max} , for Site Class C is greater than 0.47, for *buildings* of 3 storeys in *building height* and
 - i) of heavy weight construction,
 - ii) clad at full height with masonry veneer, or
 - iii) clad at full height with some stone veneer.
- (See Sentence 9.23.13.2.(3).)

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 m² 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 installation of buildings."

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 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	Supported Loads (including <i>dead loads</i>)	Minimum Stud Size, mm	Maximum Stud	Maximum Unsupported

Wall			Spacing, mm	Height, m
Interior	No load	38 × 38	400	2.4
		38 × 89 flat ⁽¹⁾	400	3.6
	Attic not accessible by a stairway	38 × 64	600	3.0
		38 × 64 flat ⁽¹⁾	400	2.4
		38 × 89	600	3.6
		38 × 89 flat ⁽¹⁾	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 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
 - a) one stud spacing where the number of nails required by Sentence (5) is not more than 16,
 - b) two stud spacings where the number of nails required by Sentence (5) is greater than 16 and not more than 32, and
 - c) three stud spacings where the number of nails required by Sentence (5) is greater than 32.
- 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) Except as provided in Sentence (7), doubled top plates in *braced wall bands* shall be fastened on each side of a splice with not less than 76 mm long common steel wire nails or spiral nails in accordance with the minimum number of nails required by Table 9.23.11.4.-A or 9.23.11.4.-C, whichever is greater, where
 - a) the seismic design parameter, S_{max} for Site Class C is greater than 0.47 and S_{max} is not greater than 2.6, or
 - b) the 1-in-50-year hourly wind pressure (HWP) is equal to or greater than 0.6 kPa but not greater than 1.2 kPa.

Table 9.23.11.4.-A
Fasteners in Doubled Top Plate Splice Connections in Braced Wall Bands where S_{max} for Site Class C > 0.47 and $S_{max} \leq 2.6^{(1)}$
 Forming Part of Sentence 9.23.11.4.(5)

$S_{max}^{(1)}$	Minimum Number of Nails on Each Side of Doubled Top Plate Splice for <i>Braced Wall Band</i> Spacing of 10.6 m ⁽²⁾			
	Weight of Construction or Cladding Type ⁽³⁾			
	Normal-Weight Construction	Heavyweight construction ⁽⁴⁾	Masonry Veneer (on one or more <i>building</i> faces) ⁽⁴⁾⁽⁵⁾	Stone Veneer (on one or more <i>building</i> faces) ⁽⁴⁾⁽⁵⁾
$S_{max} \leq 0.60$	4	7	8	10
$0.6 < S_{max} \leq 0.8$	6	8	9	12
$0.8 < S_{max} \leq 1.2$	9	12	14	19
$1.2 < S_{max} \leq 1.6$	12	16	19	25
$1.6 < S_{max} \leq 2.0$	14	20	23	31
$2.0 < S_{max} \leq 2.6$	19	25	30	40

Notes to Table 9.23.11.4.-A:

- ⁽¹⁾ See Article 9.4.2.5.
- ⁽²⁾ For *braced wall band* spacing of 7.6 m or less, the minimum number of fasteners is permitted to be divided by 2.
- ⁽³⁾ See Sentence 9.23.13.2.(3).
- ⁽⁴⁾ Limited to 2 storeys in *building height*. See Sentence (7).
- ⁽⁵⁾ Where the height of the masonry or stone veneer does not exceed half *storey* above the *foundation*, the veneer may be disregarded.

Table 9.23.11.4.-C

Fasteners in Doubled Top Plate Splice Connections in Braced Wall Bands Where $0.6 \text{ kPa} < \text{HWP} \leq 1.2 \text{ kPa}$
 Forming Part of Sentence 9.23.11.4.(5)

HWP	Minimum Number of Nails on Each Side of Doubled Top Plate Splice for <i>Braced Wall Band</i> Spacing of 10.6 m ⁽¹⁾

	Rough Terrain ⁽²⁾ , and Roof Eave-to-Ridge Height of 3 m ⁽³⁾
HWP ≤ 0.3	7
0.3 < HWP ≤ 0.4	9
0.4 < HWP ≤ 0.5	11
0.5 < HWP ≤ 0.6	13
0.6 < HWP ≤ 0.9	20
0.9 < HWP ≤ 1.2	26

Notes to Table 9.23.11.4.-C:

⁽¹⁾ For a *braced wall band* spacing of 7.6 m or less, the minimum number of nails may be divided by 2.

⁽²⁾ For open terrain, multiply the minimum number of nails by the wind exposure adjustment factor, K_{exp} , as provided in Table 9.23.13.7.-B. see Note A-9.23.13.7.(3) and (4)

⁽³⁾ For roof-level top plates (i.e. top plates supporting roof framing), multiply the minimum number of nails by the roof eave-to-ridge height adjustment factor, K_{roof} , as provided in Table 9.23.13.7-B.

6) Nails referred to in Sentence (5) shall be spaced not less than 75 mm o.c. along the top plate in rows spaced not less than 35 mm apart.

7) Doubled top plates in *braced wall bands* shall be designed according to Part 4 where

a) the 1-in-50-year hourly wind pressure (HWP) is greater than 1.2 kPa,

b) the seismic design parameter, S_{max} , is greater than 2.6, or

c) the seismic design parameter, S_{max} , is greater than 0.47 for Site Class C for *buildings* of 3 storeys in *building height* and

i) of heavy weight construction,

ii) clad with masonry veneer, or

iii) clad with stone veneer.

(see Sentence 9.23.13.2.(3)).

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

- 1) This Article applies where
 - a) the seismic design parameter, S_{max} , for Site Class C, is not more than 0.47,
 - b) the 1-in-50-year hourly wind pressure (HWP) is not greater than 0.60 kPa,
 - c) the unsupported height of the *braced wall panels* in the *building* is not greater than 3.1 m, and
 - d) the lowest exterior frame wall supports a roof and not more than 2 floors.
- 2) Bracing to resist lateral loads shall be designed and constructed in accordance with
 - a) the simplified approach outlined in Article 9.23.13.11., where the seismic design parameter, S_{max} , is not greater than 0.47 and the 1-in-50-year hourly wind pressure (HWP) is not greater than 0.60 kPa,
 - b) Articles 9.23.13.4. to 9.23.13.10.,
 - c) Part 4, or
 - d) good engineering practice such as that provided in CWC “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 where
 - a) the unsupported height of the *braced wall panels* in the *building* is not greater than 3.1 m,
 - b) 1-in-50-year hourly wind pressure (HWP) is not greater than 1.2 kPa,
 - c) the seismic design parameter, S_{max} , is not greater than 2.6, and
 - d) the lowest exterior frame wall supports a roof and not more than
 - i) 2 floors in a *building* of normal-weight construction, or
 - ii) 1 floor in a *building* of heavyweight construction or clad at full height with masonry veneer or stone veneer.
- 2) Bracing to resist lateral loads shall be designed and constructed in accordance with
 - a) Articles 9.23.13.4. to 9.23.13.10.,
 - b) Part 4, or
 - c) good engineering practice such as that provided in CWC “Engineering Guide for Wood Frame Construction.”
- 3) For the purposes of Sentence (1) and this Part,
 - a) in a *building* of normal-weight construction, the average dead weight per storey shall not exceed
 - i) 0.5 kPa for floors and 0.5 kPa for *partitions* and interior walls,

- ii) 0.5 kPa for the roof, and
- iii) 0.4 kPa for exterior walls,
- b) in a building of heavyweight construction, the average dead weight per *storey* shall conform to Clause (a), except that the average dead weight per *storey* shall not exceed
 - i) 1.5 kPa for floors and 0.5 kPa for *partitions* and interior walls,
 - ii) 1.0 kPa for the roof, or
 - iii) 1.2 kPa for exterior walls,
- c) in a *building* clad with masonry veneer, the average dead weight of the masonry veneer shall not exceed 1.9 kPa, and
- d) in a *building* clad with stone veneer, the average dead weight of the stone veneer shall not exceed 3.2 kPa. (See Note A-9.23.13.2.(3).)

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 where
 - a) the 1-in-50-year hourly wind pressure (HWP) is greater than 1.2 kPa,
 - b) the seismic design parameter, S_{max} , is greater than 2.6, or
 - d) the seismic design parameter, S_{max} , for Site Class C is greater than 0.47, and the lowest exterior frame wall supports a roof and more than 1 floor in a *building* of heavyweight construction or clad at full height with masonry veneer or stone veneer.
- 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 the CWC "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) surround the perimeter of the *building*,
 - b) be full *storey* height,
 - c) be not more than 1.2 m wide,
 - d) lap at both ends with another *braced wall band*,
 - e) be aligned with *braced wall bands* on *storeys* above and below, and
 - f) conform to the spacing and dimensions given in Table 9.23.13.5. and Article 9.23.13.7.
- 2) 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) and 9.23.13.10.(2) to (4) and Article 9.23.13.7., *braced wall panels* shall
 - a) be located within *braced wall bands*,
 - b) be laterally supported at each floor level and the roof,
 - c) 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
 - d) conform to the spacing and dimensions given in Table 9.23.13.5. and Article 9.23.13.7.

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 <i>Braced Wall Bands</i> and <i>Braced Wall Panels</i> ^{(1),(2),(3)}
Maximum distance between centre lines of adjacent <i>braced wall bands</i> measured from the furthest points between centres of the bands ⁽⁴⁾	10.6 m
Maximum distance between required <i>braced wall panels</i> measured from the edges of the panels	6.4 m
Maximum distance from the end of a <i>braced wall band</i> to the edge of the closest required <i>braced wall panel</i>	2.4 m
Minimum length of individual wood-sheathed <i>braced wall panels</i> :	
• panel located at the end of a <i>braced wall band</i> where the <i>braced wall panel</i> connects to an intersecting <i>braced wall panel</i>	600 mm
• panel not located at the end of a <i>braced wall band</i> or <i>braced wall panel</i> located at the end of a <i>braced wall band</i> where the <i>braced wall panel</i> does not connect to an intersecting <i>braced wall panel</i>	750 mm
Minimum length of individual <i>braced wall panels</i> sheathed only with gypsum board	1.2 m
Minimum length of individual diagonal-lumber-sheathed <i>braced wall panels</i>	1.2 m
Minimum total length of all <i>braced wall panels</i> in a <i>braced wall band</i>	Per Article 9.23.13.7.

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 9.23.13.10. for additional system considerations.

⁽⁴⁾ See Sentence (2) for an exception for *basements* and crawl spaces.

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

- a) have a total length of braced wall panels not less than the total length in the *braced wall band* in the storey above, and
- b) be spaced not more than
 - i) 15 m from the perimeter *foundation* walls,
 - ii) 15 m from interior *foundation* walls, and
 - iii) 15 m from adjacent *braced wall bands* constructed with *braced wall panels*.

(See Note A-9.23.13.5.(2).)

3) Interior or exterior wood-sheathed *braced wall panels*, other than panels of WSP-A framing in the uppermost storey shall

- a) extend to the roof framing, and
- b) have their the top plate connected to
 - i) top chords of perpendicular or offset parallel trusses by using blocking panels or other methods of lateral load transfer designed by the roof truss manufacturer,
 - ii) perpendicular or offset parallel joists or rafters by using blocking of the same construction as the *braced wall panel* below, or
 - iii) rafters, joists or trusses by using methods of lateral load transfer designed in accordance with good engineering practice.

(See Note A-9.23.13.5.(3) and (4).)

4) The top plates of braced wall panels described in Sentence (3) shall be fastened in accordance with Table 9.23.3.4.

(See Note A-9.23.13.5.(3) and (4).)

9.23.13.6. Materials in Braced Wall Panels

1) Required *braced wall panels* shall be

a) sheathed on the exterior side with plywood, OSB, waferboard or diagonal lumber complying with Subsection 9.23.17. fastened in accordance with Sentence 9.23.3.5.(3) and finished on the interior side with gypsum board complying with Subsection 9.29.5., or

b) sheathed on the interior side or exterior side with gypsum board complying with Subsection 9.29.5. and fastened in accordance with Sentence 9.23.3.5.(3). (See Note A-9.23.13.6.(1).)

2) Except as provided in Sentences (4) and (5), *braced wall bands* shall be constructed of *braced wall panels* of the same sheathing material.

3) *Braced wall panels* in *basements* and *crawl spaces* shall be sheathed with OSB, plywood, waferboard or diagonal lumber

a) at *braced wall band* spacing intervals of not more than 15 m, and

b) under all interior *braced wall bands* containing wood-sheathed *braced wall panels*. (See Note A-9.23.13.6.(3).)

4) Mixing of *braced wall panel* framing types is permitted in stacked *braced wall bands*, provided that wood-sheathed *braced wall panels* are not above any *braced wall bands* containing

a) gypsum-sheathed *braced wall panels*, or

b) diagonal-lumber-sheathed *braced wall panels*.

5) Mixing of *braced wall panel* framing types is permitted along a *braced wall band* within the same storey, provided that

a) panels of WSP-A or WSP-B framing type are substituted for panels of a GWB framing type and the total length of all of the *braced wall panels* is determined based on the GWB framing type, or

b) the lengths of the *braced wall panels* of mixed framing types are based on accepted engineering principles.

(See Note A-9.23.13.6.(5).)

9.23.13.7. Braced Wall Panel Length

1) Except as provided in Tables 9.23.13.7.-B and 9.23.13.7.-D, all adjustment factors required for the calculation of the minimum total length of *braced wall panels* in accordance with this Article shall be taken as 1.

2) The minimum total length of all *braced wall panels* in a *braced wall band* shall be taken as the greater of L_w determined in Sentence (3) for the appropriate 1-in-50-year hourly wind pressure (HWP) and L_s as determined in Sentence (4) for the appropriate seismic design parameter, S_{max} , where

a) HWP is not greater than 1.2 kPa, and

b) S_{max} for Site Class C, is not greater than 2.6.

3) For resistance to wind pressure, the minimum total length of *braced wall panels* in each *braced wall band*, L_w , shall be determined by applying the adjustment factors provided in Table 9.23.13.7.-B to the unadjusted minimum total *braced wall panel* length L_{uw} provided in Table 9.23.13.7.-A using the following equation:

$$L_w = L_{uw} K_{exp} K_{roof} K_{Wspacing} K_{Wnumber} K_{gyp} K_{sheath} \geq BWP_{min}$$

where

K_{exp} = wind exposure adjustment factor, and

= 1 for rough terrain (suburban, urban or wooded terrain extending upwind from the *building* uninterrupted for at least 1 km), K_{roof} = roof eave-to-ridge height adjustment factor, and

= 1 for a roof eave-to-ridge height of 3 m

$K_{Wspacing}$ = *braced wall band* spacing adjustment factor for wind (see Sentence (5)), per *building* plan direction, and
 = 1 for a *braced wall band* spacing of 7.6 m

$K_{Wnumber}$ = number of parallel *braced wall bands* adjustment factor for wind, per *building* plan direction, and
 = 1 for two exterior walls and no intermediate *braced wall bands*,

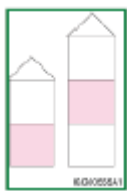
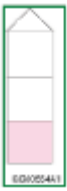
K_{gyp} = interior gypsum board adjustment factor, and
 = 1 for *braced wall panels* with gypsum board installed on the interior side,

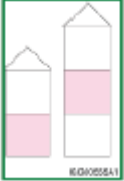
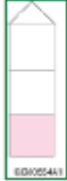
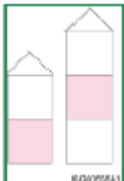
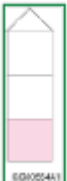
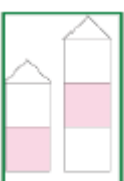
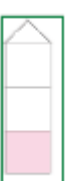
K_{sheath} = intermittent *braced wall panels* adjustment factor, and
 = 1 for continuously sheathed *braced wall bands*, and

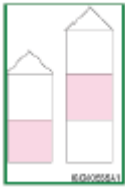
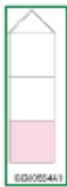
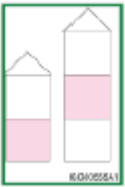
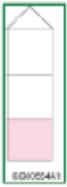
BWP_{min} = Minimum length of individual *braced wall panels* as per Table 9.23.13.5.

(See Note A-9.23.13.7.(3) for an alternative procedure to calculate L_w , directly and Note A-9.23.13.7.(4).)

Table 9.23.13.7.-A
Unadjusted Minimum Total Braced Wall Panel Lengths for Wind
 Forming Part of Sentence 9.23.13.7.(3)

		Unadjusted Minimum Total <i>Braced Wall Panel</i> Length for Wind, L_{uw} , m ⁽¹⁾									
		Diagonal-Lumber-Sheathed Framing Type (with gypsum board on opposite side) ⁽²⁾	Gypsum-Sheathed Framing Type (with gypsum board on only one side) ⁽²⁾⁽³⁾				Wood-sheathed Framing Type (with gypsum board on opposite side) ⁽²⁾				
HWP	Storey	DWB	GWB-A	GWB-B	GWB-C	GWB-D	WSP-A	WSP-B	WSP-C	WSP-D	WSP-E
HWP ≤ 0.3		0.65	3.29	1.91	1.42	1.14	1.14	0.60	0.52	0.48	0.43
		1.33	6.75	3.92	2.91	2.35	2.35	1.24	1.08	0.98	0.88
		2.02	10.21	5.93	4.40	3.57	3.57	1.87	1.63	1.49	1.34
0.3 < HWP ≤ 0.4		0.86	4.38	2.54	1.89	1.52	1.52	0.80	0.70	0.64	0.57

		1.78	9.00	5.23	3.88	3.14	3.14	1.65	1.43	1.31	1.18
		2.69	13.61	7.91	5.86	4.75	4.75	2.50	2.17	1.98	1.79
0.4 < HWP ≤ 0.5		1.08	5.84	3.18	2.36	1.90	1.90	1.00	0.87	0.79	0.72
		2.22	11.25	6.54	4.85	3.92	3.92	2.06	1.79	1.63	1.47
		3.37	17.01	9.88	7.33	5.94	5.94	3.12	2.72	2.48	2.23
0.5 < HWP ≤ 0.6		1.29	6.57	3.82	2.83	2.29	2.29	1.20	1.05	0.95	0.86
		2.67	13.50	7.84	5.82	4.71	4.71	2.47	2.15	1.96	1.77
		4.04	20.42	11.86	8.79	7.13	7.13	3.75	3.26	2.97	2.68

0.6 < HWP ≤ 0.9		1.94	9.86	5.73	4.25	3.43	3.43	1.80	1.57	1.43	1.29
		4.00	20.25	11.76	8.72	7.06	7.06	3.71	3.23	2.94	2.65
		6.06	30.62	17.79	13.19	10.70	10.70	5.62	4.89	4.46	4.02
0.9 < HWP ≤ 1.2		2.59	13.14	7.63	5.66	4.57	4.57	2.40	2.09	1.91	1.72
		5.33	27.00	15.68	11.63	9.41	9.41	4.95	4.30	3.92	3.54
		8.08	40.83	23.72	17.59	14.26	14.26	7.50	6.52	5.94	5.36

Notes to Table 9.23.13.7.-A:

- (1) Unadjusted minimum total *braced wall panel* lengths are for the applicable conditions corresponding to an adjustment factor of 1 in the equation for L_w .
- (2) See Sentence 9.23.3.5.(3) for a description of framing types and fastening requirements.
- (3) See Sentence (6) for *braced wall panels* with gypsum board installed on both sides.

Table 9.23.13.7.-B
Adjustment Factors for the Determination of Minimum Total Braced Wall Panel Lengths for Wind
Forming Part of Sentence 9.23.13.7.(3)

Symbol	Description	Storey	Condition	Adjustment Factor
$K_{exp}^{(1)}$	Wind exposure: apply factor to all storeys in both directions	All storeys	Rough terrain	1.00
		<u>All storeys in 1 – storey building</u>	Open terrain	1.29
		<u>All storeys in 2 – storey building</u>		1.40
		<u>All storeys in 3 – storey building</u>		1.48

K _{roof} ⁽²⁾	Roof eave-to-ridge height: apply factor separately to each storey	Storey supporting roof only	≤ 1.5 m	0.52
			3.0 m	1.00
			4.5 m	1.58
			6.0 m	1.99
		Storey supporting roof and 1 floor	≤ 1.5 m	0.79
			3.0 m	1.00
			4.5 m	1.26
			6.0 m	1.47
		Storey supporting roof and 2 floors	≤ 1.5 m	0.87
			3.0 m	1.00
			4.5 m	1.16
			6.0 m	1.31
K _{Wspacing} ⁽²⁾⁽³⁾⁽⁴⁾	Braced wall band spacing: apply factor to all braced wall panels per building plan direction	Any storey	3.8 m	0.51
			7.6 m	1.00
			10.6 m	1.35
			15 m ⁽⁵⁾	1.86
K _{Wnumber}	Number of parallel braced wall bands: apply factor to all braced wall panels per building plan direction	Any storey	2	1.00
			3	1.28
			4	1.38
			≥ 5	1.43
K _{gyp}	Interior gypsum board: apply factor in accordance with whether gypsum board is installed or omitted on interior side of braced wall panels	Any storey	Installed	1.00
			Omitted, blocked wall	1.20
			Omitted, unblocked wall	1.40
K _{sheath}	Intermittent braced wall panels: apply factor in accordance with continuity of sheathing within braced wall band	Any storey	Continuously sheathed	1.00
			Intermittently sheathed	1.15

Notes to Table 9.23.13.7.-B:

⁽¹⁾ K_{exp} is determined based on the terrain. Rough terrain is suburban, urban, or wooded terrain extending upwind from the building uninterrupted for at least 1 km. Open terrain is level terrain with only scattered trees, buildings or other obstructions, open water or shorelines.

⁽²⁾ For K_{roof} linear interpolation between roof eave-to-ridge heights is permitted. ³ K_{Wspacing} Linear interpolation between braced wall band spacing is permitted.

⁽⁴⁾ An average braced wall band spacing is permitted to be used for the determination of K_{Wspacing}. See Sentence (5).

⁽⁵⁾ A braced wall band spacing of 15 m is only permitted in basements and crawl spaces.

4) For resistance to seismic forces, the minimum total length of braced wall panels in each braced wall band, L_s, shall be determined by applying the adjustment factors provided in Table 9.23.13.7.-D to the unadjusted minimum total braced wall panel length, L_{us}, provided in Table 9.23.13.7.-C using the following equation:

$$L_s = L_{us} K_{weight} K_{snow} K_{spacing} K_{number} K_{gyp} K_{sheath} \geq BWP_{min}$$

Where:

K_{weight} = weight of construction and cladding adjustment factor, and
= 1 for normal-weight construction (see Sentence 9.23.13.2.(3)),

K_{snow} = roof snow load adjustment factor, and

= 1 for a specified roof snow load of 2 kPa or less, as calculated in accordance with Article 9.4.2.2.,

K_{spacing} = *braced wall band* spacing adjustment factor for seismic forces (see Sentence (5) per *building plan* direction, and

–

= 1 for a *braced wall band* spacing of 7.6 m,

K_{number} = number of parallel *braced wall bands* adjustment factor for seismic forces, per *building plan* direction, and

= 1 for two exterior walls and no intermediate *braced wall bands*,

K_{gyp} = interior gypsum board adjustment factor, and

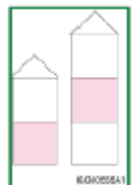
= 1 for *braced wall panels* with gypsum board installed on the interior side,

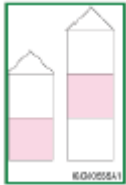
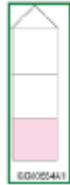
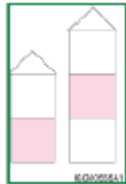
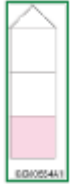
K_{sheath} = intermittent *braced wall panels* adjustment factor, and

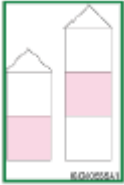
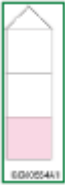
= 1 for continuously sheathed *braced wall bands*, and

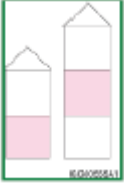
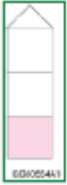
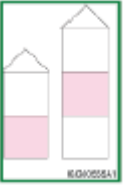
BWP_{min} = minimum length of individual *braced wall panels*, per Table 9.23.13.5. (see Note A-9.23.13.7.(4) for an alternative procedure to calculate L_s directly and Note A-9.23.13.7.(3) and (4).)

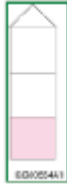
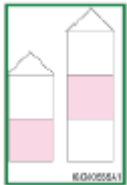
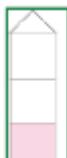
Table 9.23.13.7.-C
Unadjusted Minimum Total Braced Wall Panel Lengths for Seismic Forces
Forming Part of Sentence 9.23.13.7.(4)

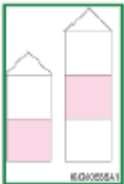
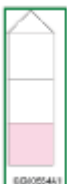
S_{max}	Storey	Building Plan Dimension Parallel to Braced Wall Band, L_{wl} , m	Unadjusted Minimum Total <i>Braced Wall Panel</i> Length for Seismic Forces, L_{us} , m ⁽¹⁾⁽²⁾									
			Diagonal-Lumber-Sheathed Framing Type (with gypsum board on opposite side) ⁽³⁾	Gypsum-Sheathed Framing Type (with gypsum board on only one side) ⁽³⁾⁽⁴⁾				Wood-Sheathed Framing Type (with gypsum board on opposite side) ⁽³⁾				
			DWB	GWB-A	GWB-B	GWB-C	GWB-D	WSP-A	WSP-B	WSP-C	WSP-D	WSP-E
$S_{\text{max}} \leq 0.2$		3.1	0.06	0.47	0.27	0.20	0.17	0.11	0.06	0.05	0.05	0.04
		6.1	0.11	.81	0.47	0.35	0.28	0.19	0.10	0.09	0.08	0.07
		9.1	0.15	1.15	0.67	0.50	0.40	0.27	0.14	0.12	0.11	0.10
		12.2	0.20	1.5	0.87	0.65	0.53	0.35	0.18	0.16	0.15	0.13
		15.2	0.24	1.81	1.05	0.78	0.64	0.43	0.23	0.20	0.18	0.16
		18.3	0.29	2.20	1.28	0.95	0.77	0.51	0.27	0.23	0.21	0.19
		3.1	0.15	1.10	0.65	0.48	0.39	0.26	0.14	0.12	0.11	0.10
		6.1	0.24	1.84	1.07	0.79	0.65	0.43	0.23	0.20	0.18	0.16
		9.1	0.34	2.57	1.49	1.11	0.90	0.60	0.32	0.27	0.25	0.23
		12.2	0.44	3.32	1.93	1.43	1.17	0.78	0.41	0.36	0.32	0.29
		15.2	0.54	3.99	2.31	1.72	1.40	0.95	0.50	0.43	0.39	0.36
		18.3	0.64	4.80	2.79	2.07	1.68	1.12	0.59	0.51	0.47	0.42
		3.1	0.23	1.76	1.02	0.76	0.62	0.41	0.22	0.19	0.17	0.15
		6.1	0.38	2.87	1.67	1.24	1.01	0.67	0.35	0.31	0.28	0.25

		9.1	0.53	3.99	1.49	1.72	1.40	0.93	0.49	0.43	0.39	0.35
		12.2	0.68	5.14	2.99	2.21	1.80	1.20	0.63	0.55	0.50	0.45
		15.2	0.83	6.16	3.58	2.65	2.16	1.46	0.77	0.67	0.61	0.55
		18.3	0.98	7.41	4.30	3.19	2.60	1.73	0.91	0.79	0.72	0.65
0.2 < S _{max} ≤ 0.4		3.1	0.13	0.94	0.55	0.41	0.33	0.22	0.12	0.10	0.09	0.08
		6.1	0.22	1.63	0.94	0.70	0.57	0.38	0.20	0.17	0.16	0.14
		9.1	0.31	2.31	1.34	0.99	0.81	0.54	0.28	0.25	0.22	0.20
		12.2	0.40	3.01	1.75	1.30	1.05	0.70	0.37	0.32	0.29	0.26
		15.2	0.49	3.63	2.11	1.56	1.27	0.86	0.45	0.39	0.36	0.32
		18.3	0.58	4.39	2.55	1.89	1.54	1.03	0.54	0.47	0.43	0.39
		3.1	0.30	2.23	1.30	0.96	0.78	0.52	0.27	0.24	0.22	0.20
		6.1	0.49	3.69	2.14	1.59	1.29	0.86	0.45	0.39	0.36	0.32
		9.1	0.68	5.14	2.99	2.21	1.80	1.20	0.63	0.55	0.50	0.45
		12.2	0.88	6.65	3.86	2.86	2.33	1.55	0.82	0.71	0.65	0.58
		15.2	1.07	7.97	4.63	3.43	2.79	1.89	1.00	0.87	0.79	0.71
		18.3	1.27	9.61	5.58	4.14	3.37	2.25	1.18	1.03	0.94	0.84
		3.1	0.47	DR (1.12)	2.04	1.51	1.23	0.82	0.43	0.38	0.34	0.31
		6.1	0.76	5.50	3.34	2.48	2.01	1.34	0.71	0.61	0.56	0.50
		9.1	1.06	7.98	4.63	3.44	2.80	1.86	0.98	0.85	0.78	0.70
		12.2	1.36	10.29	5.97	4.43	3.61	2.40	1.26	1.10	1.00	0.90
		15.2	1.66	12.31	7.15	5.30	4.32	2.93	1.54	1.34	1.22	1.10
		18.3	1.96	14.82	8.61	6.38	5.20	3.46	1.82	1.58	1.44	1.30
0.4 < S _{max} ≤ 0.6		3.1	0.19	1.42	0.82	0.61	0.50	0.33	0.17	0.15	0.14	0.12
		6.1	0.32	2.44	1.42	1.05	0.85	0.57	0.30	0.26	0.24	0.21
		9.1	0.46	3.46	2.01	1.49	1.21	0.81	0.42	0.37	0.34	0.30
		12.2	0.60	4.51	2.62	1.94	1.58	1.05	0.55	0.48	0.44	0.40
		15.2	0.73	5.44	3.16	2.34	1.91	1.29	0.68	0.59	0.54	0.49
		18.3	0.87	6.59	3.83	2.84	2.31	1.54	0.81	0.70	0.64	0.58
		3.1	0.44	DR (1.67)	1.94	1.44	1.17	0.78	0.41	0.36	0.33	0.29
		6.1	0.73	5.53	3.21	2.38	1.94	1.29	0.68	0.59	0.54	0.49
		9.1	1.02	7.71	4.48	3.32	2.70	1.80	0.95	0.82	0.75	0.68
		12.2	1.32	9.97	5.79	4.29	3.50	2.33	1.23	1.07	0.97	0.88
		15.2	1.61	11.96	6.94	5.15	4.19	2.84	1.49	1.30	1.18	1.07
		18.3	1.91	14.41	8.37	6.21	5.05	3.37	1.77	1.54	1.40	1.27
		3.1	0.70	DR (2.64)	3.06	2.27	1.85	1.23	0.65	0.56	0.51	0.46
		6.1	1.14	DR (4.31)	5.01	3.71	3.02	2.01	1.06	0.92	0.84	0.76
		9.1	1.59	DR (5.99)	6.95	5.15	4.20	2.80	1.47	1.28	1.17	1.05

		12.2	2.04	DR (7.72)	8.96	6.64	5.41	3.61	1.90	1.65	1.50	1.35
		15.2	2.49	DR (9.24)	10.73	7.96	6.48	4.39	2.31	2.01	1.83	1.65
		18.3	2.95	DR (11.12)	12.91	9.58	7.80	5.20	2.73	2.38	2.17	1.95
0.6 < S _{max} ≤ 0.8		3.1	0.25	1.89	1.10	0.81	0.66	0.44	0.23	0.20	0.18	0.17
		6.1	0.43	3.25	1.89	1.40	1.14	0.76	0.40	0.35	0.32	0.29
		9.1	0.61	4.61	2.68	1.99	1.62	1.08	0.57	0.49	0.45	0.40
		12.2	0.80	6.02	3.49	2.59	2.11	1.41	0.74	0.64	0.59	0.53
		15.2	0.98	7.25	4.21	3.12	2.54	1.72	0.91	0.79	0.72	0.65
		18.3	1.16	8.78	5.10	3.78	3.08	2.05	1.08	0.94	0.86	0.77
		3.1	0.59	DR (2.23)	2.59	1.92	1.56	1.04	0.55	0.48	0.43	0.39
		6.1	0.98	DR (3.69)	4.28	3.18	2.58	1.72	0.91	0.79	0.72	0.65
		9.1	1.36	DR (5.14)	5.97	4.43	3.61	2.40	1.26	1.10	1.00	0.90
		12.2	1.76	DR (6.65)	7.72	5.73	4.66	3.11	1.63	1.42	1.29	1.17
		15.2	2.15	DR (7.97)	9.26	6.87	5.59	3.79	1.99	1.73	1.58	1.42
		18.3	2.55	DR (9.61)	11.16	8.28	6.74	4.49	2.36	2.05	1.87	1.69
		3.1	0.93	DR	DR (2.04)	3.03	2.46	1.64	0.86	0.75	0.68	0.62
		6.1	1.52	DR (5.75)	DR (3.34)	4.95	4.03	2.69	1.41	1.23	1.12	1.01
		9.1	2.11	DR (7.98)	DR (4.64)	6.87	5.59	3.73	1.96	1.71	1.55	1.40
		12.2	2.72	DR (10.29)		8.86	7.21	4.81	2.53	2.20	2.00	1.81
		15.2	3.32	DR (12.32)		10.61	8.63	5.85	3.08	2.68	2.44	2.20
		18.3	3.93	DR (14.83)		12.77	10.39	6.93	3.64	3.17	2.89	2.60
		3.1	0.38	2.83	1.65	1.22	0.99	0.66	0.35	0.30	0.28	0.25
		6.1	0.65	4.88	2.83	2.10	1.71	1.14	0.60	0.52	0.47	0.43
		9.1	0.92	6.92	4.02	2.98	2.42	1.62	0.85	0.74	0.67	0.61
		12.2	1.20	9.03	5.24	3.89	3.16	2.11	1.11	0.96	0.88	0.79
		15.2	1.47	10.88	6.32	4.69	3.81	2.59	1.36	1.18	1.08	0.97
		18.3	1.75	13.18	7.65	5.67	4.62	3.08	1.62	1.41	1.28	1.16

0.8 < S _{max} ≤ 1.2		3.1	0.89	DR	DR (1.95)	2.88	2.35	1.56	0.82	0.71	0.65	0.59
		6.1	1.46	DR (5.53)	DR (3.21)	4.76	3.88	2.58	1.36	1.18	1.08	0.97
		9.1	2.04	DR (7.72)	8.96	6.64	5.41	3.61	1.90	1.65	1.50	1.35
		12.2	2.64	DR (9.97)	11.58	8.59	6.99	4.66	2.45	2.13	1.94	1.75
		15.2	3.22	DR (11.96)	13.89	10.30	8.38	5.68	2.99	2.60	2.37	2.13
		18.3	3.82	DR (14.41)	16.74	12.41	10.11	6.74	3.54	3.08	2.81	2.53
		3.1	1.40	DR	DR (3.06)	DR (2.27)	DR (1.85)	2.46	1.30	1.13	1.03	0.93
		6.1	2.28	DR	DR (5.01)	DR (3.72)	6.04	4.03	2.12	1.84	1.68	1.51
		9.1	3.17	DR	DR (6.95)	DR (5.16)	8.39	5.59	2.94	2.56	2.33	2.10
		12.2	4.09	DR	DR (8.96)	DR (6.65)	10.82	7.21	3.79	3.30	3.01	2.71
		15.2	4.97	DR	DR (10.73)	DR (7.96)	12.95	8.78	4.61	4.01	3.66	3.30
		18.3	5.89	DR	DR (12.92)	DR (9.58)	15.59	10.39	5.46	4.75	4.33	3.90
1.2 < S _{max} ≤ 1.6		3.1	0.50	DR (1.89)	2.19	1.63	1.32	0.88	0.46	0.40	0.37	0.33
		6.1	0.86	DR (3.25)	3.78	2.80	2.28	1.52	0.80	0.69	0.63	0.57
		9.1	1.22	DR (4.61)	5.36	3.67	3.23	2.16	1.13	0.99	0.90	0.81
		12.2	1.59	12.03	6.99	5.18	4.22	2.81	1.48	1.29	1.17	1.06
		15.2	1.95	14.51	8.43	6.25	5.09	3.45	1.81	1.58	1.44	1.30
		18.3	2.33	17.57	10.20	7.57	6.16	4.11	2.16	1.88	1.71	1.54
		3.1	1.18	DR	DR (2.59)	DR (1.92)	3.13	2.08	1.10	0.95	0.87	0.78
		6.1	1.95	DR	DR (4.28)	DR (3.18)	5.17	3.45	1.81	1.58	1.44	1.29
		9.1	2.72	DR	DR (5.98)	8.86	7.21	4.81	2.53	2.20	2.00	1.81
		12.2	3.52	DR	DR (7.72)	11.45	9.32	6.21	3.27	2.84	2.59	2.33
		15.2	4.29	DR	DR	13.73	11.18	7.58	3.98	3.46	3.16	2.85

					(9.26)							
		18.3	5.09	DR	DR (11.16)	16.55	13.47	8.98	4.72	4.11	3.74	3.37
		3.1	1.86	DR	DR	DR (3.03)	DR (2.47)	DR	1.73	1.50	1.37	1.23
		6.1	3.05	DR	DR	DR (4.95)	DR (4.03)	5.37	2.82	2.46	2.24	2.02
		9.1	4.23	DR	DR	DR (6.87)	DR (5.60)	7.46	3.92	3.41	3.11	2.80
		12.2	5.45	DR	DR (11.95)	DR (8.86)	DR (7.21)	9.62	5.06	4.40	4.01	3.61
		15.2	6.63	DR	DR (14.31)	DR (10.61)	DR (8.64)	11.70	6.15	5.35	4.88	4.40
		18.3	7.85	DR	DR (17.22)	DR (12.77)	DR (10.40)	13.86	7.29	6.34	5.78	5.21
		3.1	0.63	DR	2.74	2.03	1.66	1.10	0.58	0.50	0.46	0.41
		6.1	1.08	DR (4.07)	4.72	3.50	2.85	1.90	1.00	0.87	0.79	0.71
		9.1	1.53	DR (5.77)	6.70	4.96	4.04	2.69	1.42	1.23	1.12	1.01
		12.2	1.99	DR (7.52)	8.74	6.48	5.27	3.52	1.85	1.61	1.47	1.32
		15.2	2.44	DR (9.07)	10.53	7.81	6.36	4.31	2.27	1.97	1.80	1.62
		18.3	2.91	DR (10.98)	12.75	9.46	7.70	5.13	2.70	2.35	2.14	1.93
		3.1	1.48	DR	DR	DR (2.40)	DR (1.96)	2.61	1.37	1.19	1.09	0.98
		6.1	2.44	DR	DR (5.35)	DR (3.97)	DR (3.23)	4.31	2.26	1.97	1.80	1.62
		9.1	3.41	DR	DR (7.47)	DR (5.54)	DR (4.51)	6.01	3.16	2.75	2.50	2.26
		12.2	4.40	DR	DR (9.65)	DR (7.16)	11.65	7.77	4.08	3.55	3.24	2.92
		15.2	5.37	DR	DR (11.08)	DR (8.58)	13.97	9.47	4.98	4.33	3.95	3.56
		18.3	6.36	DR	DR (13.95)	DR (10.35)	16.84	11.23	5.90	5.13	4.68	4.22
1.6 < S _{max} ≤ 2.0		3.1	2.33	DR	DR	DR	DR (3.08)	DR	2.16	1.88	1.71	1.54
		6.1	3.81	DR	DR	DR	DR (5.04)	DR	3.53	3.07	2.80	2.52

2.0 < S _{max} ≤ 2.6		9.1	5.28	DR	DR	DR (8.59)	DR (7.00)	DR	4.90	4.26	3.89	3.50
		12.2	6.81	DR	DR	DR (11.08)	DR (9.02)	12.02	6.32	5.50	5.01	4.51
		15.2	8.29	DR	DR	DR (13.26)	DR (11.00)	14.63	7.69	6.69	6.10	5.49
		18.3	9.82	DR	DR	DR (15.96)	DR (13.00)	17.32	9.11	7.92	7.22	6.51
		3.1	0.81	DR (3.07)	DR (1.79)	2.65	2.15	1.44	0.75	0.66	0.60	0.54
		6.1	1.40	DR (5.28)	DR (3.07)	4.55	3.70	2.47	1.30	1.13	1.03	0.93
		9.1	1.99	DR (7.50)	8.70	6.45	5.25	3.50	1.84	1.60	1.46	1.32
		12.2	2.59	DR (9.78)	11.36	8.42	6.86	4.57	2.40	2.09	1.90	1.72
		15.2	3.18	DR (11.79)	13.69	10.15	8.27	5.60	2.95	2.56	2.34	2.11
		18.3	3.78	DR (14.28)	16.58	12.30	10.01	6.67	3.51	3.05	2.78	2.51
		3.1	1.92	DR	DR	DR	DR (2.54)	DR	1.78	1.55	1.41	1.27
		6.1	3.17	DR	DR	DR (5.16)	DR (4.20)	5.60	2.94	2.56	2.33	2.10
		9.1	4.43	DR	DR	DR (7.20)	DR (5.86)	7.81	4.11	3.57	3.26	2.93
		12.2	5.72	DR	DR	DR (9.31)	DR (7.58)	10.10	5.31	4.62	4.21	3.79
		15.2	6.98	DR	DR (15.05)	DR (11.16)	DR (9.58)	12.31	6.47	5.63	5.13	4.62
		18.3	8.27	DR	DR (18.14)	DR (13.45)	DR (10.95)	14.60	7.67	6.67	6.08	5.48
		3.1	3.03	DR	DR	DR	DR	DR	2.81	2.44	2.23	2.01
		6.1	4.95	DR	DR	DR	DR	DR	4.59	3.99	3.64	3.28
		9.1	6.87	DR	DR	DR	DR (9.09)	DR	6.37	5.54	5.05	4.55
		12.2	8.86	DR	DR	DR	DR (11.72)	DR	8.22	7.14	6.51	5.87
		15.2	10.78	DR	DR	DR	DR (14.03)	DR	10.00	8.69	7.92	7.14
		18.3	12.76	DR	DR	DR	DR	DR	11.84	10.30	9.38	8.46

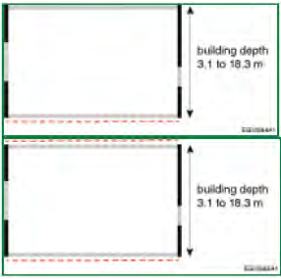
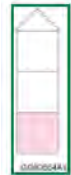
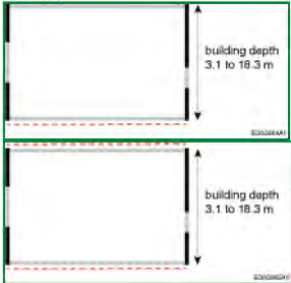
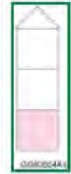
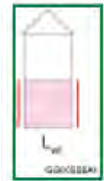
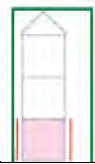
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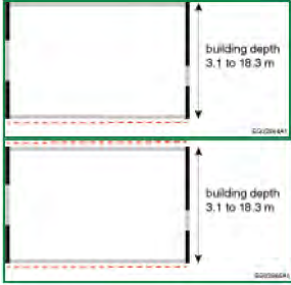
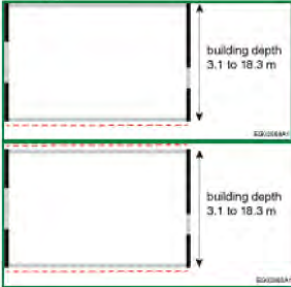
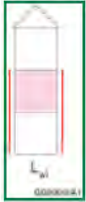
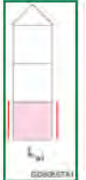
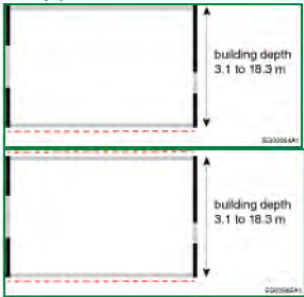
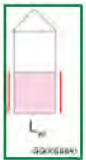
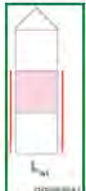
Notes to Table 9.23.13.7.-C:

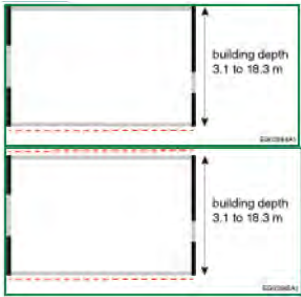
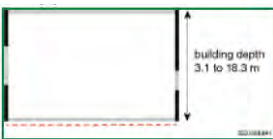
- (1) Unadjusted minimum total *braced wall panel* lengths are for the applicable conditions corresponding to an adjustment factor of 1 in the equation for L_s .
- (2) DR = design required, using the procedure outlined in Note A-9.23.13.7.(4) or according to Part 4, for *braced wall panels* with typical sheathing. L_{us} values within round brackets, to which the reduction set out in Sentence (6) has been applied, are permitted for *braced wall panels* with gypsum board installed on both sides.
- (3) See Sentence 9.23.3.5.(3) for a description of framing types and fastening requirements.
- (4) See Sentence (6) for *braced wall panels* with gypsum board installed on both sides.

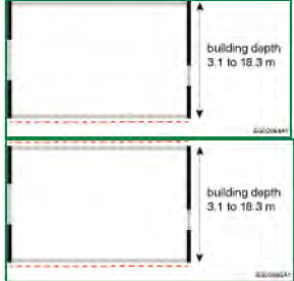
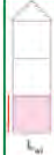
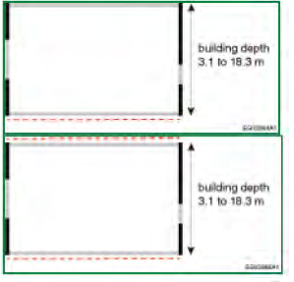
Table 9.23.13.7.-D
Adjustment Factors for the Determination of Minimum Total Braced Wall Panel Lengths for Seismic Forces
Forming Part of Sentence 9.23.13.7.(4)

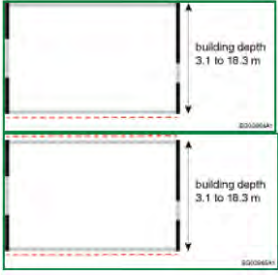
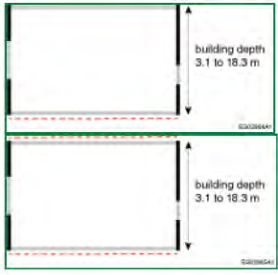
Symbol	Description	Storey	Condition	Adjustment Factor	
$K_{weight}^{(1)(2)}$	Normal-weight construction	Any storey	Any L_{wl}	1.0	
	Heavy construction: apply factor corresponding to L_{wl} separately to each storey 	 Storey supporting roof only	Building depth	1.72	
			$L_{wl} \leq 3.1$ m		
			$L_{wl} = 6.1$ m	1.54	
			$L_{wl} = 9.1$ m	1.46	
			$L_{wl} = 12.2$ m	1.42	
			$L_{wl} = 15.2$ m	1.39	
			$L_{wl} \geq 18.3$ m	1.38	
		 Storey supporting roof and 1 floor	$L_{wl} \leq 3.1$ m	1.92	
			$L_{wl} = 6.1$ m	1.71	
			$L_{wl} = 9.1$ m	1.62	
			$L_{wl} = 12.2$ m	1.57	
			$L_{wl} = 15.2$ m	1.54	
			$L_{wl} \geq 18.3$ m	1.51	
		 Storey supporting roof and 2 floors	$L_{wl} \leq 3.1$ m	1.97	
			$L_{wl} = 6.1$ m	1.76	
			$L_{wl} = 9.1$ m	1.67	
			$L_{wl} = 12.2$ m	1.61	
			$L_{wl} = 15.2$ m	1.58	
			$L_{wl} \geq 18.3$ m	1.56	
	Masonry veneer half storey above foundation: apply factor corresponding to one building face (or two building faces)	Storey supporting roof and up to 2 floors	Any L_{wl}	1.00	Two Building Faces (value)
	Masonry veneer cladding perpendicular to braced wall band, fully clad: ⁽³⁾ apply factor corresponding to L_{wl} for one building face (or two building faces)		$L_{wl} \leq 3.1$ m	1.54	2.13
			$L_{wl} = 6.1$ m	1.30	1.64
			$L_{wl} = 9.1$ m	1.21	1.45
			12.2 m	1.15	1.34
			15.2 m	1.12	1.28

		Storey supporting roof only	≥ 18.3 m	1.10	1.23
		 Storey supporting roof and 1 floor	≤ 3.1 m	1.69	2.43
			6.1 m	1.40	1.85
			9.1 m	1.28	1.60
			12.2 m	1.21	1.46
			15.2 m	1.17	1.38
			≥ 18.3 m	1.14	1.31
		 Storey supporting roof and 2 floors	≤ 3.1 m	1.73	2.51
			6.1 m	1.43	1.91
			9.1 m	1.30	1.65
			12.2 m	1.22	1.50
			15.2 m	1.18	1.41
			≥ 18.3 m	1.15	1.33
	Masonry veneer cladding perpendicular to <i>braced wall band</i>, partially clad:⁽³⁾ apply factor corresponding to L_{wl} for one <i>building face</i> (or two <i>building faces</i>) 	 Storey supporting roof only	≤ 3.1 m	1.23	1.52
			6.1 m	1.13	1.29
			9.1 m	1.08	1.20
			12.2 m	1.06	1.15
			15.2 m	1.04	1.12
			≥ 18.3 m	1.03	1.09
		 Storey supporting roof and 1 floor	≤ 3.1 m	1.30	1.66
			6.1 m	1.17	1.39
			9.1 m	1.11	1.27
			12.2 m	1.08	1.20
			15.2 m	1.06	1.16
			≥ 18.3 m	1.05	1.13
		 Storey supporting roof and 2 floors	≤ 3.1 m	1.31	1.70
			6.1 m	1.18	1.42
			9.1 m	1.12	1.29
			12.2 m	1.08	1.21
			15.2 m	1.07	1.17
			≥ 18.3 m	1.05	1.14
	Masonry veneer cladding perpendicular to the <i>braced wall band</i>, 1-storey height, partially clad: ⁽³⁾ apply factor corresponding to L_{wl} for one <i>building face</i> (or two <i>building faces</i>)	 Storey supporting roof and 1 floor	≤ 3.1 m	1.23	1.48
			6.1 m	1.13	1.28
			9.1 m	1.09	1.20
			12.2 m	1.07	1.15
			15.2 m	1.06	1.13
			≥ 18.3 m	1.05	1.10
			≤ 3.1 m	1.15	1.30
			6.1 m	1.09	1.18
			9.1 m	1.06	1.13
			12.2 m	1.04	1.10

	Storey supporting roof and 2 floors	15.2 m	1.04	1.08
		≥ 18.3 m	1.03	1.07
Masonry veneer cladding perpendicular to the <i>braced wall band</i>, 2-storey height, partially clad:⁽³⁾ apply factor corresponding to L_{wl} for one <i>building face</i>(or two <i>building faces</i>) 	 Storey supporting roof and 1 floor	≤ 3.1 m	1.10	1.22
		6.1 m	1.06	1.13
		9.1 m	1.04	1.09
		12.2 m	1.03	1.07
		15.2 m	1.02	1.05
		≥ 18.3 m	1.02	1.04
	 Supporting roof + 2 floors	≤ 3.1 m	1.19	1.42
		6.1 m	1.11	1.25
		9.1 m	1.07	1.17
		12.2 m	1.05	1.13
		15.2 m	1.04	1.10
		≥ 18.3 m	1.03	1.08
Masonry veneer cladding perpendicular to the <i>braced wall band</i>, 2 storey height, fully clad: Apply factor corresponding to <i>building depth</i> L_{wl} in the direction of the <i>braced wall band</i> for one or two <i>building face</i>(s) 	 Supporting roof + 1 floor	≤ 3.1 m	1.23	1.48
		6.1 m	1.13	1.28
		9.1 m	1.09	1.20
		12.2 m	1.07	1.15
		15.2 m	1.06	1.13
		≥ 18.3 m	1.05	1.10
	 Supporting roof + 2 floors	≤ 3.1 m	1.15	1.30
		6.1 m	1.09	1.18
		9.1 m	1.06	1.13
		12.2 m	1.04	1.10
		15.2 m	1.04	1.08
		≥ 18.3 m	1.03	1.07
		≤ 3.1 m	1.23	1.48
		6.1 m	1.13	1.28
		9.1 m	1.09	1.20
		12.2 m	1.07	1.15
		15.2 m	1.06	1.13

direction of the <i>braced wall band</i> for one or two <i>building face(s)</i> 	 Supporting roof + 1 floor	≥ 18.3 m	1.05	1.10
		≤ 3.1 m 6.1 m 9.1 m 12.2 m 15.2 m ≥ 18.3 m	1.44 1.26 1.18 1.13 1.11 1.09	1.91 1.55 1.39 1.30 1.24 1.20
Stone veneer ⁽²⁾		<i>Building depth</i>	One face	Both faces
Stone veneer half storey above <i>foundation</i>	Supporting up to a roof + 2 floors		1.00	1.00
Stone veneer cladding perpendicular to <i>braced wall band</i>, fully clad (4) : Apply factor corresponding to <i>building depth</i> in the direction of the <i>braced wall band</i> for one or two <i>building face(s)</i> 	 Supporting roof only	≤ 3.1 m 6.1 m 9.1 m 12.2 m 15.2 m ≥ 18.3 m	1.95 1.54 1.38 1.28 1.23 1.19	2.95 2.13 1.79 1.60 1.49 1.40
	 Supporting roof + 1 floor	≤ 3.1 m 6.1 m 9.1 m 12.2 m 15.2 m ≥ 18.3 m	2.21 1.72 1.51 1.38 1.31 1.26	3.48 2.50 2.06 1.82 1.66 1.55
	 Supporting roof + 2 floors	≤ 3.1 m 6.1 m 9.1 m 12.2 m 15.2 m ≥ 18.3 m	2.28 1.77 1.55 1.41 1.33 1.28	3.63 2.60 2.14 1.88 1.72 1.60
	 Supporting roof only	≤ 3.1 m 6.1 m 9.1 m 12.2 m 15.2 m ≥ 18.3 m	1.44 1.25 1.17 1.13 1.10 1.08	1.94 1.54 1.37 1.28 1.23 1.18
Stone veneer cladding perpendicular to <i>braced wall band</i>, partially clad⁽⁴⁾: Apply factor corresponding to <i>building depth</i> in the direction of the <i>braced wall band</i> for one or two <i>building face(s)</i> 	 Supporting roof + 1 floor	≤ 3.1 m 6.1 m 9.1 m 12.2 m 15.2 m	1.56 1.33 1.22 1.17 1.13	2.19 1.71 1.50 1.38 1.31

			≥ 18.3 m	1.11	1.25
			≤ 3.1 m	1.59	2.26
			6.1 m	1.35	1.76
			9.1 m	1.24	1.53
			12.2 m	1.18	1.41
			15.2 m	1.14	1.33
			≥ 18.3 m	1.12	1.27
	Stone veneer cladding perpendicular to the <i>braced wall band</i>, 1 storey height, with openings: Apply factor corresponding to depth L_{wi} in the direction of the <i>braced wall band</i> for one or two <i>building face(s)</i>. 		≤ 3.1 m	1.19	1.40
			6.1 m	1.11	1.24
			9.1 m	1.07	1.17
			12.2 m	1.06	1.13
			15.2 m	1.04	1.10
			≥ 18.3 m	1.04	1.10
			≤ 3.1 m	1.12	1.25
			6.1 m	1.07	1.15
			9.1 m	1.05	1.11
			12.2 m	1.04	1.08
			15.2 m	1.03	1.07
			≥ 18.3 m	1.02	1.05
			≤ 3.1 m	1.19	1.40
			6.1 m	1.11	1.24
			9.1 m	1.07	1.17
			12.2 m	1.06	1.13
			15.2 m	1.04	1.10
			≥ 18.3 m	1.04	1.08
	Stone veneer cladding perpendicular to the <i>braced wall band</i>, 2 storey height, with openings: Apply factor corresponding to depth L_{wi} in the direction of the <i>braced wall band</i> for one or two <i>building face(s)</i>. 		≤ 3.1 m	1.19	1.40
			6.1 m	1.11	1.24
			9.1 m	1.07	1.17
			12.2 m	1.06	1.13
			15.2 m	1.04	1.10
			≥ 18.3 m	1.04	1.08
			≤ 3.1 m	1.36	1.76
			6.1 m	1.21	1.45
			9.1 m	1.14	1.32
			12.2 m	1.11	1.24
	Stone veneer cladding perpendicular to the <i>braced wall band</i>, 1 storey height, fully clad: Apply factor corresponding to depth L_{wi} in the direction of the <i>braced wall band</i> for one or two <i>building face(s)</i>. 		≤ 3.1 m	1.40	1.83
			6.1 m	1.24	1.50
			9.1 m	1.17	1.35
			12.2 m	1.13	1.27
			15.2 m	1.10	1.22
			≥ 18.3 m	1.09	1.18
			≤ 3.1 m	1.26	1.53

		Supporting roof + 2 floors	6.1 m	1.15	1.32
			9.1 m	1.11	1.23
			12.2 m	1.08	1.18
			15.2 m	1.07	1.14
			≥ 18.3 m	1.06	1.12
	Stone veneer cladding perpendicular to the <i>braced wall band</i>, 2 storey height, fully clad: Apply factor corresponding to depth L_{wi} in the direction of the <i>braced wall band</i> for one or two <i>building face(s)</i>. 	Supporting roof + 1 floor	≤ 3.1 m	1.40	1.83
			6.1 m	1.24	1.50
			9.1 m	1.17	1.35
			12.2 m	1.13	1.27
			15.2 m	1.10	1.22
			≥ 18.3 m	1.09	1.18
		Supporting roof + 2 floors	≤ 3.1 m	1.77	2.58
			6.1 m	1.46	1.96
			9.1 m	1.33	1.68
			12.2 m	1.25	1.53
			15.2 m	1.20	1.43
			≥ 18.3 m	1.17	1.36
$K_{snow}^{(4)}$	Roof snow load: apply factor in accordance with the specified roof snow load	 Storey supporting roof only	≤ 2 kPa	1.00	
			3 kPa	1.20	
			4 kPa	1.40	
			5 kPa	1.60	
			6 kPa	1.80	
		 Storey supporting roof and 1 floor	≤ 2 kPa	1.00	
			3 kPa	1.10	
			4 kPa	1.20	
			5 kPa	1.30	
			6 kPa	1.40	
		 Storey supporting roof and 2 floors	≤ 2 kPa	1.00	
			3 kPa	1.06	
			4 kPa	1.10	
			5 kPa	1.20	
			6 kPa	1.24	
$K_{Spacing}^{(5)}$ (6)	Braced wall band spacing: apply factor to all braced wall panels per building plan direction	Any storey	3.8 m	0.60	
			7.6 m	1.00	
			10.6 m	1.35	
			15 m ⁽⁷⁾	1.90	
K_{Number}	Number of parallel braced wall bands:	Any storey	2	1.00	

	apply factor to all <i>braced wall panels</i> per <i>building plan direction</i>		3	1.33
			4	1.50
			≥ 5	1.60
K _{gyp}	Interior gypsum board: apply factor in accordance with whether gypsum board is installed or omitted on interior side of <i>braced wall panels</i>	Any storey	Installed	1.00
			Omitted, blocked wall	1.20
			Omitted, unblocked wall	1.40
K _{sheath}	Intermittent <i>braced wall panels</i> : apply factor in accordance with continuity of sheathing within <i>braced wall band</i>	Any storey	Continuously wood-sheathed	1.00
			Intermittently sheathed	1.15

Notes to Table 9.23.13.7.-D:

(1) See Sentence 9.23.13.2.(3).

(2) For K_{weight}, linear interpolation between L_{wl} values and between fully clad and partially clad veneer conditions is permitted.

(3) "Fully clad" means that there are no openings, and "partially clad" means 50% or less coverage of an elevation.

(4) For K_{snow}, linear interpolation between roof snow loads is permitted.

(5) For K_{sspacing}, linear interpolation between *braced wall band* spacings is permitted.

(6) An average *braced wall band* spacing is permitted to be used for the determination of K_{sspacing}. See Sentence (5).

(7) A *braced wall band* spacing of 15 m is only permitted in *basements* and *crawl spaces*.

between roof snow loads for K_{snow} and between *braced wall band* spacings for K_{sspacing}, and between *building depths* and between fully clad and partially clad veneer conditions for K_{weight}.

5) For 3 or more parallel *braced wall bands* that are not evenly spaced, an average *braced wall band* spacing is permitted to be used for the determination of K_{wspacing} or K_{sspacing}, provided that no single *braced wall band* spacing exceeds 10.6 m, except as provided in Sentence 9.23.13.6.(3).

6) Where *braced wall panels* of a gypsum-sheathed framing type have gypsum board installed on both sides, the minimum total length of the *braced wall panels* determined in Sentence 9.23.13.7.(3) or (4) is permitted to be reduced by 50%.

9.23.13.8. Foundation Cripple Walls

(See Note A-9.23.13.8.)

1) Except as provided in Sentences (2) and (3), *foundation* cripple walls supporting *braced wall panels* shall be

- a) considered as an additional *storey*, or
- b) designed in accordance with Part 4.

2) Where the seismic design parameter, S_{max}, is less than or equal to 0.60, *foundation* cripple walls need not comply with Sentence (1), provided they

- a) are not more than 1.2 m in height,
- b) are not more than 6 m in length,
- c) are either
- i) framed with solid blocking, or

ii) of the same construction as the *braced wall panels* of the *storey* above but sheathed with wood sheathing regardless of the construction, where the length of the cripple wall bracing is equal to the length of the *braced wall panels* multiplied by an adjustment factor of 1.2, in addition to any adjustments required by Sentences 9.23.13.7.(1) and (2), and

- d) do not support heavyweight construction, masonry or stone veneer.

(See Note A-9.23.13.8.(2).)

3) Where the seismic design parameter, S_{max}, is greater than 0.60, *foundation* cripple walls need not comply with Sentence (1), provided they

- a) comply with Clauses (2)(c) and (d),
- b) are not more than 350 mm in height, and
- c) are not more than 5 m length,

(See Note A-9.23.13.8.(3).)

4) Where interior finish, such as gypsum board, is omitted from the interior side of the cripple wall referred to in Sentence (2) or (3), the interior gypsum board adjustment factor described in Sentence 9.23.13.7.(3) or (4) shall be applied to the length of the cripple wall bracing.

9.23.13.9. Cripple Walls in Stepped Foundations

1) Cripple walls in stepped *foundations* need not be braced in accordance with Sentences 9.23.13.8.(2) to (4), provided

a) the lowest floor framing rests directly on a sill plate anchored to a *foundation* not less than 2.4 m in length within a *braced wall band* not more than 7.6 m in length,

b) the top plate of the cripple wall extends not less than 1.2 m along the *foundation*, and

c) anchor bolts are located not more than 300 mm and 900 mm from the step in the *foundation*.

(See Note A-9.23.13.9.(1).)

9.23.13.10. Additional System Considerations

1) This Article applies where

a) the seismic design parameter, S_{max} , is not greater than 1.2, and

b) the 1-in-50-year hourly wind pressure (HWP) is not greater than 1.2 kPa.

2) Portions of the perimeter of a single open or enclosed space need not comply with Sentence 9.23.13.5.(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) the perpendicular plan dimension,

b) that portion of the perimeter structure does not support a floor,

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. where roof sheathing edges are not supported on blocking and not more than 600 mm o.c. where roof sheathing edges are supported on blocking securely fastened between framing members, or

ii) constructed with roof framing not more than 400 mm o.c. where roof sheathing edges are not supported on blocking and not more than 600 mm o.c. where roof sheathing edges are supported on blocking securely fastened between framing members, and fastened to the wall framing (see Table 9.23.3.4. and Article 9.23.9.1. for balloon framing), and

d) the end-joists or end-rafters for the roof of the space are fastened to a 3-ply, 38 mm × 140 mm built-up column or a 5-ply, 38 mm × 89 mm built-up column that is integral with the wall framing.

(See Note A-9.23.13.10.(2).)

3) 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 9.23.13.5.(1) where these walls do not support a floor.

4) *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 9.23.13.5.(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 wood-sheathed *braced wall panels*, and

d) not less than 25% of the length of the side walls is constructed of wood-sheathed *braced wall panels*.

5) Except as provided in Sentences (6) and (7), 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.(1),
- 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.(3).

6) 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.

7) 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.(5) and (6).

8) 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.

9.23.13.11. Simplified Approach for Braced Wall Panel Length

- 1) This Article applies to *buildings* where
 - a) the seismic design parameter, S_{max} , is not greater than 0.47,
 - b) the 1-in-50-year hourly wind pressure (HWP) is not greater than 0.60 kPa,
 - c) the specified roof snow load, as calculated in accordance with Article 9.4.2.2, is not greater than 2 kPa,
 - d) the plan dimensions of the *building* are each not greater than 21.2 m,
 - e) the building is located in rough terrain, as described in Note A-9.23.13.7.(3) and (4),
 - f) the greatest eave-to-ridge height of the roof is not greater than 3 m,
 - g) the *braced wall panels* are constructed with gypsum board on at least one side,
 - h) the *braced wall bands* are continuously sheathed, and
 - i) the *building* is of normal-weight construction, as defined in Clause 9.23.13.2.(3)(a), except as provided in Sentence (4).
- 2) Except as provided in Sentence (3), the minimum total length of all *braced wall panels* in each direction shall be determined in accordance with
 - a) Table 9.23.13.11-A where the seismic design parameter, S_{max} , is not greater than 0.3 and the 1-in-50-year hourly wind pressure (HWP) is not greater than 0.5 kPa, or
 - b) Table 9.23.13.11-B.

Table 9.23.13.11.-A
Minimum Total Length of Braced Wall Panels where HWP ≤ 0.5 kPa and S_{max} ≤ 0.3
 Forming Part of Sentence 9.23.13.11.(2)

Storey	Minimum Total Length Braced Wall Panels, m		
	Diagonal-Lumber-Sheathed Framing Type (with gypsum)	Gypsum-Sheathed Framing Type (with gypsum board on only one side) ⁽¹⁾⁽²⁾	Wood-Sheathed Framing Type (with gypsum board on opposite side) ⁽¹⁾

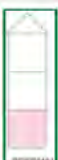
	board on opposite side) ⁽¹⁾									
	DWB	GWB-A	GWB-B	GWB-C	GWB-D	WSP-A	WSP-B	WSP-C	WSP-D	WSP-E
	1.89	9.47 (4.74)	5.50 (2.75)	4.08 (2.04)	3.32 (1.66)	3.32	1.76	1.53	1.39	1.26
	3.89	19.45 (9.73)	11.30 (5.65)	8.38 (4.19)	6.82 (3.41)	6.82	3.61	3.14	2.86	2.59
	5.88	NP (14.71)	17.09 (8.55)	12.67 (6.34)	10.31 (5.16)	10.31	5.46	4.74	4.33	3.92

Notes to Table 9.23.13.11.-A:

(1) See Sentence 9.23.3.5.(3) for a description of framing types and fastening requirements.

(2) NP = not permitted. Values within round brackets are permitted for *braced wall panels* with gypsum board installed on both sides.

Table 9.23.13.11.-B
Minimum Total Length of Braced Wall Panels Where $HWP \leq 0.6$ kPa and $S_{max} \leq 0.47$
Forming Part of Sentence 9.23.13.11.(2)

Storey	Minimum Total Length Braced Wall Panels, m									
	Diagonal-Lumber-Sheathed Framing Type (with gypsum board on opposite side) ⁽¹⁾	Gypsum-Sheathed Framing Type (with gypsum board on only one side) ^{(1) (2)}				Wood-Sheathed Framing Type (with gypsum board on opposite side) ⁽¹⁾				
	DWB	GWB-A	GWB-B	GWB-C	GWB-D	WSP-A	WSP-B	WSP-C	WSP-D	WSP-E
	2.27	11.36 (5.68)	6.60 (3.30)	4.89 (2.45)	3.98 (1.99)	3.98	2.11	1.83	1.67	1.51
	4.66	NP (11.68)	13.56 (6.78)	10.06 (5.03)	8.18 (4.09)	8.18	4.34	3.76	3.44	3.11
	7.05	NP (17.96)	20.86 (10.43)	15.47 (7.74)	12.59 (6.30)	12.37	6.56	5.69	5.19	4.70

Notes to Table 9.23.13.11.-B:

(1) See Sentence 9.23.3.5.(3) for a description of framing types and fastening requirements.

(2) NP = not permitted. Values within round brackets are permitted for *braced wall panels* with gypsum board installed on both sides.

3) Except as provided in Sentence (4), the minimum total length of all *braced wall panels* in each *braced wall band* in the direction perpendicular to a single *building face* partially clad with masonry veneer shall be determined in accordance with

a) Table 9.23.13.11-C where the seismic design parameter, S_{max} , is not greater than 0.3 and the 1-in-50-year hourly wind pressure (HWP) is not greater than 0.50 kPa, or

b) Table 9.23.13.11-D

Table 9.23.13.11.-C
Minimum Total Length of Braced Wall Panels in a Braced Wall Band Perpendicular to a Building Face
Partially Clad with Masonry Veneer where $HWP \leq 0.5$ kPa and $S_{max} \leq 0.3$
 Forming Part of Sentence 9.23.13.11.(3)

Storey	Minimum Total Length Braced Wall Panels, m									
	Diagonal-Lumber-Sheathed Framing Type (with gypsum board on opposite side) ⁽¹⁾	Gypsum-Sheathed Framing Type (with gypsum board on only one side) ^{(1) (2)}				Wood-Sheathed Framing Type (with gypsum board on opposite side) ⁽¹⁾				
	DWB	GWB-A	GWB-B	GWB-C	GWB-D	WSP-A	WSP-B	WSP-C	WSP-D	WSP-E
	1.89	9.47 (4.74)	5.50 (2.75)	4.08 (2.04)	3.25 (1.63)	3.32	1.76	1.53	1.39	1.26
	3.89	19.45 (9.73)	11.30 (5.65)	8.38 (4.19)	6.75 (3.37)	6.82	3.61	3.14	2.86	2.59
	5.88	NP (15.01)	17.44 (8.72)	12.93 (6.46)	10.49 (5.25)	10.31	5.46	4.74	4.33	3.92

Notes to Table 9.23.13.11.-C:

(1) See Sentence 9.23.3.5.(3) for a description of framing types and fastening requirements.

(2) NP = not permitted. Values within round brackets are permitted for *braced wall panels* with gypsum board installed on both sides.

Table 9.23.13.11.-D
Minimum Total Length of Braced Wall Panels in a Braced Wall Band Perpendicular to a Building Face
Partially Clad with Masonry Veneer where ≤ 0.6 kPa and $S_{max} \leq 0.47$
 Forming Part of Sentence 9.23.13.11.(3)

Storey	Minimum Total Length Braced Wall Panels, m									
	Diagonal-Lumber-Sheathed Framing Type (with gypsum board on opposite side) ⁽¹⁾	Gypsum-Sheathed Framing Type (with gypsum board on only one side) ^{(1) (2)}				Wood-Sheathed Framing Type (with gypsum board on opposite side) ⁽¹⁾				
	DWB	GWB-A	GWB-B	GWB-C	GWB-D	WSP-A	WSP-B	WSP-C	WSP-D	WSP-E

	2.27	13.12 (6.56)	7.63 (3.81)	5.66 (2.83)	4.89 (2.44)	3.98	2.11	1.83	1.67	1.51
	4.66	NP (15.14)	17.59 (8.79)	13.04 (6.52)	10.57 (5.28)	8.18	4.34	3.76	3.44	3.11
	7.05	NP (NP)	NP (13.66)	20.27 (10.13)	16.49 (8.24)	12.37	6.56	5.69	5.19	4.70

Notes to Table 9.23.13.11.-D:

(1) See Sentence 9.23.3.5.(3) for a description of framing types and fastening requirements.

(2) NP = not permitted. Values within round brackets are permitted for *braced wall panels* with gypsum board installed on both sides.

4) Wall portions clad with masonry veneer that are located both perpendicular to a *braced wall band* and within a *braced wall band* are permitted to be considered as normal-weight construction.

5) Bracing to resist lateral loads shall be designed and constructed in accordance with Articles 9.23.13.4 to 9.23.13.6 and 9.23.13.8 to 9.23.13.10.

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) Where the roof slope is 1 in 3 or steeper, 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 (8)

Roof Slope	Rafter Spacing, mm	Minimum Number of Nails Not Less Than 76 mm Long and 3.66 mm in Diameter ⁽¹⁾⁽²⁾⁽³⁾⁽⁴⁾											
		Building Width up to 4 m			Building Width up to 6 m			Building Width up to 8 m			Building Width up to 10 m		
		Specified Roof Snow Load, kPa			Specified Roof Snow Load, kPa			Specified Roof Snow Load, kPa			Specified Roof Snow Load, kPa		
		1.0	1.5	2.0	1.0	1.5	2.0	1.0	1.5	2.0	1.0	1.5	2.0
1 in 3	300	3	4	5	5	6	7	6	8	10	7	10	(5)
	400	4	5	7	6	8	10	8	10	(5)	10	(5)	(5)
	600	6	8	10	9	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)
1 in 2.4	300	3	3	4	4	5	6	5	6	8	6	8	10
	400	3	4	5	5	6	8	6	8	10	8	10	(5)
	600	5	6	8	7	9	(5)	9	(5)	(5)	(5)	(5)	(5)
1 in 2	300	2	3	4	3	4	5	4	5	7	5	7	8
	400	3	4	5	4	5	7	5	7	9	7	9	(5)

	600	4	5	7	6	8	10	8	10	(5)	10	(5)	(5)
1 in 1.71	300	2	3	3	3	4	4	4	5	6	4	6	7
	400	3	3	4	4	5	6	5	6	8	6	7	9
	600	4	5	6	5	7	8	7	9	(5)	8	(5)	(5)
1 in 1.5	300	2	2	3	3	3	4	3	4	5	4	5	6
	400	2	3	4	3	4	5	4	5	7	5	7	8
	600	3	4	5	5	6	7	6	8	10	7	10	(5)
1 in 1.33	300	2	2	3	2	3	4	3	4	5	4	5	6
	400	2	3	3	3	4	5	4	5	6	5	6	7
	600	3	4	5	4	5	7	5	7	9	7	9	(5)
1 in 1.2	300	2	2	2	2	3	3	3	3	4	3	4	5
	400	2	2	3	3	3	4	3	4	5	4	5	7
	600	3	3	4	4	5	6	5	6	8	6	8	10
1 in 1	300	2	2	2	2	2	3	2	3	4	3	4	4
	400	2	2	3	2	3	4	3	4	5	4	5	6
	600	2	3	4	3	4	5	4	5	7	5	7	8

Notes to Table 9.23.14.8.:

⁽¹⁾ Nails with a diameter less than 3.66 mm are permitted to be used, provided the minimum number of nails stated in the Table is modified as follows:

- For a nail diameter greater than or equal to 2.86 mm and less than 3.25 mm, add 3 nails to the minimum number of nails, up to a maximum of 10 nails.
- For a nail diameter greater than or equal to 3.25 mm and less than 3.66 mm, add 2 nails to the minimum number of nails, up to a maximum of 10 nails.

Where more than 10 nails are required, the connections between the rafters and the ceiling joists shall be designed in accordance with Clause 9.4.1.1.(1)(b) or (c).

⁽²⁾ The minimum number of nails stated in the Table is applicable to Spruce-Pine-Fir, Douglas Fir-Larch and Hem-Fir members. For Northern Species members, add 2 nails to the minimum number of nails, up to a maximum of 10 nails. Where more than 10 nails are required, the connections between the rafters and the ceiling joists shall be designed in accordance with Clause 9.4.1.1.(1)(b) or (c).

⁽³⁾ To accommodate nail spacing, not less than 38 mm × 140 mm joists shall be used where 6 or more nails are required, and not less than 38 mm × 184 mm joists shall be used where 8 or more nails are required.

⁽⁴⁾ The minimum number of nails in the Table is applicable for a maximum roof *dead load* of 0.5 kPa.

⁽⁵⁾ The connections between the rafters and the ceiling joists shall be designed in accordance with Clause 9.4.1.1.(1)(b) or (c).

6) Except as permitted in Sentence (7), ceiling joists referred to in Sentence (5) shall be tied to the base of every rafter.

7) Where ceiling joists referred to in Sentence (5) are raised above the base of the rafters, the connections between the rafters and the ceiling joists shall be designed in accordance with Clause 9.4.1.1.(1)(b) or (c).

8) Ceiling joists referred to in Sentence (5) that are spliced to make a continuous joist shall be fastened together at each splice with at least one more nail than required for the rafter-to-joist connection shown in Table 9.23.14.8.

9) Members referred to in Sentences (6) and (8) 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) Wood roof trusses shall be designed in accordance with good engineering practice such as that described in TPIC 2019, "Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses."

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) All member bracing shall be installed as per the truss design drawings, and continuous lateral bracing shall be adequately anchored to the roof and ceiling diaphragms at intervals no greater than 6.10 m o.c.

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	OSB, O-1 Grade, and	Particleboard	Lumber

	Grade	Waferboard, R-1 Grade		
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-year hourly wind pressure (HWP) is less than 0.8 kPa and the seismic design parameter, S_{max} , for Site Class C, is less than or equal to 0.47, 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 design parameter, S_{max} , Site Class C is greater than 0.47 but not greater than 0.8, or
 - b) the 1-in-50-year hourly wind pressure (HWP) is equal to or greater than 0.80 kPa but less than 1.2 kPa.
- 3) Lumber roof sheathing shall be designed according to Part 4, where
 - a) the seismic design parameter, S_{max} , for Site Class C is greater than 0.8, or
 - b) the 1-in-50-year hourly wind pressure (HWP) is equal to or greater than 1.2 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 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 9.23.16.7.-B.
- 3) Asphalt-coated or asphalt-impregnated fibreboard not less than 11.1 mm thick conforming to CAN/ULC-S706.1, "Standard for 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-S706.1
Gypsum sheathing	9.5	12.7	ASTM C1177/C1177M ASTM C1396/C1396M ⁽²⁾
Lumber	17.0	17.0	See Table 9.3.2.1.
Mineral Fibre, Rigid Board, Type 2	25	25	CAN/ULC-S702.1
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-S701.1
Polystyrene, Types 3 and 4	25	25	CAN/ULC-S701.1
Polyurethane and Polyisocyanurate Type 1, faced	38	38	CAN/ULC-S704.1

Polyurethane and Polyisocyanurate Types 2 and 3, faced	25	25	CAN/ULC-S704.1

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, "Standard Method of 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 2012 Edition."

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 C954, "Standard Specification for 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 C1002, "Standard Specification for 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.

(See Note A-9.25.1.1.(2).)

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 C726, "Standard Specification for 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-S701.1, "Standard for Thermal Insulation, Polystyrene Boards,"
 - e) CAN/ULC-S702.1, "Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification,"
 - f) CAN/ULC-S703, "Standard for Cellulose Fibre Insulation (CFI) for Buildings,"
 - g) CAN/ULC-S704.1, "Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced,"
 - h) CAN/ULC-S705.1, "Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Material Specification," or
 - i) CAN/ULC-S706.1, "Standard for 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 shall be installed over the full height of *foundation* walls enclosing a *basement* or heated crawl space. (See also [Part 10](#).)
- 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) 6 mm preservative-treated plywood, or
 - b) 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, "Standard for 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) Except as provided in Sentence (2), *vapour barriers* shall have a permeance not greater than 60 ng/(Pa×s×m²) measured in accordance with ASTM E96/E96M, “Standard Test Methods for Water Vapor Transmission of Materials,” using the desiccant method (dry cup).

2) Thermally insulated *foundation* wall assemblies are permitted to be constructed with variable-permeance *vapour barriers* having a permeance not greater than 60 ng/(Pa×s×m²) using the desiccant method (dry cup) and greater than 300 ng/(Pa×s×m²) using the water method (wet cup) measured in accordance with ASTM E96/E96M, “Standard Test Methods for Water Vapor Transmission of Materials.” (See Note A-9.25.4.2.(2).)

3) 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.(3).)

4) 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.”

5) 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.”

6) Membrane-type *vapour barriers* other than polyethylene that are susceptible to deterioration under prolonged exposure to direct ultraviolet radiation shall

a) be covered, or

b) only be installed in locations that are not exposed to direct ultraviolet radiation after the completion of construction.

(See Note A-9.25.4.2.(6).)

7) 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.”

8) 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 Notes A-9.25.4.3.(2) and 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 E96/E96M, “Standard Test Methods for 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 $30 \text{ ng}/(\text{Pa}\times\text{s}\times\text{m}^2)$ and a thermal resistance not less than $0.7 (\text{m}^2\times\text{K})/\text{W}$ and the heating degree-days of the *building* location are less than 6000, 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 <i>Building</i> 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 Section, or
- b) Part 5.

9.26.1.3. Alternative Installation Methods

1) Methods described in CSA A123.51, "Asphalt shingle application on roof slopes 1:6 and steeper," are permitted to be used for the installation of asphalt shingles in lieu of the methods 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 D3019/D3019M, "Standard Specification for Lap Cement Used with Asphalt Roll Roofing, Non-Fibred, and Fibred" ^(a)
	ASTM D4479/D4479M, "Standard Specification for Asphalt Roof Coatings – Asbestos-Free"
	CAN/CGSB-37.50-M, "Hot-Applied, Rubberized Asphalt for Roofing and Waterproofing"
	CGSB 37-GP-56M, "Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing"
	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"
	CSA A123.23, "Product specification for polymer-modified bitumen sheet, prefabricated and reinforced"
Single-ply membranes	ASTM D4637/D4637M, "Standard Specification for EPDM Sheet Used In Single-Ply Roof Membrane"
	ASTM D4811/D4811M, "Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing"
	ASTM D6878/D6878M, "Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing"
	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"
Shingles, shakes, tiles, panels	CSA A123.5, "Asphalt shingles made from glass felt and surfaced with mineral granules"
	CAN/CSA-A220 Series, "Concrete Roof Tiles"
	CSA O118.1, "Western Red Cedar Shakes and Shingles"

	CSA O118.2, "Eastern White Cedar Shingles"
Eave protection	CAN/CSA-A123.16, "Asphalt-coated glass-base sheets"
	CSA A123.22, "Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection"
Flashing	ASTM D4811/D4811M, "Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing"

Notes to Table 9.26.2.1.-B:

⁽¹⁾ For the purpose of this Subsection, ASTM D3019/D3019M shall only apply to the non-fibered and non-asbestos-fibered types (I and III) of asphalt roll roofing.

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 F1667, "Standard Specification for 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)

Type of Roofing	Minimum Slope	Maximum Slope
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/m², 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/m² of cemented area, or hot application asphalt applied at the rate of 1 kg/m² 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					
	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 Series, "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, insulated vinyl, polypropylene, aluminum or steel, including trim and soffits, are installed as cladding on wood-frame walls or above-ground flat insulating concrete form walls exposed to precipitation, the cladding assembly shall comply with

- a) Subsections 9.27.2. to 9.27.13., or
- b) Part 5.

2) Where stucco is installed as cladding on wood-frame walls, above-ground flat insulating concrete form walls 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 walls, above-ground flat insulating concrete form walls 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., except for masonry veneer, which shall be attached to above-ground flat insulating concrete form walls in accordance with Sentence 9.27.5.4.(2), 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, above-ground flat insulating concrete form 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 9.27.14., 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 10 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 is loosely fastened to the backing and behind each cladding component there is a clear air space that is
 - i) continuous for the full width of the component,
 - ii) not less than 10 mm deep at the bottom of the component, and
 - iii) not less than 6 mm deep over not less than 90 mm for every 230 mm of exposed height of the component,
- 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 9.27.14.

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, and
- c) furring, provided the furring does not make up more than 20% of the furred area.

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 3400 and the moisture index is greater than 0.90, or
- b) the number of degree-days is 3400 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 9.27.14., 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 Sentence (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,

d) lap not less than 10 mm vertically over the *building* element below, and

e) 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 C834, "Standard Specification for Latex Sealants,"

b) ASTM C920, "Standard Specification for Elastomeric Joint Sealants,"

- c) ASTM C1184, "Standard Specification for Structural Silicone Sealants," or
 - d) ASTM C1311, "Standard Specification for Solvent Release Sealants."
- 3) Backer rod shall conform to ASTM C1330, "Standard Specification for 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 (5), cladding shall be fastened to the framing members or furring members, or to blocking between the framing members.
- 2) Vertical lumber, stucco lath or reinforcing, vertically applied vinyl siding, vertically applied insulated vinyl siding, and polypropylene siding 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 waferboard, or
 - c) 11 mm OSB.
- 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) Cladding, trim and furring members are permitted to be attached to the web fastening strips of flat wall insulating concrete form units using screws in accordance with Sentence 9.27.5.4.(2).

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 Sentence 9.27.5.1.(4), 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 to wood framing, furring members or blocking shall conform to Table 9.27.5.4.-A.

Table 9.27.5.4.-A
Attachment of Cladding to Wood Framing, Furring Members or Blocking
 Forming Part of Sentence 9.27.5.4.(1)

Type of Cladding	Minimum Nail or Staple Length,	Minimum Number of Nails or Staples	Maximum Nail or Staple Spacing, mm o.c.

	mm ⁽¹⁾		
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			
up to 200 mm in width	32	2	—
over 200 mm in width	32	3	—
Vinyl and insulated vinyl siding			
horizontally applied	38	—	400 ⁽²⁾
vertically applied	38	—	300
Polypropylene siding	38	—	400 ⁽²⁾
Panel- or sheet-type cladding			
up to 7 mm thick	38	—	150 (along edges)
over 7 mm thick	51	—	300 (along intermediate supports)

Notes to Table 9.27.5.4.-A:

⁽¹⁾ The minimum fastener length need not exceed the minimum fastener penetration depth required by Article 9.27.5.7.

⁽²⁾ The maximum spacing of 400 mm o.c. applies to nails and staples used to attach horizontally applied vinyl, insulated vinyl and polypropylene siding, unless a greater spacing is permitted in an evaluation report prepared by an accredited certification organization.

2) Screw size and spacing for the attachment of cladding, trim and furring members to the web fastening strips of flat wall insulating concrete form (ICF) units shall conform to Table 9.27.5.4.-B where the 1-in-50 hourly wind pressure (HWP) is less than or equal to 0.60 kPa. (See Note A-9.27.5.4.(2).)

Table 9.27.5.4.-B
Attachment of Cladding to Flat Wall ICF Units where the 1-in-50 HWP ≤ 0.60 kPa
 Forming Part of Sentence 9.27.5.4.(2)

Type of Cladding ⁽¹⁾	Minimum Screw Length	Minimum Screw Diameter, mm	Maximum Horizontal Spacing of Screws, mm o.c. ⁽²⁾
Wood trim	⁽³⁾	3.5	400 or 450 (screwed to web fastening strip)
Lumber siding or horizontal siding made from sheet material	⁽³⁾	4.2	400 or 450 (screwed to web fastening strip)
Metal cladding	⁽³⁾	4.2	400 or 450 (screwed to web fastening strip)
Vinyl cladding	⁽³⁾	3.5	400 or 450 (screwed to web fastening strip)
Masonry veneer ⁽⁴⁾	⁽³⁾	4.2	400 or 450 (masonry tie screwed to web fastening strip)
Panel- or sheet-type cladding			
up to 7 mm thick	⁽³⁾	3.5	150 or 200 (along edges)
over 7 mm thick	⁽³⁾	4.2	300 or 400 (along intermediate supports)

Notes to Table 9.27.5.4.-B:

⁽¹⁾ Wood shakes and wood shingles are permitted to be attached to horizontal wood furring members in accordance with Table 9.27.5.4.-A. The wood furring members shall be attached to the web fastening strips of flat wall ICF units with screws not

less than 4.2 mm in diameter spaced horizontally not more than 400 or 450 mm o.c. (two horizontal spacing options are given to accommodate the 150 and 200 mm o.c. horizontal spacing options for web fastening strips).

⁽²⁾ Two horizontal spacing options are given to accommodate the 150 mm o.c. and 200 mm o.c. horizontal spacing options for web fastening strips. The maximum vertical spacing of screws or masonry ties, as applicable, shall be 400 mm.

⁽³⁾ Screws must be long enough to penetrate through the web fastening strips by a minimum of 6 mm.

⁽⁴⁾ See also Subsection 9.20.5. for requirements on the support of masonry veneer.

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 cladding shall be positioned to permit expansion and contraction of the cladding.

2) Fasteners for vinyl siding, insulated vinyl siding and polypropylene siding shall be installed in the centre of the slots of the nail hem.

9.27.5.7. Penetration of Fasteners

(See Note A-9.27.5.7.)

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 vinyl cladding, insulated vinyl cladding and polypropylene cladding shall penetrate through the nail-holding base or not less than 32 mm into the framing.

3) Fasteners for cladding other than that described in Sentences (1) and (2) 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, "American National Standard for 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 Sentences 9.27.8.2.(2) and 9.27.10.2.(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) Hardboard cladding shall conform to ANSI A135.6, "Engineered Wood Siding."

9.27.9.2. Thickness

- 1) Hardboard cladding shall be not less than
 - a) 9.5 mm thick when applied over sheathing that provides continuous support or over furring or framing members not more than 400 mm o.c., or
 - b) 11.1 mm thick when applied over furring or framing members not more than 600 mm o.c.
- 2) 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.(2).)

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) Steel sheet cladding, including horizontal and vertical strip steel siding, flashing and trim accessories, shall

a) have a minimum thickness of 0.33 mm, and

b) conform to CSSBI 23M, "Standard for Residential Steel Cladding."

(See Note A-9.27.11.1.(1).)

2) 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.(2) and (3).)

3) 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.(2) and (3).)

9.27.12. Vinyl Siding, Insulated Vinyl Siding and Vinyl Soffits

9.27.12.1. Material Standards

- 1) Vinyl siding shall conform to ASTM D3679, "Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding."
- 2) Insulated vinyl siding shall conform to ASTM D7793, "Standard Specification for Insulated Vinyl Siding."
- 3) Rigid vinyl soffits shall conform to ASTM D4477, "Standard Specification for Rigid (Unplasticized) Poly(Vinyl Chloride) (PVC) Soffit."
- 4) Where vinyl siding, insulated vinyl siding or rigid vinyl soffits are required to have a *flame-spread rating*, the rating shall be determined in accordance with CAN/ULC-S102.2, "Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies."

9.27.12.2. Attachment

- 1) The attachment of vinyl siding and insulated vinyl siding shall conform to the requirements in Subsection 9.27.5.

9.27.13. Polypropylene Siding

9.27.13.1. Material Standard

- 1) Polypropylene siding shall conform to ASTM D7254, "Standard Specification for Polypropylene (PP) Siding."
- 2) Where polypropylene siding is required to have a *flame-spread rating*, the rating shall be determined in accordance with CAN/ULC-S102.2, "Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies."

9.27.13.2. Attachment

- 1) The attachment of polypropylene siding shall conform to the requirements in Subsection 9.27.5.

9.27.14. Exterior Insulation Finish Systems

9.27.14.1. 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, "Standard for 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-9.27.14.1.(1).)

- 2) EIFS that are not covered by Sentence (1) shall comply with Part 5.

9.27.14.2. Materials

- 1) The materials used in EIFS shall conform to CAN/ULC-S716.1, "Standard for 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-9.27.14.2.(2)(a)), and
 - b) comply with the structural requirements for sheathing materials stated in Section 9.23.

9.27.14.3. Design and Installation

- 1) The design and installation of EIFS on the substrate described in Sentence 9.27.14.2.(2) shall comply with
 - a) CAN/ULC-S716.2, "Standard for Exterior Insulation and Finish Systems (EIFS) - Installation of EIFS Components and Water Resistive Barrier," and
 - b) CAN/ULC-S716.3, "Standard for 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 1.98 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)

Location	Type of Lath	Minimum Diam of Wire, mm	Maximum Mesh Opening	Minimum Mass, kg/m ²
Vertical surfaces	Welded or woven wire	1.15	25 mm	—
		1.30	38 mm	—
		1.50	51 mm	—
	Stucco mesh reinforcing (expanded metal)	—	25.8 cm ²	0.98
Horizontal surfaces ⁽¹⁾	9.5 mm rib lath	—	—	1.84
	Cedar lath	—	—	—

Notes to Table 9.28.4.3.:

⁽¹⁾ See Note A-Table 9.28.4.3.

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) Except as provided in Sentence (3), gypsum board applications not described in this Subsection shall conform to CSA A82.31-M, "Gypsum Board Application."

3) The application of gypsum board to flat insulating concrete form (ICF) walls shall conform to ASTM C840, "Standard Specification for Application and Finishing of Gypsum Board." (See Note A-9.29.5.1.(3).)

9.29.5.2. Materials

1) Gypsum products shall conform to

a) ASTM C1178/C1178M, "Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel," or

b) ASTM C1396/C1396M, "Standard Specification for Gypsum Board," except that the *flame-spread rating* of gypsum board shall be determined in accordance with CAN/ULC-S102, "Standard Method of 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 C1396/C1396M)				
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 C1396/C1396M)				
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 F1667, "Standard Specification for 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 C1002, "Standard Specification for 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-S706.1, "Standard for 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 $18 \text{ ng}/(\text{Pa} \times \text{s} \times \text{m}^2)$ when tested in accordance with ASTM E96/E96M, "Standard Test Methods for 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, "American National Standard for 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, 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 Section 9.36.

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 NPC.
- 2) The installation of *service water heaters*, including provisions for mounting, clearances and air supply, shall conform to
 - a) the Safety Standards Act and pursuant regulations,
 - b) CSA B139 Series, "Installation code for oil-burning equipment,"
 - c) reserved,
 - d) CSA B365, "Installation Code for Solid-Fuel-Burning Appliances and Equipment," or
 - e) a combination thereof.
- n3) Where the *building* is in a location where the seismic design parameter, S_{max} , for Site Class C is greater than 0.37, *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) Except as required by Article 9.32.4.2., 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
 - a) one *dwelling unit*, or
 - b) a house with a *secondary suite* including their common spaces.
- 2) Mechanical ventilation systems other than self-contained systems serving a single *dwelling unit* or a house with a *secondary suite* including their common spaces 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) except as required by Sentences (2) and (3), if supplied with electrical power, provisions for heating-season ventilation in accordance with Subsection 9.32.3.
- 2) A self-contained heating-season ventilation system serving a single *dwelling unit* or a single detached house shall comply with Subsection 9.32.3. (See Note A-9.32.1.2.(2).)
- 3) In single detached houses, heating-season ventilation need not be provided for
 - a) *exits*,
 - b) *public corridors*, and
 - c) ancillary spaces that are not within a *dwelling unit*, except as provided in Sentence (4).(See Note A-9.32.1.2.(2).)
- 4) Where ancillary spaces described in Clause (3)(c) contain exhaust devices, these spaces shall be provided with make-up air in accordance with Article 9.32.4.

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,
 - b) include an interlock to activate the central exhaust fan when laundry-drying equipment is in use, and
 - c) where required by Article 9.32.4.1., 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 in accordance with Article 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 <i>dwelling unit</i>	Bathrooms or water-closet rooms	0.09 m ²
	Unfinished <i>basement</i> space	0.2% of the <i>floor area</i>
	Dining rooms, living rooms, bedrooms, kitchens, combined rooms, dens, recreation rooms and all other finished rooms	0.28 m ² per room or combination of rooms
Other than within a <i>dwelling unit</i>	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 <i>floor area</i>
	Corridors, storage rooms and other similar public rooms or spaces	2% of the <i>floor area</i>
	Unfinished <i>basement</i> space not used on a shared basis	0.2% of the <i>floor area</i>

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 by a mechanical ventilation system that conforms to

a) CAN/CSA-F326-M, “Residential Mechanical Ventilation Systems,”

b) this Subsection, or

c) for ducted mechanical ventilation systems serving more than one *dwelling unit* in a **single detached** house, the mechanical ventilation system shall comply with this Subsection or Part 6.

(See Note A-9.32.3.1.(1).)

9.32.3.2. Design and Installation

1) Aspects of mechanical ventilation systems not specifically described 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 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.

4) In a **single detached** house, where a heating or ventilation system serves more than a single *dwelling unit*, the system shall be designed and installed to prevent the circulation of smoke upon a signal from a duct-type *smoke detector*. (See Note A-9.32.3.2.(4).)

5) Except as provided in Sentence 9.10.9.9.(6), ducts penetrating *fire separations* shall be equipped with *fire dampers* in conformance with Article 3.1.8.10.

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,
 - ii) each floor level without a bedroom, and
 - iii) ancillary spaces that contain an exhaust device, where the space is not within a *dwelling unit* in a **single detached** house and where the house contains a fuel-fired *space-heating appliance* or fuel-fired water-heating *appliance* of other than *direct-vented* or *mechanically vented* types,
 - 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,
 - ii) each floor level without a bedroom, and
 - iii) each ancillary space described in Subclause (2)(a)(iii), 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,
 - 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, and
 - c) deliver air to each ancillary space described in Subclause (2)(a)(iii).
- 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 m² 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, at least one common area and each ancillary space described in Subclause (2)(a)(iii),
 - ii) are located at least 1 800 mm above the floor, and
 - iii) have an unobstructed vent area of not less than 25 cm².

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. 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	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 m² 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 cm², and
 - b) 0.83 cm² for every m² 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 **Part 10**, 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 cm².

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* or house with a *secondary suite* 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 house with a *secondary suite* including their common spaces, 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, a business and personal services occupancy, or a mercantile occupancy* and that

- a) is served by or contains a fuel-burning *appliance*, or
- b) contains a *storage garage*.

2) Carbon monoxide (CO) alarms installed in a *residential occupancy* required by this Article shall

- a) conform to CSA 6.19, "Residential carbon monoxide alarming devices,"
- b) be equipped with an integral alarm that satisfies the audibility requirements of 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 installed as recommended by the manufacturer.

3) Where a room in a *residential occupancy* contains a solid-fuel-burning *appliance*, a CO alarm conforming to CSA 6.19, "Residential carbon monoxide alarming devices," shall be

a) installed as recommended by the manufacturer 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* serves a *residential occupancy* and 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) Where CO alarms are installed in a house with a *secondary suite* including their common spaces, the CO alarms shall be interconnected so that the actuation of any one CO alarm causes all CO alarms within the house with a *secondary suite* including their common spaces to sound.

8) CO alarms installed in a *business and personal services occupancy, or a mercantile occupancy* as required by this Article shall conform to

a) CAN/CSA-6.19, "Residential carbon monoxide alarming devices," notwithstanding the scope of that standard,

b) UL 2034, "Standard for Single and Multiple Station Carbon Monoxide Alarms," notwithstanding the scope of that standard, or

- c) good engineering practice.

(See Note A-6.9.3.1.(6).)

9) Where a fuel-burning *appliance* serves a *business and personal services occupancy*, or *mercantile occupancy*, a CO alarm shall be,

a) where the fuel-burning *appliance* is part of a system that could circulate or distribute CO to a *suite of business and personal services occupancy* or *mercantile occupancy*, installed on each *storey* of each *suite* that may be exposed, and

b) installed in the room or space in which the fuel-burning *appliance* is located.

(See Note A-6.9.3.1.(7).)

10) For each *suite of business and personal services occupancy* or *mercantile occupancy* that shares a wall or floor/ceiling assembly with either a *storage garage*, or a *service room* containing a fuel-burning *appliance*, or that is adjacent to an attic or crawl space to which either a *storage garage*, or a *service room* containing a fuel-burning *appliance* is also adjacent, a CO alarm shall be installed

a) on each *storey* of the adjacent *suite*, and

b) in each *service room* containing a fuel-burning *appliance*.

(See Note A-6.9.3.1.(8).)

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

a) heating systems, including requirements for combustion air, and air-conditioning systems serving only one *dwelling unit* or houses with a *secondary suite* including their common spaces, and

b) reserved.

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 Note A-9.33.1.1.(2) and Subsection 9.10.10.)

3) Unless the air duct distribution systems serving one of the *dwelling units* in a *single detached* house are designed and installed to prevent the circulation of smoke in accordance with Sentence 9.32.3.2.(4) and equipped with *fire dampers* in accordance with Sentence 9.32.3.2.(5), the air duct distribution system shall not be directly interconnected with *another principal dwelling unit and common spaces*.

4) Systems used for heating and air-conditioning shall conform to the energy efficiency requirements in Section 9.36.

9.33.2. Required Heating and Cooling Systems

9.33.2.1. Required Heating and Cooling 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.

2) Except where determination according to Article 9.33.5.1. or good engineering practice according to Article 6.2.1.1. can show it to be unnecessary, *dwelling units* intended for use in the summer months on a continuing basis shall be equipped with cooling facilities conforming to this Section. (See Note A-9.33.2.1.(2).)

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) 18°C in common *service rooms*, ancillary spaces and *exits* in *single detached* houses, and

d) 15°C in heated crawl spaces.

2) At the outside summer design temperature, required cooling facilities shall be capable of maintaining an indoor air temperature of not more than 26°C in at least one living space in each *dwelling unit*.

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. Heating System Control

1) Where a single heating system serves a house with a *secondary suite*, individual temperature controls shall be provided in each *dwelling unit* served by the system. (See Note A-9.33.4.3.(1).)

9.33.4.4. Access

(See Note A-9.33.4.4.)

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.

2) Where a heating or air-conditioning system serves more than one *dwelling unit* in a house with a *secondary suite* including their common spaces, access required by Sentence (1) from more than one *dwelling unit*, common space or ancillary space is not required.

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 seismic design parameter, S_{max} , for Site Class C is greater than 0.37, 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 Cooling Appliances and Equipment

9.33.5.1. Capacity of Heating and Cooling Appliances

1) The required capacity of heating and cooling *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 pursuant regulations,
- b) CSA B139 Series, "Installation code for oil-burning equipment," and
- c) CAN/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 4.1 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, "Standard Methods of 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, "Standard Methods of 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, "Standard Method for 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, linings and foamed plastic insulation 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 C411, "Standard Specification for Hot-Surface Performance of High-Temperature Thermal Insulation," at the maximum temperature to which they 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.
- 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	Aluminum
Round ducts serving single <i>dwelling units</i>	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 <i>dwelling units</i> , 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 firestopped 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) to (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 m² 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 m² 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, "Standard Method of 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 9.10.9.7., and Sentence 9.10.9.9.(3) 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 C411, "Standard Specification for 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
$T \leq 95$	no clearance required
$95 < T \leq 120$	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, "Standard for 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 Single Detached Houses and Duplexes

1) Exhaust Vents from heating and air conditioning equipment and similar appliances, other than direct vented fireplaces in a single detached house or duplex, 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 meet the requirements of the appropriate provincial, territorial or municipal legislation or, in the absence of such legislation, shall conform to the Safety Standards Act and pursuant regulations.

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* and houses with a *secondary suite* including their common spaces.

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 m² 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
Rooms for storage of combustible refuse	200	20
Garages	50	5
Public water-closet rooms	100	10
Service hallways and stairways	50	5
Recreation rooms	100	10

4) Notwithstanding Sentences (1) to (3), rooms and spaces used by the public shall be equipped to provide illumination as described in Sentences 3.2.7.1.(4) to (7).

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. Deleted

Section 9.37. Deleted

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 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 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)

Provision	Functional Statements and Objectives ^(a)
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 <i>chimneys</i> 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 <i>guards</i> or handrails. [F20,F21,F80-OS3.4] Applies where concrete supports or is used in <i>chimneys</i> or fireplaces.
	[F20,F21,F80-OS1.1] Applies where concrete supports or is used in <i>chimneys</i> 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 <i>chimneys</i> 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 <i>chimneys</i> or fireplaces.
	[F20,F80-OS1.1] Applies where concrete supports or is used in <i>chimneys</i> 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 <i>chimneys</i> 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 <i>guards</i> or handrails. [F20,F80-OS3.4,OS3.7] Applies where concrete supports or is used in <i>chimneys</i> or fireplaces.
	[F20,F80-OS1.1] Applies where concrete supports or is used in <i>chimneys</i> 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 <i>chimneys</i> 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 <i>guards</i> or handrails. [F80-OS3.4,OS3.7] Applies where concrete supports or is used in <i>chimneys</i> or fireplaces.
	[F80-OS1.1] Applies where concrete is used in footings for <i>chimneys</i> 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 <i>chimneys</i> and fireplaces. [F20,F80,F61-OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in <i>chimneys</i> and fireplaces.
	[F20,F80-OS1.1] Applies to concrete used in <i>chimneys</i> or fireplaces.
	[F20,F80-OS3.1] Applies to floors and elements that support floors. [F20,F80-OS3.4] Applies to concrete used in <i>chimneys</i> 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 <i>chimneys</i> and fireplaces. [F20,F80,F61-OH1.3] Applies to elements that support or are part of an environmental separator and to masonry used in <i>chimneys</i> 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 <i>guards</i> or handrails. [F20,F80-OS3.4,OS3.7] Applies where concrete supports or is used in <i>chimneys</i> or fireplaces.
	[F20,F80-OS1.1] Applies where concrete supports or is used in <i>chimneys</i> 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 <i>chimneys</i> 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 <i>chimneys</i> or fireplaces.
	(a) [F20,F21,F80-OS1.1] Applies where concrete supports or is used in <i>chimneys</i> 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 <i>chimneys</i> 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 <i>guards</i> or handrails. (a) [F20,F21,F61-OS3.4,OS3.7] Applies where concrete supports or is used in <i>chimneys</i> or fireplaces.
	(a) [F20,F21,F61-OS1.1] Applies where concrete supports or is used in <i>chimneys</i> 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 <i>chimneys</i> 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 <i>guards</i> or handrails. [F20,F80-OS3.4,OS3.7] Applies where concrete supports or is used in <i>chimneys</i> or fireplaces.
	[F20,F21-OS1.1] Applies where concrete supports or is used in <i>chimneys</i> 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 <i>chimneys</i> 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 <i>guards</i> or handrails. [F20,F80-OS3.4,OS3.7] Applies where concrete supports or is used in <i>chimneys</i> or fireplaces. [F20,F21,F80-OS1.1] Applies where concrete supports or is used in <i>chimneys</i> 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 <i>chimneys</i> 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 <i>guards</i> or handrails. [F20,F80-OS3.4,OS3.7] Applies where concrete supports or is used in <i>chimneys</i> or fireplaces. [F20,F21,F80-OS1.1] Applies where concrete supports or is used in <i>chimneys</i> or fireplaces.
(2)	[F20-OH1.1] Applies where concrete supports or is used in the walls of <i>chimneys</i> 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 <i>chimneys</i> 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 <i>chimneys</i> 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]
(4)	[F20-OS2.1,OS2.3] [F22-OS2.3]
	[F20-OP2.1,OP2.3] [F22-OP2.3]
	[F22-OH1.1,OH1.2,OH1.3]
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 <i>foundations</i> 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	
(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	
(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),(i) [F63-OH1.1] [F51,F63-OH1.2]
	(h) [F03-OS1.2]

(2)	[F30-OS3.1] [F10-OS3.7]
9.6.1.3. Structural Sufficiency of Glass	
(1)	[F20-OS2.1]
(3)	[F30-OS3.1] [F10-OS3.7]
9.6.1.4. Types of Glazing and Protection of Glazing	
(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 <i>partitions</i> shall be suitably marked to indicate their existence and position."
(5)	[F30-OS3.1] [F10-OS3.7]
(6)	[F20,F30-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 Performance Expectations	
(2)	[F81-OH1.1] Applies to skylights that provide required non-heating season ventilation. [F20,F22-OH1.3]
	[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]
(3)	[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 <i>sprinklered suites</i> .
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]
9.7.5.3. Resistance to Forced Entry for Windows	
(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]
(2)	[F54,F55,F61,F63-OH1.1,OH1.2,OH1.3]
	[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]
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]
9.8.4.9. Open Risers	
(1)	[F30-OS3.1]
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]
(2)	[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]
9.8.7.1. 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]
9.8.8.2. Loads on Guards	
(1)	[F20-OS2.1]
(2)	[F22-OS2.4]
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]
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]
(4)	[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]
9.8.9.1. 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]
(2)	[F03-OS1.2] [F05-OS1.5]
	[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]
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]
(2)	[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 <i>building</i> .”
9.10.2.2. Home-Type Care Occupancies	
(2)	[F10-OS1.5]
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)	[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 <i>fire-resistance ratings</i> 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 <i>fire-resistance ratings</i> 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]
(2)	[F03-OS1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F04-OP1.2]
(5)	[F03-OS1.2]
	[F03-OP1.2]
9.10.9.3. Openings to be Protected with Closures	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
9.10.9.4. Floor Assemblies	
(1)	[F03-OS1.2]
	[F03-OP1.2]
9.10.9.6. General Requirements for Penetrations of Fire Separations	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
9.10.9.7. Piping Penetrations	
(1)	[F03-OS1.2] [F04-OS1.2]
	[F03-OP1.2] [F04-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(5)	[F03-OS1.2] [F04-OS1.2]
	[F03-OP1.2] [F04-OP1.2]
9.10.9.8. Penetrations by Outlet Boxes or Service Equipment in Concealed Spaces	
(1)	[F03-OS1.2] [F04-OS1.2]

	[F03-OP1.2] [F04-OP1.2]
(6)	[F03-OS1.2] [F04-OS1.2]
	[F03-OP1.2] [F04-OP1.2]
9.10.9.10. Collapse of Combustible Construction	
(1)	[F03-OS1.2]
	[F03-OP1.2]
9.10.9.11. Reduction in Thickness of Fire Separation by Beams and Joists	
(1)	[F03-OS1.2]
	[F03-OP1.2]
9.10.9.12. Concealed Spaces above Fire Separations	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
9.10.9.13. 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]
9.10.9.14. Residential Suites in Industrial Buildings	
(1)	[F02-OS1.2]
9.10.9.15. Separation of Suites	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F02-OS1.2]
	[F02-OP1.2]
9.10.9.16. Separation of Residential Suites	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
9.10.9.17. 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]

(4)	[F03-OS1.2]
	[F03-OP1.2]
(5)	[F03,F05-OS1.5] [F03,F06-OS1.5,OS1.2]
	[F03,F06-OP1.2]
9.10.9.18. 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]
9.10.9.19. 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]
9.10.9.20. Exhaust Ducts Serving More Than One Fire Compartment	
(1)	[F03-OS1.2]
(2)	[F03-OS1.2]
9.10.9.21. 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]
(2)	[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]
(3)	[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 <i>service rooms</i> containing fuel-fired equipment where such doors lead to <i>public corridors</i> 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-OS1.3]
	[F03-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]
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]
9.10.15.3. Limiting Distance and Fire Department Response	
(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]
(7)	[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]
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)	[F01,F02,F05-OS1.5]
(2)	[F05-OS1.5] [F02-OS1.2]
	[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 <i>sprinklered buildings</i> . [F11-OS1.5] Applies to the supervision of the system and the flow alarm.
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]
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)	[F11,F81-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]
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]
(2)	[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)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.13.2.3. Preparation of Surface	
(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]
(4)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(5)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(6)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.13.2.4. Application of Dampproofing Material	
(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]
9.13.2.5. 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)	[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]
(4)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(5)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
9.13.3.4. Application of Waterproofing Membranes	
(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]
(4)	[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 <i>foundations</i> serve as or support an environmental separator.
	(a) [F60-OS2.1]
	(a) [F60-OS2.3] Applies where <i>foundations</i> serve as or support an environmental separator.
	(b) [F21-OS2.1]
	(b) [F21-OS2.3] Applies where <i>foundations</i> serve as or support an environmental separator.
	(b) [F21-OP2.1]
	(b) [F21-OP2.3] Applies where <i>foundations</i> serve as or support an environmental separator.
	(b) [F21-OP2.4] Applies where <i>foundations</i> support walls or floors.
	(b) [F21-OH1.1,OH1.2,OH1.3] Applies where <i>foundations</i> serve as or support an environmental separator.
	(b) [F21-OH4] Applies where <i>foundations</i> support floors or elements supporting floors.
	(b) [F21-OS3.1] Applies where <i>foundations</i> support floors or elements supporting floors.
	(b) [F21-OS3.7] Applies where <i>foundations</i> 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.
(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.
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 <i>foundation</i> supports or is part of an environmental separator.
	[F20,F22-OH4] Applies to <i>foundations</i> that support floors.
	[F20,F22-OS3.1] Applies to <i>foundations</i> that support floors.
9.15.4.1. Flat Wall Insulating Concrete Form Units	
(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]
	[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.

(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.
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 <i>chimneys</i> and fireplaces.
	[F20,F80-OS3.1] Applies to floors and elements that support floors. [F20,F80-OS3.4] Applies to masonry used in <i>chimneys</i> and fireplaces.
	[F20,F80-OS1.2] Applies to assemblies required to provide fire resistance. [F01-OS1.1,OS1.2] Applies to masonry used in <i>chimneys</i> 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 <i>chimneys</i> 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 <i>chimneys</i> and fireplaces.
	[F20,F80-OS1.2] Applies to assemblies required to provide fire resistance. [F01-OS1.1,OS1.2] Applies to masonry used in <i>chimneys</i> and fireplaces.
	[F20,F80-OS3.1] Applies to floors and elements that support floors. [F20,F80-OS3.4] Applies to masonry used in <i>chimneys</i> 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 <i>chimneys</i> 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 <i>chimneys</i> 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 <i>chimneys</i> 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 <i>chimneys</i> 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 <i>chimneys</i> and fireplaces.
	[F80-OP1.2] Applies to masonry used in <i>chimneys</i> and fireplaces.
	[F80-OS1.2] Applies to masonry used in <i>chimneys</i> 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 <i>chimneys</i> and fireplaces.
	[F20,F80-OS1.2] Applies to assemblies required to provide fire resistance. [F01-OS1.1,OS1.2] Applies to masonry used in <i>chimneys</i> 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 <i>chimneys</i> 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 <i>chimneys</i> and fireplaces.
	[F80-OP1.2] Applies to concrete blocks in <i>chimneys</i> 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 <i>chimneys</i> and fireplaces.
	[F20,F80-OS1.2] Applies to assemblies required to provide fire resistance. [F01-OS1.1,OS1.2] Applies to masonry used in <i>chimneys</i> 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 <i>chimneys</i> and fireplaces.
	[F20,F80-OP1.2] Applies to assemblies required to provide fire resistance. [F01,F20,F80-OP1.2] Applies to masonry used in <i>chimneys</i> 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 <i>chimneys</i> 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 <i>chimneys</i> 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 <i>chimneys</i> 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 <i>chimneys</i> 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 <i>chimneys</i> 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 <i>chimneys</i> 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 <i>chimneys</i> 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 <i>chimneys</i> 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 <i>chimneys</i> 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. 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 <i>chimneys</i> 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 <i>chimneys</i> 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 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 <i>chimneys</i> 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.

	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 <i>chimney</i> or <i>flue pipe</i> , which are required to be constructed to be flame-tight.
	[F44-OH1.1] Applies to the walls of any <i>chimney</i> or <i>flue pipe</i> , which are required to be constructed to be smoke-tight.
	[F01-OP1.1] Applies to the walls of any <i>chimney</i> or <i>flue pipe</i> , 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.
9.23.2.4. Connections to Preservative-Treated Wood	
(1)	[F20,F80-OS2.3]
	[F20,F80-OP2.3]
(2)	[F20,F80-OS2.3]
	[F20,F80-OP2.3]
(3)	[F20,F80-OS2.3]
	[F20,F80-OP2.3]
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.
	[F22-OS3.7] Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.
(8)	[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.
(9)	[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,OP2.5]
	[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]

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.
(5)	(d) [F80-OS2.3]
	(d) [F80-OH1.1,OH1.2,OH1.3]
	[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 <i>air barrier system</i> separates a garage, or <i>suite</i> containing a garage, from residential space.
	[F44-OS3.4] Applies where the <i>air barrier system</i> separates a garage, or <i>suite</i> 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 <i>air barrier system</i> separates a garage, or <i>suite</i> containing a garage, from residential space.
	[F20,F44-OS3.4] Applies where the <i>air barrier system</i> separates a garage, or <i>suite</i> 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 <i>air barrier system</i> separates a garage, or <i>suite</i> containing a garage, from residential space.
	[F20,F80,F44-OS3.4] Applies where the <i>air barrier system</i> separates a garage, or <i>suite</i> 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 <i>air barrier system</i> separates a garage, or <i>suite</i> containing a garage, from residential space.
	[F44-OS3.4] Applies where the <i>air barrier system</i> separates a garage, or <i>suite</i> containing a garage, from residential space.
(2)	[F55-OH1.1,OH1.2,OH1.3] [F40-OH1.1]
	(a) [F44-OS3.4] Applies where the <i>air barrier system</i> separates a garage, or <i>suite</i> containing a garage, from residential space.
	[F55-OS2.3]
	(a) [F44-OS1.1] Applies where the <i>air barrier system</i> separates a garage, or <i>suite</i> 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 <i>air barrier system</i> separates a garage, or <i>suite</i> containing a garage, from residential space.
	[F44-OS3.4] Applies where the <i>air barrier system</i> separates a garage, or <i>suite</i> 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)	[F63-OS2.3]
	[F63-OH1.1,OH1.2,OH1.3]
(3)	[F62,F63-OS2.3]
	[F62,F63-OH1.1,OH1.2,OH1.3]
(4)	[F63,F80-OS2.3]
	[F63,F80-OH1.1,OH1.2]
(5)	[F63,F80-OS2.3]
	[F63,F80-OH1.1,OH1.2]
(6)	[F63,F80-OS2.3]
	[F63,F80-OH1.1,OH1.2]
(7)	[F63-OS2.3]
	[F63-OH1.1,OH1.2]
(8)	[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 <i>chimney</i> .
	[F61-OP1.1] Applies where a shingle roof intersects with a masonry <i>chimney</i> .
	[F61-OS3.4] Applies where a shingle roof intersects with a masonry <i>chimney</i> .
(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 <i>chimney</i> .
	[F61-OP1.1] Applies where counter flashing is installed between a shingle roof and a masonry <i>chimney</i> .
	[F61-OS3.4] Applies where counter flashing is installed between a shingle roof and a masonry <i>chimney</i> .
(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 <i>chimney</i> .
	[F61-OP1.1] Applies where flashing is installed between a shingle roof and a masonry <i>chimney</i> .
	[F61-OS3.4] Applies where flashing is installed between a shingle roof and a masonry <i>chimney</i> .
(4)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
	[F61-OS1.1] Applies where a shingle roof slopes upward from a masonry <i>chimney</i> .
	[F61-OP1.1] Applies where a shingle roof slopes upward from a masonry <i>chimney</i> .
	[F61-OS3.4] Applies where a shingle roof slopes upward from a masonry <i>chimney</i> .
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 <i>chimney</i> .
	[F61-OP1.1] Applies where a built-up roof intersects with a masonry <i>chimney</i> .
	[F61-OS3.4] Applies where a built-up roof intersects with a masonry <i>chimney</i> .
(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 <i>chimney</i> .
	[F61-OP1.1] Applies where counter flashing is installed between a built-up roof and a masonry <i>chimney</i> .
	[F61-OS3.4] Applies where counter flashing is installed between a built-up roof and a masonry <i>chimney</i> .
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]
9.27.2.1. 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]
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.
(2)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.1,OS2.3]
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]
(2)	[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-OS2.1,OS2.3]
(3)	[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.
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.
	[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-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.
(2)	[F20,F22,F61-OH1.1,OH1.2,OH1.3]

	[F20-OS2.1,OS2.3] [F22,F61-OS2.3]
(3)	[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 Standards	
(1)	[F62,F61,F20-OH1.1,OH1.2,OH1.3]
	[F62,F61,F20-OS2.3]
(2)	[F62,F61,F20-OH1.1,OH1.2,OH1.3]
	[F62,F61,F20-OS2.3]
(3)	[F62,F61,F20,F42-OH1.1,OH1.2,OH1.3]
	[F62,F61,F20,F42-OS2.3]
(4)	[F02-OS1.2]
	[F02-OP1.2]
9.27.13.1. Material Standard	
(1)	[F62,F61,F20-OH1.1,OH1.2,OH1.3]
	[F62,F61,F20-OS2.3]
(2)	[F02-OS1.2]
	[F02-OP1.2]
9.27.14.2. 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]
9.27.14.3. 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 <i>chimneys</i> .
	[F80-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F80-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
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 <i>chimneys</i> .
	[F20-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
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 <i>chimneys</i> .
	[F80-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F80-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
(2)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
	[F20,F80-OS1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20,F80-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20,F80-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
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 <i>chimneys</i> .
	[F80-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F80-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
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 <i>chimneys</i> .
	[F80-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F80-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
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 <i>chimneys</i> .
	[F20-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
(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 <i>chimneys</i> .
	[F20-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
(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 <i>chimneys</i> .
	[F80-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F80-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
(2)	[F80-OH1.1,OH1.2,OH1.3]
	[F80-OS2.3]
	[F80-OS1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F80-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F80-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
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 <i>chimneys</i> .
	[F20-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
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 <i>chimneys</i> .
	[F20,F80-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20,F80-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
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 <i>chimneys</i> .
	[F20-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
(2)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
(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 <i>chimneys</i> .
	[F20-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
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 <i>chimneys</i> .
	[F20-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
(3)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
(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 <i>chimneys</i> .
	[F20,F61,F80-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20,F61,F80-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
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 <i>chimneys</i> .
	[F20,F80-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20,F80-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
(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 <i>chimneys</i> .
	[F20,F80-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20,F80-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
(2)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
	[F20,F80-OS1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20,F80-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20,F80-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
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 <i>chimneys</i> .
	[F20,F80-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20,F80-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
(2)	[F20,F80-OH1.1,OH1.2,OH1.3]
	[F20,F80-OS2.3]
	[F20,F80-OS1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20,F80-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20,F80-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
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 <i>chimneys</i> .
	[F20-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
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 <i>chimneys</i> .
	[F20,F80-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20,F80-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
(2)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
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 <i>chimneys</i> .
	[F20-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
(2)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
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 <i>chimneys</i> .
	[F80-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F80-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
(2)	[F20-OH1.1,OH1.2,OH1.3]
	[F20-OS2.3]
	[F20-OS1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F20-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
(3)	[F80-OH1.1,OH1.2,OH1.3]
	[F80-OS2.3]
	[F80-OS1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F80-OS3.4] Applies where stucco is applied to masonry <i>chimneys</i> .
	[F80-OP1.1] Applies where stucco is applied to masonry <i>chimneys</i> .
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]
(3)	[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

	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 <i>fire-resistance ratings</i> .
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,F52-OH1.1] [F51,F52-OH1.2] [F51,F52,F62,F63-OH1.3]
	[F52,F62,F63,F80-OP2.3]
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,F52-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,]
9.32.3.1. Required Ventilation	
(1)	[F40,F50,F52-OH1.1] [F51,F52-OH1.2] [F51,F52,F62,F63-OH1.3]
	[F52,F62,F63,F80-OP2.3]
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]
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]
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]
9.33.1.1. Application	
(3)	[F40-OH1.1]
	[F40-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.
9.33.4.3. Heating System Control	
(1)	[F51,F52-OH1.2] [F63-OH1.1]
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]
9.33.5.1. 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 <i>supply ducts</i> 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]
9.34.1.1. Standard for Electrical Installations	
(1)	[F32-OS3.3]
	[F01-OS1.1]
	[F01-OP1.1]
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]

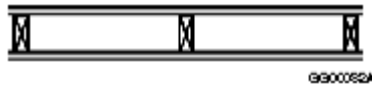
Notes to Table 9.38.1.1.:

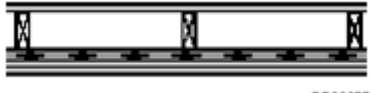
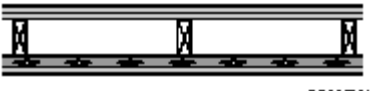
⁽¹⁾ See Parts 2 and 3 of Division A.

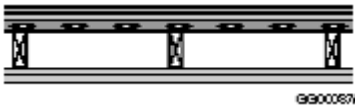
Fire and Sound Resistance Tables

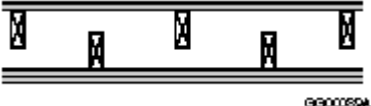
Table 9.10.3.1.-A
Fire and Sound Resistance of Walls⁽¹⁾

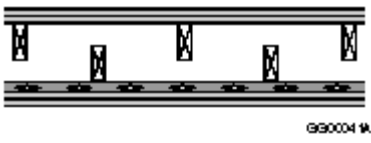
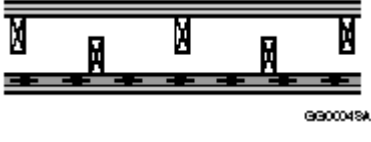
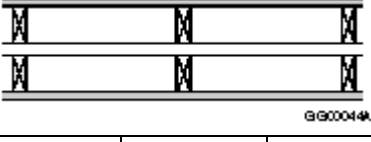
Forming Part of Article 5.8.1.3., Sentence 9.10.3.1.(1), Articles 9.11.1.3. and 9.11.1.4., and Sentence 9.29.5.9.(5)

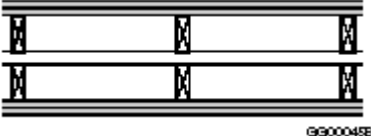
Type of Wall	Wall Number	Description	Fire-Resistance Rating ⁽²⁾⁽³⁾⁽⁴⁾		Typical Sound Transmission Class ⁽²⁾⁽⁴⁾⁽⁵⁾
			Loadbearing	Non-Loadbearing	
• Wood Studs	W1	• 38 mm × 89 mm studs spaced 400 mm or 600 mm o.c. • with or without absorptive material • 1 layer of gypsum board on each side			
• Single Row	W1a	W1 with • 89 mm thick absorptive material ⁽⁶⁾ • 15.9 mm Type X gypsum board ⁽⁷⁾	1 h	1 h	36
• Loadbearing or Non-Loadbearing	W1b	W1 with • 89 mm thick absorptive material ⁽⁶⁾ • 12.7 mm Type X gypsum board ⁽⁷⁾	45 min [1 h ⁽⁸⁾]	45 min [1 h ⁽⁸⁾]	34
	W1c	W1 with • 89 mm thick absorptive material ⁽⁶⁾ • 12.7 mm regular gypsum board ⁽⁷⁾⁽⁹⁾	30 min	30 min [45 min ⁽⁸⁾]	32
	W1d	W1 with • no absorptive material • 15.9 mm Type X gypsum board ⁽⁷⁾	1 h	1 h	32
	W1e	W1 with • no absorptive material • 12.7 mm Type X gypsum board ⁽⁷⁾	45 min	45 min	32
	W2	• 38 mm × 89 mm studs spaced 400 mm or 600 mm o.c. • with or without absorptive material • 2 layers of gypsum board on each side			
	W2a	W2 with • 89 mm thick absorptive material ⁽⁶⁾ • 15.9 mm Type X gypsum board ⁽⁷⁾	1.5 h	2 h	38
	W2b	W2 with • 89 mm thick absorptive material ⁽⁶⁾ • 12.7 mm Type X gypsum board ⁽⁷⁾	1 h	1.5 h	38
	W2c	W2 with • 89 mm thick absorptive material ⁽⁶⁾ • 12.7 mm regular gypsum board ⁽⁷⁾	45 min	1 h	36
	W2d	W2 with • no absorptive material • 15.9 mm Type X gypsum board ⁽⁷⁾	1.5 h	2 h	36
	W2e	W2 with • no absorptive material • 12.7 mm Type X gypsum board ⁽⁷⁾	1 h	1.5 h	35
	W2f	W2 with	45 min	1 h	34

		• no absorptive material • 12.7 mm regular gypsum board⁽⁷⁾			
	W3	• 38 mm × 89 mm studs spaced 400 mm or 600 mm o.c. • 89 mm thick absorptive material⁽⁸⁾ • resilient metal channels on one side spaced 400 mm or 600 mm o.c. • 1 layer of gypsum board on each side	 G300034A		
	W3a	W3 with • studs spaced 400 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾	45 min	1 h	45
	W3b	W3 with • studs spaced 600 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾	45 min	1 h	48
	W3c	W3 with • studs spaced 400 mm or 600 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾	45 min	45 min	43
	W4	• 38 mm × 89 mm studs spaced 400 mm or 600 mm o.c. • 89 mm thick absorptive material⁽⁸⁾ • resilient metal channels on one side spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on resilient metal channel side • 1 layer of gypsum board on other side	 G300065A		
	W4a	W4 with • studs spaced 400 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾	1 h	1 h [1.5 h ⁽⁸⁾]	51
	W4b	W4 with • studs spaced 600 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾	1 h	1 h [1.5 h ⁽⁸⁾]	54
	W4c	W4 with • studs spaced 400 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾	45 min [1 h ⁽⁸⁾]	1 h	49
	W4d	W4 with • studs spaced 600 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾	45 min [1 h ⁽⁸⁾]	1 h	53
	W5	• 38 mm × 89 mm studs spaced 400 mm or 600 mm o.c. • 89 mm thick absorptive material⁽⁸⁾ • resilient metal channels on one side spaced 400 mm or 600 mm o.c. • 1 layer of gypsum board on resilient metal channel side • 2 layers of gypsum board on other side	 G300089A		
	W5a	W5 with • studs spaced 400 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾	45 min	1 h	51
	W5b	W5 with • studs spaced 600 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾	45 min	1 h	54
	W5c	W5 with • studs spaced 400 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾	45 min	1 h	49

	W5d	W5 with • studs spaced 600 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾	45 min	1 h	53
	W6	• 38 mm × 89 mm studs spaced 400 mm or 600 mm o.c. • with or without absorptive material • resilient metal channels on one side • 2 layers of gypsum board on each side			
	W6a	W6 with • studs spaced 400 mm or 600 mm o.c. • 89 mm thick absorptive material⁽⁶⁾ • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾	1.5 h	2 h	55
	W6b	W6 with • studs spaced 400 mm or 600 mm o.c. with blocking at mid-height⁽¹⁰⁾ • 89 mm thick rock or slag fibre insulation⁽¹¹⁾ • resilient metal channels spaced 400 mm or 600 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾	2 h	2 h	–
	W6c	W6 with • studs spaced 400 mm o.c. with blocking at mid-height⁽¹⁰⁾ • 89 mm thick dry-blown cellulose fibre insulation⁽¹²⁾ • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾	2 h	2 h	–
	W6d	W6 with • studs spaced 400 mm or 600 mm o.c. • 89 mm thick absorptive material⁽⁶⁾ • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾	1.5 h	2 h	58
	W6e	W6 with • studs spaced 400 mm o.c. • 89 mm thick absorptive material⁽⁶⁾ • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾	1 h	1.5 h	53
	W6f	W6 with • studs spaced 400 mm o.c. • 89 mm thick absorptive material⁽⁶⁾ • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾	1 h	1.5 h	55
	W6g	W6 with • studs spaced 600 mm o.c. • 89 mm thick absorptive material⁽⁶⁾ • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾	1 h	1.5 h	55
	W6h	W6 with • studs spaced 600 mm o.c. • 89 mm thick absorptive material⁽⁶⁾ • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾	1 h	1.5 h	58
	W6i	W6 with • studs spaced 400 mm or 600 mm o.c. • no absorptive material • resilient metal channels spaced 400 mm or	1.5 h	2 h	47

		600 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾			
	W6j	W6 with • studs spaced 400 mm or 600 mm o.c. • no absorptive material • resilient metal channels spaced 400 mm or 600 mm o.c. • 12.7 mm Type X gypsum board ⁽⁷⁾	1 h	1.5 h	46
• Wood Studs • Two Rows Staggered on 38 mm × 140 mm Plate	W7	• two rows 38 mm × 89 mm studs each spaced 400 mm or 600 mm o.c. staggered on common 38 mm × 140 mm plate • 89 mm thick absorptive material on one side or 65 mm thick on each side ⁽⁸⁾ • 1 layer of gypsum board on each side			
• Loadbearing or Non- Loadbearing	W7a	W7 with • 15.9 mm Type X gypsum board ⁽⁷⁾	1 h	1 h	47
	W7b	W7 with • 12.7 mm Type X gypsum board ⁽⁷⁾	45 min [1 h ⁽⁸⁾]	45 min [1 h ⁽⁸⁾]	45
	W7c	W7 with • 12.7 mm regular gypsum board ⁽⁷⁾⁽⁹⁾	30 min	30 min [45 min ⁽⁸⁾]	42
	W8	• Two rows 38 mm × 89 mm studs each spaced 400 mm or 600 mm o.c. staggered on common 38 mm × 140 mm plate • 89 mm thick absorptive material on one side or 65 mm thick on each side ⁽⁸⁾ • 2 layers of gypsum board on one side • 1 layer of gypsum board on other side			
	W8a	W8 with • 15.9 mm Type X gypsum board ⁽⁷⁾	1 h	1.5 h	52
	W8b	W8 with • 12.7 mm Type X gypsum board ⁽⁷⁾	45 min	1 h	50
	W9	• two rows 38 mm × 89 mm studs each spaced 400 mm or 600 mm o.c. staggered on common 38 mm × 140 mm plate • with or without absorptive material • 2 layers of gypsum board on each side			
	W9a	W9 with • 89 mm thick absorptive material on one side or 65 mm thick on each side ⁽⁸⁾ • 15.9 mm Type X gypsum board ⁽⁷⁾	1.5 h	2 h	56
	W9b	W9 with • 89 mm thick absorptive material on one side or 65 mm thick on each side ⁽⁸⁾ • 12.7 mm Type X gypsum board ⁽⁷⁾	1 h	1.5 h	55
	W9c	W9 with • 89 mm thick absorptive material on one side or 65 mm thick on each side ⁽⁸⁾ • 12.7 mm regular gypsum board ⁽⁷⁾	45 min	1 h	53
	W9d	W9 with • no absorptive material • 15.9 mm Type X gypsum board ⁽⁷⁾	1.5 h	2 h	48

	W10	• two rows 38 mm × 89 mm studs each spaced 400 mm or 600 mm o.c. staggered on common 38 mm × 140 mm plate • with or without absorptive material • resilient metal channels on one side spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on each side			
	W10a	W10 with • 89 mm thick absorptive material on one side or 65 mm thick on each side^(a) • 15.9 mm Type X gypsum board⁽⁷⁾	1.5 h	2 h	62
	W10b	W10 with • 89 mm thick absorptive material on one side or 65 mm thick on each side^(a) • 12.7 mm Type X gypsum board⁽⁷⁾	1 h	1.5 h	60
	W10c	W10 with • no absorptive material • 15.9 mm Type X gypsum board⁽⁷⁾	1.5 h	2 h	50
	W10d	W10 with • no absorptive material • 12.7 mm Type X gypsum board⁽⁷⁾	1 h	1.5 h	48
	W11	• two rows 38 mm × 89 mm studs each spaced 400 mm or 600 mm o.c. staggered on common 38 mm × 140 mm plate • 89 mm thick absorptive material on one side or 65 mm thick on each side^(a) • resilient metal channels on one side spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on resilient channel side • 1 layer of gypsum board on other side			
	W11a	W11 with • 15.9 mm Type X gypsum board⁽⁷⁾	1 h	1 h	56
	W11b	W11 with • 12.7 mm Type X gypsum board⁽⁷⁾	45 min [1 h ^(a)]	1 h	54
	W12	• two rows 38 mm × 89 mm studs each spaced 400 mm or 600 mm o.c. staggered on common 38 mm × 140 mm plate • 89 mm thick absorptive material on one side or 65 mm thick on each side^(a) • resilient metal channels on one side spaced 400 mm or 600 mm o.c. • 1 layer of gypsum board on resilient metal channel side • 2 layers of gypsum board on other side			
	W12a	W12 with • 15.9 mm Type X gypsum board⁽⁷⁾	45 min	1 h	56
	W12b	W12 with • 12.7 mm Type X gypsum board⁽⁷⁾	45 min	1 h	54
• Wood Studs • Two Rows on Separate Plates	W13	• two rows 38 mm × 89 mm studs, each spaced 400 mm or 600 mm o.c. on separate 38 mm × 89 mm plates set 25 mm apart • with or without absorptive material • 1 layer of gypsum board on each side			
• Loadbearing	W13a	W13 with	1 h	1 h	57

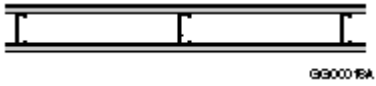
or Non-Loadbearing		• 89 mm thick absorptive material on each side⁽⁶⁾⁽¹³⁾ • 15.9 mm Type X gypsum board⁽⁷⁾			
	W13b	W13 with • 89 mm thick absorptive material on each side⁽⁶⁾⁽¹³⁾ • 12.7 mm Type X gypsum board⁽⁷⁾	45 min [1 h ⁽⁸⁾]	45 min [1 h ⁽⁸⁾]	57
	W13c	W13 with • 89 mm thick absorptive material on one side only⁽⁶⁾⁽¹³⁾ • 15.9 mm Type X gypsum board⁽⁷⁾	1 h	1 h	54
	W13d	W13 with • 89 mm thick absorptive material on one side only⁽⁶⁾⁽¹³⁾ • 12.7 mm Type X gypsum board⁽⁷⁾	45 min	45 min	53
	W13e	W13 with • no absorptive material • 15.9 mm Type X gypsum board⁽⁷⁾	1 h	1 h	45
	W13f	W13 with • no absorptive material • 12.7 mm Type X gypsum board⁽⁷⁾	45 min	45 min	45
	W14	• two rows 38 mm × 89 mm studs, each spaced 400 mm or 600 mm o.c. on separate 38 mm × 89 mm plates set 25 mm apart • with or without absorptive material • 2 layers of gypsum board on one side • 1 layer of gypsum board on other side			
	W14a	W14 with • 89 mm thick absorptive material on each side⁽⁶⁾⁽¹³⁾ • 15.9 mm Type X gypsum board⁽⁷⁾	1 h	1 h [1.5 h ⁽⁸⁾]	61
	W14b	W14 with • 89 mm thick absorptive material on each side⁽⁶⁾⁽¹³⁾ • 12.7 mm Type X gypsum board⁽⁷⁾	45 min	1 h	61
	W14c	W14 with • 89 mm thick absorptive material on one side only⁽⁶⁾⁽¹³⁾ • 15.9 mm Type X gypsum board⁽⁷⁾	1 h	1 h	57
	W14d	W14 with • 89 mm thick absorptive material on one side only⁽⁶⁾⁽¹³⁾ • 12.7 mm Type X gypsum board⁽⁷⁾	45 min	1 h	57
	W14e	W14 with • no absorptive material • 15.9 mm Type X gypsum board⁽⁷⁾	1 h	1 h	51
	W14f	W14 with • no absorptive material • 12.7 mm Type X gypsum board⁽⁷⁾	45 min	1 h	51
	W15	• two rows 38 mm × 89 mm studs, each spaced 400 mm or 600 mm o.c. on separate 38 mm × 89 mm plates set 25 mm apart • with or without absorptive material • 2 layers of gypsum board on each side			

	W15a	W15 with • 89 mm thick absorptive material on each side ⁽⁶⁾⁽¹³⁾ • 15.9 mm Type X gypsum board ⁽⁷⁾	1.5 h	2 h	66
	W15b	W15 with • 89 mm thick absorptive material on each side ⁽⁶⁾⁽¹³⁾ • 12.7 mm Type X gypsum board ⁽⁷⁾	1 h	1.5 h	65
	W15c	W15 with • 89 mm thick absorptive material on each side ⁽⁶⁾⁽¹³⁾ • 12.7 mm regular gypsum board ⁽⁷⁾	45 min	1 h	61
	W15d	W15 with • 89 mm thick absorptive material on one side only ⁽⁶⁾⁽¹³⁾ • 15.9 mm Type X gypsum board ⁽⁷⁾	1.5 h	2 h	62
	W15e	W15 with • 89 mm thick absorptive material on one side only ⁽⁶⁾⁽¹³⁾ • 12.7 mm Type X gypsum board ⁽⁷⁾	1 h	1.5 h	60
	W15f	W15 with • 89 mm thick absorptive material on one side only ⁽⁶⁾⁽¹³⁾ • 12.7 mm regular gypsum board ⁽⁷⁾	45 min	1 h	57
	W15g	W15 with • no absorptive material • 15.9 mm Type X gypsum board ⁽⁷⁾	1.5 h	2 h	56
	W15h	W15 with • no absorptive material • 12.7 mm Type X gypsum board ⁽⁷⁾	1 h	1.5 h	55
	W15i	W15 with • no absorptive material • 12.7 mm regular gypsum board ⁽⁷⁾	45 min	1 h	51
	W16	• two rows 38 mm x 89 mm studs, each spaced 400 mm or 600 mm o.c. on separate 38 mm x 89 mm plates set 25 mm apart • resilient metal channels on one side spaced 400 mm or 600 mm o.c. • with or without absorptive material • 2 layers of gypsum board on each side			
	W16a	W16 with • 89 mm thick absorptive material on each side ⁽⁶⁾⁽¹³⁾ • 15.9 mm Type X gypsum board ⁽⁷⁾	1.5 h	2 h	66
	W16b	W16 with • studs spaced 400 mm o.c. with blocking at mid-height ⁽¹⁰⁾ • 89 mm thick rock or slag fibre insulation on each side ⁽¹¹⁾ • resilient metal channels on one side spaced 400 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾⁽¹⁴⁾	2 h	2 h	–
	W16c	W16 with • 89 mm thick absorptive material on each side ⁽⁶⁾⁽¹³⁾	1 h	1.5 h	65

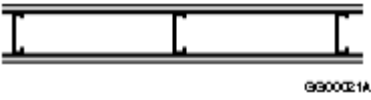
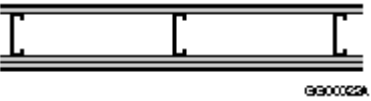
		• 12.7 mm Type X gypsum board ⁽⁷⁾			
	W16d	W16 with • 89 mm thick absorptive material on one side only ⁽⁶⁾⁽¹³⁾ • 15.9 mm Type X gypsum board ⁽⁷⁾	1.5 h	2 h	62
	W16e	W16 with • 89 mm thick absorptive material on one side only ⁽⁶⁾⁽¹³⁾ • 12.7 mm Type X gypsum board ⁽⁷⁾	1 h	1.5 h	60
	W16f	W16 with • no absorptive material • 15.9 mm Type X gypsum board ⁽⁷⁾	1.5 h	2 h	56
	W16g	W16 with • no absorptive material • 12.7 mm Type X gypsum board ⁽⁷⁾	1 h	1.5 h	55
• Exterior • Wood Studs • Single Row • Loadbearing or Non-Loadbearing	EW1	• wood studs • rock or slag fibre insulation ⁽¹¹⁾ • 1 layer of gypsum board on inside • exterior sheathing and cladding	 		
	EW1a	EW1 with • 38 mm x 89 mm studs spaced 400 mm or 600 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾⁽¹⁵⁾⁽¹⁶⁾ • exterior OSB or plywood sheathing ⁽¹⁷⁾ or exterior gypsum sheathing ⁽¹⁸⁾ and cladding ⁽¹⁹⁾	1 h	1 h	n/a
	EW1b	EW1 with • 38 mm x 89 mm studs spaced 400 mm or 600 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾⁽¹⁵⁾ • exterior OSB or plywood sheathing ⁽¹⁷⁾ or exterior gypsum sheathing ⁽¹⁸⁾ and cladding ⁽¹⁹⁾	45 min	1 h	n/a
	EW1c	EW1 with • 38 mm x 89 mm studs spaced 400 mm or 600 mm o.c. • 12.7 mm Type X gypsum board ⁽⁷⁾⁽¹⁵⁾⁽¹⁶⁾ • exterior OSB or plywood sheathing ⁽¹⁷⁾ or exterior gypsum sheathing ⁽¹⁸⁾ and cladding ⁽¹⁹⁾	45 min	1 h	n/a
	EW1d	EW1 with • 38 mm x 89 mm studs spaced 400 mm or 600 mm o.c. • 12.7 mm Type X gypsum board ⁽⁷⁾⁽¹⁵⁾ • exterior OSB or plywood sheathing ⁽¹⁷⁾ or exterior gypsum sheathing ⁽¹⁸⁾ and cladding ⁽¹⁹⁾	–	45 min	n/a
	EW1e	EW1 with • 38 mm x 140 mm studs spaced 400 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾⁽¹⁵⁾⁽¹⁶⁾ • exterior wood sheathing, exterior gypsum sheathing, or insulated exterior sheathing ⁽²⁰⁾ • masonry veneer cladding not less than 89 mm thick	45 min	45 min	n/a
	EW2	• wood studs • glass fibre insulation ⁽²¹⁾ • 1 layer of gypsum board on inside • exterior sheathing and cladding	 		

	EW2a	EW2 with • 38 mm x 89 mm studs spaced 400 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾⁽¹⁵⁾⁽²²⁾ • exterior OSB or plywood sheathing ⁽¹⁷⁾ or exterior gypsum sheathing ⁽²³⁾ and cladding ⁽¹⁹⁾	1 h	1 h	n/a
	EW2b	EW2 with • 38 mm x 89 mm studs spaced 400 mm or 600 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾⁽¹⁵⁾⁽¹⁶⁾ • exterior OSB or plywood sheathing ⁽¹⁷⁾ or exterior gypsum sheathing ⁽¹⁸⁾ and cladding ⁽¹⁹⁾	45 min	1 h	n/a
	EW2c	EW2 with • 38 mm x 89 mm studs spaced at 400 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾⁽¹⁵⁾ • exterior OSB or plywood sheathing ⁽¹⁷⁾ and cladding ⁽¹⁹⁾	45 min	1 h	n/a
	EW2d	EW2 with • 38 mm x 89 mm studs spaced at 600 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾⁽¹⁵⁾ • exterior OSB or plywood sheathing ⁽¹⁷⁾ and cladding ⁽¹⁹⁾	–	45 min	n/a
	EW2e	EW2 with • 38 mm x 89 mm studs spaced 400 mm or 600 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾⁽¹⁵⁾ • exterior gypsum sheathing ⁽¹⁸⁾ and cladding ⁽¹⁹⁾	–	45 min	n/a
	EW2f	EW2 with • 38 mm x 89 mm studs spaced at 400 mm o.c. • 12.7 mm Type X gypsum board ⁽⁷⁾⁽¹⁵⁾⁽¹⁶⁾ • exterior OSB or plywood sheathing ⁽¹⁷⁾ and cladding ⁽¹⁹⁾	45 min	1 h	n/a
	EW2g	EW2 with • 38 mm x 89 mm studs spaced at 600 mm o.c. • 12.7 mm Type X gypsum board ⁽⁷⁾⁽¹⁵⁾⁽¹⁶⁾ • exterior OSB or plywood sheathing ⁽¹⁷⁾ and cladding ⁽¹⁹⁾	–	45 min	n/a
	EW2h	EW2 with • 38 mm x 89 mm studs spaced 400 mm or 600 mm o.c. • 12.7 mm Type X gypsum board ⁽⁷⁾⁽¹⁵⁾⁽¹⁶⁾ • exterior gypsum sheathing ⁽¹⁸⁾ and cladding ⁽¹⁹⁾	–	45 min	n/a
	EW2i	EW2 with • 38 mm x 89 mm studs spaced at 400 mm o.c. • 12.7 mm Type X gypsum board ⁽⁷⁾⁽¹⁵⁾ • exterior OSB or plywood sheathing ⁽¹⁷⁾ and cladding ⁽¹⁹⁾	–	45 min	n/a
	EW2j	EW2 with • 38 mm x 140 mm studs spaced at 400 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾⁽¹⁵⁾⁽¹⁶⁾ • exterior wood sheathing, exterior gypsum sheathing or insulated exterior sheathing ⁽²⁰⁾ • masonry veneer cladding not less than 89 mm thick	45 min	45 min	n/a

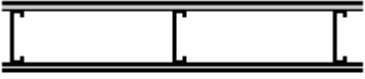
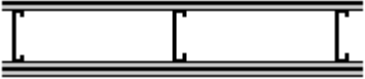
	EW3	• wood studs • dry-blown cellulose fibre insulation⁽¹²⁾ • 1 layer of gypsum board on inside • exterior sheathing and cladding	 G900000A		
	EW3a	EW3 with • 38 mm x 89 mm studs spaced at 400 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾⁽¹⁵⁾⁽¹⁶⁾ • exterior OSB or plywood sheathing⁽¹⁷⁾ or exterior gypsum sheathing⁽¹⁸⁾ and cladding⁽¹⁹⁾	1 h	1 h	n/a
	EW3b	EW3 with • 38 mm x 89 mm studs spaced at 600 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾⁽¹⁵⁾⁽¹⁶⁾ • exterior OSB or plywood sheathing⁽¹⁷⁾ and cladding⁽¹⁹⁾	1 h	1 h	n/a
	EW3c	EW3 with • 38 mm x 89 mm studs spaced at 600 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾⁽¹⁵⁾⁽¹⁶⁾ • exterior gypsum sheathing⁽¹⁸⁾ and cladding⁽¹⁹⁾	45 min	1 h	n/a
	EW3d	EW3 with • 38 mm x 89 mm studs spaced at 400 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾⁽¹⁵⁾ • exterior OSB or plywood sheathing⁽¹⁷⁾ or exterior gypsum sheathing⁽¹⁸⁾ and cladding⁽¹⁹⁾	45 min	1 h	n/a
	EW3e	EW3 with • 38 mm x 89 mm studs spaced at 600 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾⁽¹⁵⁾ • exterior OSB or plywood sheathing⁽¹⁷⁾ and cladding⁽¹⁹⁾	45 min	1 h	n/a
	EW3f	EW3 with • 38 mm x 89 mm studs spaced at 400 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾⁽¹⁵⁾⁽¹⁶⁾ • exterior OSB or plywood sheathing⁽¹⁷⁾ or exterior gypsum sheathing⁽¹⁸⁾ and cladding⁽¹⁹⁾	45 min	1 h	n/a
	EW3g	EW3 with • 38 mm x 89 mm studs spaced at 600 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾⁽¹⁵⁾⁽¹⁶⁾ • exterior OSB or plywood sheathing⁽¹⁷⁾ and cladding⁽¹⁹⁾	45 min	1 h	n/a
	EW3h	EW3 with • 38 mm x 89 mm studs spaced at 600 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾⁽¹⁵⁾⁽¹⁶⁾ • exterior gypsum sheathing⁽¹⁸⁾ and cladding⁽¹⁹⁾	–	45 min	n/a
	EW3i	EW3 with • 38 mm x 89 mm studs spaced at 400 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾⁽¹⁵⁾ • exterior OSB or plywood sheathing⁽¹⁷⁾ or exterior gypsum sheathing⁽¹⁸⁾ and cladding⁽¹⁹⁾	–	45 min	n/a
	EW3j	EW3 with • 38 mm x 89 mm studs spaced at 600 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾⁽¹⁵⁾ • exterior OSB or plywood sheathing⁽¹⁷⁾ and cladding⁽¹⁹⁾	–	45 min	n/a
	EW3k	EW3 with • 38 mm x 140 mm studs spaced at 400 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾⁽¹⁵⁾⁽¹⁶⁾	45 min	45 min	n/a

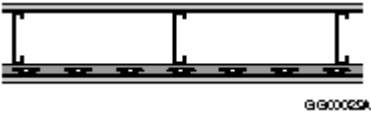
		• exterior wood sheathing, exterior gypsum sheathing or insulated exterior sheathing⁽²⁰⁾ • masonry veneer cladding not less than 89 mm thick			
• Non-Loadbearing Steel Studs	S1	• 31 mm × 64 mm steel studs spaced 400 mm or 600 mm o.c. • with or without absorptive material • 1 layer of gypsum board on each side			
• 0.46 mm (25 Gauge)	S1a	S1 with • studs spaced 600 mm o.c. • 65 mm thick absorptive material⁽⁶⁾ • 15.9 mm Type X gypsum board⁽⁷⁾	–	45 min [1 h ⁽⁸⁾]	43
	S1b	S1 with • studs spaced 400 mm o.c. • 65 mm thick absorptive material⁽⁶⁾ • 15.9 mm Type X gypsum board⁽⁷⁾	–	45 min [1 h ⁽⁸⁾]	39
	S1c	S1 with • studs spaced 400 mm or 600 mm o.c. • no absorptive material • 15.9 mm Type X gypsum board⁽⁷⁾	–	45 min	35
	S2	• 31 mm × 64 mm steel studs spaced 400 mm or 600 mm o.c. • with or without absorptive material • 1 layer of gypsum board on one side • 2 layers of gypsum board on other side			
	S2a	S2 with • studs spaced 600 mm o.c. • 65 mm thick absorptive material⁽⁶⁾ • 15.9 mm Type X gypsum board⁽⁷⁾	–	1 h	50
	S2b	S2 with • studs spaced 400 mm o.c. • 65 mm thick absorptive material⁽⁶⁾ • 15.9 mm Type X gypsum board⁽⁷⁾	–	1 h	44
	S2c	S2 with • studs spaced 600 mm o.c. • 65 mm thick absorptive material⁽⁶⁾ • 12.7 mm Type X gypsum board⁽⁷⁾	–	1 h	50
	S2d	S2 with • studs spaced 400 mm o.c. • 65 mm thick absorptive material⁽⁶⁾ • 12.7 mm Type X gypsum board⁽⁷⁾	–	1 h	42
	S2e	S2 with • studs spaced 600 mm o.c. • no absorptive material • 15.9 mm Type X gypsum board⁽⁷⁾	–	1 h	41
	S2f	S2 with • studs spaced 400 mm o.c. • no absorptive material • 15.9 mm Type X gypsum board⁽⁷⁾	–	1 h	37
	S2g	S2 with • studs spaced 600 mm o.c. • no absorptive material • 12.7 mm Type X gypsum board⁽⁷⁾	–	1 h	40
	S2h	S2 with • studs spaced 400 mm o.c.	–	1 h	35

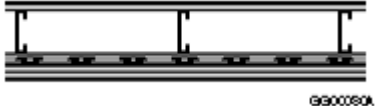
		• no absorptive material • 12.7 mm Type X gypsum board⁽⁷⁾			
	S3	• 31 mm × 64 mm steel studs spaced 400 mm or 600 mm o.c. • with or without absorptive material • 2 layers of gypsum board on each side			
	S3a	S3 with • studs spaced 600 mm o.c. • 65 mm thick absorptive material⁽⁶⁾ • 15.9 mm Type X gypsum board⁽⁷⁾	–	2 h	54
	S3b	S3 with • studs spaced 400 mm o.c. • 65 mm thick absorptive material⁽⁶⁾ • 15.9 mm Type X gypsum board⁽⁷⁾	–	2 h	51
	S3c	S3 with • studs spaced 600 mm o.c. • 65 mm thick absorptive material⁽⁶⁾ • 12.7 mm Type X gypsum board⁽⁷⁾	–	1.5 h	53
	S3d	S3 with • studs spaced 400 mm o.c. • 65 mm thick absorptive material⁽⁶⁾ • 12.7 mm Type X gypsum board⁽⁷⁾	–	1.5 h	47
	S3e	S3 with • studs spaced 600 mm o.c. • 65 mm thick absorptive material⁽⁶⁾ • 12.7 mm regular gypsum board⁽⁷⁾	–	1 h	49
	S3f	S3 with • studs spaced 400 mm o.c. • 65 mm thick absorptive material⁽⁶⁾ • 12.7 mm regular gypsum board⁽⁷⁾	–	1 h	41
	S3g	S3 with • studs spaced 600 mm o.c. • no absorptive material • 15.9 mm Type X gypsum board⁽⁷⁾	–	2 h	45
	S3h	S3 with • studs spaced 400 mm o.c. • no absorptive material • 15.9 mm Type X gypsum board⁽⁷⁾	–	2 h	42
	S3i	S3 with • studs spaced 600 mm o.c. • no absorptive material • 12.7 mm Type X gypsum board⁽⁷⁾	–	1.5 h	44
	S3j	S3 with • studs spaced 400 mm o.c. • no absorptive material • 12.7 mm Type X gypsum board⁽⁷⁾	–	1.5 h	39
	S3k	S3 with • studs spaced 600 mm o.c. • no absorptive material • 12.7 mm regular gypsum board⁽⁷⁾	–	1 h	40
	S3l	S3 with • studs spaced 400 mm o.c. • no absorptive material • 12.7 mm regular gypsum board⁽⁷⁾	–	1 h	37

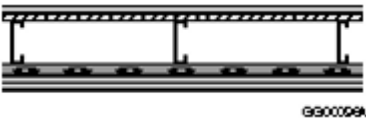
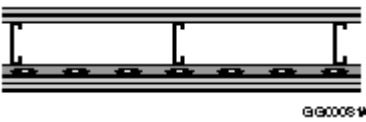
	S4	• 31 mm × 92 mm steel studs spaced 400 mm or 600 mm o.c. • with or without absorptive material • 1 layer of gypsum board on each side			
	S4a	S4 with • studs spaced 600 mm o.c. • 89 mm thick absorptive material⁽⁶⁾ • 15.9 mm Type X gypsum board⁽⁷⁾	–	45 min [1 h ⁽⁸⁾]	48
	S4b	S4 with • studs spaced 400 mm o.c. • 89 mm thick absorptive material⁽⁶⁾ • 15.9 mm Type X gypsum board⁽⁷⁾	–	45 min [1 h ⁽⁸⁾]	47
	S4c	S4 with • studs spaced 600 mm o.c. • no absorptive material • 15.9 mm Type X gypsum board⁽⁷⁾	–	45 min	38
	S4d	S4 with • studs spaced 400 mm o.c. • no absorptive material • 15.9 mm Type X gypsum board⁽⁷⁾	–	45 min	38
	S5	• 31 mm × 92 mm steel studs spaced 400 mm or 600 mm o.c. • with or without absorptive material • 1 layer of gypsum board on one side • 2 layers of gypsum board on other side			
	S5a	S5 with • studs spaced 600 mm o.c. • 89 mm thick absorptive material⁽⁶⁾ • 15.9 mm Type X gypsum board⁽⁷⁾	–	1 h [1.5 h ⁽⁸⁾]	53
	S5b	S5 with • studs spaced 400 mm o.c. • 89 mm thick absorptive material⁽⁶⁾ • 15.9 mm Type X gypsum board⁽⁷⁾	–	1 h [1.5 h ⁽⁸⁾]	52
	S5c	S5 with • studs spaced 600 mm o.c. • 89 mm thick absorptive material⁽⁶⁾ • 12.7 mm Type X gypsum board⁽⁷⁾	–	1 h [1.5 h ⁽⁸⁾]	51
	S5d	S5 with • studs spaced 400 mm o.c. • 89 mm thick absorptive material⁽⁶⁾ • 12.7 mm Type X gypsum board⁽⁷⁾	–	1 h [1.5 h ⁽⁸⁾]	50
	S5e	S5 with • studs spaced 600 mm o.c. • no absorptive material • 15.9 mm Type X gypsum board⁽⁷⁾	–	1 h	43
	S5f	S5 with • studs spaced 400 mm o.c. • no absorptive material • 15.9 mm Type X gypsum board⁽⁷⁾	–	1 h	42
	S5g	S5 with • studs spaced 600 mm o.c. • no absorptive material • 12.7 mm Type X gypsum board⁽⁷⁾	–	1 h	41
	S5h	S5 with • studs spaced 400 mm o.c.	–	1 h	40

		• no absorptive material • 12.7 mm Type X gypsum board⁽⁷⁾			
	S6	• 31 mm × 92 mm steel studs spaced 400 mm or 600 mm o.c. • with or without absorptive material • 2 layers of gypsum board on each side			
	S6a	S6 with • studs spaced 600 mm o.c. • 89 mm thick absorptive material⁽⁶⁾ • 15.9 mm Type X gypsum board⁽⁷⁾	–	2 h	56
	S6b	S6 with • studs spaced 400 mm o.c. • 89 mm thick absorptive material⁽⁶⁾ • 15.9 mm Type X gypsum board⁽⁷⁾	–	2 h	55
	S6c	S6 with • studs spaced 600 mm o.c. • 89 mm thick absorptive material⁽⁶⁾ • 12.7 mm Type X gypsum board⁽⁷⁾	–	1.5 h	55
	S6d	S6 with • studs spaced 400 mm o.c. • 89 mm thick absorptive material⁽⁶⁾ • 12.7 mm Type X gypsum board⁽⁷⁾	–	1.5 h	54
	S6e	S6 with • studs spaced 600 mm o.c. • 89 mm thick absorptive material⁽⁶⁾ • 12.7 mm regular gypsum board⁽⁷⁾	–	1 h	50
	S6f	S6 with • studs spaced 400 mm o.c. • 89 mm thick absorptive material⁽⁶⁾ • 12.7 mm regular gypsum board⁽⁷⁾	–	1 h	48
	S6g	S6 with • studs spaced 600 mm o.c. • no absorptive material • 15.9 mm Type X gypsum board⁽⁷⁾	–	2 h	47
	S6h	S6 with • studs spaced 400 mm o.c. • no absorptive material • 15.9 mm Type X gypsum board⁽⁷⁾	–	2 h	45
	S6i	S6 with • studs spaced 600 mm o.c. • no absorptive material • 12.7 mm Type X gypsum board⁽⁷⁾	–	1.5 h	45
	S6j	S6 with • studs spaced 400 mm o.c. • no absorptive material • 12.7 mm Type X gypsum board⁽⁷⁾	–	1.5 h	44
	S6k	S6 with • studs spaced 600 mm o.c. • no absorptive material • 12.7 mm regular gypsum board⁽⁷⁾	–	1 h	41
	S6l	S6 with • studs spaced 400 mm o.c. • no absorptive material • 12.7 mm regular gypsum board⁽⁷⁾	–	1 h	39

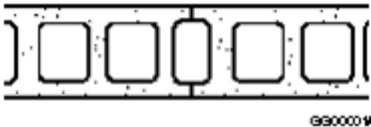
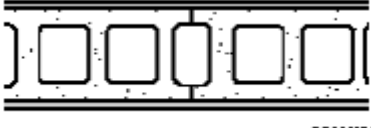
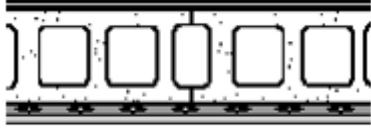
	S7	• 31 mm × 152 mm steel studs spaced 400 mm or 600 mm o.c. • with or without absorptive material • 1 layer of gypsum board on each side	 G900024A		
	S7a	S7 with • 150 mm thick absorptive material⁽⁶⁾ • 15.9 mm Type X gypsum board⁽⁷⁾	–	45 min [1 h ⁽⁸⁾]	51
	S7b	S7 with • no absorptive material • 15.9 mm Type X gypsum board⁽⁷⁾	–	45 min	41
	S8	• 31 mm × 152 mm steel studs spaced 400 mm or 600 mm o.c. • with or without absorptive material • 1 layer of gypsum board on one side • 2 layers of gypsum board on other side	 G900025A		
	S8a	S8 with • 150 mm thick absorptive material⁽⁶⁾ • 15.9 mm Type X gypsum board⁽⁷⁾	–	1 h [1.5 h ⁽⁸⁾]	55
	S8b	S8 with • 150 mm thick absorptive material⁽⁶⁾ • 12.7 mm Type X gypsum board⁽⁷⁾	–	1 h [1.5 h ⁽⁸⁾]	54
	S8c	S8 with • no absorptive material • 15.9 mm Type X gypsum board⁽⁷⁾	–	1 h	45
	S8d	S8 with • no absorptive material • 12.7 mm Type X gypsum board⁽⁷⁾	–	1 h	44
	S9	• 31 mm × 152 mm steel studs spaced 400 mm or 600 mm o.c. • with or without absorptive material • 2 layers of gypsum board on each side	 G900026A		
	S9a	S9 with • 150 mm thick absorptive material⁽⁶⁾ • 15.9 mm Type X gypsum board⁽⁷⁾	–	2 h	59
	S9b	S9 with • 150 mm thick absorptive material⁽⁶⁾ • 12.7 mm Type X gypsum board⁽⁷⁾	–	1.5 h	57
	S9c	S9 with • 150 mm thick absorptive material⁽⁶⁾ • 12.7 mm regular gypsum board⁽⁷⁾	–	1 h	53
	S9d	S9 with • no absorptive material • 15.9 mm Type X gypsum board⁽⁷⁾	–	2 h	49
	S9e	S9 with • no absorptive material • 12.7 mm Type X gypsum board⁽⁷⁾	–	1.5 h	47
	S9f	S9 with • no absorptive material • 12.7 mm regular gypsum board⁽⁷⁾	–	1 h	43
• Loadbearing Steel Studs • 0.84 mm to 1.52 mm	S10	• 41 mm × 92 mm loadbearing steel studs spaced 400 mm or 600 mm o.c. • with or without cross-bracing on one side • with or without absorptive material	 G900028A		

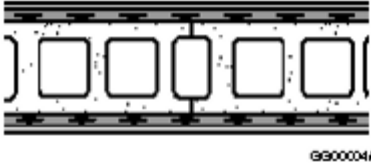
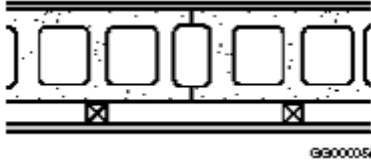
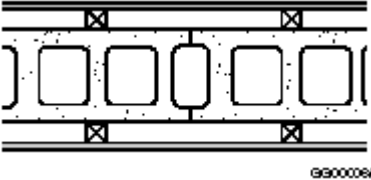
Thickness		• 2 layers gypsum board on each side			
	S10a	S10 with • 89 mm thick absorptive material ⁽⁶⁾ • 15.9 mm Type X gypsum board ⁽⁷⁾	1 h	–	38
	S10b	S10 with • 89 mm thick absorptive material ⁽⁶⁾ • 12.7 mm Type X gypsum board ⁽⁷⁾	45 min [1 h]	–	38
	S10c	S10 with • 89 mm thick absorptive material ⁽⁶⁾ • 12.7 mm regular gypsum board ⁽⁷⁾	–	–	36
	S10d	S10 with • no absorptive material • 15.9 mm Type X gypsum board ⁽⁷⁾	1 h	–	36
	S10e	S10 with • no absorptive material • 12.7 mm Type X gypsum board ⁽⁷⁾	1 h	–	35
	S10f	S10 with • no absorptive material • 12.7 mm regular gypsum board ⁽⁷⁾	–	–	34
	S11	• 41 mm × 92 mm loadbearing steel studs spaced 400 mm or 600 mm o.c. • with or without cross-bracing on one side • with or without absorptive material • resilient metal channels on one side • 1 layer gypsum board on each side			
	S11a	S11 with • 89 mm thick absorptive material ⁽⁶⁾ • resilient metal channels spaced at 600 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾	–	–	50
	S11b	S11 with • 89 mm thick absorptive material ⁽⁶⁾ • resilient metal channels spaced at 400 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾	–	–	47
	S11c	S11 with • no absorptive material • resilient metal channels spaced at 600 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾	–	–	41
	S11d	S11 with • 89 mm thick absorptive material ⁽⁶⁾ • resilient metal channels spaced at 600 mm o.c. • 12.7 mm Type X gypsum board ⁽⁷⁾	–	–	47
	S11e	S11 with • 89 mm thick absorptive material ⁽⁶⁾ • resilient metal channels spaced at 400 mm o.c. • 12.7 mm Type X gypsum board ⁽⁷⁾	–	–	45
	S11f	S11 with • no absorptive material ⁽⁶⁾ • resilient metal channels spaced at 400 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾	–	–	39

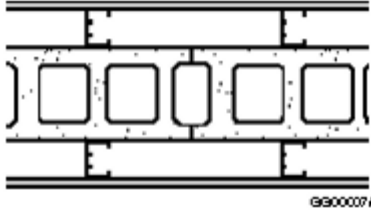
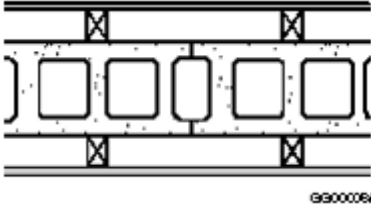
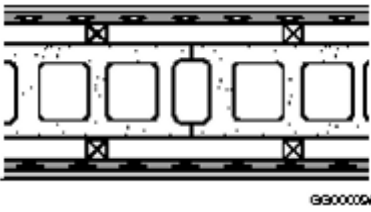
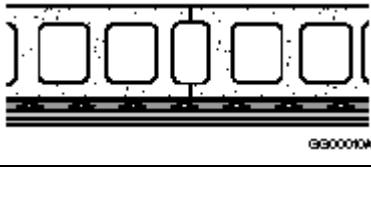
	S11g	S11 with • no absorptive material⁽⁶⁾ • resilient metal channels spaced at 400 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾	–	–	36
	S11h	S11 with • no absorptive material⁽⁶⁾ • resilient metal channels spaced at 600 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾	–	–	38
	S12	• 41 mm × 92 mm loadbearing steel studs spaced 400 mm or 600 mm o.c. • with or without cross-bracing on one side • with or without absorptive material • resilient metal channels on one side • 2 layers gypsum board on resilient channel side • 1 layer gypsum board on other side			
	S12a	S12 with • 89 mm thick absorptive material⁽⁶⁾ • resilient metal channels spaced at 600 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾	–	–	54
	S12b	S12 with • no absorptive material • resilient metal channels spaced at 600 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾	–	–	46
	S12c	S12 with • 89 mm thick absorptive material⁽⁶⁾ • resilient metal channels spaced at 400 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾	–	–	52
	S12d	S12 with • no absorptive material • resilient metal channels spaced at 400 mm o.c. • 15.9 mm Type X gypsum board⁽⁷⁾	–	–	43
	S12e	S12 with • 89 mm thick absorptive material⁽⁶⁾ • resilient metal channels spaced at 600 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾	–	–	52
	S12f	S12 with • no absorptive material • resilient metal channels spaced at 600 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾	–	–	43
	S12g	S12 with • 89 mm thick absorptive material⁽⁶⁾ • resilient metal channels spaced at 400 mm o.c. • 12.7 mm Type X gypsum board⁽⁷⁾	–	–	50
	S12h	S12 with • no absorptive material • resilient metal channels spaced at 400 mm	–	–	41

		o.c. • 12.7 mm Type X gypsum board ⁽⁷⁾			
	S13	• 41 mm × 92 mm loadbearing steel studs spaced 400 mm or 600 mm o.c. • with or without absorptive material • resilient metal channels on one side spaced at 400 mm o.c. • 2 layers gypsum board on resilient channel side • 1 layer shear membrane and 1 layer gypsum board on other side			
	S13a	S13 with • 89 mm thick absorptive material ⁽⁶⁾ • 12.7 mm OSB shear membrane • 12.7 mm Type X gypsum board ⁽⁷⁾	30 min	–	57
	S14	• 41 mm × 92 mm loadbearing steel studs spaced 400 mm or 600 mm o.c. • with or without absorptive material • resilient metal channels on one side • 2 layers gypsum board on each side			
	S14a	S14 with • 89 mm thick absorptive material ⁽⁶⁾ • resilient metal channels spaced at 600 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾	1 h	–	60
	S14b	S14 with • 89 mm thick absorptive material ⁽⁶⁾ • resilient metal channels spaced at 600 mm o.c. • 12.7 mm Type X gypsum board ⁽⁷⁾	45 min [1 h]	–	57
	S14c	S14 with • 89 mm thick absorptive material ⁽⁶⁾ • resilient metal channels spaced at 600 mm o.c. • 12.7 mm regular gypsum board ⁽⁷⁾	–	–	54
	S14d	S14 with • no absorptive material • resilient metal channels spaced at 600 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾	1 h	–	51
	S14e	S14 with • studs at 400 mm o.c. • no absorptive material • resilient metal channels spaced at 600 mm o.c. • 12.7 mm Type X gypsum board ⁽⁷⁾	1 h	–	49
	S14f	S14 with • studs at 600 mm o.c. • no absorptive material • resilient metal channels spaced at 600 mm o.c. • 12.7 mm regular gypsum board ⁽⁷⁾	1 h	–	50
	S14g	S14 with • no absorptive material • resilient metal channels spaced at 600 mm o.c.	–	–	45

		• 12.7 mm regular gypsum board ⁽⁷⁾			
	S14h	S14 with • studs at 400 mm o.c. • 89 mm thick absorptive material ⁽⁶⁾ • resilient metal channels spaced at 400 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾	1 h	–	58
	S14i	S14 with • studs at 600 mm o.c. • 89 mm thick absorptive material ⁽⁶⁾ • resilient metal channels spaced at 400 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾	1 h	–	60
	S14j	S14 with • 89 mm thick absorptive material ⁽⁶⁾ • resilient metal channels spaced at 400 mm o.c. • 12.7 mm Type X gypsum board ⁽⁷⁾	45 min [1 h]	–	55
	S14k	S14 with • studs at 400 mm o.c. • no absorptive material • resilient metal channels spaced at 400 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾	1 h	–	49
	S14l	S14 with • studs at 600 mm o.c. • no absorptive material • resilient metal channels spaced at 400 mm o.c. • 15.9 mm Type X gypsum board ⁽⁷⁾	1 h	–	51
	S14m	S14 with • no absorptive material • resilient metal channels spaced at 400 mm o.c. • 12.7 mm Type X gypsum board ⁽⁷⁾	1 h	–	47
	S15	• 2 rows of 92 mm loadbearing steel studs spaced 400 mm or 600 mm o.c. staggered on separate 41 mm x 92 mm runners • with cross-bracing • with or without absorptive material • 2 layers of gypsum board each side			
	S15a	S15 with • 89 mm thick absorptive material in each cavity ⁽⁶⁾ • 12.7 mm Type X gypsum board ⁽⁷⁾	1 h	–	68
	S15b	S15 with • no absorptive material • 12.7 mm Type X gypsum board ⁽⁷⁾	1 h	–	52
	S15c	S15 with • 89 mm thick absorptive material in each cavity ⁽⁶⁾ • 15.9 mm Type X gypsum board ⁽⁷⁾	1 h	–	68
	S15d	S15 with • no absorptive material • 15.9 mm Type X gypsum board ⁽⁷⁾	1.5 h	–	52

• Hollow Concrete Block (Normal Weight Aggregate)	B1	• 140 mm or 190 mm concrete block			
	B1a	• 140 mm bare concrete block ⁽⁵⁾	1 h	1 h	48
	B1b	• 190 mm bare concrete block ⁽⁵⁾	1.5 h	1.5 h	50
	B2	• 140 mm or 190 mm concrete block • no absorptive material • 1 layer gypsum-sand plaster or gypsum board on each side			
	B2a	B2 with • 140 mm concrete block • 12.7 mm gypsum-sand plaster	2 h	2 h	50
	B2b	B2 with • 140 mm concrete block • 12.7 mm Type X gypsum board or 15.9 mm Type X gypsum board ⁽⁷⁾	2 h	2 h	47
	B2c	B2 with • 140 mm concrete block • 12.7 mm regular gypsum board ⁽⁷⁾	1.5 h	1.5 h	46
	B2d	B2 with • 190 mm concrete block • 12.7 mm gypsum-sand plaster	2.5 h	2.5 h	51
	B2e	B2 with • 190 mm concrete block • 15.9 mm Type X gypsum board ⁽⁷⁾	3 h	3 h	50
	B2f	B2 with • 190 mm concrete block • 12.7 mm Type X gypsum board ⁽⁷⁾	2.5 h	2.5 h	49
	B2g	B2 with • 190 mm concrete block • 12.7 mm regular gypsum board ⁽⁷⁾	2 h	2 h	48
	B3	• 140 mm or 190 mm concrete block • resilient metal channels on one side spaced at 400 mm or 600 mm o.c. • absorptive material filling resilient metal channel space ⁽⁶⁾ • 1 layer gypsum board on each side			
	B3a	B3 with • 140 mm concrete block • 12.7 mm Type X gypsum board or 15.9 mm Type X gypsum board ⁽⁷⁾	2 h	2 h	51
	B3b	B3 with • 140 mm concrete block • 12.7 mm regular gypsum board ⁽⁷⁾⁽⁸⁾	1.5 h	1.5 h	48
	B3c	B3 with • 190 mm concrete block • 15.9 mm Type X gypsum board ⁽⁷⁾	3 h	3 h	54
	B3d	B3 with • 190 mm concrete block • 12.7 mm Type X gypsum board ⁽⁷⁾	2.5 h	2.5 h	53

	B3e	B3 with • 190 mm concrete block • 12.7 mm regular gypsum board⁽⁷⁾⁽⁹⁾	2 h	2 h	51
	B4	• 140 mm or 190 mm concrete block • resilient metal channels on each side spaced at 400 mm or 600 mm o.c. • with or without absorptive material • 1 layer gypsum board on each side			
	B4a	B4 with • 140 mm concrete block • 12.7 mm Type X gypsum board⁽⁷⁾, or 15.9 mm Type X gypsum board⁽⁷⁾	2 h	2 h	47
	B4b	B4 with • 140 mm concrete block • 12.7 mm regular gypsum board⁽⁷⁾⁽⁹⁾	1.5 h	1.5 h	42
	B4c	B4 with • 190 mm concrete block • 15.9 mm Type X gypsum board⁽⁷⁾	3 h	3 h	50
	B4d	B4 with • 190 mm concrete block • 12.7 mm Type X gypsum board⁽⁷⁾	2.5 h	2.5 h	49
	B4e	B4 with • 190 mm concrete block • 12.7 mm regular gypsum board⁽⁷⁾⁽⁹⁾	2 h	2 h	45
	B5	• 190 mm concrete block • 38 mm × 38 mm horizontal or vertical wood strapping on one side spaced at 600 mm o.c. • with or without absorptive material • 1 layer gypsum board on each side			
	B5a	B5 with • 15.9 mm Type X gypsum board⁽⁷⁾	3 h	3 h	54
	B5b	B5 with • 12.7 mm Type X gypsum board⁽⁷⁾	2.5 h	2.5 h	53
	B5c	B5 with • 12.7 mm regular gypsum board⁽⁷⁾⁽⁹⁾	2 h	2 h	51
	B6	• 140 mm or 190 mm concrete block • 38 mm × 38 mm horizontal or vertical wood strapping on each side spaced at 600 mm o.c. • absorptive material filling strapping space on each side⁽⁹⁾ • 1 layer gypsum board on each side			
	B6a	B6 with • 140 mm concrete block • 12.7 mm Type X gypsum board or 15.9 mm Type X gypsum board⁽⁷⁾	2 h	2 h	57
	B6b	B6 with • 140 mm concrete block • 12.7 mm regular gypsum board⁽⁷⁾⁽⁹⁾	1.5 h	1.5 h	56
	B6c	B6 with • 190 mm concrete block • 15.9 mm Type X gypsum board⁽⁷⁾	3 h	3 h	60

	B6d	B6 with • 190 mm concrete block • 12.7 mm Type X gypsum board⁽⁷⁾	2.5 h	2.5 h	59
	B6e	B6 with • 190 mm concrete block • 12.7 regular gypsum board⁽⁷⁾⁽⁹⁾	2 h	2 h	57
	B7	• 190 mm concrete block • 65 mm steel studs each side spaced at 600 mm o.c. • absorptive material filling stud space on each side⁽⁸⁾ • 1 layer gypsum board on each side			
	B7a	B7 with • 15.9 mm Type X gypsum board⁽⁷⁾	3 h	3 h	71
	B7b	B7 with • 12.7 mm Type X gypsum board⁽⁷⁾	2.5 h	2.5 h	70
	B7c	B7 with • 12.7 mm regular gypsum board⁽⁷⁾⁽⁹⁾	2 h	2 h	69
	B8	• 190 mm concrete block • 38 mm × 64 mm wood studs on each side spaced at 600 mm o.c. • absorptive material filling stud space on each side⁽⁸⁾ • 1 layer gypsum board on each side			
	B8a	B8 with • 15.9 mm Type X gypsum board⁽⁷⁾	3 h	3 h	71
	B8b	B8 with • 12.7 mm Type X gypsum board⁽⁷⁾	2.5 h	2.5 h	70
	B8c	B8 with • 12.7 mm regular gypsum board⁽⁷⁾⁽⁹⁾	2 h	2 h	69
	B9	• 190 mm concrete block • 50 mm metal Z-bars on each side spaced at 600 mm o.c. (or 38 mm × 38 mm horizontal or vertical wood strapping plus resilient metal channels) • absorptive material filling Z-bar space on each side⁽⁸⁾ • 1 layer gypsum board on each side			
	B9a	B9 with • 15.9 mm Type X gypsum board⁽⁷⁾	3 h	3 h	65
	B9b	B9 with • 12.7 mm Type X gypsum board⁽⁷⁾	2.5 h	2.5 h	64
	B9c	B9 with • 12.7 mm regular gypsum board⁽⁷⁾⁽⁹⁾	2 h	2 h	63
	B10	• 190 mm concrete block • resilient metal channels on one side spaced at 600 mm o.c. • absorptive material filling resilient metal channel space⁽⁸⁾ • 2 layers gypsum board on one side only			

	B10a	B10 with • 15.9 mm Type X gypsum board ⁽⁷⁾	3 h	3 h	56
	B10b	B10 with • 12.7 mm Type X gypsum board ⁽⁷⁾	2.5 h	2.5 h	55
	B10c	B10 with • 12.7 mm regular gypsum board ⁽⁷⁾	2 h	2 h	54

Notes to Table 9.10.3.1.-A:

⁽¹⁾ See Note A-9.10.3.1.

⁽²⁾ *Fire-resistance ratings* and *STC ratings* of wood-frame construction were evaluated only for constructions with solid-sawn 38 mm × 89 mm lumber. However, the *fire-resistance ratings* and *STC ratings* provided for 38 mm × 89 mm wood-frame construction may be applied to wood-frame constructions with solid-sawn 38 mm × 140 mm lumber; in some cases the ratings may be conservative. Where 38 mm × 140 mm framing is used and absorptive material is called for, the absorptive material must be 140 mm thick. (See

Sentence D-1.2.1.(2) of Appendix D for the significance of *fire-resistance ratings*.) The *STC ratings* may also be applied to fingerjoined lumber. The *fire-resistance ratings* are applicable to constructions using fingerjoined lumber that has been manufactured with a heat-resistant adhesive (HRA) in accordance with NLGA special product standard SPS-1, "Fingerjoined Structural Lumber," or SPS-3, "Fingerjoined "Vertical Stud Use Only" Lumber." (See also Note A-9.23.10.4.(1).)

⁽³⁾ For all *fire-resistance ratings*, the given spacing for framing is a maximum value.

⁽⁴⁾ Sound ratings listed are based on the most reliable laboratory test data available for specimens conforming to installation details required by CSA A82.31-M, "Gypsum Board Application." Results of specific tests may differ slightly because of measurement precision and minor variations in construction details. These results should only be used where the actual construction details, including spacing of fasteners and supporting framing, correspond exactly to the details of the test specimens on which the ratings are based. For wood- and steel-framed assemblies, if the fasteners are spaced less than 300 mm o.c., subtract 1 from the *sound transmission class* value; if the fasteners are spaced less than 200 mm o.c., subtract 2 from the *sound transmission class* value. Narrower fastener spacing is not detrimental to the *fire-resistance rating*. Assemblies with *sound transmission class* ratings of 50 or more require methods to minimize airborne sound transmission at electrical boxes and other openings, and at the junction of intersecting walls and floors, except intersection of walls constructed of concrete or *solid masonry units* where the masonry joints at the intersection are mortared.

⁽⁵⁾ Sound ratings are only valid where there are no discernible cracks or voids in the visible surfaces. For concrete blocks, surfaces must be sealed by at least 2 coats of paint or other surface finish described in Section 9.29. to prevent sound leakage.

⁽⁶⁾ Sound absorptive material includes fibre processed from rock, slag, glass or cellulose fibre. It must fill at least 90% of the cavity thickness for the wall to have the listed *STC* value. The absorptive material should not overfill the cavity to the point of producing significant outward pressure on the finishes; such an assembly will not achieve the *STC* rating. Where the absorptive material used with steel stud assemblies is in batt form, "steel stud batts," which are wide enough to fill the cavity from the web of one stud to the web of the adjacent stud, must be used.

⁽⁷⁾ The complete descriptions of indicated finishes are as follows:

- 12.7 mm regular gypsum board – 12.7 mm regular gypsum board conforming to Article 9.29.5.2.
- 12.7 mm Type X gypsum board – 12.7 mm special fire-resistant Type X gypsum board conforming to Article 9.29.5.2.
- 15.9 mm Type X gypsum board – 15.9 mm special fire-resistant Type X gypsum board conforming to Article 9.29.5.2.
- Except for exterior walls (see Table Note (15)), the outer layer of finish on both sides of the wall must have its joints taped and finished.
- Except as otherwise required for fastener spacing (see Table Notes (14), (16) and (22)), fastener type, spacing and penetration depth for the attachment of gypsum board must conform to Subsection 9.29.5. and fasteners must consist of
 - nails or screws when attaching gypsum board to wood studs or wood strapping, and
 - screws when attaching gypsum board to cold-formed steel studs or resilient metal channels.

⁽⁸⁾ Absorptive material required for the higher *fire-resistance rating* shall be mineral fibre processed from rock or slag with a mass per unit area of wall surface of at least 4.8 kg/m² for 150 mm thickness, 2.8 kg/m² for 89 mm thickness and 2.0 kg/m² for 65 mm thickness and shall completely fill the wall cavity. For assemblies with double wood studs on separate plates, absorptive material is required in the stud cavities on both sides.

⁽⁹⁾ Regular gypsum board used in single layer assemblies must be installed so all edges are supported.

⁽¹⁰⁾ The *fire-resistance rating* values are achieved as follows:

- for a single row of studs, by installing blocking at a spacing of not more than 1 524 mm o.c. as shown in Case A of Figure A-9.10.3.1.-E, or
- for two rows of studs on separate plates, by installing blocking in both rows at a spacing of not more than 1 524 mm o.c. as shown in Case B of Figure A-9.10.3.1.-E.

⁽¹¹⁾ The mineral fibre insulation processed from rock or slag shall have a mass per unit area of wall surface of not less than 4.48 kg/m² for 140 mm thickness and 2.85 kg/m² for 89 mm thickness and shall completely fill the wall cavity.

⁽¹²⁾ The dry-blown cellulose fibre insulation shall have a mass per unit area of wall surface of not less than 6.80 kg/m² for 140 mm thickness and 4.32 kg/m² for 89 mm thickness and shall completely fill the wall cavity.

⁽¹³⁾ Where bracing material, such as diagonal lumber or plywood, OSB, gypsum board or fibreboard sheathing is installed on the inner face of one row of studs in double stud assemblies, the *STC* rating will be reduced by 3 for any assemblies containing absorptive material in both rows of studs or in the row of studs opposite to that to which the bracing material is attached. Attaching such layers on both inner faces of the studs may drastically reduce the *STC* value but enough data to permit assignment of *STC* ratings for this situation is not available. The *fire-resistance rating* is not affected by the inclusion of such bracing.

⁽¹⁴⁾ For the attachment of the gypsum board, fasteners shall be spaced at not more than 200 mm (nominal) o.c. along the framing members and resilient metal channels in both the base and face layers.

⁽¹⁵⁾ For exterior walls, the finish joints must be taped and finished for the outer layer of the interior side only.

⁽¹⁶⁾ For the attachment of the gypsum board on the interior side of exterior wall assemblies, fasteners shall be spaced at not more than 200 mm (nominal) o.c. along the framing members. All joints shall be backed with lumber having the same dimensions as the framing members as shown in Figures A-9.10.3.1.-F and A-9.10.3.1.-G. For EW1e, EW2j and EW3k walls, blocking shall be installed at a spacing of not more than 1 524 mm o.c. as shown in Case A of Figure A-9.10.3.1.-E where joints are backed at a spacing of more than 1 524 mm o.c. along the height of the wall.

⁽¹⁷⁾ The exterior OSB or plywood sheathing shall be not less than 11.1 mm thick and shall be installed with a gap of not less than 2 mm between sheets. Fastener types and spacing shall conform to Table 9.23.3.5.-A. All joints shall be backed with lumber having the same dimensions as the framing members as shown in Figures A-9.10.3.1.-F and A-9.10.3.1.-G.

⁽¹⁸⁾ The exterior gypsum sheathing shall be Type X gypsum sheathing not less than 15.9 mm thick. Fasteners shall be spaced at not more than 200 mm (nominal) o.c. along the framing members.

⁽¹⁹⁾ Any cladding allowed under Part 9 is permitted. The cladding can include foamed plastic and other insulations outboard of the sheathing, where permitted by spatial separation requirements in

Subsection 9.10.14. or 9.10.15. Where OSB or plywood sheathing acts as the cladding, no additional outboard cladding is required, but is permitted.

⁽²⁰⁾ Includes any exterior wall sheathing listed in Table 9.23.17.2.-A and masonry veneer cladding conforming to Section 9.20. Foamed plastic sheathing is permitted in EW1e, EW2j and EW3k walls without the use of other sheathing, provided it is directly attached to the framing.

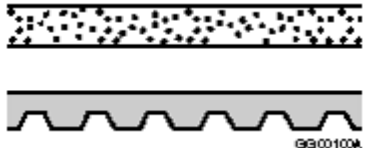
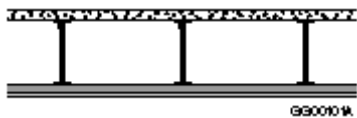
⁽²¹⁾ The glass fibre insulation shall have a mass per unit area of wall surface of not less than 1.30 kg/m² for 140 mm thickness and 1.0 kg/m² for 89 mm thickness and shall completely fill the wall cavity.

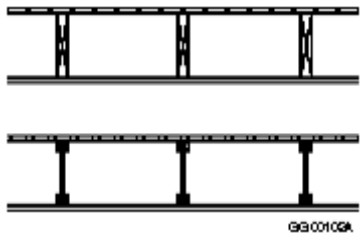
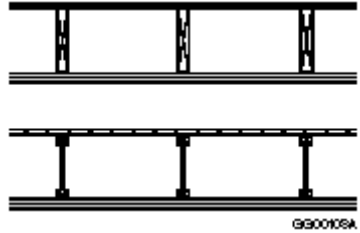
⁽²²⁾ For the attachment of the gypsum board on the interior side of exterior wall assemblies, fasteners shall be spaced at not more than 150 mm (nominal) o.c. along the edges and 200 mm (nominal) o.c. along the intermediate supports. All joints shall be backed with lumber having the same dimensions as the framing members as shown in Figures A-9.10.3.1.-F and A-9.10.3.1.-G.

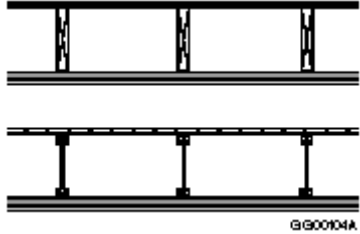
⁽²³⁾ The exterior gypsum sheathing shall be not less than 12.7 mm thick. Fasteners shall be spaced at not more than 200 mm (nominal) o.c. along the framing members.

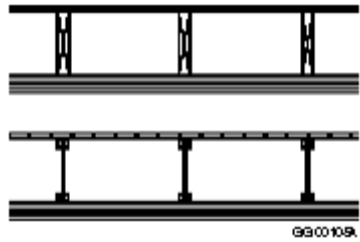
Table 9.10.3.1.-B
Fire and Sound Resistance of Floors, Ceilings and Roofs⁽¹⁾

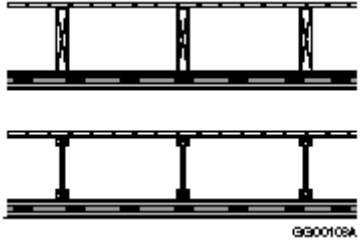
Forming Part of Article 5.8.1.3., Sentences 9.10.3.1.(1) and 9.10.5.1.(3), and Article 9.11.1.3.

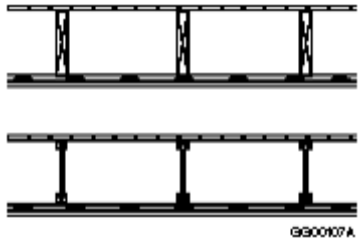
Type of Assembly	Assembly Number	Description ⁽²⁾⁽³⁾⁽⁴⁾	Fire-Resistance Rating ⁽⁵⁾⁽⁶⁾⁽⁷⁾⁽⁸⁾	Typical Sound Transmission Class ⁽⁵⁾⁽⁶⁾⁽⁷⁾⁽⁸⁾⁽¹⁰⁾⁽¹¹⁾ (STC)	Typical Impact Insulation Class ⁽⁵⁾⁽⁹⁾⁽¹²⁾ (IIC)
Floors and Ceilings					
Concrete Slabs	F1	concrete floors			
	F1a	90 mm reinforced concrete with 20 mm minimum cover over reinforcing steel	1 h	47	23
	F1b	130 mm reinforced concrete with 25 mm minimum cover over reinforcing steel	2 h	52	27
	F1c	pre-stressed hollow core slab 200 mm deep with 25 mm minimum cover over reinforcing steel	1 h	50	28
	F1d	150 mm composite slab on 75 mm steel deck with 152 × 152 × MW3.8 × MW3.8 wire mesh	-	51	21
	F1e	150 mm composite slab on 75 mm steel deck with 152 × 152 × MW3.8 × MW3.8 wire mesh - resilient metal channels 400 mm or 600 mm o.c. 2 layers of 12.7 mm Type X gypsum board or 2 layers of 15.9 mm Type X gypsum board	1.5 h	57	36
Open Web Steel Joists	F2	open web steel joists with concrete floor			
	F2a	50 mm thick concrete deck - on open web steel joists spaced 400 mm o.c. - furring channels spaced not more than 600 mm o.c. wired to underside of joists 1 layer of 15.9 mm Type X gypsum board on ceiling side	45 min	53	27
	F2b	65 mm regular concrete minimum 155 kg/m² - on composite steel joists spaced 1250 mm o.c. - furring channels spaced not more than 600 mm o.c. wired to underside of joists 1 layer of 12.7 mm or 15.9 mm Type X	1.5 h	53	28

		gypsum board on ceiling side			
Wood Floor Joists ⁽¹³⁾	F3 ⁽¹⁴⁾	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 1 layer of gypsum board on ceiling side			
	F3a	F3 with • no absorptive material in cavity • 15.9 mm Type X gypsum board	-	29	27
	F3b	F3 with • absorptive material in cavity • 15.9 mm Type X gypsum board	-	31	30
	F3c	F3 with • no absorptive material in cavity • 12.7 mm Type X gypsum board	-	27	26
	F3d	F3 with • absorptive material in cavity • 12.7 mm Type X gypsum board	-	29	29
	F3e	F3 with • no absorptive material in cavity • 12.7 mm regular gypsum board	-	27	25
	F3f	F3 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	29	28
	F4 ⁽¹⁴⁾	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 2 layers of gypsum board on ceiling side			
	F4a	F4 with • wood joists or wood I-joists spaced 400 mm o.c. • no absorptive material in cavity • 15.9 mm Type X gypsum board	1 h	33	31
	F4b	F4 with • wood joists or wood I-joists spaced 600 mm o.c. • no absorptive material in cavity • 15.9 mm Type X gypsum board	1 h	34	31
	F4c	F4 with • wood joists or wood I-joists spaced 400 mm o.c. • absorptive material in cavity • 15.9 mm Type X gypsum board	45 min [1 h] ⁽¹⁵⁾	35	34

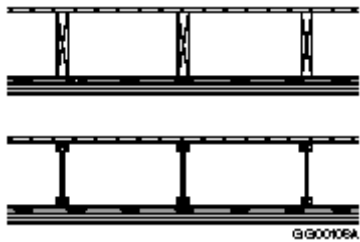
	F4d	F4 with • wood joists or wood I-joists spaced 600 mm o.c. • absorptive material in cavity • 15.9 mm Type X gypsum board	45 min	38	34
	F4e	F4 with • wood joists or wood I-joists spaced 400 mm o.c. • no absorptive material in cavity • 12.7 mm Type X gypsum board	1 h	32	30
	F4f	F4 with • wood joists or wood I-joists spaced 400 mm o.c. • no absorptive material in cavity • 12.7 mm Type X gypsum board	45 min	33	30
	F4g	F4 with • wood joists or wood I-joists spaced 400 mm o.c. • absorptive material in cavity • 12.7 mm Type X gypsum board	45 min	34	33
	F4h	F4 with • wood joists or wood I-joists spaced 600 mm o.c. • absorptive material in cavity • 12.7 mm Type X gypsum board	-	35	33
	F4i	F4 with • no absorptive material in cavity • 12.7 mm regular gypsum board	-	31	30
	F4j	F4 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	33	33
	F5⁽¹⁴⁾	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • steel furring channels spaced 400 mm or 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F5a	F5 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 15.9 mm Type X gypsum	30 min	35	37
	F5b	F5 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	30 min	37	30
	F5c	F5 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	30 min [45 min] ⁽¹⁶⁾	38	30

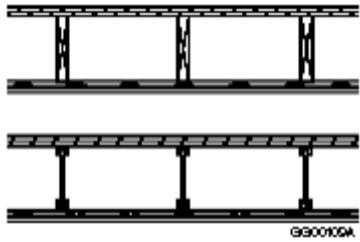
	F5d	F5 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	30 min	40	33
	F5e	F5 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	30 min	33	26
	F5f	F5 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	30 min	35	29
	F5g	F5 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	30 min [45 min] ⁽¹⁶⁾	36	29
	F5h	F5 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	30 min	38	32
	F5i	F5 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	<30 min	33	25
	F5j	F5 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	<30 min	35	28
	F5k	F5 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	<30 min	36	28
	F5l	F5 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	<30 min	38	33
	F6⁽¹⁴⁾	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • steel furring channels spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on ceiling side			
	F6a ⁽¹⁷⁾	F6 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	39	32
	F6b ⁽¹⁷⁾	F6 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c.	1 h	41	32

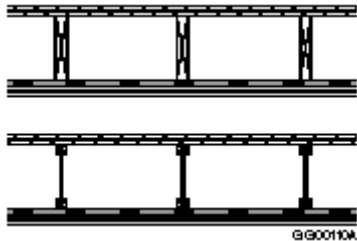
		• 15.9 mm Type X gypsum board			
	F6c ⁽¹⁷⁾	F6 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	42	35
	F6d ⁽¹⁷⁾	F6 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h	44	37
	F6e ⁽¹⁷⁾	F6 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	38	30
	F6f ⁽¹⁷⁾	F6 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	1 h	40	33
	F6g ⁽¹⁷⁾	F6 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	41	33
	F6h ⁽¹⁷⁾	F6 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	45 min [1 h] ⁽¹⁸⁾	43	36
	F6i	F6 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	37	30
	F6j	F6 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	39	33
	F6k	F6 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	40	33
	F6l	F6 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	42	36
	F7 ⁽¹⁴⁾	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 1 layer of gypsum board attached directly to joists on ceiling side • resilient metal channels spaced 400 mm or 600 mm o.c. attached to joists through gypsum board			

		• 1 layer of gypsum board attached to resilient metal channels			
	F7a ⁽¹⁷⁾	F7 with • no absorptive material in cavity • 15.9 mm Type X gypsum board • resilient metal channels • 15.9 mm Type X gypsum board	1 h	35	27
	F7b ⁽¹⁷⁾	F7 with • absorptive material in cavity • 15.9 mm Type X gypsum board • resilient metal channels • 15.9 mm Type X gypsum board	1 h	37	30
	F7c ⁽¹⁷⁾	F7 with • no absorptive material in cavity • 12.7 mm Type X gypsum board • resilient metal channels • 12.7 mm Type X gypsum board	1 h	35	27
	F7d ⁽¹⁷⁾	F7 with • absorptive material in cavity • 12.7 mm Type X gypsum board • resilient metal channels • 12.7 mm Type X gypsum board	1 h	37	30
	F7e	F7 with • no absorptive material in cavity • 12.7 mm regular gypsum board • resilient metal channels • 12.7 mm regular gypsum board	-	32	26
	F7f	F7 with • absorptive material in cavity • 12.7 mm regular gypsum board • resilient metal channels • 12.7 mm regular gypsum board	-	35	28
	F8 ⁽¹⁴⁾	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F8a	F8 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	30 min	41	33
	F8b	F8 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	30 min	43	36
	F8c	F8 with • absorptive material in cavity	30 min [45 min] ⁽¹⁶⁾	48	41

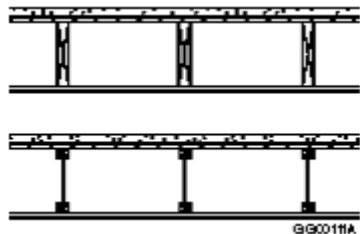
		• resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board			
	F8d	F8 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	30 min	50	44
	F8e	F8 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	30 min	39	32
	F8f	F8 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	30 min	41	35
	F8g	F8 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	30 min [45 min] ^(a6)	46	40
	F8h	F8 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	30 min	48	43
	F8i	F8 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	< 30 min	41	31
	F8j	F8 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	< 30 min	41	34
	F8k	F8 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	< 30 min	46	39
	F8l	F8 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	< 30 min	48	42

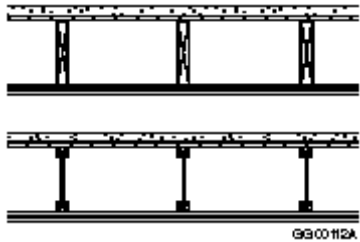
	F9⁽¹⁴⁾	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on ceiling side			
	F9a ⁽¹⁷⁾	F9 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	45	38
	F9b ⁽¹⁷⁾	F9 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h	47	40
	F9c ⁽¹⁷⁾	F9 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h [1.5 h] ⁽¹⁹⁾	52 [54] ⁽¹⁹⁾	46
	F9d ⁽¹⁷⁾	F9 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h [1.5 h] ⁽¹⁹⁾	54 [56] ⁽¹⁹⁾	48
	F9e ⁽¹⁷⁾	F9 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	44	36
	F9f ⁽¹⁷⁾	F9 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	1 h	46	39
	F9g ⁽¹⁷⁾	F9 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h [1.5 h] ⁽¹⁹⁾	51 [53] ⁽¹⁹⁾	44
	F9h ⁽¹⁷⁾	F9 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	45 min [1 h] ⁽¹⁸⁾	53	47
	F9i	F9 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	43	36

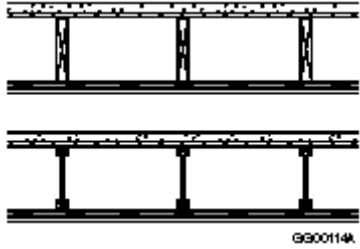
	F9j	F9 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	45	39
	F9k	F9 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	50	44
	F9l	F9 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	52	47
	F10⁽¹⁴⁾	• one subfloor layer of 11 mm sanded plywood, or OSB or waferboard • one subfloor layer of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 300, 400 or 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F10a	F10 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	30 min	44	34
	F10b	F10 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	30 min	46	37
	F10c	F10 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	30 min [45 min] ⁽¹⁵⁾	51	42
	F10d	F10 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	30 min [45 min] ⁽¹⁵⁾	53	45
	F10e	F10 with • wood joists spaced at 400 mm o.c. • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h ⁽²⁰⁾	53 ⁽²⁰⁾	44
	F10f ⁽²¹⁾	F10 with • wood I-joists spaced at 400 mm o.c.	1 h ⁽²⁰⁾	52 ⁽²⁰⁾	43

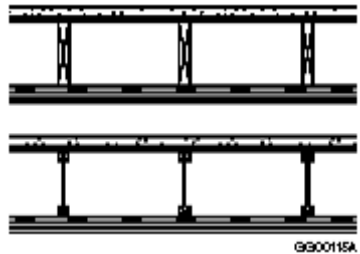
		• absorptive material in cavity • resilient metal channels spaced 300 mm o.c. • 15.9 mm Type X gypsum board			
	F10g	F10 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	30 min	42	33
	F10h	F10 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	30 min	44	36
	F10i	F10 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	30 min [45 min] ⁽¹⁸⁾	49	41
	F10j	F10 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	30 min [45 min] ⁽¹⁸⁾	51	44
	F10k	F10 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	42	33
	F10l	F10 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	44	35
	F10m	F10 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	49	41
	F10n	F10 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	51	43
	F11 ⁽¹⁴⁾	• one subfloor layer of 11 mm sanded plywood, or OSB or waferboard • one subfloor layer of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c.			

		• 2 layers of gypsum board on ceiling side			
	F11a ⁽¹⁷⁾	F11 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	48	39
	F11b ⁽¹⁷⁾	F11 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h	50	42
	F11c ⁽¹⁷⁾	F11 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h [1.5 h] ⁽¹⁹⁾	55 [56] ⁽¹⁹⁾	47
	F11d ⁽¹⁷⁾	F11 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h [1.5 h] ⁽¹⁹⁾	57 [58] ⁽¹⁹⁾	50
	F11e ⁽¹⁷⁾	F11 with • wood joists spaced 400 mm o.c. • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1.5 h ⁽²²⁾	56 ⁽²²⁾	47
	F11f ⁽²¹⁾	F11 with • wood I-joists spaced 400 mm o.c. • absorptive material in cavity • resilient metal channels spaced 300 mm o.c. • 15.9 mm Type X gypsum board	1.5 h ⁽²²⁾	56 ⁽²²⁾	46
	F11g ⁽¹⁷⁾	F11 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	47	38
	F11h ⁽¹⁷⁾	F11 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	1 h	49	40
	F11i ⁽¹⁷⁾	F11 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h [1.5 h] ⁽¹⁹⁾	54 [55] ⁽¹⁹⁾	46
	F11j ⁽¹⁷⁾	F11 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	45 min [1 h] ⁽¹⁸⁾	56	48

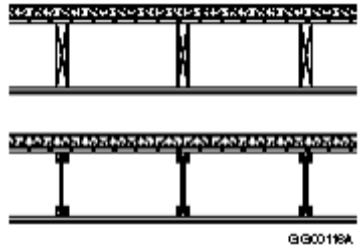
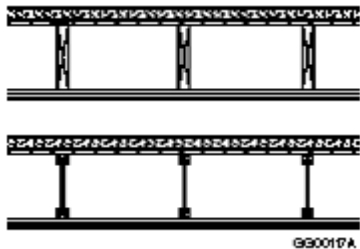
	F11k	F11 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	46	37
	F11l	F11 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	48	40
	F11m	F11 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	53	45
	F11n	F11 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	55	48
	F12⁽¹⁴⁾	• 25 mm gypsum-concrete topping (at least 44 kg/m³) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 1 layer of gypsum board on ceiling side			
	F12a	F12 with • no absorptive material in cavity • 15.9 mm Type X gypsum board	-	41	13
	F12b	F12 with • absorptive material in cavity • 15.9 mm Type X gypsum board	-	43	16
	F12c	F12 with • no absorptive material in cavity • 12.7 mm Type X gypsum board	-	39	12
	F12d	F12 with • absorptive material in cavity • 12.7 mm Type X gypsum board	-	41	15
	F12e	F12 with • no absorptive material in cavity • 12.7 mm regular gypsum board	-	39	12
	F12f	F12 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	41	15

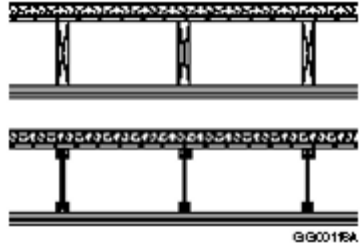
	F13⁽¹⁴⁾	• 25 mm gypsum-concrete topping (at least 44 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 2 layers of gypsum board on ceiling side			
	F13a	F13 with • wood joists or wood I-joists spaced 400 mm o.c. • no absorptive material in cavity • 15.9 mm Type X gypsum board	1 h	43	16
	F13b	F13 with • wood joists or wood I-joists spaced 600 mm o.c. • no absorptive material in cavity • 15.9 mm Type X gypsum board	1 h	45	16
	F13c	F13 with • wood joists or wood I-joists spaced 400 mm o.c. • absorptive material in cavity • 15.9 mm Type X gypsum board	45 min [1 h] ⁽¹⁵⁾	45	19
	F13d	F13 with • wood joists or wood I-joists spaced 600 mm o.c. • absorptive material in cavity • 15.9 mm Type X gypsum board	45 min	47	19
	F13e	F13 with • wood joists or wood I-joists spaced 400 mm o.c. • no absorptive material in cavity • 12.7 mm Type X gypsum board	1 h	42	15
	F13f	F13 with • wood joists or wood I-joists spaced 600 mm o.c. • no absorptive material in cavity • 12.7 mm Type X gypsum board	45 min	44	15
	F13g	F13 with • wood joists or wood I-joists spaced 400 mm o.c. • absorptive material in cavity • 12.7 mm Type X gypsum board	45 min	44	18
	F13h	F13 with • wood joists or wood I-joists spaced 600 mm o.c. • no absorptive material in cavity • 12.7 mm Type X gypsum board	-	46	18
	F13i	F13 with • no absorptive material in cavity • 12.7 mm regular gypsum board	-	41	14
	F13j	F13 with	-	45	14

		• absorptive material in cavity • 12.7 mm regular gypsum board			
	F14⁽¹⁴⁾	• 25 mm gypsum-concrete topping (at least 44 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 300, 400 or 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F14a	F14 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	-	53	22
	F14b	F14 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	55	22
	F14c	F14 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	30 min [45 min] ⁽¹⁸⁾	60	30
	F14d	F14 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	62	30
	F14e	F14 with • wood joists spaced 400 mm o.c. • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h ⁽²⁰⁾	60 ⁽²⁰⁾	31
	F14f ⁽²¹⁾	F14 with • wood I-joists spaced 400 mm o.c. • absorptive material in cavity • resilient metal channels spaced 300 mm o.c. • 15.9 mm Type X gypsum board	1 h ⁽²⁰⁾	61 ⁽²⁰⁾	31
	F14g	F14 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	51	21
	F14h	F14 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c.	-	53	21

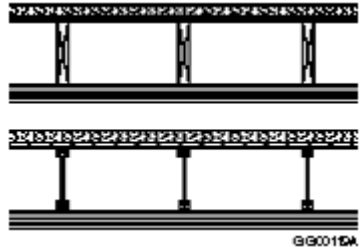
		• 12.7 mm Type X gypsum board			
	F14i	F14 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	58	29
	F14j	F14 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	60	29
	F14k	F14 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	51	21
	F14l	F14 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	53	21
	F14m	F14 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	58	29
	F14n	F14 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	60	29
	F15⁽¹⁴⁾	• 25 mm gypsum-concrete topping (at least 44 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on ceiling side			
	F15a ⁽¹⁷⁾	F15 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h ⁽²³⁾	57	25
	F15b ⁽¹⁷⁾	F15 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h	59	25
	F15c ⁽¹⁷⁾	F15 with	1 h	64	33

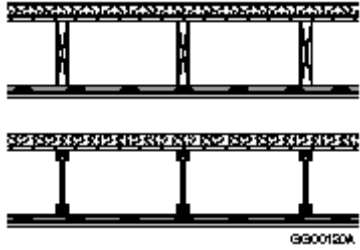
		• absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	[1.5 h] ⁽¹⁹⁾	[65] ⁽¹⁹⁾	
	F15d ⁽¹⁷⁾	F15 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h [1.5 h] ⁽¹⁹⁾	66 [67] ⁽¹⁹⁾	33
	F15e ⁽¹⁷⁾	F15 with • wood joists spaced 400 mm o.c. • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1.5 h ⁽²²⁾	65 ⁽²²⁾	33
	F15f ⁽²¹⁾	F15 with • wood I-joists spaced 400 mm o.c. • absorptive material in cavity • resilient metal channels spaced 300 mm o.c. • 15.9 mm Type X gypsum board	1.5 h ⁽²²⁾	64 ⁽²²⁾	33
	F15g ⁽¹⁷⁾	F15 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	56	24
	F15h ⁽¹⁷⁾	F15 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	1 h	58	24
	F15i ⁽¹⁷⁾	F15 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h [1.5 h] ⁽¹⁹⁾	63 [64] ⁽¹⁹⁾	32
	F15j ⁽¹⁷⁾	F15 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	45 min [1 h] ⁽¹⁸⁾	65	32
	F15k	F15 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	55	23
	F15l	F15 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	57	23
	F15m	F15 with • absorptive material in cavity	-	62	31

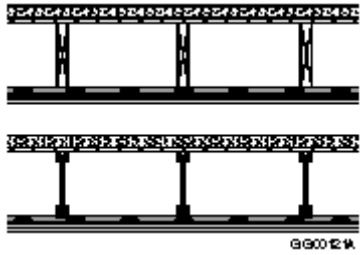
		• resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board			
	F15n	F15 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	64	31
	F16⁽¹⁴⁾	• 38 mm concrete topping (at least 70 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 1 layer of gypsum board on ceiling side	 G900116A		
	F16a	F 16 with • no absorptive material in cavity • 15.9 mm Type X gypsum board	-	44	22
	F16b	F16 with • absorptive material in cavity • 15.9 mm Type X gypsum board	-	46	25
	F16c	F16 with • no absorptive material in cavity • 12.7 mm Type X gypsum board	-	43	21
	F16d	F16 with • absorptive material in cavity • 12.7 mm Type X gypsum board	-	45	24
	F16e	F16 with • no absorptive material in cavity • 12.7 mm regular gypsum board	-	42	21
	F16f	F16 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	44	24
	F17⁽¹⁴⁾	• 38 mm concrete topping (at least 70 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 2 layers of gypsum board on ceiling side	 G900117A		
	F17a	F17 with • wood joists or wood I-joists spaced 400 mm o.c. • no absorptive material in cavity • 15.9 mm Type X gypsum board	1 h	48	24
	F17b	F17 with • wood joists or wood I-joists spaced 600 mm o.c.	1 h	51	24

		• no absorptive material in cavity • 15.9 mm Type X gypsum board			
	F17c	F17 with • wood joists or wood I-joists spaced 400 mm o.c. • absorptive material in cavity • 15.9 mm Type X gypsum board	45 min [1 h] ^(a5)	48	27
	F17d	F17 with • wood joists or wood I-joists spaced 600 mm o.c. • absorptive material in cavity • 15.9 mm Type X gypsum board	45 min	51	27
	F17e	F17 with • wood joists or wood I-joists spaced 400 mm o.c. • no absorptive material in cavity • 12.7 mm Type X gypsum board	1 h	47	23
	F17f	F17 with • wood joists or wood I-joists spaced 600 mm o.c. • no absorptive material in cavity • 12.7 mm Type X gypsum board	45 min	48	23
	F17g	F17 with • wood joists or wood I-joists spaced 400 mm o.c. • absorptive material in cavity • 12.7 mm Type X gypsum board	45 min	49	26
	F17h	F17 with • wood joists or wood I-joists spaced 600 mm o.c. • absorptive material in cavity • 12.7 mm Type X gypsum board	-	50	26
	F17i	F17 with • no absorptive material in cavity • 12.7 mm regular gypsum board	-	47	23
	F17j	F17 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	49	26
	F18⁽¹⁻⁴⁾	• 38 mm concrete topping (at least 70 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • steel furring channels spaced 400 mm or 600 mm o.c. • 1 layer of gypsum board on ceiling side	 The diagram shows a cross-section of a ceiling assembly. At the top is a concrete topping. Below it is a subfloor made of plywood, OSB, or waferboard, or 17 mm tongue and groove lumber. This subfloor is supported by wood joists or wood I-joists. Below the joists are steel furring channels. A layer of gypsum board is attached to the bottom of the furring channels. The label 'GG0018A' is at the bottom right of the diagram.		
	F18a	F18 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	-	50	25

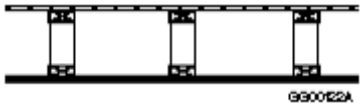
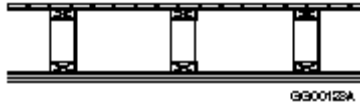
	F18b	F18 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	52	25
	F18c	F18 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	-	53	28
	F18d	F18 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	55	28
	F18e	F18 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	49	24
	F18f	F18 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	51	24
	F18g	F18 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	52	27
	F18h	F18 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	54	27
	F18i	F18 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	48	24
	F18j	F18 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	50	24
	F18k	F18 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	51	27
	F18l	F18 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	53	27

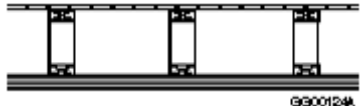
	F19⁽¹⁴⁾	• 38 mm concrete topping (at least 70 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • steel furring channels spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on ceiling side			
	F19a ⁽¹⁷⁾	F19 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	54	27
	F19b ⁽¹⁷⁾	F19 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h	56	27
	F19c ⁽¹⁷⁾	F19 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	57	30
	F19d ⁽¹⁷⁾	F19 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h	59	30
	F19e ⁽¹⁷⁾	F19 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	53	26
	F19f ⁽¹⁷⁾	F19 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	1 h	55	26
	F19g ⁽¹⁷⁾	F19 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	56	29
	F19h ⁽¹⁷⁾	F19 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	1 h	58	29
	F19i	F19 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	53	26
	F19j	F19 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	55	26
	F19k	F19 with • absorptive material in cavity	-	56	29

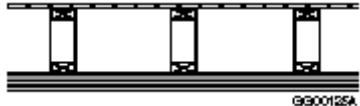
		• steel furring channels spaced 400 mm o.c. • 12.7 mm regular gypsum board			
	F19l	F19 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	58	29
	F20⁽¹⁴⁾	• 38 mm concrete topping (at least 70 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 300, 400 or 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F20a	F20 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	45 min ⁽²³⁾	56	31
	F20b	F20 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	58	31
	F20c	F20 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	30 min [45 min] ⁽¹⁸⁾⁽²³⁾	63	39
	F20d	F20 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	65	39
	F20e	F20 with • wood joists spaced 400 mm o.c. • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h ⁽²⁰⁾	64 ⁽²⁰⁾	40
	F20f ⁽²¹⁾	F20 with • wood I-joists spaced 400 mm o.c. • absorptive material in cavity • resilient metal channels spaced 300 mm o.c. • 15.9 mm Type X gypsum board	1 h ⁽²⁰⁾	65 ⁽²⁰⁾	40
	F20g	F20 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	55	30

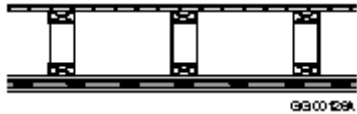
	F20h	F20 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	57	30
	F20i	F20 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	62	38
	F20j	F20 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	64	38
	F20k	F20 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	54	30
	F20l	F20 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	56	30
	F20m	F20 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	61	38
	F20n	F20 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	63	38
	F21⁽¹⁴⁾	• 38 mm concrete topping (at least 70 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood joists or wood I-joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on ceiling side			
	F21a ⁽¹⁷⁾	F21 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	60	33
	F21b ⁽¹⁷⁾	F21 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c.	1 h	62	33

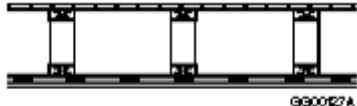
		• 15.9 mm Type X gypsum board			
	F21c ⁽¹⁷⁾	F21 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h [1.5 h] ⁽¹⁹⁾	67 [68] ⁽¹⁹⁾	41 [42] ⁽¹⁹⁾
	F21d ⁽¹⁷⁾	F21 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h [1.5 h] ⁽¹⁹⁾	69 [70] ⁽¹⁹⁾	41 [42] ⁽¹⁹⁾
	F21e ⁽¹⁷⁾	F21 with • wood joists spaced 400 mm o.c. • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	[1.5 h] ⁽²²⁾	68 ⁽²²⁾	42
	F21f ⁽²¹⁾	F21 with • wood I-joists spaced 400 mm o.c. • absorptive material in cavity • resilient metal channels spaced 300 mm o.c. • 15.9 mm Type X gypsum board	[1.5 h] ⁽²²⁾	68 ⁽²²⁾	42
	F21g ⁽¹⁷⁾	F21 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	59	32
	F21h ⁽¹⁷⁾	F21 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	1 h	61	32
	F21i ⁽¹⁷⁾	F21 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h [1.5 h] ⁽¹⁹⁾	66 [67] ⁽¹⁹⁾	40
	F21j ⁽¹⁷⁾	F21 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	1 h	68	40
	F21k	F21 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	59	32
	F21l	F21 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	61	32

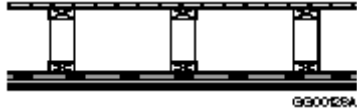
	F21m	F21 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	66	40
	F21n	F21 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	68	40
Wood Floor Trusses ⁽²⁴⁾	F22	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood trusses spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 1 layer gypsum board on ceiling side			
	F22a	F22 with • no absorptive material in cavity • 15.9 mm Type X gypsum board	-	29	27
	F22b	F22 with • absorptive material in cavity • 15.9 mm Type X gypsum board	-	31	30
	F22c	F22 with • no absorptive material in cavity • 12.7 mm Type X gypsum board	-	28	26
	F22d	F22 with • absorptive material in cavity • 12.7 mm Type X gypsum board	-	30	29
	F22e	F22 with • no absorptive material in cavity • 12.7 mm regular gypsum board	-	27	25
	F22f	F22 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	31	28
	F23	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood trusses spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 2 layers of gypsum board on ceiling side			
	F23a	F23 with • wood trusses spaced 400 mm o.c. • no absorptive material in cavity • 15.9 mm Type X gypsum board	1 h	34	31
	F23b	F23 with • wood trusses spaced 600 mm o.c. • no absorptive material in cavity • 15.9 mm Type X gypsum board	1 h	35	31
	F23c	F23 with	45 min	36	34

		• wood trusses spaced 400 mm o.c. • absorptive material in cavity • 15.9 mm Type X gypsum board	[1 h] ⁽¹⁵⁾		
	F23d	F23 with • wood trusses spaced 600 mm o.c. • absorptive material in cavity • 15.9 mm Type X gypsum board	45 min	37	34
	F23e	F23 with • wood trusses spaced 400 mm o.c. • no absorptive material in cavity • 12.7 mm Type X gypsum board	1 h	32	30
	F23f	F23 with • wood trusses spaced 600 mm o.c. • no absorptive material in cavity • 12.7 mm Type X gypsum board	45 min	33	30
	F23g	F23 with • absorptive material in cavity • 12.7 mm Type X gypsum board	-	34	33
	F23h	F23 with • no absorptive material in cavity • 12.7 mm regular gypsum board	-	32	30
	F23i	F23 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	34	33
	F24	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood trusses spaced not more than 600 mm o.c. • with or without absorptive material in cavity • steel furring channels spaced 400 mm or 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F24a	F24 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	-	35	27
	F24b	F24 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	37	30
	F24c	F24 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	-	38	30
	F24d	F24 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	40	33
	F24e	F24 with • no absorptive material in cavity	-	33	26

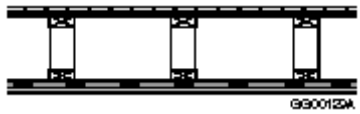
		• steel furring channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board			
	F24f	F24 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	36	29
	F24g	F24 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	37	29
	F24h	F24 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	39	32
	F24i	F24 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	33	25
	F24j	F24 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	35	28
	F24k	F24 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	36	28
	F24l	F24 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	38	31
	F25	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood trusses spaced not more than 600 mm o.c. • with or without absorptive material in cavity • steel furring channels spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on ceiling side			
	F25a	F25 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	40	32
	F25b	F25 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h	42	34
	F25c	F25 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	43	35

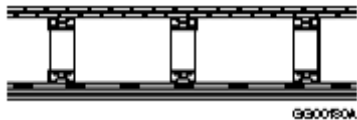
	F25d	F25 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	45 min [1 h] ⁽¹⁸⁾	45	37
	F25e	F25 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	38	30
	F25f	F25 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	1 h	40	33
	F25g	F25 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	41	33
	F25h	F25 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	45 min [1 h] ⁽¹⁸⁾	43	36
	F25i	F25 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	38	30
	F25j	F25 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	40	33
	F25k	F25 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	41	33
	F25l	F25 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	43	36
	F26	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood trusses spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 1 layer of gypsum board attached directly to trusses on ceiling side • resilient metal channels spaced 400 mm or 600 mm o.c. attached to trusses through the gypsum board • 1 layer of gypsum board attached to resilient metal channels			
	F26a	F26 with • no absorptive material in cavity • 15.9 mm Type X gypsum board • resilient metal channels	-	35	27

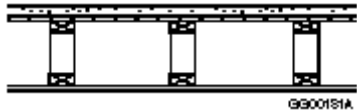
		• 15.9 mm Type X gypsum board			
	F26b	F26 with • absorptive material in cavity • 15.9 mm Type X gypsum board • resilient metal channels • 15.9 mm Type X gypsum board	-	37	30
	F26c	F26 with • no absorptive material in cavity • 12.7 mm Type X gypsum board • resilient metal channels • 12.7 mm Type X gypsum board	-	35	27
	F26d	F26 with • absorptive material in cavity • 12.7 mm Type X gypsum board • resilient metal channels • 12.7 mm Type X gypsum board	-	37	30
	F26e	F26 with • no absorptive material in cavity • 12.7 mm regular gypsum board • resilient metal channels • 12.7 mm regular gypsum board	-	32	26
	F26f	F26 with • absorptive material in cavity • 12.7 mm regular gypsum board • resilient metal channels • 12.7 mm regular gypsum board	-	35	28
	F27	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood trusses spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F27a	F27 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	-	41	33
	F27b	F27 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	43	36
	F27c	F27 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	30 min [45 min] ⁽²⁵⁾	48	41
	F27d	F27 with • absorptive material in cavity • resilient metal channels spaced 600 mm	-	50	44

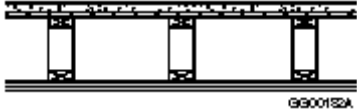
		o.c. • 15.9 mm Type X gypsum board			
	F27e	F27 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	40	32
	F27f	F27 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	42	35
	F27g	F27 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	47	40
	F27h	F27 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	49	43
	F27i	F27 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	39	31
	F27j	F27 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	41	34
	F27k	F27 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	46	39
	F27l	F27 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	48	42
	F28	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood trusses spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on ceiling side			
	F28a	F28 with • no absorptive material in cavity	1 h	46	38

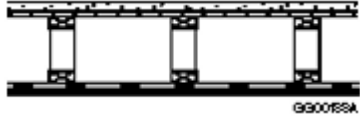
		• resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board			
	F28b	F28 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h	48	40
	F28c	F28 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	54	46
	F28d	F28 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	45 min [1 h] ^(a)	55	48
	F28e	F28 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	44	36
	F28f	F28 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	1 h	46	39
	F28g	F28 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	51	44
	F28h	F28 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	45 min [1 h] ^(a)	53	47
	F28i	F28 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	44	36
	F28j	F28 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	46	39
	F28k	F28 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	51	44

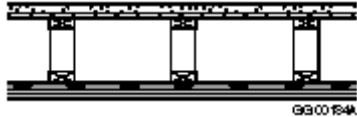
	F28l	- F28 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	53	47
	F29	• one subfloor layer 11 mm sanded plywood, or OSB or waferboard • one subfloor layer of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood trusses spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F29a	- F29 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	-	44	35
	F29b	- F29 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	46	37
	F29c	- F29 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	30 min [45 min] ⁽²⁵⁾	51	43
	F29d	- F29 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	53	45
	F29e	- F29 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	43	33
	F29f	- F29 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	45	36
	F29g	- F29 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	50	41
	F29h	- F29 with • absorptive material in cavity • resilient metal channels spaced 600 mm	-	52	44

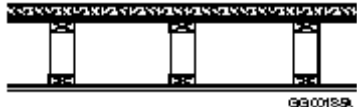
		o.c. • 12.7 mm Type X gypsum board			
	F29i	F29 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	42	34
	F29j	F29 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	44	36
	F29k	F29 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	49	41
	F29l	F29 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	51	44
	F30	• one subfloor layer 11 mm sanded plywood, or OSB or waferboard • one subfloor layer of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood trusses spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on ceiling side			
	F30a	F30 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	49	39
	F30b	F30 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h	51	42
	F30c	F30 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h [1.5 h] ⁽²⁶⁾	56 [58] ⁽²⁶⁾	47 [50] ⁽²⁶⁾
	F30d	F30 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	45 min [1 h] ⁽¹⁸⁾	58	50

	F30e	F30 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	47	38
	F30f	F30 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	1 h	49	40
	F30g	F30 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	54	46
	F30h	F30 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	45 min [1 h] ⁽¹⁸⁾	56	48
	F30i	F30 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	47	37
	F30j	F30 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	49	40
	F30k	F30 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	54	45
	F30l	F30 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	56	48
	F31	• 25 mm gypsum-concrete topping (at least 44 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood trusses spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 1 layer of gypsum board on ceiling side	 G300181A		
	F31a	F31 with • no absorptive material in cavity • 15.9 mm Type X gypsum board	-	41	17
	F31b	F31 with	-	43	20

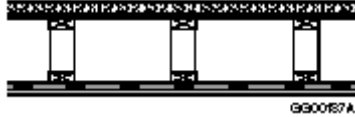
		• absorptive material in cavity • 15.9 mm Type X gypsum board			
	F31c	F31 with • no absorptive material in cavity • 12.7 mm Type X gypsum board	-	40	17
	F31d	F31 with • absorptive material in cavity • 12.7 mm Type X gypsum board	-	42	20
	F31e	F31 with • no absorptive material in cavity • 12.7 mm regular gypsum board	-	39	16
	F31f	F31 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	41	19
	F32	• 25 mm gypsum-concrete topping (at least 44 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood trusses spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 2 layers of gypsum board on ceiling side			
	F32a	F32 with • wood trusses spaced 400 mm o.c. • no absorptive material in cavity • 15.9 mm Type X gypsum board	1 h	46	20
	F32b	F32 with • wood trusses spaced 600 mm o.c. • no absorptive material in cavity • 15.9 mm Type X gypsum board	1 h	47	20
	F32c	F32 with • wood trusses spaced 400 mm o.c. • absorptive material in cavity • 15.9 mm Type X gypsum board	45 min [1 h] ^(a5)	48	23
	F32d	F32 with • wood trusses spaced 600 mm o.c. • absorptive material in cavity • 15.9 mm Type X gypsum board	45 min	49	23
	F32e	F32 with • wood trusses spaced 400 mm o.c. • no absorptive material in cavity • 12.7 mm Type X gypsum board	1 h	44	19
	F32f	F32 with • wood trusses spaced 600 mm o.c. • no absorptive material in cavity • 12.7 mm Type X gypsum board	45 min	45	19
	F32g	F32 with • absorptive material in cavity • 12.7 mm Type X gypsum board	-	46	19
	F32h	F32 with	-	44	19

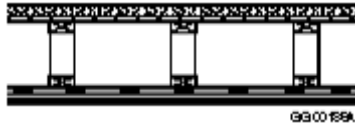
		• no absorptive material in cavity • 12.7 mm regular gypsum board			
	F32i	F32 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	46	22
	F33	• 25 mm gypsum-concrete topping (at least 44 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood trusses spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F33a	F33 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	-	53	26
	F33b	F33 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	55	26
	F33c	F33 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	30 min [45 min] ⁽²⁵⁾	60	34
	F33d	F33 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	62	34
	F33e	F33 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	52	26
	F33f	F33 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	54	26
	F33g	F33 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	59	34
	F33h	F33 with • absorptive material in cavity	-	61	34

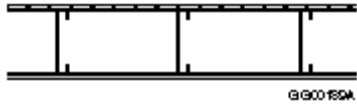
		• resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board			
	F33i	F33 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	51	25
	F33j	F33 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	53	25
	F33k	F33 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	58	33
	F33l	F33 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	60	33
	F34	• 25 mm gypsum-concrete topping (at least 44 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood trusses spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on ceiling side			
	F34a	F34 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	57	29
	F34b	F34 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h	60	29
	F34c	F34 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h [1.5 h] ⁽²⁶⁾	65 [67] ⁽²⁶⁾	37
	F34d	F34 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	45 min [1 h] ⁽¹⁸⁾	67	37

	F34e	F34 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	56	28
	F34f	F34 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	1 h	58	28
	F34g	F34 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	63	36
	F34h	F34 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	45 min [1 h] ⁽¹⁸⁾	65	36
	F34i	F34 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	56	28
	F34j	F34 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	58	28
	F34k	F34 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	63	36
	F34l	F34 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	65	36
	F35	• 38 mm concrete topping (at least 70 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood trusses spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 1 layer of gypsum board on ceiling side			
	F35a	F35 with • no absorptive material in cavity • 15.9 mm Type X gypsum board	-	45	26
	F35b	F35 with • absorptive material in cavity	-	47	29

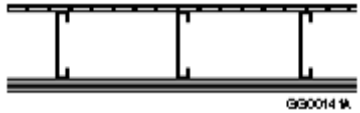
		• 15.9 mm Type X gypsum board			
	F35c	F35 with • no absorptive material in cavity • 12.7 mm Type X gypsum board	-	43	26
	F35d	F35 with • absorptive material in cavity • 12.7 mm Type X gypsum board	-	45	29
	F35e	F35 with • no absorptive material in cavity • 12.7 mm regular gypsum board	-	43	26
	F35f	F35 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	45	29
	F36	• 38 mm concrete topping (at least 70 kg/m³) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood trusses spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 2 layers of gypsum board on ceiling side			
	F36a	F36 with • wood trusses spaced 400 mm o.c. • no absorptive material in cavity • 15.9 mm Type X gypsum board	1 h	49	28
	F36b	F36 with • wood trusses spaced 600 mm o.c. • no absorptive material in cavity • 15.9 mm Type X gypsum board	1 h	50	28
	F36c	F36 with • wood trusses spaced 400 mm o.c. • absorptive material in cavity • 15.9 mm Type X gypsum board	45 min [1 h] ⁽¹⁵⁾	51	31
	F36d	F36 with • wood trusses spaced 600 mm o.c. • absorptive material in cavity • 15.9 mm Type X gypsum board	45 min	52	31
	F36e	F36 with • wood trusses spaced 400 mm o.c. • no absorptive material in cavity • 12.7 mm Type X gypsum board	1 h	48	27
	F36f	F36 with • wood trusses spaced 600 mm o.c. • no absorptive material in cavity • 12.7 mm Type X gypsum board	45 min	49	27
	F36g	F36 with • absorptive material in cavity • 12.7 mm Type X gypsum board	-	50	30
	F36h	F36 with • no absorptive material in cavity • 12.7 mm regular gypsum board	-	47	27

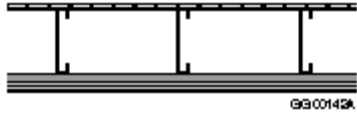
	F36i	F36 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	49	30
	F37	• 38 mm concrete topping (at least 70 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood trusses spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F37a	F37 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	45 min	56	35
	F37b	F37 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	59	35
	F37c	F37 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	30 min [45 min] ⁽²⁵⁾	63	43
	F37d	F37 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	66	43
	F37e	F37 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	55	35
	F37f	F37 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	57	35
	F37g	F37 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	62	43
	F37h	F37 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	64	43

	F37i	F37 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	54	35
	F37j	F37 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	57	35
	F37k	F37 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	61	43
	F37l	F37 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	64	43
	F38	• 38 mm concrete topping (at least 70 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on wood trusses spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on ceiling side			
	F38a	F38 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	61	37
	F38b	F38 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h	63	37
	F38c	F38 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h [1.5] ⁽²⁶⁾	68 [71] ⁽²⁶⁾	45
	F38d	F38 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h	70	45
	F38e	F38 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c.	1 h	60	36

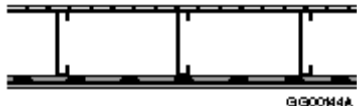
		• 12.7 mm Type X gypsum board			
	F38f	F38 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	1 h	62	36
	F38g	F38 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	67	44
	F38h	F38 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	1 h	69	44
	F38i	F38 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	59	36
	F38j	F38 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	61	36
	F38k	F38 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	66	44
	F38l	F38 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	68	44
Cold-Formed-Steel Floor Joists ⁽²⁷⁾	F39	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on steel joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 1 layer of gypsum board on ceiling side			
	F39a	F39 with • no absorptive material in cavity • 15.9 mm Type X gypsum board	-	29	27
	F39b	F39 with • absorptive material in cavity • 15.9 mm Type X gypsum board	-	31	30
	F39c	F39 with • no absorptive material in cavity • 12.7 mm Type X gypsum board	-	27	26

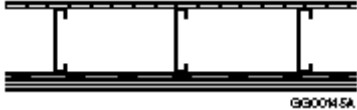
	F39d	F39 with • absorptive material in cavity • 12.7 mm Type X gypsum board	-	29	29
	F39e	F39 with • no absorptive material in cavity • 12.7 mm regular gypsum board	-	27	25
	F39f	F39 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	29	28
	F40	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on steel joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 2 layers of gypsum board on ceiling side			
	F40a	F40 with • steel joists spaced 400 mm o.c. • no absorptive material in cavity • 15.9 mm Type X gypsum board	1 h	34	31
	F40b	F40 with • steel joists spaced 600 mm o.c. • no absorptive material in cavity • 15.9 mm Type X gypsum board	45 min	35	31
	F40c	F40 with • steel joists spaced 400 mm o.c. • absorptive material in cavity • 15.9 mm Type X gypsum board	45 min	36	34
	F40d	F40 with • steel joists spaced 600 mm o.c. • absorptive material in cavity • 15.9 mm Type X gypsum board	45 min	37	34
	F40e	F40 with • steel joists spaced 400 mm o.c. • no absorptive material in cavity • 12.7 mm Type X gypsum board	1 h	32	30
	F40f	F40 with • steel joists spaced 600 mm o.c. • no absorptive material in cavity • 12.7 mm Type X gypsum board	45 min	33	30
	F40g	F40 with • steel joists spaced 400 mm o.c. • absorptive material in cavity • 12.7 mm Type X gypsum board	45 min	34	33
	F40h	F40 with • steel joists spaced 600 mm o.c. • absorptive material in cavity • 12.7 mm Type X gypsum board	45 min	35	33
	F40i	F40 with • no absorptive material in cavity • 12.7 mm regular gypsum board	-	31	30

	F40j	F40 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	33	33
	F41	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on steel joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • steel furring channels spaced 400 mm or 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F41a	F41 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	-	34	27
	F41b	F41 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	37	30
	F41c	F41 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	30 min [45 min] ⁽²⁵⁾	37	30
	F41d	F41 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	30 min	40	33
	F41e	F41 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	33	26
	F41f	F41 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	35	29
	F41g	F41 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	30 min [45 min] ⁽²⁵⁾	36	29
	F41h	F41 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	30 min	38	32
	F41i	F41 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	<30 min	32	25
	F41j	F41 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	<30 min	35	28

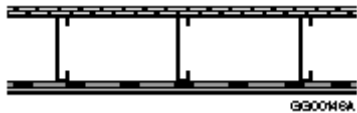
	F41k	F41 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	<30 min	35	28
	F41l	F41 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	<30 min	38	31
	F42	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on steel joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • steel furring channels spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on ceiling side			
	F42a	F42 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	39	32
	F42b	F42 with • steel joists spaced 400 mm o.c. • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	45 min	42	34
	F42c	F42 with • steel joists spaced 600 mm o.c. • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	45 min	43	34
	F42d	F42 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	42	35
	F42e	F42 with • steel joists spaced 400 mm o.c. • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	45 min [1 h] ⁽²⁸⁾	45	37
	F42f	F42 with • steel joists spaced 600 mm o.c. • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	45 min [1 h] ⁽³⁵⁾	46	37
	F42g	F42 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	38	30
	F42h	F42 with • steel joists spaced 400 mm o.c. • no absorptive material in cavity • steel furring channels spaced 600 mm o.c.	45 min	40	33

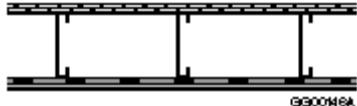
		• 12.7 mm Type X gypsum board			
	F42i	F42 with • steel joists spaced 600 mm o.c. • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	45 min	41	33
	F42j	F42 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	41	33
	F42k	F42 with • steel joists spaced 400 mm o.c. • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	45 min [1 h] ⁽²⁸⁾	43	36
	F42l	F42 with • steel joists spaced 600 mm o.c. • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	45 min [1 h] ⁽¹⁵⁾	44	36
	F42m	F42 with • no absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	37	30
	F42n	F42 with • no absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	39	33
	F42o	F42 with • absorptive material in cavity • steel furring channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	40	33
	F42p	F42 with • absorptive material in cavity • steel furring channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	42	36
	F43	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on steel joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 1 layer of gypsum board attached directly to joists on ceiling side • resilient metal channels spaced 400 mm or 600 mm o.c. attached to joists through the gypsum board • 1 layer of gypsum board attached to resilient metal channels			
	F43a	F43 with • no absorptive material in cavity • 15.9 mm Type X gypsum board • resilient metal channels	1 h	35	27

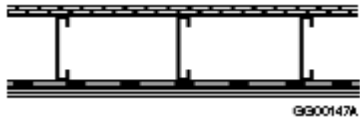
		• 15.9 mm Type X gypsum board			
	F43b	F43 with • absorptive material in cavity • 15.9 mm Type X gypsum board • resilient metal channels • 15.9 mm Type X gypsum board	1 h	37	30
	F43c	F43 with • no absorptive material in cavity • 12.7 mm Type X gypsum board • resilient metal channels • 12.7 mm Type X gypsum board	1 h	35	27
	F43d	F43 with • absorptive material in cavity • 12.7 mm Type X gypsum board • resilient metal channels • 12.7 mm Type X gypsum board	1 h	37	30
	F43e	F43 with • no absorptive material in cavity • 12.7 mm regular gypsum board • resilient metal channels • 12.7 mm regular gypsum board	-	32	26
	F43f	F43 with • absorptive material in cavity • 12.7 mm regular gypsum board • resilient metal channels • 12.7 mm regular gypsum board	-	35	28
	F44	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on steel joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F44a	F44 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	-	40	33
	F44b	F44 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	43	36
	F44c	F44 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	30 min [45 min] ⁽²⁵⁾	47	41
	F44d	F44 with • absorptive material in cavity • resilient metal channels spaced 600 mm	30 min	50	44

		o.c. • 15.9 mm Type X gypsum board			
	F44e	F44 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	39	32
	F44f	F44 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	41	35
	F44g	F44 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	30 min [45 min] ⁽²⁵⁾	46	40
	F44h	F44 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	30 min	48	43
	F44i	F44 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	< 30 min	38	31
	F44j	F44 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	< 30 min	41	34
	F44k	F44 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	< 30 min	45	39
	F44l	F44 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	< 30 min	48	42
	F45	• subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on steel joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on ceiling side			
	F45a	F45 with • no absorptive material in cavity	1 h	45	38

		• resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board			
	F45b	F45 with • steel joists spaced 400 mm o.c. • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	45 min	48	40
	F45c	F45 with • steel joists spaced 600 mm o.c. • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	45 min	49	40
	F45d	F45 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	52	46
	F45e	F45 with • steel joists spaced 400 mm o.c. • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	45 min [1 h] ⁽²⁸⁾	55	48
	F45f	F45 with • steel joists spaced 600 mm o.c. • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	45 min [1 h] ⁽³⁵⁾	56	48
	F45g	F45 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	44	36
	F45h	F45 with • steel joists spaced 400 mm o.c. • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	45 min	46	39
	F45i	F45 with • steel joists spaced 600 mm o.c. • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	45 min	47	39
	F45j	F45 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	51	44

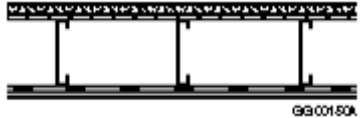
	F45k	F45 with • steel joists spaced 400 mm o.c. • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	45 min [1 h] ⁽²⁸⁾	53	47
	F45l	F45 with • steel joists spaced 600 mm o.c. • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	45 min [1 h] ⁽¹⁵⁾	54	47
	F45m	F45 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	43	36
	F45n	F45 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	45	39
	F45o	F45 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	50	44
	F45p	F45 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	52	47
	F46	• one subfloor layer of 11 mm sanded plywood, or OSB or waferboard • one subfloor layer of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on steel joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F46a	F46 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	-	43	34
	F46b	F46 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	46	37
	F46c	F46 with	-	50	42

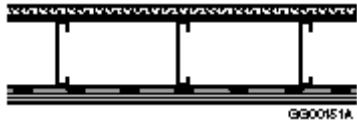
		• absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board			
	F46d	F46 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	53	45
	F46e	F46 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	42	33
	F46f	F46 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	44	36
	F46g	F46 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	49	41
	F46h	F46 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	51	44
	F46i	F46 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	41	33
	F46j	F46 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	44	36
	F46k	F46 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	48	41
	F46l	F46 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	51	44
	F47	• one subfloor layer of 15.5 mm plywood, or OSB or waferboard • one subfloor layer of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and			

		groove lumber • on steel joists spaced not more than 400 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F47a	F47 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	30 min	45	35
	F47b	F47 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	30 min	47	38
	F47c	F47 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	30 min [45 min] ⁽¹⁸⁾ [1 h] ⁽²⁸⁾	51	45
	F47d	F47 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	[30 min] ⁽¹⁸⁾ [45 min] ⁽²⁸⁾	53	47
	F47e	F47 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	30 min	43	44
	F47f	F47 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	45	47
	F47g	F47 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	[30 min] ⁽¹⁸⁾ [45 min] ⁽²⁸⁾	50	43
	F47h	F47 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	52	46
	F48	• one subfloor layer of 11 mm sanded plywood, or OSB or waferboard • one subfloor layer of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on steel joists spaced not more than 600 mm o.c.			

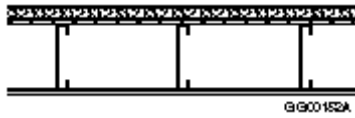
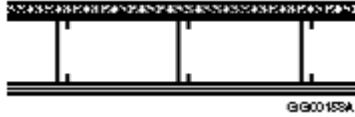
		• with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on ceiling side			
	F48a	F48 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	48	39
	F48b	F48 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h	50	42
	F48c	F48 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	56	47
	F48d	F48 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h	57	50
	F48e	F48 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	47	38
	F48f	F48 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	49	40
	F48g	F48 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	54	46
	F48h	F48 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	56	48
	F48i	F48 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	46	37
	F48j	F48 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c.	-	48	40

		• 12.7 mm regular gypsum board			
	F48k	F48 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	53	45
	F48l	F48 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	55	48
	F49	• 25 mm gypsum-concrete topping (at least 44 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on steel joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 1 layer of gypsum board on ceiling side			
	F49a	F49 with • no absorptive material in cavity • 15.9 mm Type X gypsum board	-	40	13
	F49b	F49 with • absorptive material in cavity • 15.9 mm Type X gypsum board	-	42	16
	F49c	F49 with • no absorptive material in cavity • 12.7 mm Type X gypsum board	-	39	12
	F49d	F49 with • absorptive material in cavity • 12.7 mm Type X gypsum board	-	41	15
	F49e	F49 with • no absorptive material in cavity • 12.7 mm regular gypsum board	-	38	12
	F49f	F49 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	40	15
	F50	• 25 mm gypsum-concrete topping (at least 44 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on steel joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • 2 layers of gypsum board on ceiling side			
	F50a	F50 with • no absorptive material in cavity • 15.9 mm Type X gypsum board	-	45	16
	F50b	F50 with	-	47	19

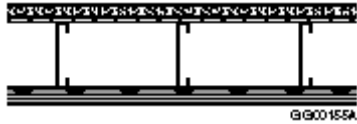
		• absorptive material in cavity • 15.9 mm Type X gypsum board			
	F50c	F50 with • no absorptive material in cavity • 12.7 mm Type X gypsum board	-	44	15
	F50d	F50 with • absorptive material in cavity • 12.7 mm Type X gypsum board	-	46	18
	F50e	F50 with • no absorptive material in cavity • 12.7 mm regular gypsum board	-	43	14
	F50f	F50 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	45	17
	F51	• 25 mm gypsum-concrete topping (at least 44 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on steel joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F51a	F51 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	-	52	22
	F51b	F51 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	54	22
	F51c	F51 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	-	59	30
	F51d	F51 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	61	30
	F51e	F51 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	51	21
	F51f	F51 with • no absorptive material in cavity	-	53	21

		• resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board			
	F51g	F51 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	58	29
	F51h	F51 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	60	29
	F51i	F51 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	50	21
	F51j	F51 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	52	21
	F51k	F51 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	57	29
	F51l	F51 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	59	29
	F52	• 25 mm gypsum-concrete topping (at least 44 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on steel joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on ceiling side			
	F52a	F52 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	57	25
	F52b	F52 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h	59	25

	F52c	F52 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	64	33
	F52d	F52 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	45 min [1 h] ⁽²⁵⁾	66	33
	F52e	F52 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	55	24
	F52f	F52 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	1 h	58	24
	F52g	F52 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	62	32
	F52h	F52 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	45 min [1 h] ⁽²⁵⁾	65	32
	F52i	F52 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	55	23
	F52j	F52 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	57	23
	F52k	F52 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	62	31
	F52l	F52 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	64	31

	F53	• 38 mm concrete topping (at least 70 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on steel joists spaced not more than 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F53a	F53 with • no absorptive material in cavity • 15.9 mm Type X gypsum board	-	44	22
	F53b	F53 with • absorptive material in cavity • 15.9 mm Type X gypsum board	-	46	25
	F53c	F53 with • no absorptive material in cavity • 12.7 mm Type X gypsum board	-	42	21
	F53d	F53 with • absorptive material in cavity • 12.7 mm Type X gypsum board	-	44	24
	F53e	F53 with • no absorptive material in cavity • 12.7 mm regular gypsum board	-	42	21
	F53f	F53 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	44	24
	F54	• 38 mm concrete topping (at least 70 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on steel joists spaced not more than 600 mm o.c. • 2 layers of gypsum board on ceiling side			
	F54a	F54 with • no absorptive material in cavity • 15.9 mm Type X gypsum board	-	48	24
	F54b	F54 with • absorptive material in cavity • 15.9 mm Type X gypsum board	-	50	27
	F54c	F54 with • no absorptive material in cavity • 12.7 mm Type X gypsum board	-	47	23
	F54d	F54 with • absorptive material in cavity • 12.7 mm Type X gypsum board	-	49	26
	F54e	F54 with • no absorptive material in cavity • 12.7 mm regular gypsum board	-	47	23
	F54f	F54 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	49	26

	F55	• 38 mm concrete topping (at least 70 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on steel joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F55a	F55 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	-	56	31
	F55b	F55 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	58	31
	F55c	F55 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	-	63	39
	F55d	F55 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	65	39
	F55e	F55 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	54	30
	F55f	F55 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	56	30
	F55g	F55 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	61	38
	F55h	F55 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	63	38
	F55i	F55 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c.	-	54	30

		• 12.7 mm regular gypsum board			
	F55j	F55 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	56	30
	F55k	F55 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	61	38
	F55l	F55 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	63	38
	F56	• 38 mm concrete topping (at least 70 kg/m²) • subfloor of 15.5 mm plywood, OSB or waferboard, or 17 mm tongue and groove lumber • on steel joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on ceiling side			
	F56a	F56 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	60	33
	F56b	F56 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h	62	33
	F56c	F56 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	67	41
	F56d	F56 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	45 min [1 h] ⁽²⁵⁾	69	41
	F56e	F56 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	59	32
	F56f	F56 with • no absorptive material in cavity	1 h	61	32

		• resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board			
	F56g	F56 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	66	40
	F56h	F56 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	45 min [1 h] ⁽²⁵⁾	68	40
	F56i	F56 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	58	32
	F56j	F56 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	61	32
	F56k	F56 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	65	40
	F56l	F56 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	68	40
	F57	• 50 mm concrete • 0.46 mm metal pan with 19 mm rib • on steel joists spaced not more than 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F57a	F57 with • no absorptive material in cavity • 15.9 mm Type X gypsum board	-	45	26
	F57b	F57 with • absorptive material in cavity • 15.9 mm Type X gypsum board	-	47	29
	F57c	F57 with • no absorptive material in cavity • 12.7 mm Type X gypsum board	-	44	25
	F57d	F57 with • absorptive material in cavity • 12.7 mm Type X gypsum board	-	46	28
	F57e	F57 with	-	43	25

		• no absorptive material in cavity • 12.7 mm regular gypsum board			
	F57f	F57 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	45	28
	F58	• 50 mm concrete • 0.38 mm metal pan with 16 mm rib • on steel joists spaced not more than 600 mm o.c. • 2 layers of gypsum board on ceiling side			
	F58a	F58 with • no absorptive material in cavity • 15.9 mm Type X gypsum board	-	50	27
	F58b	F58 with • absorptive material in cavity • 15.9 mm Type X gypsum board	-	52	30
	F58c	F58 with • no absorptive material in cavity • 12.7 mm Type X gypsum board	-	48	27
	F58d	F58 with • absorptive material in cavity • 12.7 mm Type X gypsum board	-	50	30
	F58e	F58 with • no absorptive material in cavity • 12.7 mm regular gypsum board	-	48	27
	F58f	F58 with • absorptive material in cavity • 12.7 mm regular gypsum board	-	50	30
	F59	• 50 mm concrete • 0.38 mm metal pan with 16 mm rib • on steel joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 1 layer of gypsum board on ceiling side			
	F59a	F59 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	-	57	35
	F59b	F59 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	59	35
	F59c	F59 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	-	64	43

	F59d	F59 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	66	43
	F59e	F59 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	56	34
	F59f	F59 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	56	34
	F59g	F59 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	-	63	42
	F59h	F59 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	65	42
	F59i	F59 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	55	34
	F59j	F59 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	57	34
	F59k	F59 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	62	42
	F59l	F59 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	64	42
	F60	• 50 mm concrete • 0.46 mm metal pan with a 19 mm rib • on steel joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on ceiling side	 The diagram illustrates a cross-section of a ceiling assembly. It shows a top layer of concrete, followed by a metal pan with a ribbed profile. This assembly is supported by steel joists. Below the joists, there are two layers of gypsum board. The entire assembly is labeled 'G30015A'.		

	F60a	F60 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	62	36
	F60b	F60 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h	64	36
	F60c	F60 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	69	44
	F60d	F60 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	45 min [1 h] ⁽²⁵⁾	71	44
	F60e	F60 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1h	60	36
	F60f	F60 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	1 h	62	36
	F60g	F60 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	67	44
	F60h	F60 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	45 min [1 h] ⁽²⁵⁾	69	44
	F60i	F60 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm regular gypsum board	-	60	36
	F60j	F60 with • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	62	36
	F60k	F60 with • absorptive material in cavity • resilient metal channels spaced 400 mm	-	67	44

		o.c. • 12.7 mm regular gypsum board			
	F60l	F60 with • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm regular gypsum board	-	69	44
	F61	• 50 mm concrete • 0.38 mm metal pan with 16 mm rib • on steel joists spaced not more than 600 mm o.c. • with or without absorptive material in cavity • resilient metal channels spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on ceiling side			
	F61a	F61 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	62	32
	F61b	F61 with • steel joists spaced 400 mm o.c. • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1 h	64	32
	F61c	F61 with • steel joists spaced 600 mm o.c. • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	65	29
	F61d	F61 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 15.9 mm Type X gypsum board	1 h	68	37
	F61e	F61 with • steel joists spaced 400 mm o.c. • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	1h	66	34
	F61f	F61 with • steel joists spaced 600 mm o.c. • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 15.9 mm Type X gypsum board	-	71	34
	F61g	F61 with • no absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	62	32

	F61h	F61 with • steel joists spaced 400 mm o.c. • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	1 h	64	32
	F61i	F61 with • steel joists spaced 600 mm o.c. • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	64	28
	F61j	F61 with • absorptive material in cavity • resilient metal channels spaced 400 mm o.c. • 12.7 mm Type X gypsum board	1 h	68	36
	F61k	F61 with • steel joists spaced 400 mm o.c. • absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	1 h	64	32
	F61l	F61 with • steel joists spaced 600 mm o.c. • no absorptive material in cavity • resilient metal channels spaced 600 mm o.c. • 12.7 mm Type X gypsum board	-	70	34
Roofs					
Wood Roof Trusses	R1	• wood trusses spaced not more than 600 mm o.c. • 1 layer 15.9 mm Type X gypsum board	45 min	-	-
Rating Provided by Membrane Only					
	M1	• supporting members spaced not more than 600 mm o.c. • 1 layer 15.9 mm Type X gypsum board	30 min	-	-
	M2	• supporting members spaced not more than 600 mm o.c. • 2 layers 15.9 mm Type X gypsum board	1 h	-	-

Notes to Table 9.10.3.1.-B:

⁽¹⁾ See Note A-9.10.3.1.

⁽²⁾ For assemblies with a ceiling consisting of a single layer of gypsum board on resilient metal channels to obtain the listed ratings, the resilient metal channel arrangement at the gypsum board butt end joints should be as shown in Figure A-9.10.3.1.-A.

⁽³⁾ For assemblies with a ceiling consisting of 2 layers of gypsum board on resilient metal channels to obtain the listed ratings, the fastener and resilient metal channel arrangement at the gypsum board butt end joints should be as shown in Figure A-9.10.3.1.-B.

⁽⁴⁾ The *fire-resistance rating* and *sound transmission class* values given are for a minimum thickness of subfloor or deck as shown. Minimum subfloor thickness required is determined by structural member spacing (see Table 9.23.15.5.-A). Thicker subflooring or decking is also acceptable.

⁽⁵⁾ Sound absorptive material includes

(i) fibre processed from rock, slag, or glass, and

- (ii) loose-fill or spray-applied cellulose fibre.

To obtain the listed *sound transmission class* rating, the nominal insulation thickness is 150 mm for rock, slag, or glass fibres or loose-fill cellulose fibre, and 90 mm for spray-applied cellulose fibre, unless otherwise specified. Absorptive material will affect the *sound transmission class* by approximately adding or subtracting 1 per 50 mm change of thickness. However, no additional *sound transmission class* value is achieved by adding a greater thickness of insulation than the depth of the assembly.

⁽⁶⁾ The *fire-resistance rating* and *sound transmission class* values are based on the spacing of ceiling supports as noted. (See also Table Note (10).) A narrower spacing will be detrimental to the *sound transmission class* rating, but not to the *fire-resistance rating*.

⁽⁷⁾ To obtain the listed rating, fastener type, spacing and penetration depth for the attachment of gypsum board must conform to Subsection 9.29.5., and

- (i) fastener distance to board edges and butt ends should be not less than 38 mm, except for fasteners on the butt ends of the base layer in ceilings with two layers (see Figure A-9.10.3.1.-B),
- (ii) fasteners are spaced not more than 300 mm o.c.,
- (iii) fasteners must consist of nails or screws when attaching gypsum board to wood members, and
- (iv) fasteners must consist of screws when attaching gypsum board to cold-formed steel channels or resilient metal channels.

For wood- and steel-framed assemblies, if fasteners are spaced less than 300 mm o.c., subtract 1 from the *sound transmission class* value; if fasteners are spaced less than 200 mm o.c., subtract 2 from the *sound transmission class* value. Narrower fastener spacing is not detrimental to the *fire-resistance rating*.

⁽⁸⁾ See Sentence D-1.2.1.(2) of Appendix D for the significance of *fire-resistance ratings*.

⁽⁹⁾ The *sound transmission class* values given in the Table are for the minimum depth of structural member noted in the description and applicable table notes. To obtain *sound transmission class* values for structural members deeper than that minimum, add 1 to the *sound transmission class* value in the Table for each 170 mm increase in structural member depth.

⁽¹⁰⁾ The *sound transmission class* values given in the Table are for structural member spacing of 300 mm o.c., unless otherwise noted in the description and applicable table notes. To obtain *sound transmission class* values for assemblies with structural members spaced more than 500 mm o.c., add 1 to the *sound transmission class* value in the Table.

⁽¹¹⁾ Assemblies with *sound transmission class* ratings of 50 or more require methods to minimize airborne sound transmission at electrical boxes and other openings, and at wall/wall and wall/floor junctions, except at junctions constructed of concrete-to-concrete, concrete-to-masonry, or masonry-to-masonry where the intersecting joint along the junction is cast or mortared.

⁽¹²⁾ The impact insulation class values given are for floor assemblies tested with no finished flooring.

⁽¹³⁾ Wood floor joists are:

- (i) wood joists with a minimum member size of 38 mm (width) × 235 mm (depth), except as otherwise noted (see Table Note (16)); or
- (ii) wood I-joists with a minimum flange size of 38 mm × 38 mm, a minimum OSB or plywood web thickness of 9.5 mm, and a minimum joist depth of 241 mm.

⁽¹⁴⁾ Except where assemblies with wood I-joists are tested according to CAN/ULC-S101 the *fire-resistance rating* values apply only to I-joists that have been fabricated with a phenolic-based structural wood adhesive complying with CSA O112.10. For I-joists with flanges made of laminated veneer lumber (LVL), the *fire-resistance rating* values apply only where the adhesive used in the LVL fabrication is a phenolic-based structural wood adhesive complying with CSA O112.9.

⁽¹⁵⁾ The *fire-resistance rating* value within square brackets is achieved only where absorptive material includes spray-applied cellulose fibre with

- (i) adhesive that is capable of providing a minimum cohesive/adhesive bond strength per unit area of 5 times the weight of the material under the test plate when tested in accordance with ASTM E736/E736M,
- (ii) a minimum density of 35 kg/m³, and
- (iii) a minimum thickness of 90 mm on the underside of the subfloor or deck, of 90 mm on the sides of the structural members, and for cold-formed steel joists, of 13 mm on the underside of the bottom flange other than at resilient metal channel locations.

⁽¹⁶⁾ The *fire-resistance rating* value within square brackets only applies to assemblies with solid wood joists and is achieved only where absorptive material includes:

- (i) fibre processed from rock or slag with a minimum thickness of 90 mm and a minimum surface area mass of 2.8 kg/m²; or

(ii) spray-applied cellulose fibre with a minimum density of 50 kg/m³ and a minimum depth of 90 mm on the underside of the subfloor and of 90 mm on the sides of the floor joists.

⁽¹⁷⁾ The *fire-resistance rating*, *sound transmission class* and impact insulation class values given are also applicable to assemblies with 38 mm (width) × 184 mm (depth) solid wood joists.

⁽¹⁸⁾ The *fire-resistance rating* value within square brackets is achieved only where absorptive material includes:

(i) fibre processed from rock or slag with a minimum thickness of 90 mm and a minimum surface area mass of 2.8 kg/m²; or

(ii) spray-applied cellulose fibre with a minimum density of 50 kg/m³ and a minimum depth of 90 mm on the underside of the subfloor and of 90 mm on the webs or the sides of the structural members.

⁽¹⁹⁾ The *fire-resistance rating*, *sound transmission class* and impact insulation class values within the square brackets only apply to assemblies with solid wood joists and are achieved only where absorptive material includes dry-blown cellulose fibre with a minimum density of 40 kg/m³ filling the entire cavity; the cellulose fibre is supported on zinc-coated (galvanized) steel poultry fence fabric conforming to ASTM A390, which has 25-mm-wide hexagonal mesh openings and 0.81-mm-thick (20-gauge) wire and is attached to wood joists with metal staples having legs that are 50 mm long.

⁽²⁰⁾ The *fire-resistance rating* and *sound transmission class* values are achieved only where absorptive material includes:

(i) fibre processed from rock or slag that fills the joist cavity and has a minimum surface area mass of 2.8 kg/m², and for structural members at least 270 mm in depth, the fibre includes three layers each of which has a minimum thickness of 90 mm; or

(ii) dry-blown cellulose fibre with a minimum density of 40 kg/m³ filling the entire cavity; the cellulose fibre is supported on zinc-coated (galvanized) steel poultry fence fabric conforming to ASTM A390, which has 25-mm-wide hexagonal mesh openings and 0.81-mm-thick (20-gauge) wire and is attached to wood joists or wood I-joists with metal staples having legs that are 50 mm or 30 mm long, respectively.

⁽²¹⁾ The *fire-resistance rating* value only applies to assemblies with wood I-joists with flanges with a minimum thickness of 38 mm and a minimum width of 63 mm.

⁽²²⁾ The *fire-resistance rating* and *sound transmission class* values are achieved only where absorptive material includes:

(i) fibre processed from rock or slag that fills the joist cavity and has a minimum surface area mass of 2.8 kg/m², and for structural members at least 270 mm in depth, the fibre includes three layers each of which has a minimum thickness of 90 mm; or

(ii) dry-blown cellulose fibre with a minimum density of 40 kg/m³ filling the entire cavity; the cellulose fibre is supported on zinc-coated (galvanized) steel poultry fence fabric conforming to ASTM A390, which has 25-mm-wide hexagonal mesh openings and 0.81-mm-thick (20-gauge) wire and is attached to wood joists with metal staples having legs that are 50 mm long.

⁽²³⁾ The *fire-resistance rating* values given only apply to assemblies with solid wood joists spaced not more than 400 mm o.c. No information is available for assemblies constructed with wood I-joists.

⁽²⁴⁾ Wood floor trusses are:

(i) metal-plate-connected wood trusses with wood framing members not less than 38 mm × 64 mm, metal connector plates not less than 1 mm (nominal) thick with teeth not less than 8 mm long, and a minimum truss depth of 305 mm;

(ii) metal-web wood trusses with wood chords not less than 38 mm × 64 mm, V-shaped webs made from galvanized steel of 1 mm (nominal) thickness with plate areas having teeth not less than 8 mm long, and a minimum truss depth of 286 mm; or

(iii) fingerjoined wood trusses with glued fingerjoined connections, chord members not less than 38 mm × 64 mm, web members not less than 38 mm × 38 mm and a minimum truss depth of 330 mm, all of which is glued together with an R-14 phenol-resorcinol resin conforming to CSA O112.10.

⁽²⁵⁾ The *fire-resistance rating* value within square brackets is achieved only where absorptive material includes fibre processed from rock or slag with a minimum thickness of 90 mm and a minimum surface area mass of 2.8 kg/m².

⁽²⁶⁾ The *fire-resistance rating* and *sound transmission class* values within square brackets are achieved only where absorptive material includes dry-blown cellulose fibre with a minimum density of 40 kg/m³ filling the entire cavity; the cellulose fibre is supported on zinc-coated (galvanized) steel poultry fence fabric conforming to ASTM A390, which has 25-mm-wide hexagonal mesh openings and 0.81-mm-thick (20-gauge) wire and is attached to wood trusses with metal staples having legs that are 38 mm long.

⁽²⁷⁾ Cold-formed steel floor joists (C-shaped joists) are members with a minimum size of 41 mm (width) × 203 mm (depth) × 1.22 mm (material thickness).

⁽²⁸⁾ The *fire-resistance rating* value within square brackets is achieved only where absorptive material includes spray-applied cellulose fibre with a minimum density of 50 kg/m³ and a minimum thickness of 90 mm on the underside of the subfloor, of 90 mm on the sides of the cold-formed steel floor joists, and of 13 mm on the underside of the bottom flange other than at resilient metal channel locations.

Span Tables

Table 9.20.17.4.-A
Maximum Allowable Clear Spans for Lintels in Flat Loadbearing Insulating Concrete
Form (ICF) Walls⁽¹⁾⁽²⁾⁽³⁾ (1-10M Bottom Bar)
 Forming Part of Sentences 9.3.2.8.(1) and 9.20.17.4.(3)

Minimum Lintel Thickness, mm	Minimum Lintel Depth, mm	Maximum Clear Span, m			
		Supporting Light-Frame Roof Only		Supporting ICF Second Storey and Light-Frame Roof	
		Maximum Ground Snow Load, kN/m²			
		1.50	3.33	1.50	3.33
140	200	1.41	1.18	1.03	0.93
	300	1.78	1.50	1.30	1.18
	400	2.08	1.75	1.53	1.38
	500	2.33	1.97	1.72	1.56
	600	2.55	2.16	1.89	1.71
150	200	1.41	1.18	1.02	0.92
	300	1.78	1.50	1.29	1.17
	400	2.08	1.75	1.51	1.37
	500	2.33	1.97	1.70	1.54
	600	2.54	2.15	1.87	1.70
160	200	1.41	1.18	1.01	0.91
	300	1.78	1.50	1.28	1.16
	400	2.07	1.75	1.50	1.36
	500	2.32	1.96	1.68	1.53
	600	2.53	2.15	1.85	1.68
190	200	1.41	1.19	0.98	0.89
	300	1.78	1.50	1.24	1.13
	400	2.06	1.74	1.45	1.32
	500	2.30	1.95	1.63	1.49
	600	2.51	2.13	1.78	1.63
200	200	1.41	1.19	0.97	0.89
	300	1.77	1.49	1.23	1.12
	400	2.06	1.74	1.43	1.31
	500	2.30	1.95	1.61	1.48
	600	2.50	2.13	1.77	1.62
240	200	1.41	1.19	0.94	0.86
	300	1.76	1.49	1.18	1.09

	400	2.04	1.73	1.38	1.27
	500	2.27	1.93	1.55	1.43
	600	2.47	2.11	1.70	1.56

Notes to Table 9.20.17.4.-A:

- ⁽¹⁾ Deflection criterion is $L/240$, where “L” is the clear span of the lintel.
- ⁽²⁾ Linear interpolation is permitted between ground snow loads and between lintel depths.
- ⁽³⁾ 10M stirrups are required at a maximum $d/2$ spacing for spans greater than 1 200 mm, where “d” is the distance from the top of the lintel to the level of the bottom reinforcing bar in the lintel.

Table 9.20.17.4.-B
Maximum Allowable Clear Spans for Lintels in Flat Loadbearing Insulating Concrete
Form (ICF) Walls⁽¹⁾⁽²⁾⁽³⁾ (1-15M Bottom Bar)
Forming Part of Sentences 9.3.2.8.(1) and 9.20.17.4.(3)

Minimum Lintel Thickness, mm	Minimum Lintel Depth, mm	Maximum Clear Span, m			
		Supporting Light-Frame Roof Only		Supporting ICF Second Storey and Light-Frame Roof	
		Maximum Ground Snow Load, kN/m²			
		1.50	3.33	1.50	3.33
140	200	1.63	1.46	1.31	1.23
	300	2.43	2.08	1.81	1.64
	400	2.90	2.44	2.13	1.93
	500	3.26	2.75	2.41	2.18
	600	3.58	3.03	2.65	2.4
150	200	1.67	1.49	1.33	1.25
	300	2.48	2.08	1.79	1.62
	400	2.90	2.44	2.11	1.91
	500	3.26	2.75	2.38	2.16
	600	3.57	3.02	2.62	2.38
160	200	1.70	1.53	1.35	1.26
	300	2.48	2.08	1.78	1.61
	400	2.90	2.44	2.09	1.90
	500	3.25	2.75	2.36	2.14
	600	3.56	3.02	2.59	2.36
190	200	1.80	1.61	1.36	1.24
	300	2.48	2.09	1.73	1.58
	400	2.89	2.44	2.03	1.85
	500	3.23	2.74	2.29	2.09
	600	3.53	3.00	2.51	2.30
200	200	1.83	1.64	1.35	1.23
	300	2.48	2.09	1.71	1.57
	400	2.88	2.44	2.01	1.84
	500	3.22	2.74	2.26	2.07
	600	3.52	2.99	2.48	2.28
240	200	1.93	1.65	1.30	1.20
	300	2.47	2.08	1.66	1.52
	400	2.86	2.43	1.94	1.78
	500	3.19	2.72	2.18	2.01
	600	3.47	2.97	2.39	2.20

Notes to Table 9.20.17.4.-B:

⁽¹⁾ Deflection criterion is $L/240$, where “L” is the clear span of the lintel.

⁽²⁾ Linear interpolation is permitted between ground snow loads and between lintel depths.

⁽³⁾ 10M stirrups are required at a maximum $d/2$ spacing for spans greater than 1 200 mm, where “d” is the distance from the top of the lintel to the level of the bottom reinforcing bar in the lintel.

Table 9.20.17.4.-C
Maximum Allowable Clear Spans for Lintels in Flat Loadbearing Insulating Concrete
Form (ICF) Walls⁽¹⁾⁽²⁾⁽³⁾ (2-15M Bottom Bar)
Forming Part of Sentences 9.3.2.8.(1) and 9.20.17.4.(3)

Minimum Lintel Thickness, mm	Minimum Lintel Depth, mm	Maximum Clear Span, m			
		Supporting Light-Frame Roof Only		Supporting ICF Second Storey and Light-Frame Roof	
		Maximum Ground Snow Load, kN/m²			
		1.50	3.33	1.50	3.33
140	200	1.63	1.46	1.31	1.23
	300	2.43	2.18	1.96	1.84
	400	3.22	2.90	2.60	2.42
	500	4.00	3.60	3.25	2.70
	600	4.71	4.20	3.61	2.97
150	200	1.67	1.49	1.33	1.25
	300	2.48	2.23	1.99	1.87
	400	3.29	2.96	2.64	2.45
	500	4.80	3.68	3.29	2.74
	600	4.87	4.20	3.64	3.02
160	200	1.70	1.53	1.35	1.27
	300	2.53	2.28	2.02	1.90
	400	3.36	3.02	2.68	2.48
	500	4.16	3.76	3.27	2.78
	600	4.95	4.20	3.61	3.08
190	200	1.80	1.61	1.39	1.32
	300	2.67	2.40	2.09	1.97
	400	3.53	3.19	2.77	2.56
	500	4.38	3.81	3.18	2.90
	600	4.92	4.19	3.50	3.21
200	200	1.83	1.64	1.41	1.33
	300	2.87	2.44	2.11	2.00
	400	3.78	3.24	2.79	2.55
	500	4.46	3.81	3.15	2.89
	600	4.86	4.18	3.47	3.18
240	200	2.07	1.74	1.46	1.38
	300	3.07	2.59	2.18	2.07
	400	3.95	3.38	2.70	2.48
	500	4.40	3.80	3.04	2.80
	600	4.78	4.16	3.34	3.08

Notes to Table 9.20.17.4.-C:

- ⁽¹⁾ Deflection criterion is $L/240$, where "L" is the clear span of the lintel.
- ⁽²⁾ Linear interpolation is permitted between ground snow loads and between lintel depths.
- ⁽³⁾ 10M stirrups are required at a maximum $d/2$ spacing for spans greater than 1 200 mm, where "d" is the distance from the top of the lintel to the level of the bottom reinforcing bar in the lintel.

Table 9.23.4.2.-A
Maximum Spans for Floor Joists – General Cases⁽¹⁾

Forming Part of Sentences 9.3.2.8.(1), 9.23.4.2.(1) and (2), 9.23.4.4.(1) and 9.23.9.4.(1) to (3)

Commercial Designation	Grade	Joist Size, mm	Maximum Span, m								
			With Strapping ⁽²⁾			With Bridging			With Strapping ⁽³⁾ and Bridging		
			Joist Spacing, mm			Joist Spacing, mm			Joist Spacing, mm		
			300	400	600	300	400	600	300	400	600
Douglas Fir – Larch (includes Douglas Fir and Western Larch)	Select Structural	38 × 89	2.13	1.97	1.73	2.19	1.99	1.73	2.19	1.99	1.73
		38 × 140	3.23	3.07	2.73	3.44	3.12	2.73	3.44	3.12	2.73
		38 × 184	3.88	3.69	3.51	4.18	3.92	3.59	4.37	4.07	3.59
		38 × 235	4.57	4.34	4.13	4.86	4.57	4.29	5.05	4.70	4.39
		38 × 286	5.21	4.95	4.71	5.49	5.16	4.85	5.66	5.28	4.92
	No. 1 and No. 2	38 × 89	2.00	1.85	1.66	2.09	1.90	1.66	2.09	1.90	1.66
		38 × 140	3.09	2.91	2.62	3.29	2.99	2.62	3.29	2.99	2.62
		38 × 184	3.71	3.53	3.36	4.00	3.76	3.44	4.19	3.90	3.44
		38 × 235	4.38	4.16	3.96	4.66	4.38	4.11	4.84	4.51	4.20
		38 × 286	4.99	4.75	4.52	5.26	4.94	4.65	5.43	5.06	4.72
	No. 3	38 × 89	1.90	1.69	1.38	1.95	1.69	1.38	1.95	1.69	1.38
		38 × 140	2.78	2.41	1.97	2.78	2.41	1.97	2.78	2.41	1.97
		38 × 184	3.38	2.93	2.39	3.38	2.93	2.39	3.38	2.93	2.39
		38 × 235	4.14	3.58	2.93	4.14	3.58	2.93	4.14	3.58	2.93
		38 × 286	4.80	4.16	3.39	4.80	4.16	3.39	4.80	4.16	3.39
	Construction	38 × 89	1.90	1.77	1.61	2.03	1.84	1.61	2.03	1.84	1.61
	Standard	38 × 89	1.81	1.63	1.33	1.88	1.63	1.33	1.88	1.63	1.33
Hem – Fir (includes Western Hemlock and Amabilis Fir)	Select Structural	38 × 89	2.08	1.93	1.71	2.16	1.96	1.71	2.16	1.96	1.71
		38 × 140	3.18	3.03	2.69	3.39	3.08	2.69	3.39	3.08	2.69
		38 × 184	3.82	3.64	3.46	4.12	3.87	3.54	4.31	4.02	3.54
		38 × 235	4.50	4.28	4.08	4.80	4.51	4.23	4.98	4.64	4.33
		38 × 286	5.14	4.89	4.65	5.42	5.09	4.78	5.59	5.21	4.86
	No. 1 and No. 2	38 × 89	2.00	1.85	1.66	2.09	1.90	1.66	2.09	1.90	1.66
		38 × 140	3.09	2.91	2.62	3.29	2.99	2.62	3.29	2.99	2.62
		38 × 184	3.71	3.53	3.36	4.00	3.76	3.44	4.19	3.90	3.44
		38 × 235	4.38	4.16	3.96	4.66	4.38	4.11	4.84	4.51	4.20
		38 × 286	4.99	4.75	4.52	5.26	4.94	4.65	5.43	5.06	4.72
	No. 3	38 × 89	1.90	1.77	1.61	2.03	1.84	1.61	2.03	1.84	1.61
		38 × 140	2.99	2.78	2.43	3.19	2.90	2.43	3.19	2.90	2.43
		38 × 184	3.60	3.42	2.95	3.88	3.61	2.95	4.06	3.61	2.95

		38 × 235	4.24	4.03	3.61	4.51	4.24	3.61	4.68	4.37	3.61
		38 × 286	4.84	4.60	4.19	5.10	4.79	4.19	5.26	4.90	4.19
	Construction	38 × 89	1.90	1.77	1.61	2.03	1.84	1.61	2.03	1.84	1.61
	Standard	38 × 89	1.81	1.68	1.39	1.96	1.71	1.39	1.96	1.71	1.39
Spruce – Pine – Fir (includes Spruce (all species except Coast Sitka Spruce), Jack Pine, Lodgepole Pine, Balsam Fir and Alpine Fir)	Select Structural	38 × 89	1.95	1.81	1.64	2.06	1.87	1.64	2.06	1.87	1.64
		38 × 140	3.05	2.85	2.57	3.24	2.95	2.57	3.24	2.95	2.57
		38 × 184	3.66	3.48	3.31	3.94	3.70	3.38	4.12	3.84	3.38
		38 × 235	4.31	4.10	3.90	4.59	4.31	4.05	4.76	4.44	4.14
		38 × 286	4.91	4.67	4.45	5.18	4.87	4.57	5.34	4.98	4.64
	No. 1 and No. 2	38 × 89	1.86	1.72	1.58	1.99	1.81	1.58	1.99	1.81	1.58
		38 × 140	2.92	2.71	2.49	3.14	2.85	2.49	3.14	2.85	2.49
		38 × 184	3.54	3.36	3.20	3.81	3.58	3.27	3.99	3.72	3.27
		38 × 235	4.17	3.96	3.77	4.44	4.17	3.92	4.60	4.29	4.00
		38 × 286	4.75	4.52	4.30	5.01	4.71	4.42	5.17	4.82	4.49
	No. 3	38 × 89	1.81	1.68	1.55	1.96	1.78	1.55	1.96	1.78	1.55
		38 × 140	2.84	2.64	2.43	3.08	2.80	2.43	3.08	2.80	2.43
		38 × 184	3.47	3.30	2.95	3.74	3.52	2.95	3.92	3.61	2.95
		38 × 235	4.09	3.89	3.61	4.36	4.09	3.61	4.52	4.22	3.61
		38 × 286	4.67	4.44	4.19	4.92	4.62	4.19	5.08	4.73	4.19
	Construction	38 × 89	1.81	1.68	1.55	1.96	1.78	1.55	1.96	1.78	1.55
	Standard	38 × 89	1.70	1.58	1.44	1.88	1.71	1.44	1.88	1.71	1.44
Northern Species (includes any Canadian species covered by the NLGA Standard Grading Rules)	Select Structural	38 × 89	1.65	1.53	1.42	1.84	1.68	1.46	1.84	1.68	1.46
		38 × 140	2.59	2.41	2.24	2.90	2.63	2.30	2.90	2.63	2.30
		38 × 184	3.27	3.11	2.94	3.52	3.31	3.03	3.69	3.44	3.03
		38 × 235	3.85	3.66	3.48	4.10	3.85	3.62	4.26	3.97	3.70
		38 × 286	4.39	4.18	3.97	4.63	4.35	4.09	4.78	4.45	4.15
	No. 1 and No. 2	38 × 89	1.59	1.48	1.37	1.80	1.64	1.43	1.80	1.64	1.43
		38 × 140	2.51	2.33	2.16	2.83	2.57	2.25	2.83	2.57	2.25
		38 × 184	3.19	3.04	2.84	3.44	3.23	2.96	3.60	3.36	2.96
		38 × 235	3.76	3.58	3.41	4.01	3.77	3.54	4.16	3.88	3.62
		38 × 286	4.29	4.08	3.88	4.53	4.25	4.00	4.67	4.35	4.06
	No. 3	38 × 89	1.54	1.43	1.32	1.74	1.57	1.36	1.76	1.60	1.36
		38 × 140	2.42	2.24	1.94	2.74	2.38	1.94	2.75	2.38	1.94
		38 × 184	3.12	2.90	2.37	3.35	2.90	2.37	3.35	2.90	2.37
		38 × 235	3.67	3.49	2.89	3.91	3.54	2.89	4.06	3.54	2.89
		38 × 286	4.19	3.98	3.36	4.42	4.11	3.36	4.55	4.11	3.36
	Construction	38 × 89	1.54	1.43	1.32	1.74	1.57	1.40	1.76	1.60	1.40

	Standard	38 × 89	1.48	1.37	1.15	1.63	1.41	1.15	1.63	1.41	1.15

Notes to Table 9.23.4.2.-A:

⁽¹⁾ Spans apply only where the floors serve residential areas as described in Table 4.1.5.3., or 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⁾ See Sentence 9.23.9.4.(5) for alternatives to strapping.

Table 9.23.4.2.-B
Maximum Spans for Floor Joists – Special Cases⁽¹⁾

Forming Part of Sentences 9.3.2.8.(1), 9.23.4.2.(1) and (2), 9.23.4.4.(2) and 9.23.9.4.(4) and (6)

Commercial Designation	Grade	Joist Size, mm	Maximum Span, m								
			Joists with Ceilings Attached to Wood Furring						Joists with Concrete Topping		
			Without Bridging			With Bridging			With or Without Bridging ⁽²⁾		
			Joist Spacing, mm			Joist Spacing, mm			Joist Spacing, mm		
			300	400	600	300	400	600	300	400	600
Douglas Fir – Larch (includes Douglas Fir and Western Larch)	Select Structural	38 × 89	2.19	1.99	1.73	2.19	1.99	1.73	2.19	1.99	1.73
		38 × 140	3.44	3.12	2.73	3.44	3.12	2.73	3.44	3.12	2.73
		38 × 184	4.24	3.99	3.59	4.52	4.11	3.59	4.52	4.11	3.59
		38 × 235	4.98	4.69	4.29	5.47	5.20	4.58	5.77	5.24	4.58
		38 × 286	5.67	5.34	4.88	6.19	5.89	5.54	6.83	6.37	5.58
	No. 1 and No. 2	38 × 89	2.09	1.90	1.66	2.09	1.90	1.66	2.09	1.90	1.66
		38 × 140	3.29	2.99	2.62	3.29	2.99	2.62	3.29	2.99	2.55
		38 × 184	4.06	3.83	3.44	4.33	3.93	3.44	4.33	3.81	3.11
		38 × 235	4.78	4.50	4.11	5.24	4.98	4.31	5.37	4.65	3.80
		38 × 286	5.44	5.12	4.68	5.93	5.64	5.00	6.24	5.40	4.41
	No. 3	38 × 89	1.95	1.69	1.38	1.95	1.69	1.38	1.72	1.49	1.21
		38 × 140	2.78	2.41	1.97	2.78	2.41	1.97	2.45	2.12	1.73
		38 × 184	3.38	2.93	2.39	3.38	2.93	2.39	2.98	2.58	2.11
		38 × 235	4.14	3.58	2.93	4.14	3.58	2.93	3.65	3.16	2.58
		38 × 286	4.80	4.16	3.39	4.80	4.16	3.39	4.23	3.66	2.99
	Construction	38 × 89	2.03	1.84	1.61	2.03	1.84	1.61	2.03	1.84	1.61
	Standard	38 × 89	1.88	1.63	1.33	1.88	1.63	1.33	1.66	1.44	1.17
Hem – Fir (includes Western Hemlock and Amabilis Fir)	Select Structural	38 × 89	2.16	1.96	1.71	2.16	1.96	1.71	2.16	1.96	1.71
		38 × 140	3.39	3.08	2.69	3.39	3.08	2.69	3.39	3.08	2.69
		38 × 184	4.18	3.94	3.54	4.46	4.05	3.54	4.46	4.05	3.54
		38 × 235	4.92	4.63	4.23	5.39	5.13	4.52	5.69	5.17	4.52
		38 × 286	5.60	5.27	4.82	6.10	5.81	5.47	6.74	6.28	5.50
	No. 1 and No. 2	38 × 89	2.09	1.90	1.66	2.09	1.90	1.66	2.09	1.90	1.66
		38 × 140	3.29	2.99	2.62	3.29	2.99	2.62	3.29	2.99	2.62
		38 × 184	4.06	3.83	3.44	4.33	3.93	3.44	4.33	3.93	3.26
		38 × 235	4.78	4.50	4.11	5.24	4.98	4.39	5.53	4.88	3.99
		38 × 286	5.44	5.12	4.68	5.93	5.64	5.25	6.54	5.66	4.63
	No. 3	38 × 89	2.03	1.84	1.61	2.03	1.84	1.61	2.03	1.83	1.50
		38 × 140	3.19	2.90	2.43	3.19	2.90	2.43	3.02	2.62	2.14

		38 × 184	3.94	3.61	2.95	4.17	3.61	2.95	3.68	3.18	2.60
		38 × 235	4.63	4.36	3.61	5.08	4.42	3.61	4.50	3.89	3.18
		38 × 286	5.27	4.96	4.19	5.74	5.13	4.19	5.22	4.52	3.69
	Construction	38 × 89	2.03	1.84	1.61	2.03	1.84	1.61	2.03	1.84	1.61
	Standard	38 × 89	1.96	1.71	1.39	1.96	1.71	1.39	1.74	1.50	1.23
Spruce – Pine – Fir (includes Spruce (all species except Coast Sitka Spruce), Jack Pine, Lodgepole Pine, Balsam Fir and Alpine Fir)	Select Structural	38 × 89	2.06	1.87	1.64	2.06	1.87	1.64	2.06	1.87	1.64
		38 × 140	3.24	2.95	2.57	3.24	2.95	2.57	3.24	2.95	2.57
		38 × 184	4.00	3.77	3.38	4.26	3.87	3.38	4.26	3.87	3.38
		38 × 235	4.70	4.43	4.05	5.16	4.91	4.32	5.45	4.95	4.32
		38 × 286	5.35	5.04	4.61	5.84	5.55	5.23	6.45	6.01	5.26
	No. 1 and No. 2	38 × 89	1.99	1.81	1.58	1.99	1.81	1.58	1.99	1.81	1.58
		38 × 140	3.14	2.85	2.49	3.14	2.85	2.49	3.14	2.85	2.49
		38 × 184	3.87	3.64	3.27	4.12	3.75	3.27	4.12	3.75	3.27
		38 × 235	4.55	4.28	3.91	4.99	4.75	4.18	5.27	4.79	4.13
		38 × 286	5.18	4.88	4.46	5.65	5.37	5.06	6.23	5.81	4.79
	No. 3	38 × 89	1.96	1.78	1.55	1.96	1.78	1.55	1.96	1.78	1.50
		38 × 140	3.08	2.80	2.43	3.08	2.80	2.43	3.02	2.62	2.14
		38 × 184	3.80	3.58	2.95	4.05	3.61	2.95	3.68	3.18	2.60
		38 × 235	4.47	4.21	3.61	4.90	4.42	3.61	4.50	3.89	3.18
		38 × 286	5.09	4.79	4.19	5.55	5.13	4.19	5.22	4.52	3.69
	Construction	38 × 89	1.96	1.78	1.55	1.96	1.78	1.55	1.96	1.78	1.55
	Standard	38 × 89	1.88	1.71	1.44	1.88	1.71	1.44	1.80	1.56	1.27
Northern Species (includes any Canadian species covered by the NLGA Standard Grading Rules)	Select Structural	38 × 89	1.84	1.68	1.46	1.84	1.68	1.46	1.84	1.68	1.46
		38 × 140	2.90	2.63	2.30	2.90	2.63	2.30	2.90	2.63	2.30
		38 × 184	3.58	3.37	3.03	3.81	3.46	3.03	3.81	3.46	3.03
		38 × 235	4.20	3.96	3.62	4.61	4.39	3.86	4.87	4.42	3.86
		38 × 286	4.79	4.51	4.12	5.22	4.96	4.68	5.76	5.37	4.54
	No. 1 and No. 2	38 × 89	1.80	1.64	1.43	1.80	1.64	1.43	1.80	1.64	1.43
		38 × 140	2.83	2.57	2.25	2.83	2.57	2.25	2.83	2.57	2.23
		38 × 184	3.50	3.29	2.96	3.72	3.38	2.96	3.72	3.32	2.71
		38 × 235	4.11	3.87	3.54	4.51	4.29	3.76	4.69	4.06	3.31
		38 × 286	4.68	4.40	4.03	5.10	4.85	4.36	5.44	4.71	3.84
	No. 3	38 × 89	1.76	1.60	1.36	1.76	1.60	1.36	1.70	1.47	1.20
		38 × 140	2.75	2.38	1.94	2.75	2.38	1.94	2.42	2.10	1.71
		38 × 184	3.35	2.90	2.37	3.35	2.90	2.37	2.95	2.55	2.08
		38 × 235	4.01	3.54	2.89	4.09	3.54	2.89	3.61	3.12	2.55
		38 × 286	4.56	4.11	3.36	4.75	4.11	3.36	4.18	3.62	2.96

	Construction	38 × 89	1.76	1.60	1.40	1.76	1.60	1.40	1.76	1.60	1.37
	Standard	38 × 89	1.63	1.41	1.15	1.63	1.41	1.15	1.44	1.25	1.02

Notes to Table 9.23.4.2.-B:

⁽¹⁾ Spans apply only where the floors serve residential areas as described in Table 4.1.5.3., or 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⁾ No bridging is assumed for spans for floor joists with concrete topping.

Table 9.23.4.2.-C
Maximum Spans for Ceiling Joists – Attic not Accessible by a Stairway
Forming Part of Sentences 9.3.2.8.(1), 9.23.4.2.(1) and 9.23.14.10.(2)

Commercial Designation	Grade	Joist Size, mm	Maximum Span, m		
			Joist Spacing, mm		
			300	400	600
Douglas Fir – Larch (includes Douglas Fir and Western Larch)	Select Structural	38 × 89	3.41	3.10	2.71
		38 × 140	5.37	4.88	4.26
		38 × 184	7.05	6.41	5.60
		38 × 235	9.01	8.18	7.15
		38 × 286	10.96	9.96	8.70
	No. 1 and No. 2	38 × 89	3.27	2.97	2.59
		38 × 140	5.14	4.67	4.08
		38 × 184	6.76	6.14	5.36
		38 × 235	8.63	7.84	6.85
		38 × 286	10.50	9.54	8.34
	No. 3	38 × 89	3.17	2.88	2.42
		38 × 140	4.89	4.23	3.46
		38 × 184	5.95	5.15	4.20
		38 × 235	7.27	6.30	5.14
		38 × 286	8.44	7.31	5.97
	Construction	38 × 89	3.17	2.88	2.51
	Standard	38 × 89	3.06	2.78	2.34
Hem – Fir (includes Western Hemlock and Amabilis Fir)	Select Structural	38 × 89	3.36	3.06	2.67
		38 × 140	5.29	4.81	4.20
		38 × 184	6.96	6.32	5.52
		38 × 235	8.88	8.07	7.05
		38 × 286	10.81	9.82	8.58
	No. 1 and No. 2	38 × 89	3.27	2.97	2.59
		38 × 140	5.14	4.67	4.08
		38 × 184	6.76	6.14	5.36
		38 × 235	8.63	7.84	6.85
		38 × 286	10.50	9.54	8.34
	No. 3	38 × 89	3.17	2.88	2.51
		38 × 140	4.98	4.53	3.95
		38 × 184	6.55	5.95	5.19
		38 × 235	8.36	7.60	6.34
		38 × 286	10.18	9.01	7.36

	Construction	38 × 89	3.17	2.88	2.50
	Standard	38 × 89	3.06	2.78	2.43
Spruce – Pine – Fir (includes Spruce (all species except Coast Sitka Spruce), Jack Pine, Lodgepole Pine, Balsam Fir and Alpine Fir)	Select Structural	38 × 89	3.22	2.92	2.55
		38 × 140	5.06	4.60	4.02
		38 × 184	6.65	6.05	5.28
		38 × 235	8.50	7.72	6.74
		38 × 286	10.34	9.40	8.21
	No. 1 and No. 2	38 × 89	3.11	2.83	2.47
		38 × 140	4.90	4.45	3.89
		38 × 184	6.44	5.85	5.11
		38 × 235	8.22	7.47	6.52
		38 × 286	10.00	9.09	7.94
	No. 3	38 × 89	3.06	2.78	2.43
		38 × 140	4.81	4.37	3.82
		38 × 184	6.32	5.74	5.02
		38 × 235	8.07	7.33	6.34
		38 × 286	9.82	8.93	7.36
	Construction	38 × 89	3.06	2.78	2.43
	Standard	38 × 89	2.94	2.67	2.33
Northern Species (includes any Canadian species covered by the NLGA Standard Grading Rules)	Select Structural	38 × 89	2.88	2.61	2.28
		38 × 140	4.53	4.11	3.59
		38 × 184	5.95	5.40	4.72
		38 × 235	7.60	6.90	6.03
		38 × 286	9.25	8.40	7.34
	No. 1 and No. 2	38 × 89	2.81	2.55	2.23
		38 × 140	4.42	4.02	3.51
		38 × 184	5.81	5.28	4.61
		38 × 235	7.42	6.74	5.89
		38 × 286	9.03	8.21	7.17
	No. 3	38 × 89	2.74	2.49	2.18
		38 × 140	4.31	3.92	3.42
		38 × 184	5.67	5.09	4.16
		38 × 235	7.19	6.23	5.08
		38 × 286	8.34	7.23	5.90
	Construction	38 × 89	2.74	2.49	2.18
	Standard	38 × 89	2.67	2.43	2.03

Table 9.23.4.2.-D
Maximum Spans for Roof Joists – Specified Roof Snow Loads 1.0 to 2.0 kPa
Forming Part of Sentences 9.3.2.8.(1), 9.23.4.2.(1), 9.23.4.5.(1) and 9.23.14.10.(2)

Commercial Designation	Grade	Joist Size, mm	Maximum Span, m								
			Specified Snow Load, kPa								
			1.0			1.5			2.0		
			Joist Spacing, mm			Joist Spacing, mm			Joist Spacing, mm		
			300	400	600	300	400	600	300	400	600
Douglas Fir – Larch (includes Douglas Fir and Western Larch)	Select Structural	38 × 89	2.71	2.46	2.15	2.37	2.15	1.88	2.15	1.95	1.71
		38 × 140	4.26	3.87	3.38	3.72	3.38	2.95	3.38	3.07	2.68
		38 × 184	5.60	5.09	4.44	4.89	4.44	3.88	4.44	4.04	3.53
		38 × 235	7.15	6.49	5.67	6.24	5.67	4.96	5.67	5.15	4.50
		38 × 286	8.70	7.90	6.91	7.60	6.91	6.03	6.91	6.27	5.48
	No. 1 and No. 2	38 × 89	2.59	2.36	2.06	2.27	2.06	1.80	2.06	1.87	1.63
		38 × 140	4.08	3.71	3.24	3.57	3.24	2.83	3.24	2.94	2.57
		38 × 184	5.36	4.87	4.26	4.69	4.26	3.72	4.26	3.87	3.38
		38 × 235	6.85	6.22	5.44	5.98	5.44	4.74	5.44	4.94	4.22
		38 × 286	8.34	7.57	6.40	7.28	6.62	5.50	6.62	6.00	4.90
	No. 3	38 × 89	2.49	2.16	1.76	2.14	1.85	1.51	1.91	1.65	1.35
		38 × 140	3.56	3.08	2.51	3.06	2.65	2.16	2.72	2.36	1.92
		38 × 184	4.33	3.75	3.06	3.72	3.22	2.63	3.31	2.87	2.34
		38 × 235	5.29	4.58	3.74	4.55	3.94	3.22	4.05	3.51	2.86
		38 × 286	6.14	5.32	4.34	5.28	4.57	3.73	4.70	4.07	3.32
	Construction	38 × 89	2.51	2.28	1.99	2.20	1.99	1.74	1.99	1.81	1.58
	Standard	38 × 89	2.41	2.08	1.70	2.07	1.79	1.46	1.84	1.60	1.30
Hem – Fir (includes Western Hemlock and Amabilis Fir)	Select Structural	38 × 89	2.67	2.43	2.12	2.33	2.12	1.85	2.12	1.93	1.68
		38 × 140	4.20	3.82	3.33	3.67	3.33	2.91	3.33	3.03	2.65
		38 × 184	5.52	5.02	4.38	4.82	4.38	3.83	4.38	3.98	3.48
		38 × 235	7.05	6.41	5.60	6.16	5.60	4.89	5.60	5.09	4.44
		38 × 286	8.58	7.80	6.81	7.50	6.81	5.95	6.81	6.19	5.41
	No. 1 and No. 2	38 × 89	2.59	2.36	2.06	2.27	2.06	1.80	2.06	1.87	1.63
		38 × 140	4.08	3.71	3.24	3.57	3.24	2.83	3.24	2.94	2.57
		38 × 184	5.36	4.87	4.26	4.69	4.26	3.72	4.26	3.87	3.38
		38 × 235	6.85	6.22	5.44	5.98	5.44	4.75	5.44	4.94	4.32
		38 × 286	8.34	7.57	6.62	7.28	6.62	5.77	6.62	6.01	5.25
	No. 3	38 × 89	2.51	2.28	1.99	2.20	1.99	1.74	1.99	1.81	1.58
		38 × 140	3.95	3.59	3.10	3.45	3.14	2.67	3.14	2.85	2.37
		38 × 184	5.20	4.62	3.77	4.54	3.97	3.24	4.09	3.54	2.89

		38 × 235	6.53	5.65	4.61	5.61	4.86	3.97	5.00	4.33	3.53
		38 × 286	7.57	6.56	5.35	6.51	5.64	4.60	5.80	5.02	4.10
	Construction	38 × 89	2.51	2.28	1.99	2.20	1.99	1.74	1.99	1.81	1.58
	Standard	38 × 89	2.43	2.18	1.78	2.12	1.88	1.53	1.93	1.67	1.36
Spruce – Pine – Fir (includes Spruce (all species except Coast Sitka Spruce), Jack Pine, Lodgepole Pine, Balsam Fir and Alpine Fir)	Select Structural	38 × 89	2.55	2.32	2.03	2.23	2.03	1.77	2.03	1.84	1.61
		38 × 140	4.02	3.65	3.19	3.51	3.19	2.79	3.19	2.90	2.53
		38 × 184	5.28	4.80	4.19	4.61	4.19	3.66	4.19	3.81	3.33
		38 × 235	6.74	6.13	5.35	5.89	5.35	4.68	5.35	4.86	4.25
		38 × 286	8.21	7.46	6.52	7.17	6.52	5.69	6.52	5.92	5.17
	No. 1 and No. 2	38 × 89	2.47	2.24	1.96	2.16	1.96	1.71	1.96	1.78	1.56
		38 × 140	3.89	3.53	3.08	3.40	3.08	2.69	3.08	2.80	2.45
		38 × 184	5.11	4.64	4.05	4.46	4.05	3.54	4.05	3.68	3.22
		38 × 235	6.52	5.93	5.18	5.70	5.18	4.52	5.18	4.70	4.11
		38 × 286	7.94	7.21	6.30	6.94	6.30	5.50	6.30	5.73	5.00
	No. 3	38 × 89	2.43	2.20	1.93	2.12	1.93	1.68	1.93	1.75	1.53
		38 × 140	3.82	3.47	3.03	3.33	3.03	2.65	3.03	2.75	2.37
		38 × 184	5.02	4.56	3.77	4.38	3.97	3.24	3.98	3.54	2.89
		38 × 235	6.41	5.65	4.61	5.60	4.86	3.97	5.00	4.33	3.53
		38 × 286	7.57	6.56	5.35	6.51	5.64	4.60	5.80	5.02	4.10
	Construction	38 × 89	2.43	2.20	1.93	2.12	1.93	1.68	1.93	1.75	1.53
	Standard	38 × 89	2.33	2.12	1.85	2.04	1.85	1.59	1.85	1.68	1.41
Northern Species (includes any Canadian species covered by the NLGA Standard Grading Rules)	Select Structural	38 × 89	2.28	2.07	1.81	1.99	1.81	1.58	1.81	1.65	1.44
		38 × 140	3.59	3.26	2.85	3.14	2.85	2.49	2.85	2.59	2.26
		38 × 184	4.72	4.29	3.75	4.12	3.75	3.27	3.75	3.40	2.97
		38 × 235	6.03	5.48	4.79	5.27	4.79	4.18	4.79	4.35	3.80
		38 × 286	7.34	6.67	5.82	6.41	5.82	5.09	5.82	5.29	4.62
	No. 1 and No. 2	38 × 89	2.23	2.03	1.77	1.95	1.77	1.55	1.77	1.61	1.41
		38 × 140	3.51	3.19	2.79	3.07	2.79	2.43	2.79	2.53	2.21
		38 × 184	4.61	4.19	3.66	4.03	3.66	3.20	3.66	3.33	2.91
		38 × 235	5.89	5.35	4.68	5.15	4.68	4.09	4.68	4.25	3.68
		38 × 286	7.17	6.52	5.58	6.26	5.69	4.80	5.69	5.17	4.27
	No. 3	38 × 89	2.18	1.98	1.73	1.90	1.73	1.50	1.73	1.57	1.33
		38 × 140	3.42	3.05	2.49	2.99	2.62	2.14	2.69	2.33	1.90
		38 × 184	4.28	3.71	3.03	3.68	3.19	2.60	3.28	2.84	2.32
		38 × 235	5.23	4.53	3.70	4.50	3.90	3.18	4.01	3.47	2.83
		38 × 286	6.07	5.26	4.29	5.22	4.52	3.69	4.65	4.03	3.29
	Construction	38 × 89	2.18	1.98	1.73	1.90	1.73	1.51	1.73	1.57	1.37

	Standard	38 × 89	2.09	1.81	1.48	1.80	1.56	1.27	1.60	1.38	1.13

Table 9.23.4.2.-E
Maximum Spans for Roof Joists – Specified Roof Snow Loads 2.5 and 3.0 kPa
Forming Part of Sentences 9.3.2.8.(1), 9.23.4.2.(1), 9.23.4.5.(1) and 9.23.14.10.(2)

Commercial Designation	Grade	Joist Size, mm	Maximum Span, m					
			Specified Snow Load, kPa					
			2.5			3.0		
			Joist Spacing, mm			Joist Spacing, mm		
			300	400	600	300	400	600
Douglas Fir – Larch (includes Douglas Fir and Western Larch)	Select Structural	38 × 89	1.99	1.81	1.58	1.88	1.71	1.49
		38 × 140	3.14	2.85	2.49	2.95	2.68	2.34
		38 × 184	4.12	3.75	3.27	3.88	3.53	3.08
		38 × 235	5.27	4.79	4.18	4.96	4.50	3.93
		38 × 286	6.41	5.82	5.09	6.03	5.48	4.79
	No. 1 and No. 2	38 × 89	1.91	1.74	1.52	1.80	1.63	1.43
		38 × 140	3.01	2.73	2.39	2.83	2.57	2.25
		38 × 184	3.95	3.59	3.14	3.72	3.38	2.90
		38 × 235	5.05	4.59	3.84	4.75	4.32	3.55
		38 × 286	6.14	5.46	4.46	5.78	5.05	4.12
	No. 3	38 × 89	1.74	1.50	1.23	1.60	1.39	1.13
		38 × 140	2.48	2.15	1.75	2.29	1.98	1.62
		38 × 184	3.01	2.61	2.13	2.79	2.41	1.97
		38 × 235	3.69	3.19	2.61	3.41	2.95	2.41
		38 × 286	4.28	3.70	3.03	3.95	3.42	2.79
	Construction	38 × 89	1.85	1.68	1.47	1.74	1.58	1.38
	Standard	38 × 89	1.68	1.45	1.19	1.55	1.34	1.10
Hem – Fir (includes Western Hemlock and Amabilis Fir)	Select Structural	38 × 89	1.97	1.79	1.56	1.85	1.68	1.47
		38 × 140	3.10	2.81	2.46	2.91	2.65	2.31
		38 × 184	4.07	3.70	3.23	3.83	3.48	3.04
		38 × 235	5.20	4.72	4.12	4.89	4.44	3.88
		38 × 286	6.32	5.75	5.02	5.95	5.41	4.72
	No. 1 and No. 2	38 × 89	1.91	1.74	1.52	1.80	1.63	1.43
		38 × 140	3.01	2.73	2.39	2.83	2.57	2.25
		38 × 184	3.95	3.59	3.14	3.72	3.38	2.95
		38 × 235	5.05	4.59	4.01	4.75	4.32	3.72
		38 × 286	6.14	5.58	4.68	5.78	5.25	4.32
	No. 3	38 × 89	1.85	1.68	1.47	1.74	1.58	1.38
		38 × 140	2.91	2.65	2.16	2.74	2.45	2.00
		38 × 184	3.72	3.22	2.63	3.44	2.98	2.43

		38 × 235	4.55	3.94	3.22	4.20	3.64	2.97
		38 × 286	5.28	4.57	3.73	4.88	4.22	3.45
	Construction	38 × 89	1.85	1.68	1.47	1.74	1.58	1.38
	Standard	38 × 89	1.76	1.52	1.24	1.62	1.40	1.15
Spruce – Pine – Fir (includes Spruce (all species except Coast Sitka Spruce), Jack Pine, Lodgepole Pine, Balsam Fir and Alpine Fir)	Select Structural	38 × 89	1.88	1.71	1.49	1.77	1.61	1.41
		38 × 140	2.96	2.69	2.35	2.79	2.53	2.21
		38 × 184	3.89	3.54	3.09	3.66	3.33	2.91
		38 × 235	4.97	4.52	3.94	4.68	4.25	3.71
		38 × 286	6.05	5.50	4.80	5.69	5.17	4.52
	No. 1 and No. 2	38 × 89	1.82	1.65	1.44	1.71	1.56	1.36
		38 × 140	2.86	2.60	2.27	2.69	2.45	2.14
		38 × 184	3.76	3.42	2.99	3.54	3.22	2.81
		38 × 235	4.81	4.37	3.82	4.52	4.11	3.59
		38 × 286	5.85	5.31	4.64	5.50	5.00	4.37
	No. 3	38 × 89	1.79	1.62	1.42	1.68	1.53	1.34
		38 × 140	2.81	2.56	2.16	2.65	2.40	2.00
		38 × 184	3.70	3.22	2.63	3.44	2.98	2.43
		38 × 235	4.55	3.94	3.22	4.20	3.64	2.97
		38 × 286	5.28	4.57	3.73	4.88	4.22	3.45
	Construction	38 × 89	1.79	1.62	1.42	1.68	1.53	1.34
	Standard	38 × 89	1.72	1.56	1.29	1.62	1.46	1.19
Northern Species (includes any Canadian species covered by the NLGA Standard Grading Rules)	Select Structural	38 × 89	1.68	1.53	1.34	1.58	1.44	1.26
		38 × 140	2.65	2.40	2.10	2.49	2.26	1.98
		38 × 184	3.48	3.16	2.76	3.27	2.97	2.60
		38 × 235	4.44	4.04	3.53	4.18	3.80	3.32
		38 × 286	5.41	4.91	4.29	5.09	4.62	4.04
	No. 1 and No. 2	38 × 89	1.64	1.49	1.31	1.55	1.41	1.23
		38 × 140	2.59	2.35	2.05	2.43	2.21	1.93
		38 × 184	3.40	3.09	2.70	3.20	2.91	2.53
		38 × 235	4.34	3.94	3.35	4.09	3.71	3.10
		38 × 286	5.28	4.76	3.89	4.97	4.40	3.59
	No. 3	38 × 89	1.60	1.46	1.21	1.51	1.37	1.12
		38 × 140	2.45	2.12	1.73	2.26	1.96	1.60
		38 × 184	2.98	2.58	2.11	2.76	2.39	1.95
		38 × 235	3.65	3.16	2.58	3.37	2.92	2.38
		38 × 286	4.23	3.66	2.99	3.91	3.39	2.76
	Construction	38 × 89	1.60	1.46	1.27	1.51	1.37	1.20

	Standard	38 × 89	1.46	1.26	1.03	1.34	1.16	0.95

Table 9.23.4.2.-F
Maximum Spans for Roof Rafters – Specified Roof Snow Loads 1.0 to 2.0 kPa
Forming Part of Sentences 9.3.2.8.(1), 9.23.4.2.(1), 9.23.4.5.(1) and 9.23.14.10.(2)

Commercial Designation	Grade	Rafter Size, mm	Maximum Span, m								
			Specified Snow Load, kPa								
			1.0			1.5			2.0		
			Rafter Spacing, mm			Rafter Spacing, mm			Rafter Spacing, mm		
			300	400	600	300	400	600	300	400	600
Douglas Fir – Larch (includes Douglas Fir and Western Larch)	Select Structural	38 × 89	3.41	3.10	2.71	2.98	2.71	2.37	2.71	2.46	2.15
		38 × 140	5.37	4.88	4.26	4.69	4.26	3.72	4.26	3.87	3.38
		38 × 184	7.05	6.41	5.60	6.16	5.60	4.89	5.60	5.09	4.44
		38 × 235	9.01	8.18	7.15	7.87	7.15	6.24	7.15	6.49	5.62
		38 × 286	10.96	9.96	8.70	9.58	8.70	7.40	8.70	7.90	6.52
	No. 1 and No. 2	38 × 89	3.27	2.97	2.59	2.86	2.59	2.27	2.59	2.36	2.06
		38 × 140	5.14	4.67	3.95	4.49	4.08	3.34	4.08	3.60	2.94
		38 × 184	6.76	5.88	4.80	5.74	4.97	4.06	5.06	4.38	3.58
		38 × 235	8.30	7.19	5.87	7.02	6.08	4.96	6.19	5.36	4.38
		38 × 286	9.63	8.34	6.81	8.14	7.05	5.76	7.18	6.22	5.08
	No. 3	38 × 89	2.65	2.30	1.87	2.24	1.94	1.58	1.98	1.71	1.40
		38 × 140	3.78	3.28	2.68	3.20	2.77	2.26	2.82	2.44	1.99
		38 × 184	4.61	3.99	3.26	3.89	3.37	2.75	3.43	2.97	2.43
		38 × 235	5.63	4.88	3.98	4.76	4.12	3.37	4.20	3.64	2.97
		38 × 286	6.53	5.66	4.62	5.52	4.78	3.91	4.87	4.22	3.44
	Construction	38 × 89	3.17	2.88	2.42	2.77	2.50	2.04	2.51	2.21	1.80
	Standard	38 × 89	2.56	2.22	1.81	2.17	1.88	1.53	1.91	1.65	1.35
Hem – Fir (includes Western Hemlock and Amabilis Fir)	Select Structural	38 × 89	3.36	3.06	2.67	2.94	2.67	2.33	2.67	2.43	2.12
		38 × 140	5.29	4.81	4.20	4.62	4.20	3.67	4.20	3.82	3.33
		38 × 184	6.96	6.32	5.52	6.08	5.52	4.82	5.52	5.02	4.38
		38 × 235	8.88	8.07	7.05	7.76	7.05	6.16	7.05	6.41	5.54
		38 × 286	10.81	9.82	8.58	9.45	8.58	7.28	8.58	7.80	6.42
	No. 1 and No. 2	38 × 89	3.27	2.97	2.59	2.86	2.59	2.27	2.59	2.36	2.06
		38 × 140	5.14	4.67	4.08	4.49	4.08	3.50	4.08	3.71	3.08
		38 × 184	6.76	6.14	5.04	5.90	5.21	4.26	5.31	4.60	3.75
		38 × 235	8.63	7.54	6.16	7.36	6.37	5.20	6.49	5.62	4.59
		38 × 286	10.11	8.75	7.15	8.54	7.40	6.04	7.53	6.52	5.33
	No. 3	38 × 89	3.17	2.83	2.31	2.76	2.39	1.95	2.44	2.11	1.72
		38 × 140	4.67	4.04	3.30	3.95	3.42	2.79	3.48	3.01	2.46
		38 × 184	5.68	4.92	4.02	4.80	4.16	3.40	4.23	3.67	2.99

		38 × 235	6.95	6.02	4.91	5.87	5.08	4.15	5.18	4.48	3.66
		38 × 286	8.06	6.98	5.70	6.81	5.90	4.82	6.01	5.20	4.25
	Construction	38 × 89	3.17	2.88	2.51	2.77	2.51	2.14	2.51	2.28	1.89
	Standard	38 × 89	2.68	2.32	1.90	2.27	1.96	1.60	2.00	1.73	1.41
Spruce – Pine – Fir (includes Spruce (all species except Coast Sitka Spruce), Jack Pine, Lodgepole Pine, Balsam Fir and Alpine Fir)	Select Structural	38 × 89	3.22	2.92	2.55	2.81	2.55	2.23	2.55	2.32	2.03
		38 × 140	5.06	4.60	4.02	4.42	4.02	3.51	4.02	3.65	3.19
		38 × 184	6.65	6.05	5.28	5.81	5.28	4.61	5.28	4.80	4.19
		38 × 235	8.50	7.72	6.74	7.42	6.74	5.89	6.74	6.13	5.35
		38 × 286	10.34	9.40	8.21	9.03	8.21	7.17	8.21	7.46	6.52
	No. 1 and No. 2	38 × 89	3.11	2.83	2.47	2.72	2.47	2.16	2.47	2.24	1.96
		38 × 140	4.90	4.45	3.89	4.28	3.89	3.40	3.89	3.53	3.08
		38 × 184	6.44	5.85	5.11	5.62	5.11	4.41	5.11	4.64	3.89
		38 × 235	8.22	7.47	6.38	7.18	6.52	5.39	6.52	5.82	4.75
		38 × 286	10.00	9.06	7.40	8.74	7.66	6.25	7.80	6.76	5.52
	No. 3	38 × 89	3.06	2.78	2.31	2.67	2.39	1.95	2.43	2.11	1.72
		38 × 140	4.67	4.04	3.30	3.95	3.42	2.79	3.48	3.01	2.46
		38 × 184	5.68	4.92	4.02	4.80	4.16	3.40	4.23	3.67	2.99
		38 × 235	6.95	6.02	4.91	5.87	5.08	4.15	5.18	4.48	3.66
		38 × 286	8.06	6.98	5.70	6.81	5.90	4.82	6.01	5.20	4.25
	Construction	38 × 89	3.06	2.78	2.43	2.67	2.43	2.12	2.43	2.20	1.93
	Standard	38 × 89	2.78	2.41	1.97	2.35	2.04	1.66	2.07	1.79	1.47
Northern Species (includes any Canadian species covered by the NLGA Standard Grading Rules)	Select Structural	38 × 89	2.88	2.61	2.28	2.51	2.28	1.99	2.28	2.07	1.81
		38 × 140	4.53	4.11	3.59	3.95	3.59	3.14	3.59	3.26	2.85
		38 × 184	5.95	5.40	4.72	5.20	4.72	4.12	4.72	4.29	3.68
		38 × 235	7.60	6.90	6.03	6.64	6.03	5.11	6.03	5.48	4.51
		38 × 286	9.25	8.40	7.01	8.08	7.26	5.93	7.34	6.40	5.23
	No. 1 and No. 2	38 × 89	2.81	2.55	2.23	2.46	2.23	1.95	2.23	2.03	1.77
		38 × 140	4.42	4.02	3.44	3.86	3.51	2.91	3.51	3.14	2.56
		38 × 184	5.81	5.13	4.19	5.00	4.33	3.54	4.41	3.82	3.12
		38 × 235	7.24	6.27	5.12	6.12	5.30	4.33	5.40	4.67	3.82
		38 × 286	8.40	7.27	5.94	7.10	6.15	5.02	6.26	5.42	4.43
	No. 3	38 × 89	2.62	2.27	1.85	2.22	1.92	1.57	1.95	1.69	1.38
		38 × 140	3.74	3.24	2.65	3.16	2.74	2.24	2.79	2.42	1.97
		38 × 184	4.56	3.94	3.22	3.85	3.33	2.72	3.40	2.94	2.40
		38 × 235	5.57	4.82	3.94	4.71	4.08	3.33	4.15	3.60	2.94
		38 × 286	6.46	5.60	4.57	5.46	4.73	3.86	4.82	4.17	3.41
	Construction	38 × 89	2.74	2.49	2.11	2.40	2.18	1.90	2.18	1.93	1.57

	Standard	38 × 89	2.22	1.93	1.57	1.88	1.63	1.33	1.66	1.44	1.17

Table 9.23.4.2.-G
Maximum Spans for Roof Rafters – Specified Roof Snow Loads 2.5 and 3.0 kPa
Forming Part of Sentences 9.3.2.8.(1), 9.23.4.2.(1) and 9.23.4.5.(1)

Commercial Designation	Grade	Rafter Size, mm	Maximum Span, m					
			Specified Snow Load, kPa					
			2.5			3.0		
			Rafter Spacing, mm			Rafter Spacing, mm		
			300	400	600	300	400	600
Douglas Fir – Larch (includes Douglas Fir and Western Larch)	Select Structural	38 × 89	2.51	2.28	1.99	2.37	2.15	1.88
		38 × 140	3.95	3.59	3.14	3.72	3.38	2.95
		38 × 184	5.20	4.72	4.12	4.89	4.44	3.83
		38 × 235	6.64	6.03	5.08	6.24	5.67	4.68
		38 × 286	8.08	7.23	5.90	7.60	6.65	5.43
	No. 1 and No. 2	38 × 89	2.41	2.19	1.86	2.27	2.06	1.71
		38 × 140	3.76	3.26	2.66	3.46	3.00	2.45
		38 × 184	4.58	3.96	3.24	4.21	3.65	2.98
		38 × 235	5.60	4.85	3.96	5.15	4.46	3.64
		38 × 286	6.50	5.63	4.59	5.98	5.17	4.23
	No. 3	38 × 89	1.79	1.55	1.26	1.64	1.42	1.16
		38 × 140	2.55	2.21	1.80	2.35	2.03	1.66
		38 × 184	3.10	2.69	2.20	2.86	2.47	2.02
		38 × 235	3.80	3.29	2.68	3.49	3.02	2.47
		38 × 286	4.41	3.82	3.12	4.05	3.51	2.87
	Construction	38 × 89	2.30	2.00	1.63	2.12	1.84	1.50
	Standard	38 × 89	1.73	1.50	1.22	1.59	1.38	1.12
Hem – Fir (includes Western Hemlock and Amabilis Fir)	Select Structural	38 × 89	2.48	2.25	1.97	2.33	2.12	1.85
		38 × 140	3.90	3.54	3.10	3.67	3.33	2.91
		38 × 184	5.13	4.66	4.07	4.82	4.38	3.77
		38 × 235	6.55	5.95	5.01	6.16	5.60	4.61
		38 × 286	7.97	7.12	5.81	7.50	6.55	5.34
	No. 1 and No. 2	38 × 89	2.41	2.19	1.91	2.27	2.06	1.80
		38 × 140	3.79	3.42	2.79	3.57	3.14	2.57
		38 × 184	4.80	4.16	3.40	4.42	3.83	3.12
		38 × 235	5.87	5.08	4.15	5.40	4.68	3.82
		38 × 286	6.81	5.90	4.82	6.27	5.43	4.43
	No. 3	38 × 89	2.21	1.91	1.56	2.03	1.76	1.43
		38 × 140	3.15	2.73	2.23	2.90	2.51	2.05
		38 × 184	3.83	3.32	2.71	3.52	3.05	2.49

		38 × 235	4.68	4.06	3.31	4.31	3.73	3.05
		38 × 286	5.43	4.71	3.84	5.00	4.33	3.54
	Construction	38 × 89	2.33	2.09	1.71	2.20	1.93	1.57
	Standard	38 × 89	1.81	1.57	1.28	1.66	1.44	1.18
Spruce – Pine – Fir (includes Spruce (all species except Coast Sitka Spruce), Jack Pine, Lodgepole Pine, Balsam Fir and Alpine Fir)	Select Structural	38 × 89	2.37	2.15	1.88	2.23	2.03	1.77
		38 × 140	3.73	3.39	2.96	3.51	3.19	2.79
		38 × 184	4.90	4.45	3.89	4.61	4.19	3.66
		38 × 235	6.26	5.69	4.97	5.89	5.35	4.68
		38 × 286	7.62	6.92	5.90	7.17	6.52	5.43
	No. 1 and No. 2	38 × 89	2.29	2.08	1.82	2.16	1.96	1.71
		38 × 140	3.61	3.28	2.86	3.40	3.08	2.66
		38 × 184	4.74	4.31	3.52	4.46	3.96	3.23
		38 × 235	6.06	5.27	4.30	5.59	4.84	3.96
		38 × 286	7.06	6.11	4.99	6.49	5.62	4.59
	No. 3	38 × 89	2.21	1.91	1.56	2.03	1.76	1.43
		38 × 140	3.15	2.73	2.23	2.90	2.51	2.05
		38 × 184	3.83	3.32	2.71	3.52	3.05	2.49
		38 × 235	4.68	4.06	3.31	4.31	3.73	3.05
		38 × 286	5.43	4.71	3.84	5.00	4.33	3.54
	Construction	38 × 89	2.25	2.05	1.77	2.12	1.93	1.63
	Standard	38 × 89	1.87	1.62	1.33	1.72	1.49	1.22
Northern Species (includes any Canadian species covered by the NLGA Standard Grading Rules)	Select Structural	38 × 89	2.12	1.93	1.68	1.99	1.81	1.58
		38 × 140	3.33	3.03	2.65	3.14	2.85	2.49
		38 × 184	4.38	3.98	3.33	4.12	3.75	3.07
		38 × 235	5.60	4.99	4.08	5.27	4.59	3.75
		38 × 286	6.69	5.79	4.73	6.15	5.33	4.35
	No. 1 and No. 2	38 × 89	2.07	1.88	1.62	1.95	1.77	1.49
		38 × 140	3.26	2.84	2.32	3.02	2.61	2.13
		38 × 184	3.99	3.46	2.82	3.67	3.18	2.60
		38 × 235	4.88	4.23	3.45	4.49	3.89	3.17
		38 × 286	5.66	4.90	4.00	5.21	4.51	3.68
	No. 3	38 × 89	1.77	1.53	1.25	1.63	1.41	1.15
		38 × 140	2.52	2.19	1.78	2.32	2.01	1.64
		38 × 184	3.07	2.66	2.17	2.82	2.45	2.00
		38 × 235	3.76	3.25	2.66	3.45	2.99	2.44
		38 × 286	4.36	3.77	3.08	4.01	3.47	2.83
	Construction	38 × 89	2.01	1.74	1.42	1.85	1.60	1.31

	Standard	38 × 89	1.50	1.30	1.06	1.38	1.19	0.98

Table 9.23.4.2.-H
Maximum Spans for Built-up Floor Beams Supporting not more than One Floor⁽¹⁾⁽²⁾
Forming Part of Sentences 9.3.2.8.(1), 9.23.4.2.(3), 9.23.4.4.(3) and 9.23.8.1.(1)

Commercial Designation	Grade	Supported Length, m ⁽³⁾⁽⁴⁾	Maximum Span, m ⁽⁵⁾⁽⁶⁾								
			Size of Built-up Beam, mm								
			3-38×184	4-38×184	5-38×184	3-38×235	4-38×235	5-38×235	3-38×286	4-38×286	5-38×286
Douglas Fir – Larch (includes Douglas Fir and Western Larch)	Select Structural	2.4	3.36	3.70	3.99	4.30	4.73	5.09	5.23	5.66	5.99
		3.0	3.12	3.44	3.70	3.99	4.39	4.73	4.84	5.34	5.66
		3.6	2.94	3.23	3.48	3.75	4.13	4.45	4.41	5.03	5.41
		4.2	2.79	3.07	3.31	3.52	3.92	4.23	4.09	4.72	5.14
		4.8	2.67	2.94	3.17	3.29	3.75	4.04	3.82	4.41	4.92
		5.4	2.54	2.83	3.04	3.11	3.59	3.89	3.60	4.16	4.65
		6.0	2.41	2.73	2.94	2.95	3.40	3.75	3.42	3.95	4.41
	No. 1 and No. 2	2.4	2.97	3.42	3.82	3.63	4.19	4.68	4.21	4.86	5.43
		3.0	2.65	3.06	3.42	3.24	3.75	4.19	3.76	4.35	4.86
		3.6	2.42	2.80	3.13	2.96	3.42	3.82	3.44	3.97	4.44
		4.2	2.24	2.59	2.89	2.74	3.17	3.54	3.18	3.67	4.11
		4.8	2.10	2.42	2.71	2.56	2.96	3.31	2.98	3.44	3.84
		5.4	1.98	2.28	2.55	2.42	2.79	3.12	2.81	3.24	3.62
		6.0	1.88	2.17	2.42	2.29	2.65	2.96	2.66	3.07	3.44
Hem – Fir (includes Western Hemlock and Amabilis Fir)	Select Structural	2.4	3.32	3.65	3.93	4.24	4.66	5.03	5.16	5.61	5.93
		3.0	3.08	3.39	3.65	3.93	4.33	4.66	4.76	5.27	5.61
		3.6	2.90	3.19	3.44	3.70	4.08	4.39	4.35	4.96	5.34
		4.2	2.75	3.03	3.27	3.47	3.87	4.17	4.02	4.65	5.07
		4.8	2.63	2.90	3.12	3.24	3.70	3.99	3.66	4.35	4.85
		5.4	2.49	2.79	3.00	2.95	3.53	3.83	3.32	4.10	4.58
		6.0	2.28	2.69	2.90	2.70	3.35	3.70	3.04	3.87	4.35
	No. 1 and No. 2	2.4	3.11	3.55	3.82	3.80	4.39	4.88	4.41	5.10	5.70
		3.0	2.78	3.21	3.55	3.40	3.93	4.39	3.95	4.56	5.10
		3.6	2.54	2.93	3.28	3.11	3.59	4.01	3.60	4.16	4.65
		4.2	2.35	2.72	3.04	2.88	3.32	3.71	3.34	3.85	4.31
		4.8	2.20	2.54	2.84	2.69	3.11	3.47	3.12	3.60	4.03
		5.4	2.07	2.39	2.68	2.54	2.93	3.27	2.94	3.40	3.80
		6.0	1.97	2.27	2.54	2.41	2.78	3.11	2.79	3.22	3.60
Spruce – Pine – Fir (includes Spruce (all	Select Structural	2.4	3.17	3.49	3.76	4.05	4.46	4.81	4.93	5.42	5.73
		3.0	2.95	3.24	3.49	3.76	4.14	4.46	4.58	5.04	5.42
		3.6	2.77	3.05	3.29	3.54	3.90	4.20	4.31	4.74	5.11

species except Coast Sitka Spruce), Jack Pine, Lodgepole Pine, Balsam Fir and Alpine Fir)		4.2	2.63	2.90	3.12	3.36	3.70	3.99	4.09	4.51	4.85
		4.8	2.52	2.77	2.99	3.22	3.54	3.81	3.82	4.31	4.64
		5.4	2.42	2.67	2.87	3.09	3.41	3.67	3.60	4.14	4.46
		6.0	2.34	2.57	2.77	2.95	3.29	3.54	3.32	3.95	4.31
	No. 1 and No. 2	2.4	3.07	3.38	3.64	3.92	4.32	4.65	4.57	5.25	5.59
		3.0	2.85	3.14	3.38	3.52	4.01	4.32	4.09	4.72	5.25
		3.6	2.63	2.95	3.18	3.22	3.71	4.06	3.73	4.31	4.82
		4.2	2.44	2.80	3.02	2.98	3.44	3.84	3.46	3.99	4.46
		4.8	2.28	2.63	2.89	2.79	3.22	3.60	3.23	3.73	4.17
		5.4	2.15	2.48	2.77	2.63	3.03	3.39	3.05	3.52	3.93
		6.0	2.04	2.35	2.63	2.49	2.88	3.22	2.89	3.34	3.73
Northern Species (includes any Canadian species covered by the NLGA Standard Grading Rules)	Select Structural	2.4	2.84	3.12	3.36	3.62	3.99	4.30	4.33	4.85	5.23
		3.0	2.63	2.90	3.12	3.34	3.70	3.99	3.88	4.47	4.85
		3.6	2.48	2.73	2.94	3.05	3.48	3.75	3.54	4.08	4.57
		4.2	2.31	2.59	2.79	2.82	3.26	3.57	3.28	3.78	4.23
		4.8	2.16	2.48	2.67	2.64	3.05	3.41	3.06	3.54	3.96
		5.4	2.04	2.35	2.57	2.49	2.87	3.21	2.89	3.34	3.73
		6.0	1.93	2.23	2.48	2.36	2.73	3.05	2.74	3.16	3.54
	No. 1 and No. 2	2.4	2.59	2.99	3.29	3.16	3.65	4.08	3.67	4.24	4.74
		3.0	2.31	2.67	2.99	2.83	3.27	3.65	3.28	3.79	4.24
		3.6	2.11	2.44	2.73	2.58	2.98	3.33	3.00	3.46	3.87
		4.2	1.95	2.26	2.52	2.39	2.76	3.09	2.77	3.20	3.58
		4.8	1.83	2.11	2.36	2.24	2.58	2.89	2.59	3.00	3.35
		5.4	1.72	1.99	2.23	2.11	2.43	2.72	2.45	2.82	3.16
		6.0	1.64	1.89	2.11	2.00	2.31	2.58	2.32	2.68	3.00

Notes to Table 9.23.4.2.-H:

⁽¹⁾ Beam spans apply only where the floors serve residential areas as described in Table 4.1.5.3., or 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⁾ When the floors have a concrete topping of not more than 51 mm, the spans must be multiplied by 0.8.

⁽³⁾ Supported length means half the sum of the joist spans on both sides of the beam.

⁽⁴⁾ Straight interpolation may be used for other supported lengths.

⁽⁵⁾ Spans are clear spans between supports. For total span, add two bearing lengths.

⁽⁶⁾ 3-ply beams with supported lengths greater than 4.2 m require 114 mm bearing. All other beams require 76 mm bearing.

Table 9.23.4.2.-I
Maximum Spans for Built-up Floor Beams Supporting not more than Two Floors⁽¹⁾⁽²⁾
Forming Part of Sentences 9.3.2.8.(1), 9.23.4.2.(3), 9.23.4.4.(3) and 9.23.8.1.(1)

Commercial Designation	Grade	Supported Length, m ⁽³⁾⁽⁴⁾	Maximum Span, m ⁽⁵⁾⁽⁶⁾								
			Size of Built-up Beam, mm								
			3-38×184	4-38×184	5-38×184	3-38×235	4-38×235	5-38×235	3-38×286	4-38×286	5-38×286
Douglas Fir – Larch (includes Douglas Fir and Western Larch)	Select Structural	2.4	2.80	3.08	3.32	3.49	3.93	4.24	4.05	4.67	5.16
		3.0	2.55	2.86	3.08	3.12	3.60	3.93	3.62	4.18	4.67
		3.6	2.33	2.69	2.90	2.85	3.29	3.68	3.30	3.82	4.27
		4.2	2.16	2.49	2.75	2.64	3.04	3.40	2.99	3.53	3.95
		4.8	2.00	2.33	2.60	2.38	2.85	3.18	2.69	3.30	3.69
		5.4	1.82	2.20	2.45	2.17	2.68	3.00	2.45	3.08	3.48
		6.0	1.67	2.08	2.33	2.00	2.51	2.85	2.26	2.83	3.30
	No. 1 and No. 2	2.4	2.22	2.56	2.87	2.72	3.14	3.51	3.15	3.64	4.07
		3.0	1.99	2.29	2.56	2.43	2.80	3.14	2.82	3.25	3.64
		3.6	1.81	2.09	2.34	2.22	2.56	2.86	2.57	2.97	3.32
		4.2	1.68	1.94	2.17	2.05	2.37	2.65	2.38	2.75	3.07
		4.8	1.57	1.81	2.03	1.92	2.22	2.48	2.23	2.57	2.88
		5.4	1.48	1.71	1.91	1.81	2.09	2.34	2.10	2.43	2.71
		6.0	1.40	1.62	1.81	1.72	1.98	2.22	1.99	2.30	2.57
Hem – Fir (includes Western Hemlock and Amabilis Fir)	Select Structural	2.4	2.76	3.04	3.27	3.43	3.88	4.18	3.99	4.60	5.09
		3.0	2.51	2.82	3.04	2.97	3.55	3.88	3.34	4.12	4.60
		3.6	2.15	2.65	2.86	2.56	3.24	3.62	2.88	3.65	4.20
		4.2	1.90	2.40	2.72	2.26	2.85	3.35	2.55	3.21	3.87
		4.8	1.70	2.15	2.56	2.03	2.56	3.08	2.30	2.88	3.46
		5.4	1.56	1.95	2.35	1.86	2.32	2.79	2.11	2.62	3.14
		6.0	1.44	1.79	2.15	1.72	2.14	2.56	1.96	2.42	2.88
	No. 1 and No. 2	2.4	2.33	2.69	3.01	2.85	3.29	3.68	3.30	3.82	4.27
		3.0	2.08	2.41	2.69	2.55	2.94	3.29	2.96	3.41	3.82
		3.6	1.90	2.20	2.45	2.33	2.68	3.00	2.70	3.12	3.48
		4.2	1.76	2.03	2.27	2.15	2.49	2.78	2.50	2.88	3.22
		4.8	1.65	1.90	2.13	2.01	2.33	2.60	2.30	2.70	3.02
		5.4	1.55	1.79	2.00	1.86	2.19	2.45	2.11	2.54	2.84
		6.0	1.44	1.70	1.90	1.72	2.08	2.33	1.96	2.41	2.70
Spruce – Pine – Fir (includes Spruce (all	Select Structural	2.4	2.64	2.91	3.13	3.37	3.71	4.00	4.05	4.52	4.87
		3.0	2.45	2.70	2.91	3.12	3.45	3.71	3.62	4.18	4.52
		3.6	2.31	2.54	2.73	2.79	3.24	3.49	3.14	3.82	4.25

species except Coast Sitka Spruce), Jack Pine, Lodgepole Pine, Balsam Fir and Alpine Fir)		4.2	2.07	2.41	2.60	2.46	3.04	3.32	2.77	3.50	3.95
		4.8	1.85	2.31	2.48	2.21	2.79	3.17	2.50	3.14	3.69
		5.4	1.69	2.13	2.39	2.02	2.53	3.00	2.28	2.85	3.42
		6.0	1.56	1.95	2.31	1.86	2.32	2.79	2.11	2.62	3.14
	No. 1 and No. 2	2.4	2.41	2.79	3.03	2.95	3.41	3.81	3.42	3.95	4.42
		3.0	2.16	2.49	2.79	2.64	3.05	3.41	3.06	3.53	3.95
		3.6	1.97	2.27	2.54	2.41	2.78	3.11	2.79	3.23	3.61
		4.2	1.82	2.11	2.35	2.23	2.57	2.88	2.59	2.99	3.34
		4.8	1.71	1.97	2.20	2.09	2.41	2.69	2.42	2.79	3.12
		5.4	1.61	1.86	2.08	1.97	2.27	2.54	2.28	2.63	2.95
		6.0	1.53	1.76	1.97	1.86	2.15	2.41	2.11	2.50	2.79
Northern Species (includes any Canadian species covered by the NLGA Standard Grading Rules)	Select Structural	2.4	2.29	2.60	2.80	2.80	3.23	3.57	3.24	3.75	4.19
		3.0	2.04	2.36	2.60	2.50	2.89	3.23	2.90	3.35	3.75
		3.6	1.87	2.16	2.41	2.28	2.64	2.95	2.65	3.06	3.42
		4.2	1.73	2.00	2.23	2.11	2.44	2.73	2.45	2.83	3.17
		4.8	1.62	1.87	2.09	1.98	2.28	2.55	2.29	2.65	2.96
		5.4	1.52	1.76	1.97	1.86	2.15	2.41	2.11	2.50	2.79
		6.0	1.44	1.67	1.87	1.72	2.04	2.28	1.96	2.37	2.65
	No. 1 and No. 2	2.4	1.94	2.24	2.50	2.37	2.73	3.06	2.75	3.17	3.55
		3.0	1.73	2.00	2.24	2.12	2.44	2.73	2.46	2.84	3.17
		3.6	1.58	1.83	2.04	1.93	2.23	2.50	2.24	2.59	2.90
		4.2	1.46	1.69	1.89	1.79	2.07	2.31	2.08	2.40	2.68
		4.8	1.37	1.58	1.77	1.67	1.93	2.16	1.94	2.24	2.51
		5.4	1.29	1.49	1.67	1.58	1.82	2.04	1.83	2.11	2.36
		6.0	1.22	1.41	1.58	1.50	1.73	1.93	1.74	2.01	2.24

Notes to Table 9.23.4.2.-I:

⁽¹⁾ Beam spans apply only where the floors serve residential areas as described in Table 4.1.5.3., or 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⁾ When the floors have a concrete topping of not more than 51 mm, the spans must be multiplied by 0.8.

⁽³⁾ Supported length means half the sum of the joist spans on both sides of the beam.

⁽⁴⁾ Straight interpolation may be used for other supported lengths.

⁽⁵⁾ Spans are clear spans between supports. For total span, add two bearing lengths.

⁽⁶⁾ 3-ply beams require 114 mm bearing. 4-ply and 5-ply beams with supported lengths greater than 3 m require 114 mm bearing. All other beams require 76 mm bearing.

Table 9.23.4.2.-J
Maximum Spans for Built-up Floor Beams Supporting not more than Three Floors⁽¹⁾⁽²⁾
Forming Part of Sentences 9.3.2.8.(1), 9.23.4.2.(3), 9.23.4.4.(3) and 9.23.8.1.(1)

Commercial Designation	Grade	Supported Length, m ⁽³⁾⁽⁴⁾	Maximum Span, m ⁽⁵⁾⁽⁶⁾								
			Size of Built-up Beam, mm								
			3-38×184	4-38×184	5-38×184	3-38×235	4-38×235	5-38×235	3-38×286	4-38×286	5-38×286
Douglas Fir – Larch (includes Douglas Fir and Western Larch)	Select Structural	2.4	2.38	2.74	2.95	2.91	3.36	3.75	3.37	3.89	4.35
		3.0	2.13	2.46	2.74	2.60	3.00	3.36	2.92	3.48	3.89
		3.6	1.88	2.24	2.51	2.24	2.74	3.06	2.53	3.18	3.56
		4.2	1.66	2.08	2.32	1.99	2.49	2.84	2.25	2.81	3.29
		4.8	1.50	1.88	2.17	1.80	2.24	2.65	2.04	2.53	3.02
		5.4	1.38	1.71	2.05	1.65	2.04	2.44	1.88	2.31	2.75
		6.0	1.28	1.58	1.88	1.53	1.89	2.24	1.75	2.14	2.53
	No. 1 and No. 2	2.4	1.85	2.14	2.39	2.26	2.61	2.92	2.63	3.03	3.39
		3.0	1.66	1.91	2.14	2.02	2.34	2.61	2.35	2.71	3.03
		3.6	1.51	1.74	1.95	1.85	2.13	2.39	2.14	2.48	2.77
		4.2	1.40	1.62	1.81	1.71	1.98	2.21	1.99	2.29	2.56
		4.8	1.31	1.51	1.69	1.60	1.85	2.07	1.86	2.14	2.40
		5.4	1.23	1.42	1.59	1.51	1.74	1.95	1.75	2.02	2.26
		6.0	1.17	1.35	1.51	1.43	1.65	1.85	1.66	1.92	2.14
Hem – Fir (includes Western Hemlock and Amabilis Fir)	Select Structural	2.4	2.22	2.70	2.91	2.64	3.31	3.70	2.98	3.78	4.29
		3.0	1.85	2.35	2.70	2.21	2.79	3.31	2.50	3.14	3.78
		3.6	1.61	2.02	2.43	1.92	2.40	2.89	2.18	2.71	3.24
		4.2	1.43	1.78	2.14	1.71	2.13	2.54	1.95	2.40	2.86
		4.8	1.30	1.61	1.92	1.56	1.92	2.28	1.77	2.18	2.58
		5.4	1.19	1.47	1.74	1.44	1.76	2.08	1.64	2.00	2.35
		6.0	1.11	1.36	1.61	1.34	1.63	1.92	1.53	1.85	2.18
	No. 1 and No. 2	2.4	1.94	2.24	2.51	2.37	2.74	3.06	2.75	3.18	3.56
		3.0	1.74	2.00	2.24	2.12	2.45	2.74	2.46	2.84	3.18
		3.6	1.58	1.83	2.05	1.92	2.24	2.50	2.18	2.60	2.90
		4.2	1.43	1.69	1.89	1.71	2.07	2.32	1.95	2.40	2.69
		4.8	1.30	1.58	1.77	1.56	1.92	2.17	1.77	2.18	2.51
		5.4	1.19	1.47	1.67	1.44	1.76	2.04	1.64	2.00	2.35
		6.0	1.11	1.36	1.58	1.34	1.63	1.92	1.53	1.85	2.18
Spruce – Pine – Fir (includes Spruce (all	Select Structural	2.4	2.35	2.58	2.78	2.89	3.30	3.55	3.24	3.89	4.33
		3.0	2.02	2.40	2.58	2.40	3.00	3.30	2.71	3.42	3.89
		3.6	1.74	2.20	2.43	2.08	2.62	3.06	2.35	2.95	3.54

species except Coast Sitka Spruce), Jack Pine, Lodgepole Pine, Balsam Fir and Alpine Fir)		4.2	1.55	1.94	2.31	1.85	2.31	2.77	2.10	2.61	3.12
		4.8	1.40	1.74	2.09	1.68	2.08	2.48	1.91	2.35	2.80
		5.4	1.28	1.59	1.90	1.54	1.90	2.26	1.76	2.16	2.55
		6.0	1.19	1.47	1.74	1.44	1.76	2.08	1.64	2.00	2.35
	No. 1 and No. 2	2.4	2.01	2.32	2.60	2.46	2.84	3.17	2.85	3.29	3.68
		3.0	1.80	2.08	2.32	2.20	2.54	2.84	2.55	2.95	3.29
		3.6	1.64	1.90	2.12	2.01	2.32	2.59	2.33	2.69	3.01
		4.2	1.52	1.75	1.96	1.85	2.15	2.40	2.10	2.49	2.78
		4.8	1.40	1.64	1.84	1.68	2.01	2.24	1.91	2.33	2.60
		5.4	1.28	1.55	1.73	1.54	1.89	2.12	1.76	2.16	2.46
		6.0	1.19	1.47	1.64	1.44	1.76	2.01	1.64	2.00	2.33
Northern Species (includes any Canadian species covered by the NLGA Standard Grading Rules)	Select Structural	2.4	1.91	2.20	2.46	2.33	2.69	3.01	2.70	3.12	3.49
		3.0	1.70	1.97	2.20	2.08	2.41	2.69	2.42	2.79	3.12
		3.6	1.56	1.80	2.01	1.90	2.20	2.46	2.18	2.55	2.85
		4.2	1.43	1.66	1.86	1.71	2.03	2.27	1.95	2.36	2.64
		4.8	1.30	1.56	1.74	1.56	1.90	2.13	1.77	2.18	2.47
		5.4	1.19	1.47	1.64	1.44	1.76	2.01	1.64	2.00	2.33
		6.0	1.11	1.36	1.56	1.34	1.63	1.90	1.53	1.85	2.18
	No. 1 and No. 2	2.4	1.61	1.86	2.08	1.97	2.28	2.55	2.29	2.64	2.96
		3.0	1.44	1.67	1.86	1.76	2.04	2.28	2.05	2.36	2.64
		3.6	1.32	1.52	1.70	1.61	1.86	2.08	1.87	2.16	2.41
		4.2	1.22	1.41	1.57	1.49	1.72	1.93	1.73	2.00	2.23
		4.8	1.14	1.32	1.47	1.40	1.61	1.80	1.62	1.87	2.09
		5.4	1.08	1.24	1.39	1.32	1.52	1.70	1.53	1.76	1.97
		6.0	1.02	1.18	1.32	1.25	1.44	1.61	1.45	1.67	1.87

Notes to Table 9.23.4.2.-J:

⁽¹⁾ Beam spans apply only where the floors serve residential areas as described in Table 4.1.5.3., or 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⁾ When the floors have a concrete topping of not more than 51 mm, the spans must be multiplied by 0.8.

⁽³⁾ Supported length means half the sum of the joist spans on both sides of the beam.

⁽⁴⁾ Straight interpolation may be used for other supported lengths.

⁽⁵⁾ Spans are clear spans between supports. For total span, add two bearing lengths.

⁽⁶⁾ 3-ply beams with supported lengths greater than 4.2 m require 152 mm bearing. All other beams require 114 mm bearing.

Table 9.23.4.2.-K
Maximum Spans for Glued-Laminated Floor Beams – 20f-E Grade⁽¹⁾
Forming Part of Sentences 9.3.2.8.(1), 9.23.4.2.(3), 9.23.4.4.(3) and 9.23.8.1.(1)

Number of Storeys Supported	Beam Width, mm	Supported Length, m ⁽²⁾⁽³⁾	Maximum Span, m ⁽⁴⁾⁽⁵⁾⁽⁶⁾⁽⁷⁾						
			Beam Depth, mm						
			228	266	304	342	380	418	456
1	80	2.4	4.32	5.04	5.76	6.48	7.20	7.92	8.64
		3.0	3.87	4.51	5.15	5.80	6.44	7.09	7.73
		3.6	3.53	4.12	4.70	5.29	5.88	6.47	7.06
		4.2	3.27	3.81	4.36	4.90	5.44	5.99	6.53
		4.8	3.06	3.57	4.07	4.58	5.09	5.60	6.11
		5.4	2.88	3.36	3.84	4.32	4.80	5.28	5.76
		6.0	2.73	3.19	3.64	4.10	4.56	5.01	5.47
	130	2.4	5.51	6.43	7.35	8.26	9.18	10.10	11.02
		3.0	4.93	5.75	6.57	7.39	8.21	9.03	9.86
		3.6	4.50	5.25	6.00	6.75	7.50	8.25	9.00
		4.2	4.16	4.86	5.55	6.25	6.94	7.64	8.33
		4.8	3.90	4.54	5.19	5.84	6.49	7.14	7.79
		5.4	3.67	4.28	4.90	5.51	6.12	6.73	7.35
		6.0	3.48	4.07	4.65	5.23	5.81	6.39	6.97
2	80	2.4	3.28	3.83	4.37	4.92	5.47	6.01	6.56
		3.0	2.93	3.42	3.91	4.40	4.89	5.38	5.87
		3.6	2.68	3.12	3.57	4.02	4.46	4.91	5.36
		4.2	2.48	2.89	3.31	3.72	4.13	4.54	4.96
		4.8	2.32	2.71	3.09	3.48	3.86	4.25	4.64
		5.4	2.19	2.55	2.91	3.28	3.64	4.01	4.37
		6.0	2.07	2.42	2.77	3.11	3.46	3.80	4.15
	130	2.4	4.18	4.88	5.57	6.27	6.97	7.66	8.36
		3.0	3.74	4.36	4.99	5.61	6.23	6.85	7.48
		3.6	3.41	3.98	4.55	5.12	5.69	6.26	6.83
		4.2	3.16	3.69	4.21	4.74	5.27	5.79	6.32
		4.8	2.96	3.45	3.94	4.43	4.93	5.42	5.91
		5.4	2.79	3.25	3.72	4.18	4.64	5.11	5.57
		6.0	2.64	3.08	3.53	3.97	4.41	4.85	5.29
3	80	2.4	2.75	3.21	3.66	4.12	4.58	5.04	5.50
		3.0	2.46	2.87	3.28	3.69	4.10	4.51	4.92
		3.6	2.24	2.62	2.99	3.37	3.74	4.11	4.49
		4.2	2.08	2.42	2.77	3.12	3.46	3.81	4.15

		4.8	1.94	2.27	2.59	2.91	3.24	3.56	3.89
		5.4	1.83	2.14	2.44	2.75	3.05	3.36	3.66
		6.0	1.74	2.03	2.32	2.61	2.90	3.19	3.48
	130	2.4	3.50	4.09	4.67	5.25	5.84	6.42	7.01
		3.0	3.13	3.66	4.18	4.70	5.22	5.74	6.27
		3.6	2.86	3.34	3.81	4.29	4.77	5.24	5.72
		4.2	2.65	3.09	3.53	3.97	4.41	4.85	5.30
		4.8	2.48	2.89	3.30	3.72	4.13	4.54	4.95
		5.4	2.34	2.72	3.11	3.50	3.89	4.28	4.67
		6.0	2.22	2.58	2.95	3.32	3.69	4.06	4.43

Notes to Table 9.23.4.2.-K:

- ⁽¹⁾ Spans apply only where the floors serve residential areas as described in Table 4.1.5.3., or 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⁾ Supported length means half the sum of the joist spans on both sides of the beam.
- ⁽³⁾ Straight interpolation may be used for other supported lengths.
- ⁽⁴⁾ Spans are valid for glued-laminated timber conforming to CAN/CSA-O122 and CSA O177.
- ⁽⁵⁾ Spans are clear spans between supports. For total span, add two bearing lengths.
- ⁽⁶⁾ Provide a minimum bearing length of 89 mm. (Alternatively, the bearing length may be designed in accordance with Part 4.)
- ⁽⁷⁾ Top edge of beam assumed to be fully laterally supported by joists.

Table 9.23.4.2.-L
Maximum Spans for Built-up Ridge Beams and Lintels Supporting the Roof and Ceiling
Only, No. 1 or No. 2 Grade

Forming Part of Sentences 9.3.2.8.(1), 9.23.4.2.(4), 9.23.4.5.(1), 9.23.12.3.(1) and (3),
and 9.23.14.10.(2)

Commercial Designation	Beam or Lintel Size, mm	Maximum Span, m ⁽¹⁾⁽²⁾⁽³⁾				
		Specified Snow Load, kPa				
		1.0	1.5	2.0	2.5	3.0
Douglas Fir – Larch (includes Douglas Fir and Western Larch)	3-38×184	2.65	2.28	2.03	1.85	1.71
	4-38×184	3.06	2.64	2.35	2.14	1.97
	5-38×184	3.43	2.95	2.62	2.39	2.21
	3-38×235	3.25	2.79	2.49	2.26	2.09
	4-38×235	3.75	3.22	2.87	2.61	2.41
	5-38×235	4.19	3.60	3.21	2.92	2.70
	3-38×286	3.77	3.24	2.88	2.62	2.43
	4-38×286	4.35	3.74	3.33	3.03	2.80
	5-38×286	4.86	4.18	3.72	3.39	3.13
Hem – Fir (includes Western Hemlock and Amabilis Fir)	3-38×184	2.78	2.39	2.13	1.94	1.79
	4-38×184	3.21	2.76	2.46	2.24	2.07
	5-38×184	3.59	3.09	2.75	2.50	2.31
	3-38×235	3.40	2.93	2.61	2.37	2.19
	4-38×235	3.93	3.38	3.01	2.74	2.53
	5-38×235	4.39	3.78	3.36	3.06	2.83
	3-38×286	3.95	3.40	3.02	2.75	2.54
	4-38×286	4.56	3.92	3.49	3.18	2.94
	5-38×286	5.10	4.38	3.90	3.55	3.28
Spruce – Pine – Fir (includes Spruce (all species except Coast Sitka Spruce) Jack Pine, Lodgepole Pine, Balsam Fir and Alpine Fir)	3-38×184	2.88	2.48	2.21	2.01	1.86
	4-38×184	3.30	2.86	2.55	2.32	2.14
	5-38×184	3.55	3.10	2.82	2.59	2.40
	3-38×235	3.53	3.03	2.70	2.46	2.27
	4-38×235	4.07	3.50	3.12	2.84	2.62
	5-38×235	4.54	3.91	3.49	3.17	2.93
	3-38×286	4.09	3.52	3.13	2.85	2.63
	4-38×286	4.72	4.06	3.62	3.29	3.04
	5-38×286	5.28	4.54	4.04	3.68	3.40

Notes to Table 9.23.4.2.-L:

⁽¹⁾ Beam and lintel spans are calculated based on a maximum supported length of 4.9 m. Spans may be increased by 5% for supported lengths of not more than 4.3 m, by 10% for supported lengths of not more than 3.7 m, and by 25% for supported lengths of not more than 2.4 m.

⁽²⁾ For ridge beams, supported length means half the sum of the rafter, joist or truss spans on both sides of the beam. For lintels, supported length means half the sum of truss, roof joist or rafter spans supported by the lintel plus the length of the overhang beyond the lintel.

⁽³⁾ Provide minimum 76 mm bearing.

Table 9.23.12.3.-A
Maximum Spans for Douglas Fir – Larch Lintels – No. 1 or No. 2 Grade – Non-structural Sheathing(1)

Forming Part of Sentences 9.3.2.8.(1), 9.23.4.5.(1) and 9.23.12.3.(1) and (3)

Lintel Supporting	Lintel Size, ⁽²⁾ mm	Maximum Span, m ⁽³⁾⁽⁴⁾					
		Exterior Walls					Interior Walls
		Specified Snow Load, kPa					
		1.0	1.5	2.0	2.5	3.0	
Limited attic storage and ceiling	2-38×89	This Area Intentionally Left Blank					1.25
	2-38×140						1.78
	2-38×184						2.17
	2-38×235						2.65
	2-38×286						3.08
Roof and ceiling only (tributary width of 0.6 m maximum) ⁽⁵⁾	2-38×89	2.68	2.34	2.13	1.97	1.86	1.97
	2-38×140	4.21	3.68	3.34	3.10	2.92	3.10
	2-38×184	5.50	4.84	4.39	4.08	3.84	4.08
	2-38×235	6.61	5.97	5.56	5.21	4.88	5.21
	2-38×286	7.66	6.92	6.44	6.09	5.66	6.09
Roof and ceiling only (tributary width of 4.9 m maximum) ⁽⁶⁾	2-38×89	1.25	1.07	0.96	0.87	0.80	0.87
	2-38×140	1.78	1.53	1.36	1.24	1.15	1.24
	2-38×184	2.17	1.86	1.66	1.51	1.40	1.51
	2-38×235	2.65	2.28	2.03	1.85	1.71	1.85
	2-38×286	3.08	2.64	2.35	2.14	1.98	2.14
Roof, ceiling and 1 storey ⁽³⁾⁽⁶⁾⁽⁷⁾	2-38×89	0.96	0.88	0.82	0.77	0.73	0.68
	2-38×140	1.37	1.26	1.17	1.10	1.04	0.97
	2-38×184	1.67	1.53	1.42	1.34	1.26	1.18
	2-38×235	2.04	1.88	1.74	1.63	1.54	1.44
	2-38×286	2.37	2.18	2.02	1.90	1.79	1.67
Roof, ceiling and 2 storeys ⁽³⁾⁽⁶⁾⁽⁷⁾	2-38×89	0.86	0.81	0.77	0.73	0.70	0.61
	2-38×140	1.23	1.16	1.09	1.04	0.99	0.87
	2-38×184	1.50	1.41	1.33	1.27	1.21	1.06
	2-38×235	1.84	1.72	1.63	1.55	1.48	1.30
	2-38×286	2.13	2.00	1.89	1.80	1.72	1.51
Roof, ceiling and 3 storeys ⁽³⁾⁽⁶⁾⁽⁷⁾	2-38×89	0.81	0.77	0.73	0.71	0.68	0.57
	2-38×140	1.15	1.10	1.05	1.01	0.97	0.82
	2-38×184	1.40	1.33	1.28	1.22	1.18	1.00
	2-38×235	1.71	1.63	1.56	1.50	1.44	1.22
	2-38×286	1.99	1.89	1.81	1.74	1.67	1.41

Notes to Table 9.23.12.3.-A:

- ⁽¹⁾ Where structural sheathing is used, lintel spans may be increased by 15%. Structural sheathing consists of a minimum 9.5 mm thick structural panel conforming to CSA O121, CSA O151, CSA O325 or CSA O437.0 fastened with at least two rows of fasteners to the exterior face of the lintel, and a single row to the top plates and studs. Fasteners shall conform to Table 9.23.3.5.-A.
- ⁽²⁾ A single piece of 89 mm thick lumber may be used in lieu of 2 pieces of 38 mm thick lumber on edge.
- ⁽³⁾ If floor joists span the full width of the *building* without support, lintel spans shall be reduced by 15% for “roof, ceiling and 1 storey,” by 20% for “roof, ceiling and 2 storeys,” and by 25% for “roof, ceiling and 3 storeys.”
- ⁽⁴⁾ For ends of lintels fully supported by walls, provide minimum 38 mm bearing for lintel spans up to 3 m, or minimum 76 mm bearing for lintel spans greater than 3 m.
- ⁽⁵⁾ Spans for 0.6 m tributary width are calculated for lintels in end walls that support only a 0.6 m width of roof and ceiling, but do not support roof joists, roof rafters or roof trusses.
- ⁽⁶⁾ Lintel spans are calculated based on a maximum floor joist, roof joist or rafter span of 4.9 m and a maximum roof truss span of 9.8 m. Lintel spans may be increased by 5% if rafter and joist spans are no greater than 4.3 m and roof truss spans are no greater than 8.6 m. Spans may be increased by 10% if rafter and joist spans are no greater than 3.7 m and roof truss spans are no greater than 7.4 m.
- ⁽⁷⁾ Spans apply only where the floors serve residential areas as described in Table 4.1.5.3., or the uniformly distributed *live load* does not exceed that specified for residential areas as described in Table 4.1.5.3.

Table 9.23.12.3.-B
Maximum Spans for Hem – Fir Lintels – No. 1 or No. 2 Grade – Non-structural Sheathing(1)

Forming Part of Sentences 9.3.2.8.(1), 9.23.4.5.(1) and 9.23.12.3.(1) and (3)

Lintel Supporting	Lintel Size, ⁽²⁾ mm	Maximum Span, m ⁽³⁾⁽⁴⁾					
		Exterior Walls					Interior Walls
		Specified Snow Load, kPa					
		1.0	1.5	2.0	2.5	3.0	
Limited attic storage and ceiling	2-38×89	This Area Intentionally Left Blank					1.31
	2-38×140						1.87
	2-38×184						2.27
	2-38×235						2.78
	2-38×286						3.23
Roof and ceiling only (tributary width of 0.6 m maximum) ⁽⁵⁾	2-38×89	2.68	2.34	2.13	1.97	1.86	1.97
	2-38×140	4.21	3.68	3.34	3.10	2.92	3.10
	2-38×184	5.50	4.84	4.39	4.08	3.84	4.08
	2-38×235	6.61	5.97	5.56	5.21	4.90	5.21
	2-38×286	7.66	6.92	6.44	6.09	5.82	6.09
Roof and ceiling only (tributary width of 4.9 m maximum) ⁽⁶⁾	2-38×89	1.31	1.13	1.00	0.91	0.84	0.91
	2-38×140	1.87	1.61	1.43	1.30	1.20	1.30
	2-38×184	2.27	1.95	1.74	1.58	1.42	1.58
	2-38×235	2.78	2.39	2.13	1.92	1.71	1.92
	2-38×286	3.23	2.77	2.47	2.17	1.94	2.17
Roof, ceiling and 1 storey ⁽³⁾⁽⁶⁾⁽⁷⁾	2-38×89	1.01	0.93	0.86	0.81	0.76	0.69
	2-38×140	1.44	1.32	1.23	1.14	1.05	0.95
	2-38×184	1.75	1.61	1.47	1.34	1.23	1.12
	2-38×235	2.14	1.96	1.76	1.60	1.48	1.35
	2-38×286	2.49	2.22	2.00	1.82	1.69	1.55
Roof, ceiling and 2 storeys ⁽³⁾⁽⁶⁾⁽⁷⁾	2-38×89	0.91	0.85	0.80	0.76	0.72	0.60
	2-38×140	1.29	1.21	1.13	1.05	0.98	0.82
	2-38×184	1.57	1.44	1.33	1.24	1.16	0.98
	2-38×235	1.90	1.73	1.60	1.49	1.40	1.19
	2-38×286	2.15	1.97	1.82	1.70	1.60	1.37
Roof, ceiling and 3 storeys ⁽³⁾⁽⁶⁾⁽⁷⁾	2-38×89	0.85	0.81	0.77	0.74	0.69	0.55
	2-38×140	1.21	1.14	1.06	1.00	0.95	0.76
	2-38×184	1.43	1.33	1.25	1.18	1.12	0.91
	2-38×235	1.72	1.60	1.50	1.42	1.35	1.10
	2-38×286	1.95	1.82	1.72	1.63	1.55	1.27

Notes to Table 9.23.12.3.-B:

- ⁽¹⁾ Where structural sheathing is used, lintel spans may be increased by 15%. Structural sheathing consists of a minimum 9.5 mm thick structural panel conforming to CSA O121, CSA O151, CSA O325 or CSA O437.0 fastened with at least two rows of fasteners to the exterior face of the lintel, and a single row to the top plates and studs. Fasteners shall conform to Table 9.23.3.5.-A.
- ⁽²⁾ A single piece of 89 mm thick lumber may be used in lieu of 2 pieces of 38 mm thick lumber on edge.
- ⁽³⁾ If floor joists span the full width of the *building* without support, lintel spans shall be reduced by 15% for “roof, ceiling and 1 storey,” by 20% for “roof, ceiling and 2 storeys,” and by 25% for “roof, ceiling and 3 storeys.”
- ⁽⁴⁾ For ends of lintels fully supported by walls, provide minimum 38 mm bearing for lintel spans up to 3 m, or minimum 76 mm bearing for lintel spans greater than 3 m.
- ⁽⁵⁾ Spans for 0.6 m tributary width are calculated for lintels in end walls that support only a 0.6 m width of roof and ceiling, but do not support roof joists, roof rafters or roof trusses.
- ⁽⁶⁾ Lintel spans are calculated based on a maximum floor joist, roof joist or rafter span of 4.9 m and a maximum roof truss span of 9.8 m. Lintel spans may be increased by 5% if rafter and joist spans are no greater than 4.3 m and roof truss spans are no greater than 8.6 m. Spans may be increased by 10% if rafter and joist spans are no greater than 3.7 m and roof truss spans are no greater than 7.4 m.
- ⁽⁷⁾ Spans apply only where the floors serve residential areas as described in Table 4.1.5.3., or the uniformly distributed *live load* does not exceed that specified for residential areas as described in Table 4.1.5.3.

Table 9.23.12.3.-C
Maximum Spans for Spruce – Pine – Fir Lintels – No. 1 or No. 2 Grade – Non-structural Sheathing(1)

Forming Part of Sentences 9.3.2.8.(1), 9.23.4.5.(1) and 9.23.12.3.(1) and (3)

Lintel Supporting	Lintel Size, ⁽²⁾ mm	Maximum Span, m ⁽³⁾⁽⁴⁾					
		Exterior Walls					Interior Walls
		Specified Snow Load, kPa					
		1.0	1.5	2.0	2.5	3.0	
Limited attic storage and ceiling	2-38×89	This Area Intentionally Left Blank					1.27
	2-38×140						1.93
	2-38×184						2.35
	2-38×235						2.88
	2-38×286						3.34
Roof and ceiling only (tributary width of 0.6 m maximum) ⁽⁵⁾	2-38×89	2.55	2.23	2.02	1.88	1.77	1.88
	2-38×140	4.01	3.50	3.18	2.96	2.78	2.96
	2-38×184	5.27	4.61	4.18	3.88	3.66	3.88
	2-38×235	6.37	5.76	5.34	4.96	4.67	4.96
	2-38×286	7.38	6.67	6.21	5.87	5.61	5.87
Roof and ceiling only (tributary width of 4.9 m maximum) ⁽⁶⁾	2-38×89	1.27	1.11	1.01	0.93	0.87	0.93
	2-38×140	1.93	1.66	1.48	1.35	1.25	1.35
	2-38×184	2.35	2.02	1.80	1.64	1.52	1.64
	2-38×235	2.88	2.47	2.20	2.01	1.84	2.01
	2-38×286	3.34	2.87	2.56	2.33	2.09	2.33
Roof, ceiling and 1 storey ⁽³⁾⁽⁶⁾⁽⁷⁾	2-38×89	1.05	0.96	0.89	0.84	0.79	0.74
	2-38×140	1.49	1.37	1.27	1.19	1.13	1.02
	2-38×184	1.82	1.67	1.55	1.44	1.33	1.20
	2-38×235	2.22	2.04	1.89	1.73	1.59	1.45
	2-38×286	2.58	2.36	2.15	1.96	1.81	1.66
Roof, ceiling and 2 storeys ⁽³⁾⁽⁶⁾⁽⁷⁾	2-38×89	0.94	0.88	0.83	0.79	0.76	0.64
	2-38×140	1.34	1.26	1.19	1.13	1.06	0.88
	2-38×184	1.63	1.53	1.44	1.33	1.25	1.05
	2-38×235	1.99	1.87	1.72	1.60	1.50	1.27
	2-38×286	2.31	2.12	1.96	1.82	1.71	1.45
Roof, ceiling and 3 storeys ⁽³⁾⁽⁶⁾⁽⁷⁾	2-38×89	0.88	0.83	0.80	0.77	0.74	0.59
	2-38×140	1.25	1.19	1.14	1.08	1.02	0.81
	2-38×184	1.52	1.44	1.35	1.27	1.21	0.97
	2-38×235	1.86	1.73	1.62	1.53	1.45	1.17
	2-38×286	2.11	1.96	1.84	1.74	1.66	1.35

Notes to Table 9.23.12.3.-C:

- ⁽¹⁾ Where structural sheathing is used, lintel spans may be increased by 15%. Structural sheathing consists of a minimum 9.5 mm thick structural panel conforming to CSA O121, CSA O151, CSA O325 or CSA O437.0 fastened with at least two rows of fasteners to the exterior face of the lintel, and a single row to the top plates and studs. Fasteners shall conform to Table 9.23.3.5.-A.
- ⁽²⁾ A single piece of 89 mm thick lumber may be used in lieu of 2 pieces of 38 mm thick lumber on edge.
- ⁽³⁾ If floor joists span the full width of the *building* without support, lintel spans shall be reduced by 15% for “roof, ceiling and 1 *storey*,” by 20% for “roof, ceiling and 2 *storeys*,” and by 25% for “roof, ceiling and 3 *storeys*.”
- ⁽⁴⁾ For ends of lintels fully supported by walls, provide minimum 38 mm bearing for lintel spans up to 3 m, or minimum 76 mm bearing for lintel spans greater than 3 m.
- ⁽⁵⁾ Spans for 0.6 m tributary width are calculated for lintels in end walls that support only a 0.6 m width of roof and ceiling, but do not support roof joists, roof rafters or roof trusses.
- ⁽⁶⁾ Lintel spans are calculated based on a maximum floor joist, roof joist or rafter span of 4.9 m and a maximum roof truss span of 9.8 m. Lintel spans may be increased by 5% if rafter and joist spans are no greater than 4.3 m and roof truss spans are no greater than 8.6 m. Spans may be increased by 10% if rafter and joist spans are no greater than 3.7 m and roof truss spans are no greater than 7.4 m.
- ⁽⁷⁾ Spans apply only where the floors serve residential areas as described in Table 4.1.5.3., or the uniformly distributed *live load* does not exceed that specified for residential areas as described in Table 4.1.5.3.

Table 9.23.12.3.-D
Maximum Spans for Glued-Laminated Timber Lintels – 20f-E Stress Grade – Exterior
Walls – Roof and Ceiling Load Only

Forming Part of Sentences 9.3.2.8.(1), 9.23.4.5.(1) and 9.23.12.3.(1) and (3)

Lintel Size, mm	Maximum Span, m ⁽¹⁾⁽²⁾⁽³⁾														
	Specified Snow Load, kPa														
	1.0			1.5			2.0			2.5			3.0		
	Supported length, m ⁽⁴⁾⁽⁵⁾			Supported length, m ⁽⁴⁾⁽⁵⁾			Supported length, m ⁽⁴⁾⁽⁵⁾			Supported length, m ⁽⁴⁾⁽⁵⁾			Supported length, m ⁽⁴⁾⁽⁵⁾		
	2.4	3.6	4.8	2.4	3.6	4.8	2.4	3.6	4.8	2.4	3.6	4.8	2.4	3.6	4.8
130 × 304	6.23	5.63	5.24	5.63	5.09	4.73	5.24	4.73	4.40	4.95	4.48	4.17	4.73	4.28	3.87
80 × 380	6.52	5.89	5.48	5.89	5.32	4.96	5.48	4.96	4.52	5.19	4.69	4.11	4.96	4.39	3.80
130 × 342	6.80	6.15	5.72	6.15	5.56	5.17	5.72	5.17	4.81	5.41	4.89	4.55	5.17	4.67	4.35
80 × 418	7.00	6.33	5.89	6.33	5.72	5.32	5.89	5.32	4.96	5.57	5.03	4.52	5.32	4.81	4.18
130 × 380	7.36	6.65	6.19	6.65	6.01	5.59	6.19	5.59	5.21	5.86	5.29	4.92	5.59	5.06	4.70
80 × 456	7.48	6.76	6.29	6.76	6.10	5.68	6.29	5.68	5.29	5.95	5.37	4.93	5.68	5.13	4.56
130 × 418	7.91	7.15	6.65	7.15	6.46	6.01	6.65	6.01	5.59	6.29	5.68	5.29	6.01	5.43	5.05
80 × 494	7.94	7.17	6.68	7.17	6.48	6.03	6.68	6.03	5.61	6.31	5.71	5.31	6.03	5.45	4.94
80 × 532	8.39	7.58	7.06	7.58	6.85	6.38	7.06	6.38	5.93	6.67	6.03	5.61	6.38	5.76	5.32
130 × 456	8.44	7.63	7.10	7.63	6.89	6.41	7.10	6.41	5.97	6.71	6.07	5.65	6.41	5.80	5.39

Notes to Table 9.23.12.3.-D:

- ⁽¹⁾ Spans are valid for glued-laminated timber conforming to CAN/CSA-O122 and CSA O177.
- ⁽²⁾ Provide minimum 89 mm bearing. (Alternatively, the bearing length may be calculated in accordance with Part 4.)
- ⁽³⁾ Top edge of lintel assumed to be fully laterally supported.
- ⁽⁴⁾ Supported length means half the length of trusses or rafters, plus the length of the overhang beyond the wall.
- ⁽⁵⁾ For intermediate supported lengths, straight interpolation may be used.

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 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.

Energy Efficiency

Clause 9.36.1.3.(5)(b) exempts seasonally occupied residential buildings such as summer cottages from the requirements of Section 9.36. Cottages intended for continuous or regular winter use such as ski cabins are required to conform to Section 9.36.

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 tables in 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

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.

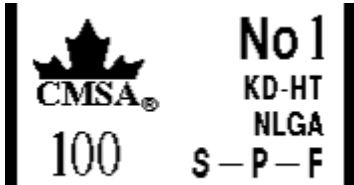
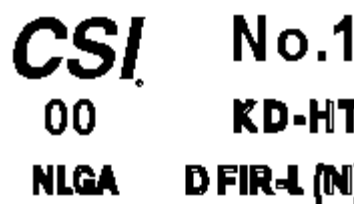
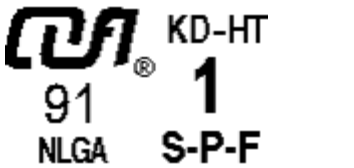
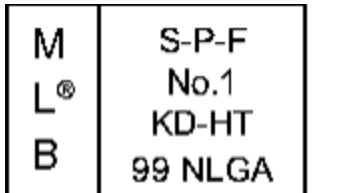
Grade marks denote the moisture content of lumber at the time of surfacing. "S-Dry" in the mark indicates the lumber was surfaced at a moisture content not exceeding 19%. "MC 15" indicates a moisture content not exceeding 15%. "S-GRN" in the grade mark signifies that the lumber was surfaced at a moisture content higher than 19% at a size to allow for natural shrinkage during seasoning.

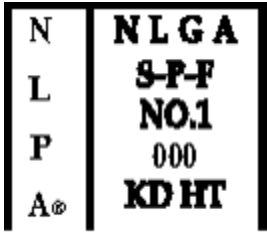
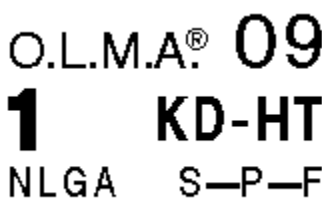
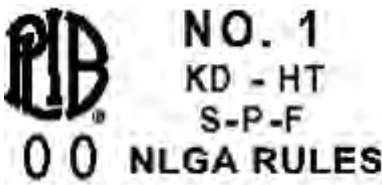
Each mill or grader is assigned a permanent number. The point of origin of lumber is identified in the grade mark by use of a mill or grader number or by the mill name or abbreviation. The CLS certified agency under whose supervision the lumber was grade marked is identified in the mark by the registered 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

Facsimiles of Grade Mark	Association or Agency
	Alberta Forest Products Association www.albertaforestproducts.ca

 No 1 KD-HT NLGA S-P-F ©300062B	Canadian Mill Services Association www.canserve.org
 No.1 KD-HT NLGA D FIR-L (N) ©300064A	Canadian Softwood Inspection Agency Inc. www.canadiansoftwood.com
 26 S-P-F KD-HT NLGA 2 ©300065B	Central Forest Products Association Inc. www.cfpa-lumber.com
 KD-HT 1 NLGA S-P-F  KD-HT 1 NLGA D FIR-L(N) ©300067B	Council of Forest Industries www.cofi.org
 No. 2 KD-HT S-P-F NLGA ©300068B	Macdonald Inspection Services Ltd. www.gradestamp.com
 S-P-F No.1 KD-HT 99 NLGA ©300069B	Maritime Lumber Bureau www.mlb.ca

 6300068	Newfoundland & Labrador Lumber Producers' Association c/o Canadian Lumber Standards Accreditation Board www.clsab.ca
 6300078	Northwest Territories Forest Industries Association
 6300056	Ontario Forest Industries Association (Home of CLA Grading and Inspection) www.ofia.com
 6300088	Ontario Lumber Manufacturers' Association www.olma.ca
 6300086	Pacific Lumber Inspection Bureau www.plib.org
 6300070	Conseil de l'industrie forestière du Québec (Quebec Forest Industry Council) www.cifq.com

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 WWPB “Western Lumber Grading Rules 2017” and paragraph 114 is equivalent to the WCLIB “Grading Rules for West Coast Lumber.” When graded in accordance with WWPB or WCLIB rules, the grade mark will not contain a paragraph number.

A-9.3.2.8.(1) Non-Standard Lumber. NLGA 2017, "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.

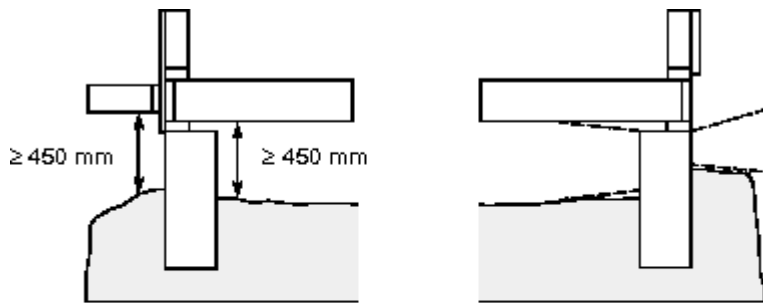


Figure A-9.3.2.9.(1)-A

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).



clear height of 450 mm between structural wood elements and finished ground directly below

supporting elements visible to permit inspection⁽¹⁾

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Figure A-9.3.2.9.(1)-B

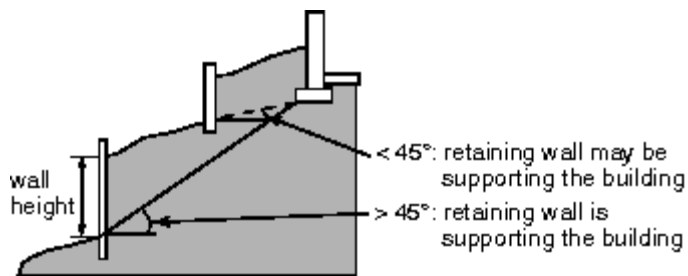
Clearances under structural wood elements and visibility of supporting elements where required to permit inspection for termite infestation

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.



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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.

Design according to Part 4 or accepted good engineering practice, such as that described in the CWC, "Engineering Guide for 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. and 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 4 550 m². Thus, these snow loads 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 load calculation of Sentence 9.4.2.2.(1) is not applicable to roof configurations that seriously exacerbate snow accumulation. This limitation does not pertain to typical projections above a sloped roof, such as dormers, but rather to high parapets and other significant projections above a flat roof, such as elevator penthouses, mechanical rooms and larger equipment, that collect snow and prevent it from blowing off the roof.

Although multi-level roofs generally lead to snow drift loads, smaller light-frame buildings constructed according to Part 9 have not collapsed under these loads. Consequently, the simplified calculation may be used for multi-level roofs where the upper level roof does not exceed 600 m² in area. For multi-level roofs with larger upper roof areas (formed by multiple adjoining Part 9 buildings), where the upper level roof has a slope less than 1 in 6 and the roof step has a height greater than 2 m, the snow drift load on the lower level roof near the roof step must be considered in accordance with Sentence 9.4.2.2.(4).

The reference in Clause 9.4.2.1.(1)(d) to Article 9.4.3.1. invokes, for roof assemblies other than common lumber trusses, the same performance criteria for deflection.

Values of the specific weight of snow on roofs, γ , obtained from measurements at a number of weather stations across Canada ranged from about 1.0 to 4.5 kN/m³ with an average of approximately 3.0 kN/m³. ASCE/SEI 7, "Minimum Design Loads for Buildings and Other Structures," contains a formula to calculate the increase in the value of γ based on an increase in the ground snow load: $0.43S_s + 2.2$ kN/m³. This formula provides results that are reasonably consistent with Canada's climatic reality. In Clause 9.4.2.1.(1)(f), the specific weight of snow is capped at 4.0 kN/m³, as higher values are extremely rare.

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.

Note A-9.4.2.5. Seismic Design Parameter. The seismic design parameter, S_{max} , is used as a trigger for the application of seismic design provisions in Part 9. It was derived by considering the upper limit on the minimum lateral earthquake force, V , as specified in Clause 4.1.8.11.(2)(c), and is taken as the larger of $2/3 S(0.2)$ and $S(0.5)$, with $S(0.2)$ and $S(0.5)$ calculated in accordance with Sentence 4.1.8.4.(6).

Note A-9.4.2.5.(2) Determination of Site Class. To benefit from a refined, and possibly less conservative, value of S_{max} , the Site Class can be determined on the basis of the ground profile at the site in accordance with Article 4.1.8.4. Determination of the Site Class will require the involvement of a suitably qualified and experienced professional engineer.

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 152, 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/m³. 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 m² 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-9.5.3.1. Ceiling Heights and Clear Heights. Figure A-9.5.3.1. shows ceiling heights in relation to clear heights and also clear heights over stairs described in Article 9.8.2.2.

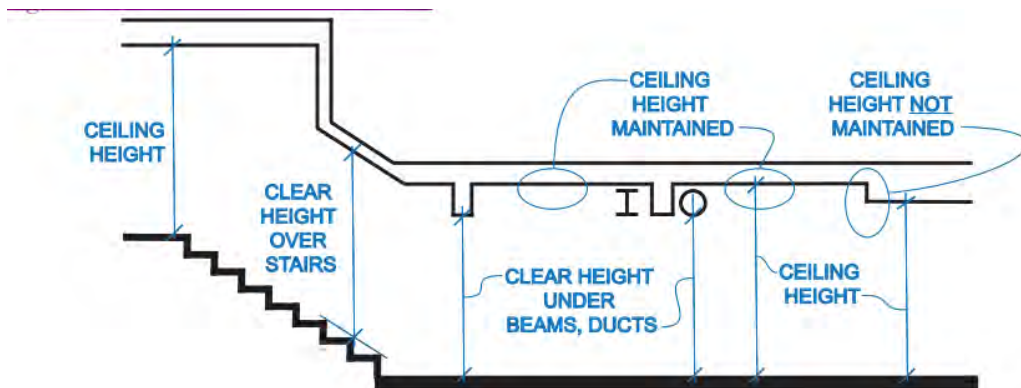


Figure A-9.5.3.1.
Ceiling Heights and Clear Heights

A-9.5.5.3. Doorways to Rooms with a Bathtub, Shower or Water Closet. The intent of Article 9.5.5.3. is to ensure a certain degree of access to rooms that provide some or all of the facilities found in a typical residential bathroom.

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-Table 9.6.1.3 Glass in Doors. Maximum areas in Table 9.6.1.3. for other than fully tempered glazing are cut off at 1.50 m², as this would be the practical limit after which safety glazing would be required by Sentence 9.6.1.4.(2).

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 2 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 BC Building Code takes precedence, these doors are not required to conform to "NAFS". This Subsection of the Code 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/A440-17, North American Fenestration Standard/Specification for windows, doors, and skylights," the Harmonized Standard, AAMA/WDMA/CSA 101/I.S.2/A440, "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 Code; 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 Canada, 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 Code, 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. The DRWP given in the Canadian Supplement should be used for all products covered in the scope of the Harmonized Standard.

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 NBC 2005 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 NBC has traditionally applied a factor of 1.5 rather than 2.0 for snow. Incorporating these lower load factors into the Code requirements for fenestration would better reflect acceptable minimum performance levels; however, this has not been done in order to avoid adding complexity to the Code, 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," which is referenced in Table 9.7.3.3., 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 Code requirements for ventilation and emergency egress. The minimum test size of 800 mm × 360 mm (total area of 0.288 m²) specified in the standard will not provide the minimum openable area required by the Code for bedrooms (i.e. 0.35 m² 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 Code (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 m² required for non-heating-season natural ventilation (see Article 9.32.2.2.).

Performance of Doors: Limited Water Ingress Control

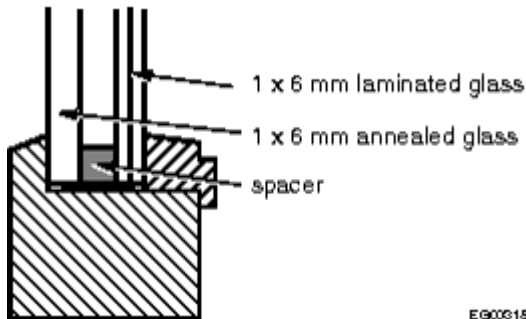
While the control of precipitation ingress is a performance requirement for exterior doors, side-hinged doors can comply with the referenced standard, AAMA/WDMA/CSA 101/I.S.2/A440, "North American Fenestration Standard/Specification for windows, doors, and skylights," when tested at a pressure differential 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 BC Building Code. 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.



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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.

ULC Standards has produced ULC-S332, "Standard for 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.(2) Resistance of Doors To Forced Entry. Sentence 9.7.5.2.(2) designates standard ASTM F476, "Standard Test Methods for Security of Swinging Door Assemblies," as an alternative to compliance with the prescriptive requirements for doors and hardware. The annex to the standard provides four security classifications, with acceptance criteria, depending on the type of building and the crime rate of the area in which it is located. The NBC only specifies Grade 10, the minimum level. The annex suggests the following guidelines be followed when selecting security levels for door assemblies:

Grade 10: This is the minimum security level and is quite adequate for single-family residential buildings located in stable, low-crime areas.

Grade 20: This is the low-medium security level and is designed to provide security for residential buildings located in average crime-rate areas and for apartments in both low and average crime-rate areas.

Grade 30: This is the medium-high security level and is designed to provide security for residential buildings located in higher than average crime-rate areas or for small commercial buildings in average or low crime-rate areas.

Grade 40: This is the high security level and is designed for small commercial buildings located in high crime-rate areas. This level could also be used for residential buildings having an exceptionally high incidence of semi-skilled burglary attacks.

All these grades satisfy the Code and can be considered for use where a higher level of security is desired or warranted.

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.

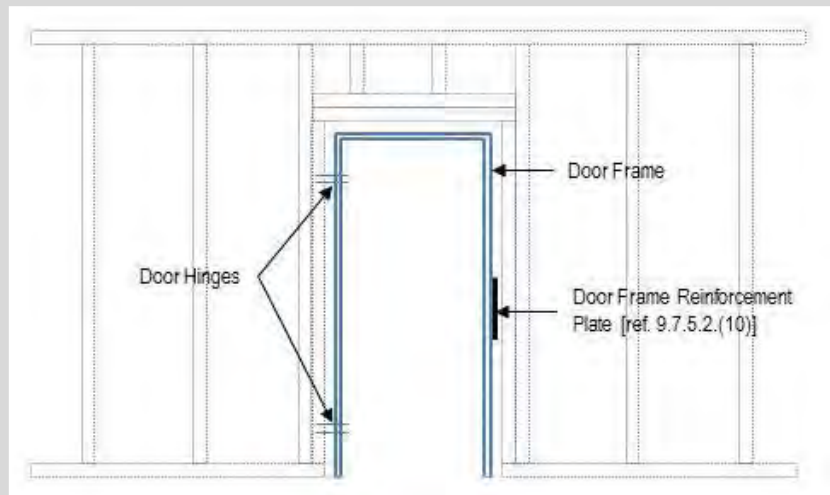


Figure A-9.7.5.2.(10)-A
Typical Location of Door Frame Reinforcement

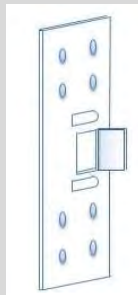


Figure A-9.7.5.2.(10)-B
Frame Reinforcement (Example)

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 Code 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.

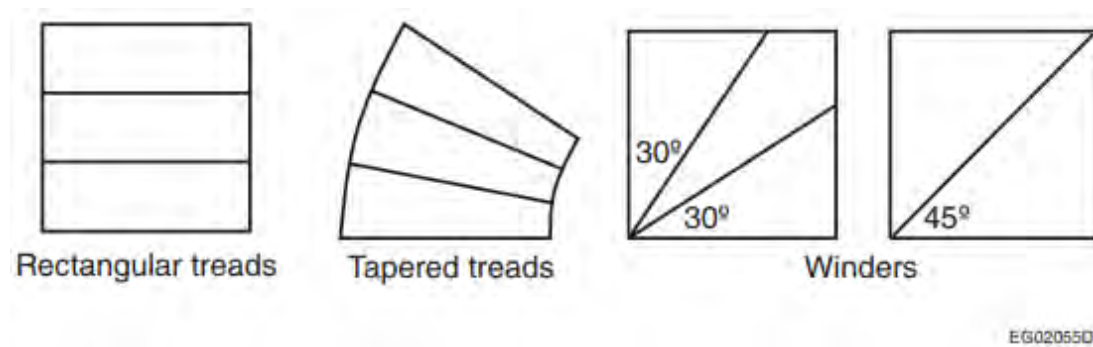


Figure A-9.8.4.-A
Types of treads

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.

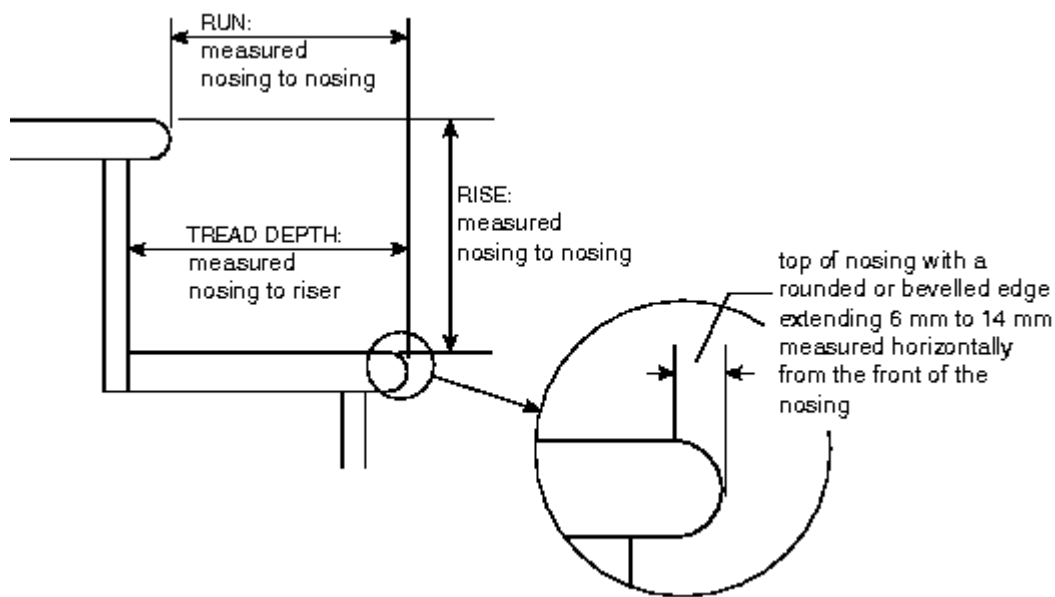


Figure A-9.8.4.-B
Step dimensions and their measurement

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 Code permits only these two angles. Although it is normal Code 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.

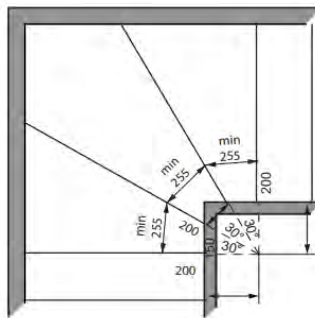


Figure A-9.8.4.6.
Winders

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-9.8.6.2.(2) **Exemption from Required Landing at Top of Stairs.** A door that swings away from a stair exposes sufficient floor space to act as a landing for users before descending the stairs.

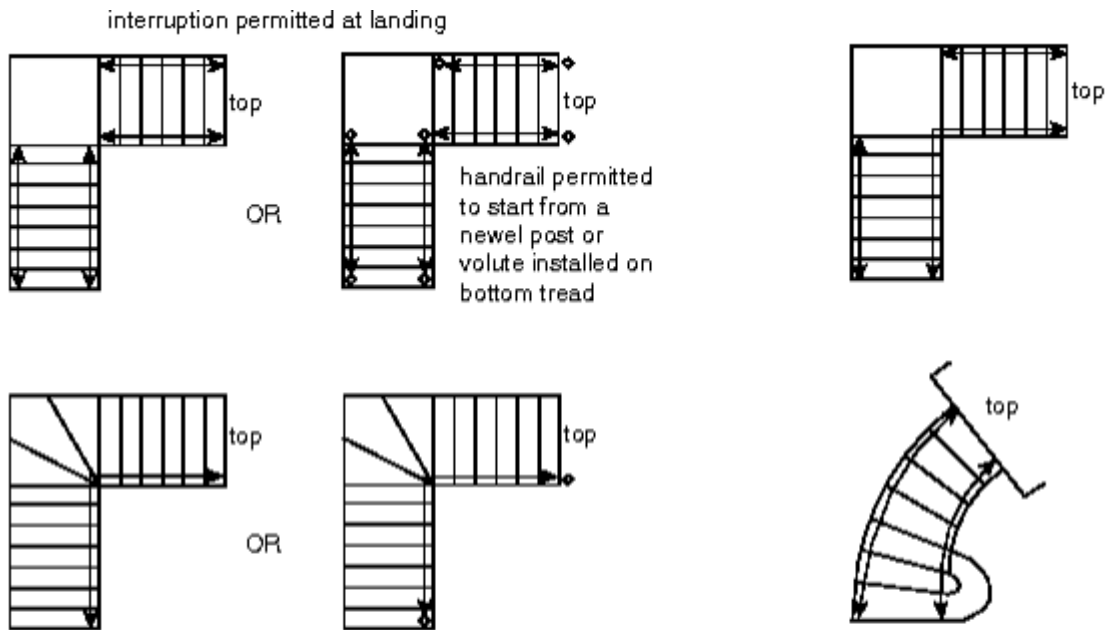
A-9.8.7.1.(2) **Wider Stairs than Required.** The intent of Sentence 9.8.7.1.(2) is that handrails be installed in relation to the required exit width only, regardless of the actual width of the stair and ramp. The required handrails are provided along the assumed natural path of travel to, from and within the building.

A-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.



Stairs serving a single dwelling unit or a house with a secondary suite (including their common spaces):

required handrails continuous throughout length of flight from bottom riser to top riser

Stairs not serving a single dwelling unit or a house with a secondary suite (including their common spaces):

at least one required handrail continuous throughout length of stair, including at landings except where interrupted by doorways

↔ minimum extent of handrail where handrail is required⁽¹⁾
 ♦ newel post

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Figure A-9.8.7.2.

Continuity of handrails on stairs

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.

A-9.8.7.3.(1) Termination of Handrails. Handrails are required to be installed so as not to obstruct pedestrian travel. 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 head 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.

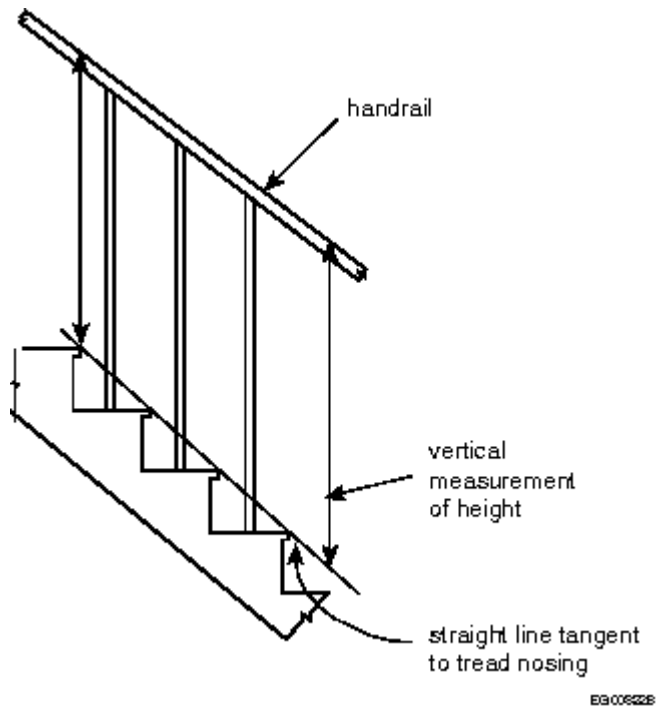


Figure A-9.8.7.4.
Measuring handrail height

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.

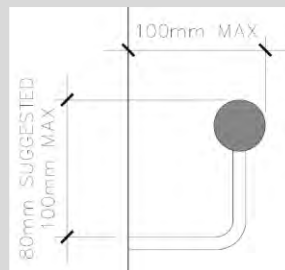


Figure A-9.8.7.6.(1)
Construction below handrails

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 (3), A-9.8.8.5.(4) 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 1.2 m from it. (See Figure A-9.8.8.1.)

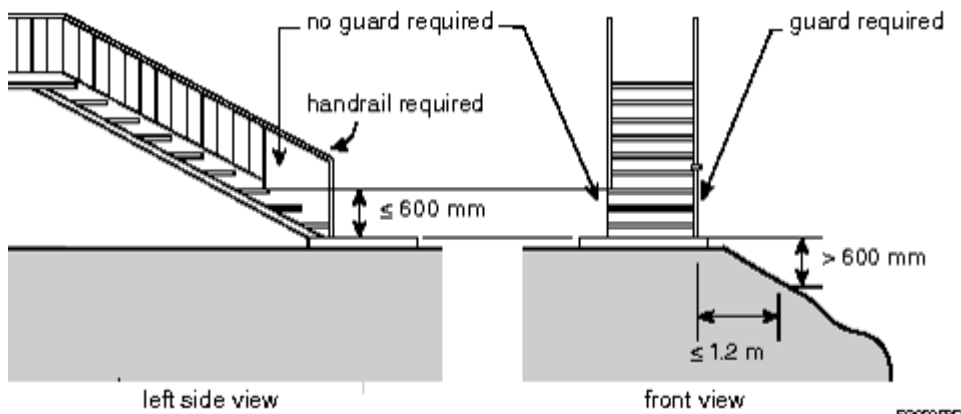


Figure A-9.8.8.1.
Guards for exterior walking surfaces

A-9.8.8.1.(4) Window Fall Prevention. 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 to openable windows in dwelling units and generally those located on the second floor or higher of residential or mixed use buildings.

Once cracked open, some openable windows 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 or by deactivating a spring-loaded button or other mechanism that is not considered a window opening control device (WOCD) that could be inadvertently operated by a young child. A technical description of WOCDs can be found in ASTM F2090, "Standard Specification for Window Fall Prevention Devices With Emergency Escape (Egress) Release Mechanisms."

Examples of WOCDs that can limit window openings to a maximum of 100 mm as required by Clause 9.8.8.1.(4)(b) include, but are not limited to, a fixed-stop lever, a fixed-length cable and a fixed-position stop block. It is important to note that rotary opening mechanisms cannot limit window openings to 100 mm as required by Clause 9.8.8.1.(4)(b) and that windows with such mechanisms cannot act as guards as required by Clause 9.8.8.1.(4)(a), even when the crank handle is removed. Similarly, awning windows with scissor hardware 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 stated in Sentence 9.8.8.1.(4) is recognized as the maximum opening size required to protect small children from falling through open windows. The minimum 900 mm height of the openable portion of windows required by Sentence 9.8.8.1.(5) corresponds to the minimum height of guards required by Sentence 9.8.8.3.(2) as a means of fall protection in residential occupancies.

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 (3).

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.

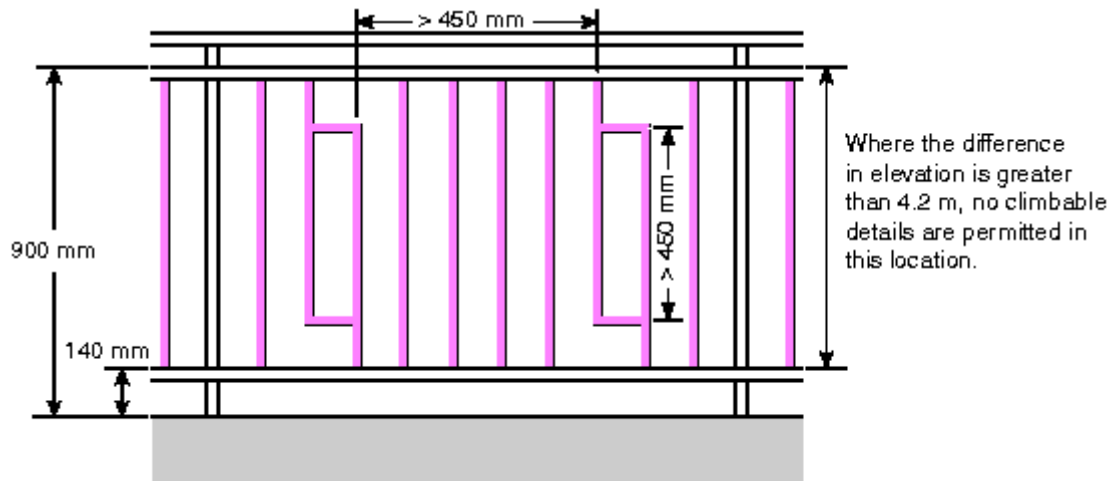
A-9.8.8.3. Minimum Heights. Guard heights are generally based on the waist heights of average persons. Generally, lower heights are permitted in dwelling units because the occupants become familiar with the potential hazards, and situations which lead to pushing and jostling under crowded conditions are less likely to arise.

A-9.8.8.5.(1) and (3) 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.(4) 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.

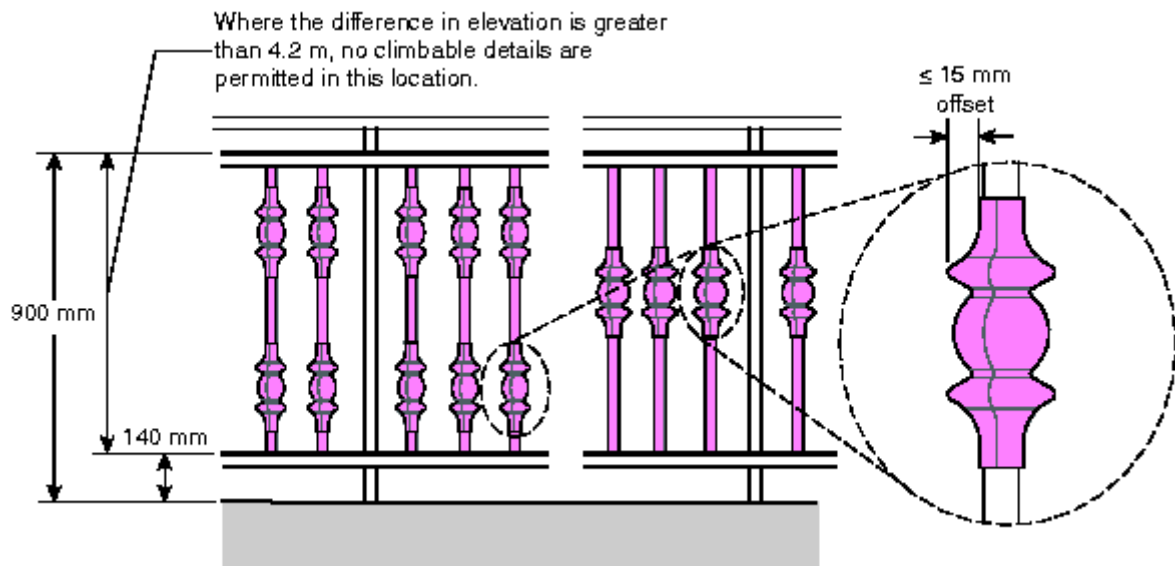


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Figure A-9.8.8.6(1)-A

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.



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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.

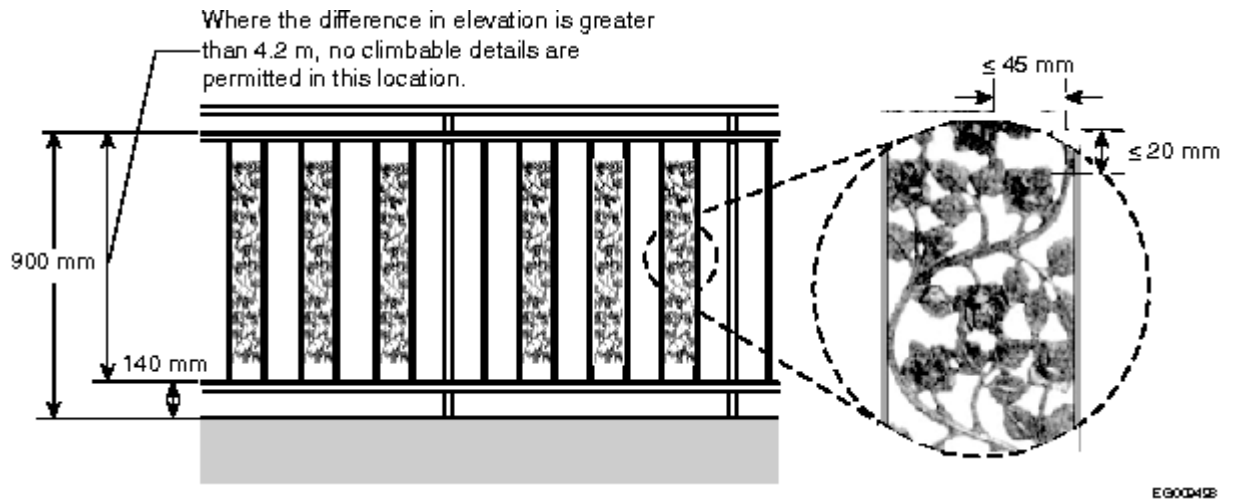


Figure A-9.8.8.6.(1)-C

Example of a guard with spaces 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.

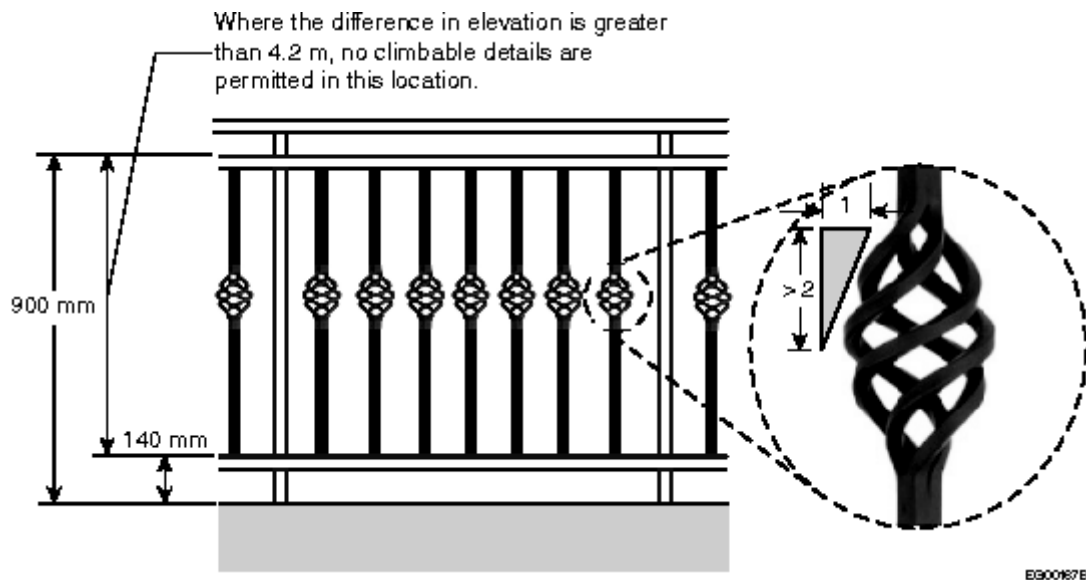


Figure A-9.8.8.6.(1)-D

Example of guard protrusions with a slope greater than 2 in 1

A-9.9.4.5.(1) Openings in Exterior Walls of Exits.

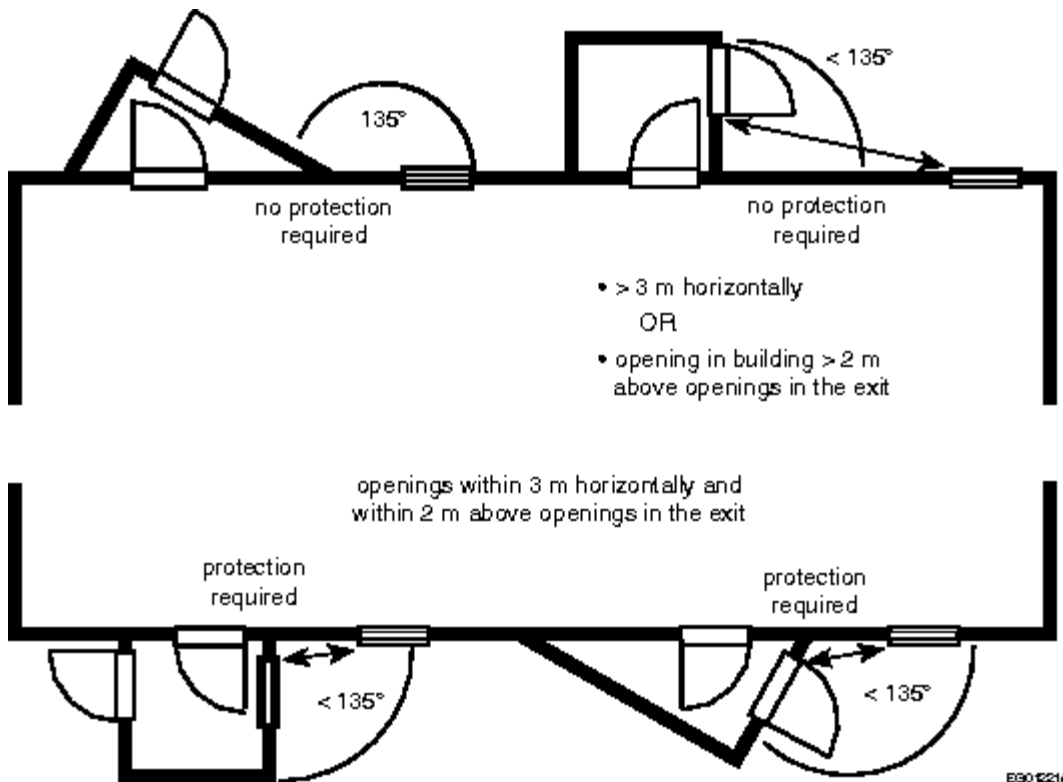


Figure A-9.9.4.5.(1)
Protection of openings in exterior walls of exits

A-9.9.6.4.(6) Garage Doors Used as a Means of Egress. The provisions of Sentence 9.9.6.4.(6) are intended to clarify that garage doors intended for vehicular access are not generally permitted to be used as a means of egress. The exception to this, are garage doors designed in conformance with the requirements of a means of egress. These are typically horizontally swinging garage doors (barn door type).

As with all horizontally swinging egress doors to the exterior, these must consider the potential for snow accumulation or other obstructions which could block or impede their opening in the event of an emergency. This creates practical limitations on the location and width of such doors. Likewise, consideration of door operating conditions must be considered. If automatic hardware for the doors is proposed, this must be readily disengaged or overridden as part of the manual operation of the doors in a manner no more onerous than the disengaging of locking devices that might be placed on any other exterior door from a dwelling unit. Given the variety of concerns that could arise and relative infrequency of such doors, approval by the Chief Building Official is required.

Note that the provisions of this Sentence do not address the related case of swing doors installed in overhead garage doors, which may have additional operational concerns due to the potential for such doors to be jammed during egress or their ability to satisfy accessibility needs. Such cases are not explicitly permitted by the provisions of this By-law.

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 a suite that is not sprinklered 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 a suite that is not sprinklered 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

Article 9.9.10.1. 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.

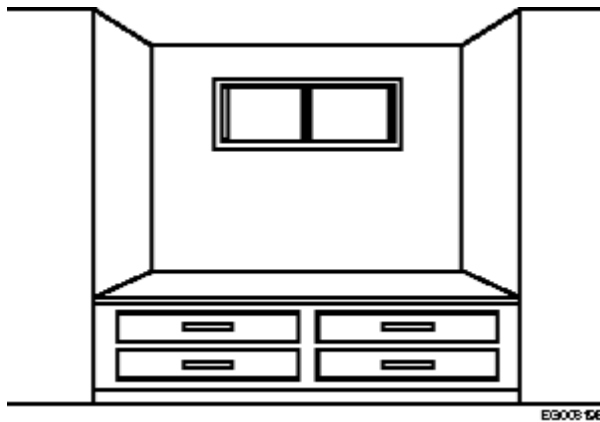
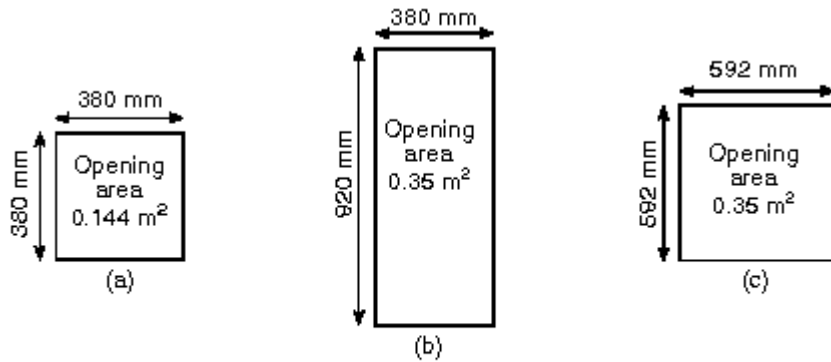


Figure A-9.9.10.1.(1)
Built-in furniture to improve access to a window

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))



(a) conforms to opening height and width requirements; does not conform to opening area requirements

(b) and (c) conform to height, width and opening area requirements

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Figure A-9.9.10.1(2)

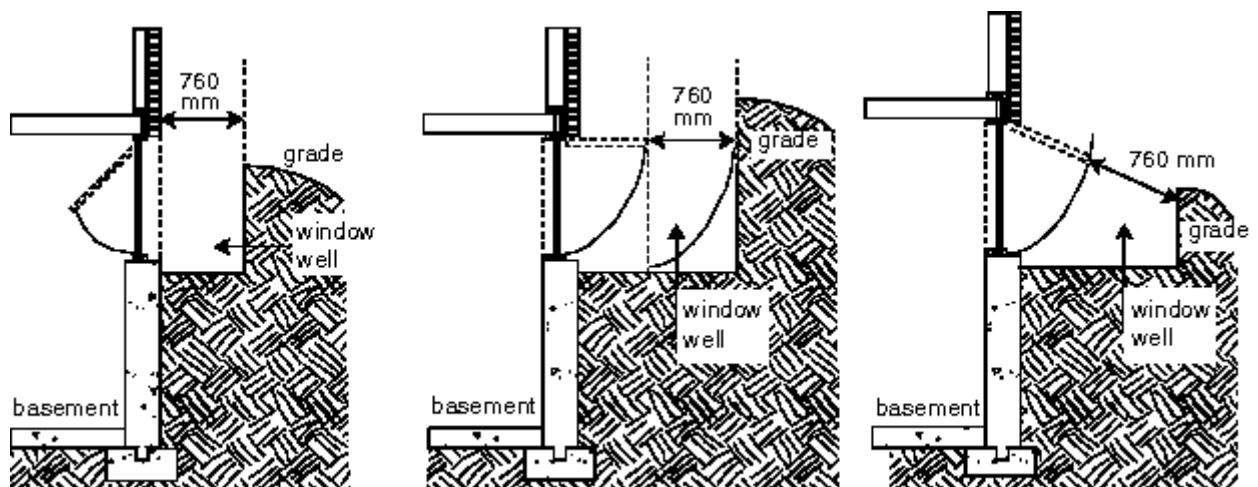
Window opening areas and dimensions

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.



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Figure A-9.9.10.1(3)

Windows providing a means of escape that open into a window well

A-9.9.11.5.(1)(d) **Colour Contrast.** The identification of floors and other signs intended to facilitate orientation for persons with vision loss 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-9.10.1.4.(1) **Commercial Cooking Equipment.** Part 6 refers to NFPA 96, “Standard for 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.(1)(c) **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 Code users and do not limit the number of assemblies permitted to those in the Tables. The notes to Tables 9.10.3.1.-A and 9.10.3.1.-B are mandatory parts of the Tables and must be used by designers in complying with the design requirements of a particular assembly. 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 the important 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).

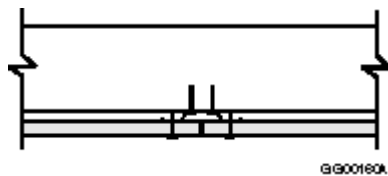


Figure A-9.10.3.1.-A
Single layer butt joint details

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.

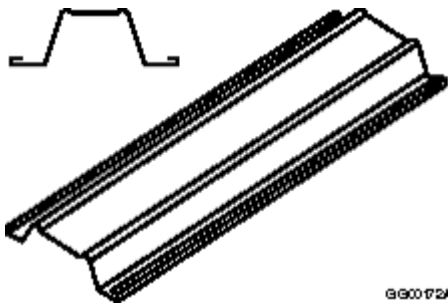


Figure A-9.10.3.1.-C
Example of steel furring channel

Note to Figure A-9.10.3.1.-C:

- (1) Figure is for illustrative purposes only and is not to scale.

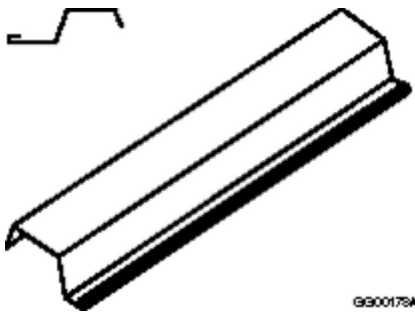


Figure A-9.10.3.1.-D
Example of resilient metal channel

Note to Figure A-9.10.3.1.-D:

- (1) Figure is for illustrative purposes only and is not to scale.

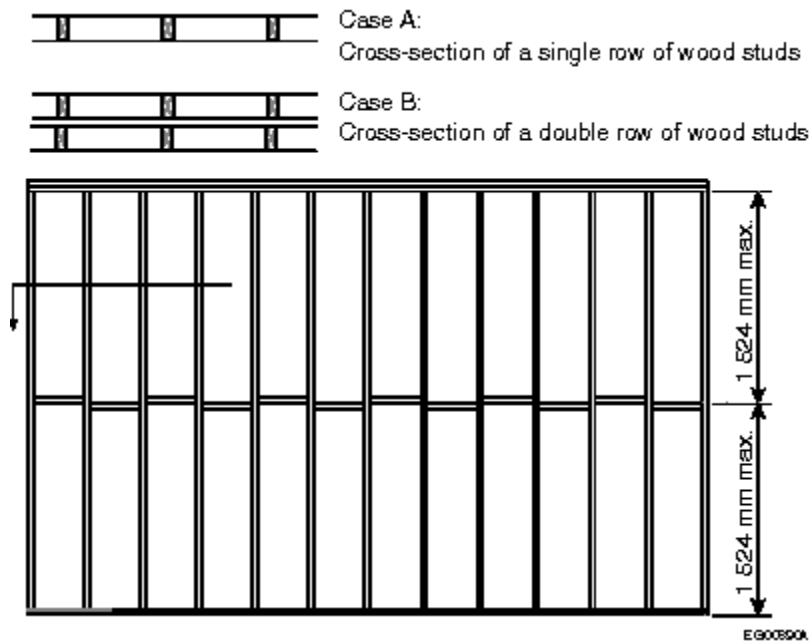


Figure A-9.10.3.1-E
Blocking for lightweight wood-frame walls with a single or double row of studs

Note to Figure A-9.10.3.1.-E:

(1) Figure is for illustrative purposes only and is not to scale.

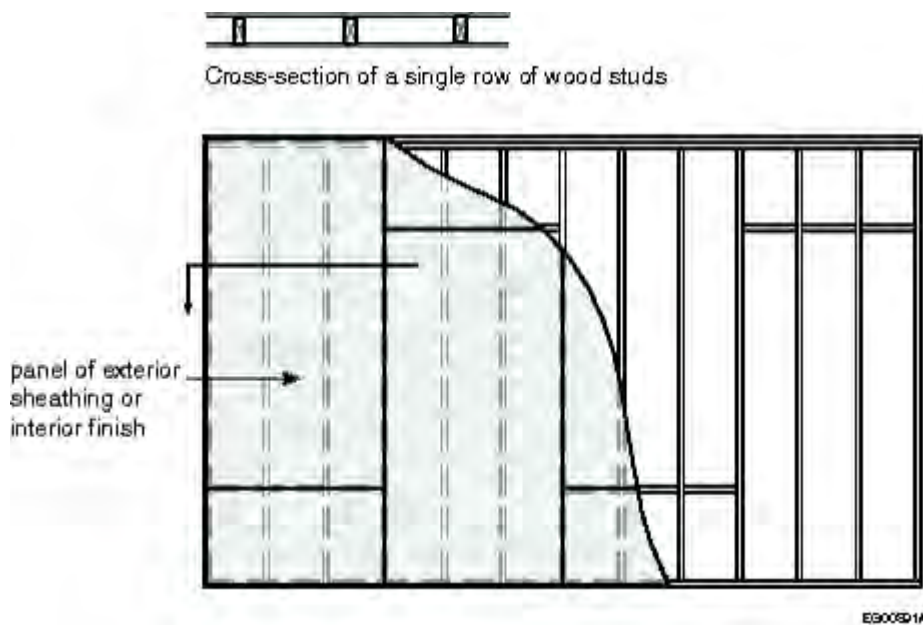


Figure A-9.10.3.1-F
Vertical application of exterior wall sheathing or interior wall finish with all joints backed with lumber having the same dimensions as the framing members

Note to Figure A-9.10.3.1.-F:

(1) Figure is for illustrative purposes only and is not to scale.

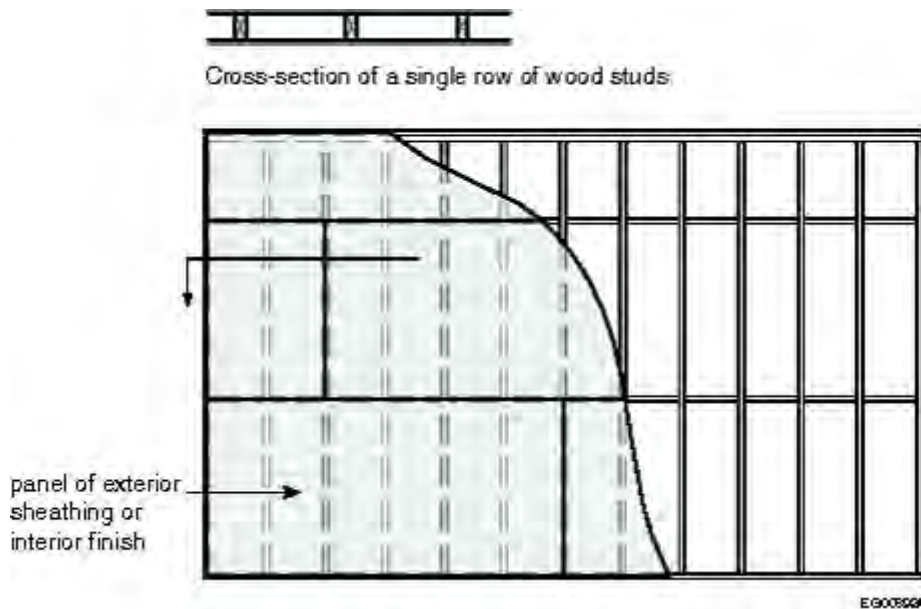


Figure A-9.10.3.1.-G

Horizontal application of exterior wall sheathing or interior wall finish with all joints backed with lumber having the same dimensions as the framing members

Note to Figure A-9.10.3.1.-G:

(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-9.10.8.3.(2) **Light-frame Construction.** Light-frame walls, columns, arches and beams do not include heavy timber elements or masonry or concrete construction.

A-9.10.9.3.(2) **Openings in Fire Separations with a 15 min Fire-Resistance Rating to be Protected with Closures.** Doors described in Sentence 9.10.9.3.(2) are deemed to provide a minimum 20 min fire-protection rating, which is considered an acceptable level of protection against the spread of fire in a house with a secondary suite. They are not required to be marked to identify conformance to CAN/ULC-S113, "Standard Specification for Wood Core Doors Meeting the Performance Required by CAN/ULC-S104 for Twenty Minute Fire Rated Closure Assemblies," as is the case for solid-core doors installed in fire separations.

A-9.10.9.6.(1) **Penetrations of Fire Separations.** Sentence 9.10.9.6.(1), like Article 3.1.9.1., is intended to ensure that the integrity of fire separations is maintained where they are penetrated by various types of service equipment.

For buildings regulated by Part 3, firestop 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.

A similar approach is applied to buildings regulated by Part 9 when complying with Clause 9.10.9.6.(1)(a). In addition, because of the type of construction normally used for Part 9 buildings, it is assumed that the requirement to maintain the integrity of the fire separation is satisfied by the use of generic firestop materials such as mineral wool, gypsum plaster or Portland cement mortar to seal penetrations in accordance with Clause 9.10.9.6.(1)(c).

The use of the terms "tightly fitted" and "cast in place" in Clause 9.10.9.6.(1)(b) is intended to emphasize that there are to be no gaps between the building service or penetrating item and the membrane or assembly it penetrates.

A-9.10.9.8.(1) **Large Recessed Outlet Boxes.** Outlet boxes that exceed the area limits specified in Sentence 9.10.9.8.(2) or (3) do not need to be sealed at the penetration by a firestop in accordance with Sentence 9.10.9.8.(1) if they are installed in a recessed enclosure with a construction that maintains the continuity of the fire-resistance rating of the fire separation or membrane. Any penetrations of the enclosure by wiring or cables must comply with all applicable requirements.

A-9.10.9.8.(3)(a)(i) **Separating Enclosures.** The fire block material separating the outlet box from the adjacent space within the assembly should span the framing members such that all four sides and the back of the outlet box are enclosed by a membrane or framing member conforming to Article 9.10.16.3. Any penetrations of the enclosure by wiring or cables must comply with all applicable requirements. (See also Note A-3.1.11.7.(7).)

A-9.10.9.18.(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.**

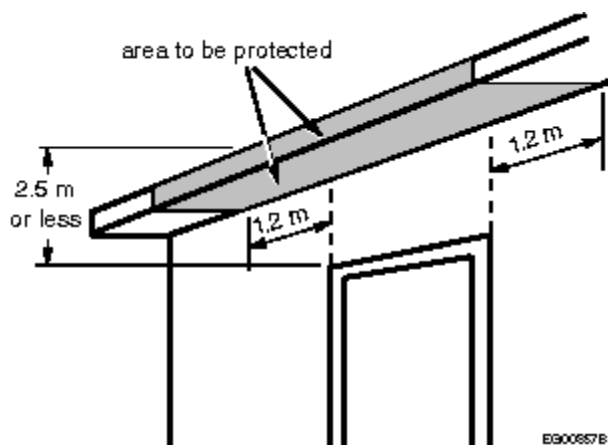


Figure A-9.10.12.4.(1)

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, "Standard Specification for 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.

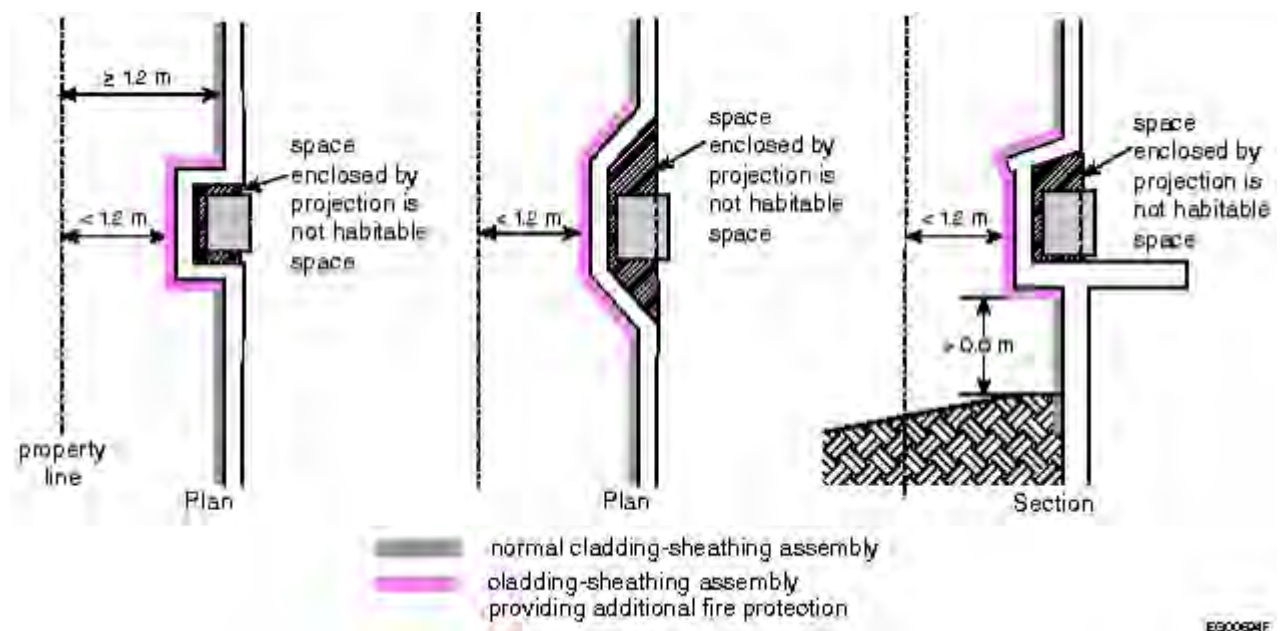
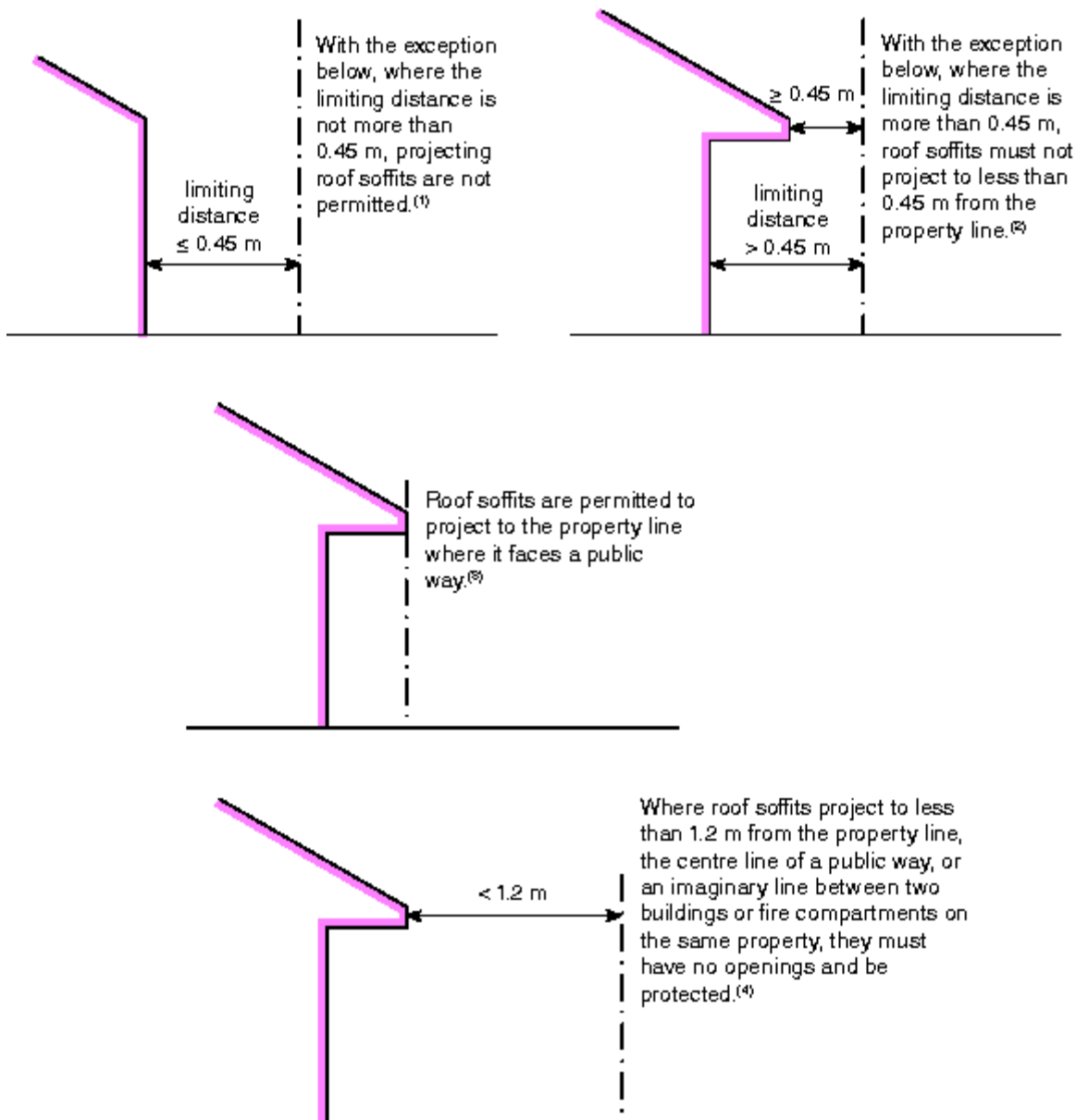


Figure A-9.10.14.5.(8)

Protection at projections

A-9.10.14.5.(11) and 9.10.15.5.(10) Roof Soffit Projections.



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Figure A-9.10.14.5.(11) and 9.10.15.5.(10)

Location and protection of projecting roof soffits

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).
- (4) See Sentences 3.2.3.6.(5), 9.10.14.5.(12) and 9.10.15.5.(11).

A-9.10.15.1.(1) Application of Subsection 9.10.15. 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 predicated upon the idea 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 glazed 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 glazed openings permitted in each portion of the exposing building face according to the limiting distance for that portion.
6. Calculate the maximum area of glazed 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 glazed 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 glazed 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.

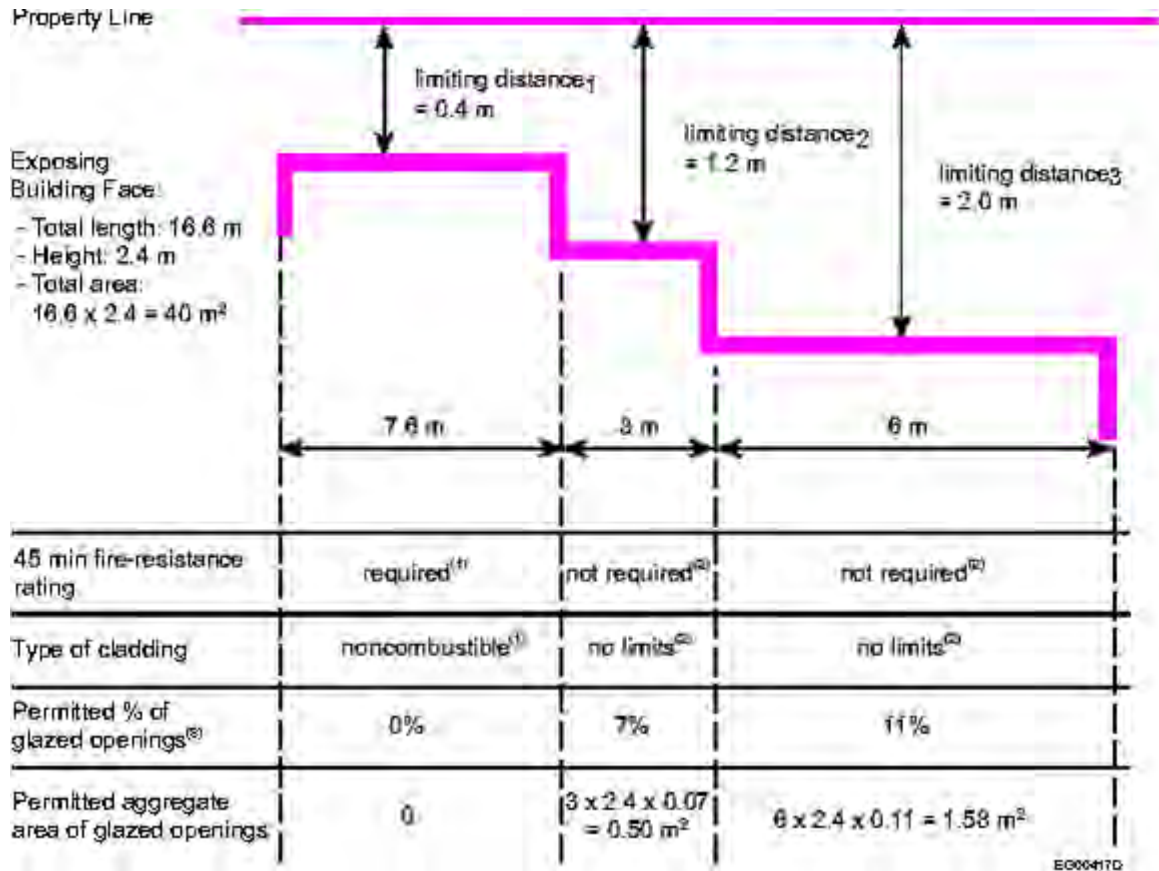


Figure A-9.10.15.4.(2)-A

Example of determination of criteria for the exposing building face of a staggered wall of a house (plan view)

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).

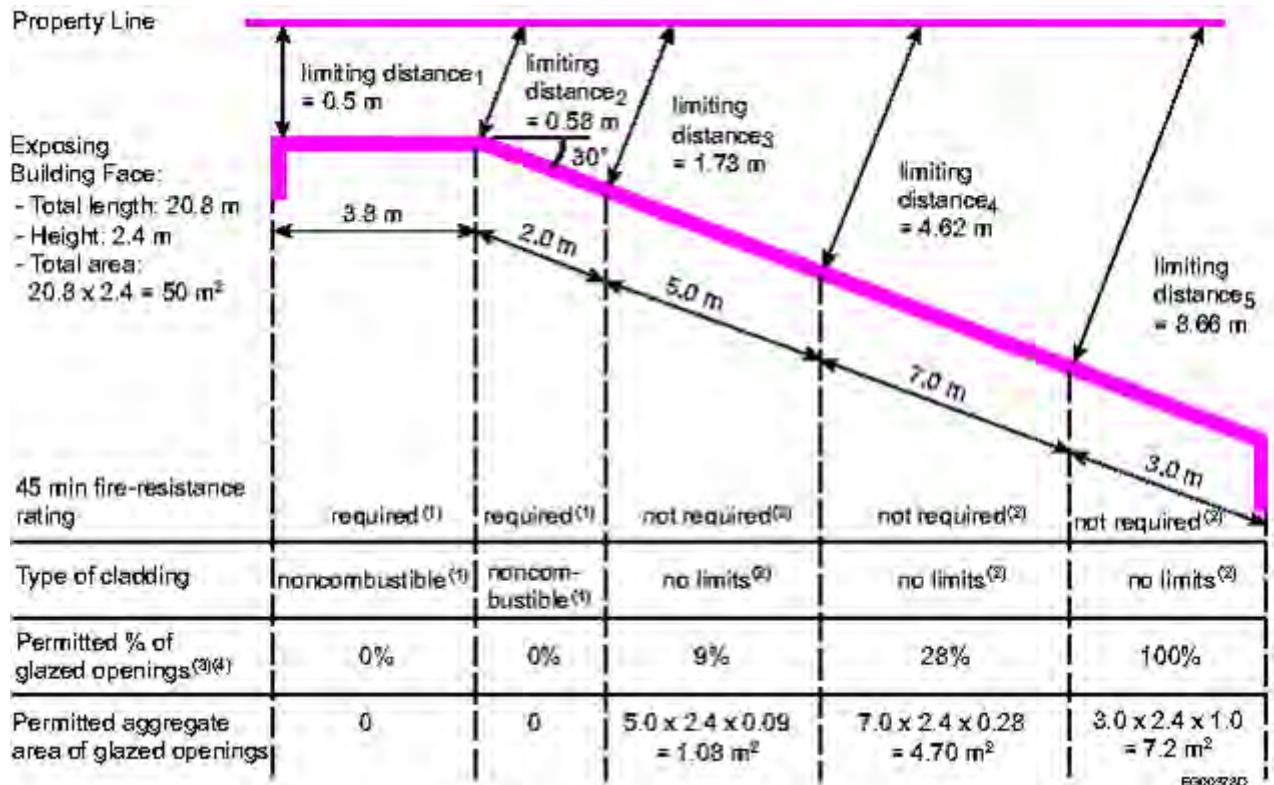


Figure A-9.10.15.4.(2)-B

Example of determination of criteria for the exposing building face of a skewed wall of a house with some arbitrary division of the wall (plan view)

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.

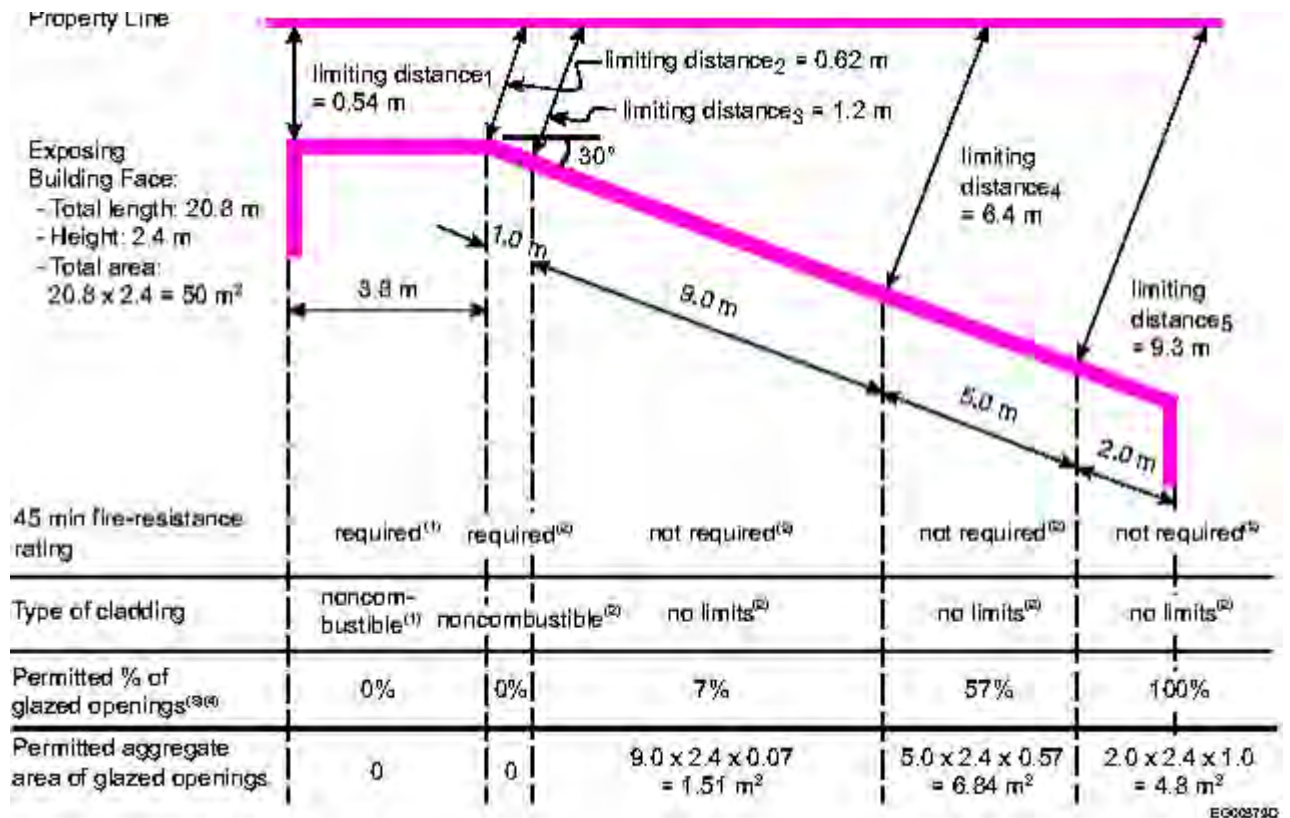


Figure A-9.10.15.4.(2)-C

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 (plan view)

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).

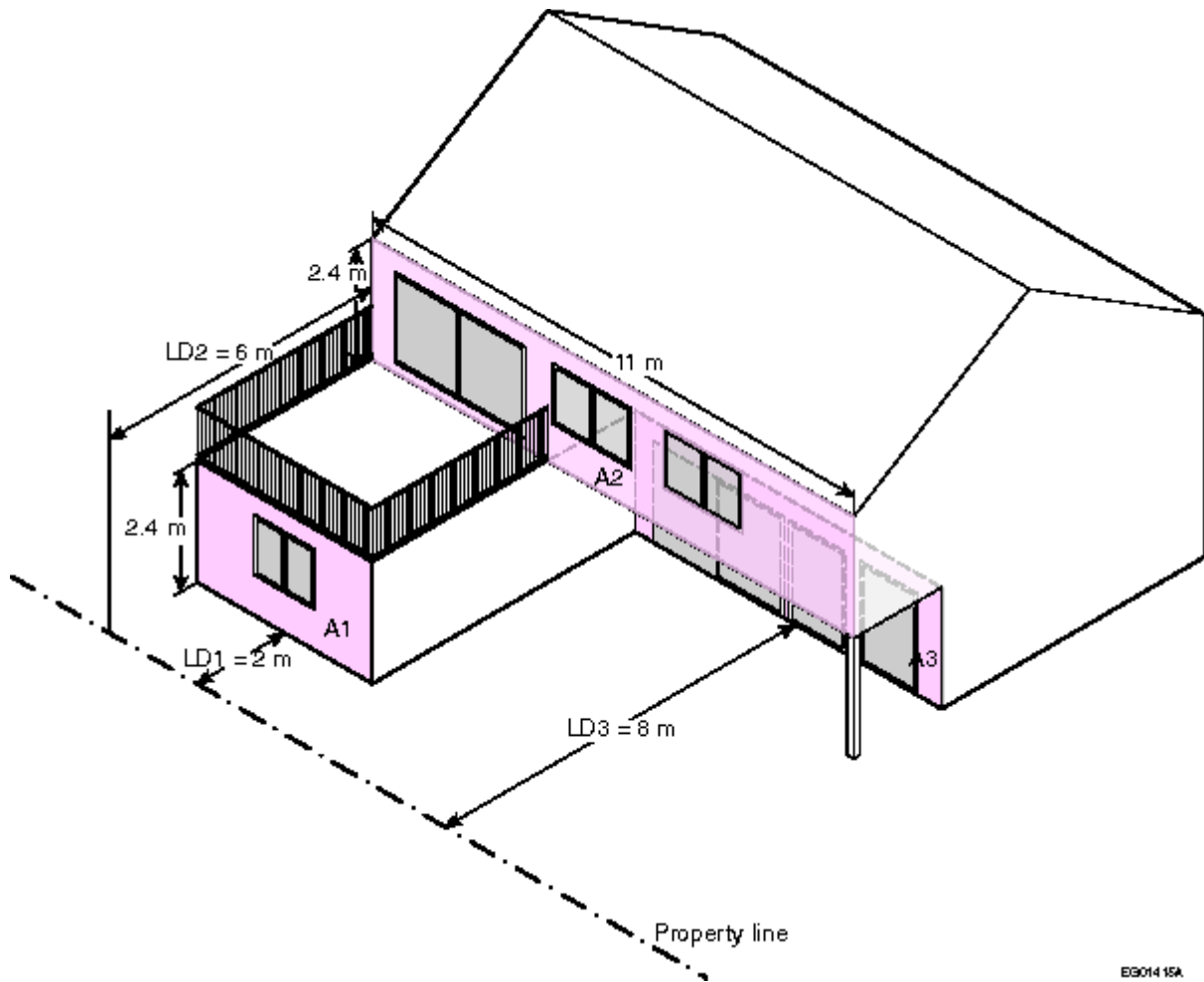
(3) See Table 9.10.15.4., Subclause 9.10.15.2.(1)(b)(iii) and Sentence 9.10.15.4.(2).

(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 glazed openings. Interpolation can only be used for limiting distances greater than 1.2 m.

Table A-9.10.15.4.(2)

Example of Determination of Maximum Area of Glazed Openings for the Exposing Building Face (EBF) of a House with a Setback Wall Using Figure A-9.10.15.4.(2)-D

Portion of EBF	Area of Each Portion of EBF	Limiting Distance of Each Portion of EBF	Permitted % of Glazed Openings Based on Total Area of EBF (52.8 m ²) and Limiting Distance of Each Portion of EBF Using Table 9.10.15.4.	Permitted Area of Glazed Openings for Each Portion of EBF
A1	4 m × 2.4 m = 9.6 m ²	LD1 = 2 m	10%	9.6 m ² × 10% = 0.96 m ²
A2	11 m × 2.4 m = 26.4 m ²	LD2 = 6 m	57%	26.4 m ² × 57% = 15.05 m ²
A3	7 m × 2.4 m = 16.8 m ²	LD3 = 8 m	100%	16.8 m ² × 100% = 16.8 m ²



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Figure A-9.10.15.4.(2)-D

Example of determination of criteria for the exposing building face of a house with a setback wall (perspective view)

Note to Figure A-9.10.15.4.(2)-D:

(1) LD = limiting distance; A = area.

A-9.10.15.4.(11) Small Attached Carports or Garages Ancillary to a Residential Building An attached carport or open-air storage garage located beneath building floor area and supporting the storage of vehicles form a part of the building regardless of whether or not this is substantially open. As such, they are required to comply with the spatial separation requirements of the Building By-law, typically Division B, Subsections 9.10.14. or 9.10.15.

These types of storage garages are typically small, and serve small multiplex and duplex buildings, located on a small site with severe competition for ground level access. Where these types of garages can be shown to serve a limited number of vehicles and are substantially open, the Chief Building Official may permit 100% unprotected openings where the design incorporates the additional fire safety features described in Sentence 9.10.15.4.(11).

Cross Ventilation

The fire protection requirements of Sentence 9.10.15.4.(11) recognize that the open-air nature of attached carports or open-air storage garages, which are not typically subject to the same degree of fire intensity and smoke entrapment they are within an enclosed interior space. This assumption is dependent upon the degree of openness and the availability of cross-ventilation in order to ensure that the products of combustion are not confined, and which could increase the severity of a fire. Consequently, the arrangement of the parking should be such that it avoids the creation of barriers that would impede the free movement of the products of combustion resulting from a fire.

Spatial Separation

Multiplex buildings are fully residential, and generally contain a small number of suites with a combined floor area consistent with traditional detached houses or duplexes. Sprinklers are already required under covered areas where storage is expected by NFPA 13 and its derivative standards. The provisions of Sentence 9.10.15.4.(11) provide for supplemental minimum water delivery requirements that are broadly consistent with the protection of storage garages in other larger multi-family residential buildings. This is intended to contain a fire and its effect to the area of origin, thereby reducing the concerns related to unprotected openings.

Resiliency and Subsidiary Uses

The enhanced fire separation and sprinkler requirements espoused by these provisions are intended to limit the likelihood of fire spread into the attached residential units. This is intended to provide greater containment of a fire until the fire department can arrive and begin suppression operations and may also reduce the likelihood of occupants being displaced following a fire. In this regard, Clause 9.10.15.4.(11)(c) identifies the requirement for a minimum 1 h fire separation, and therefore structural elements supporting the fire separation, such as columns and beams, are also required to be protected.

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).

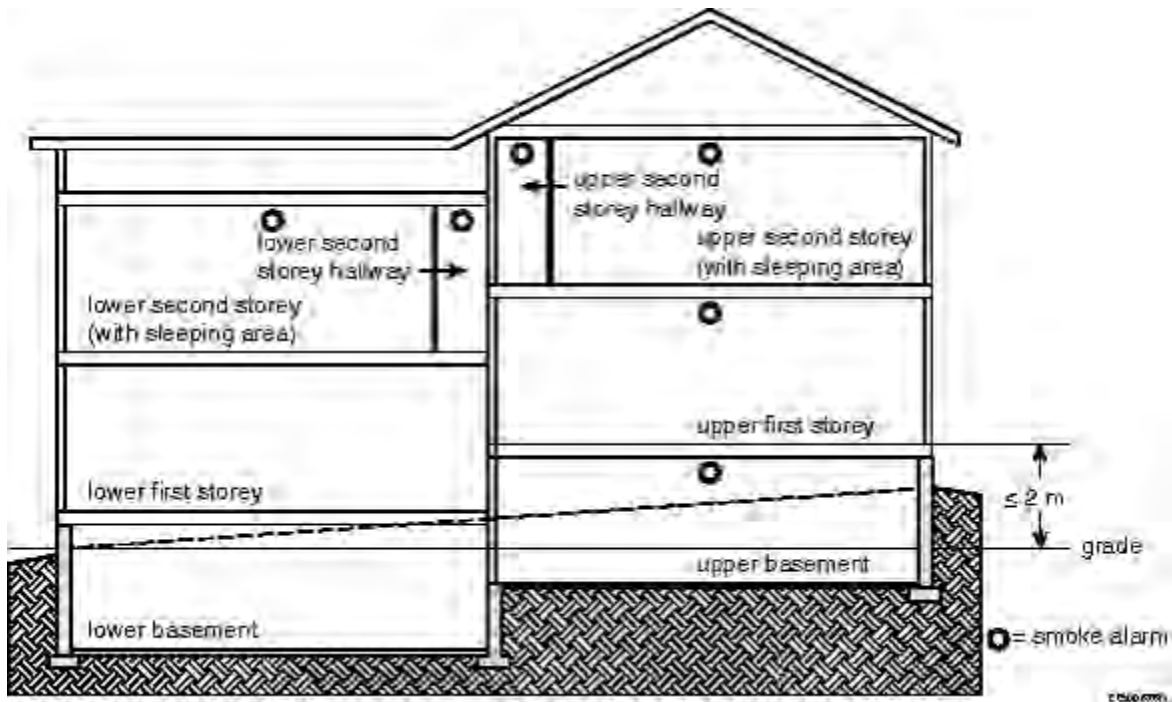


Figure A-9.10.19.3.(1)

Location of smoke alarms in a two-storey split-level dwelling unit

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," and CSA B149.1, "Natural gas and propane installation code," 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 NBC 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.

Figure A-9.10.22. illustrates the minimum clearances addressed in Subsection 9.10.22.

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.

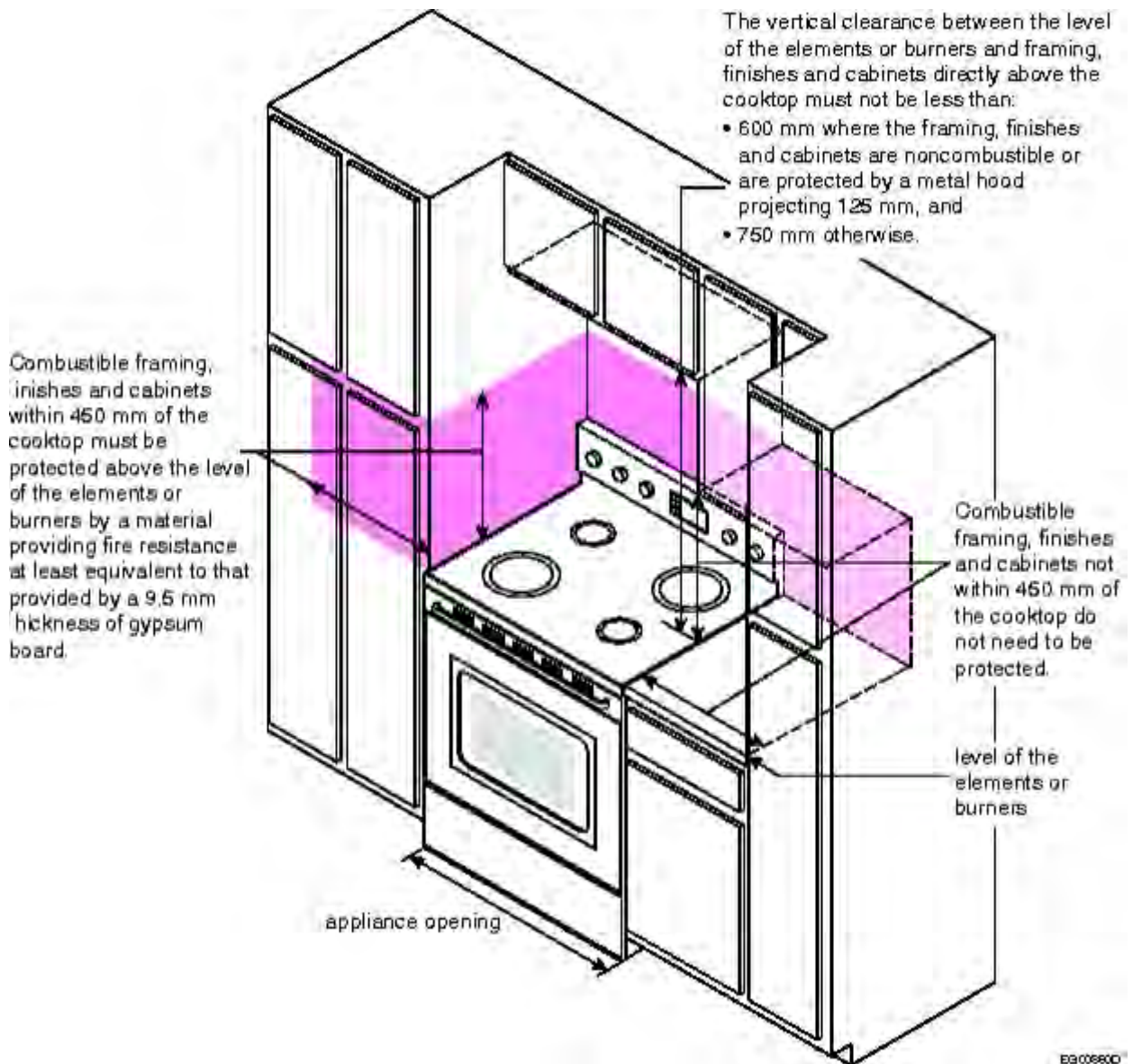


Figure A-9.10.22.

Minimum clearances from cooktops and protection of 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.

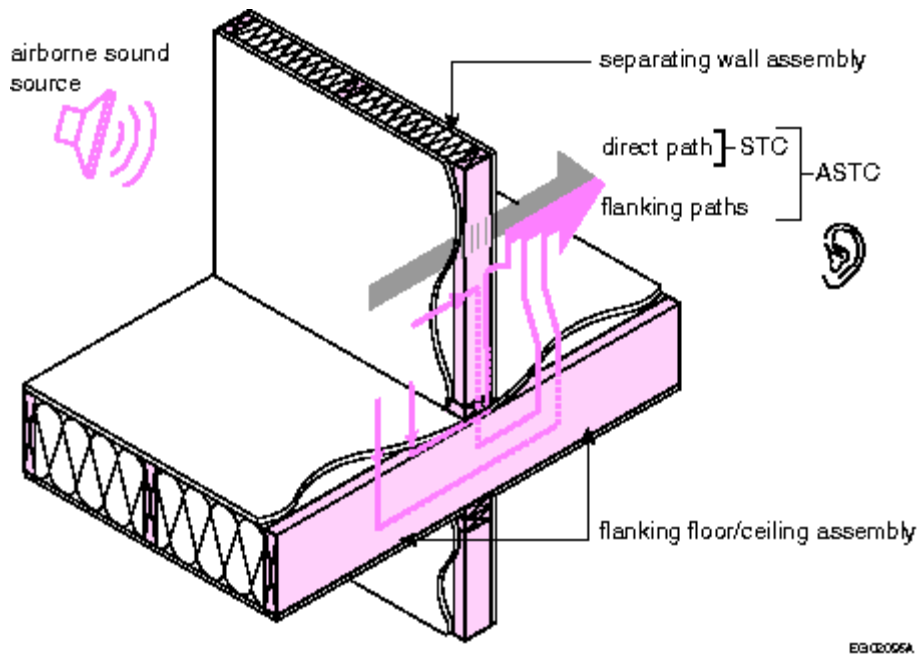


Figure A-9.11.-A

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.

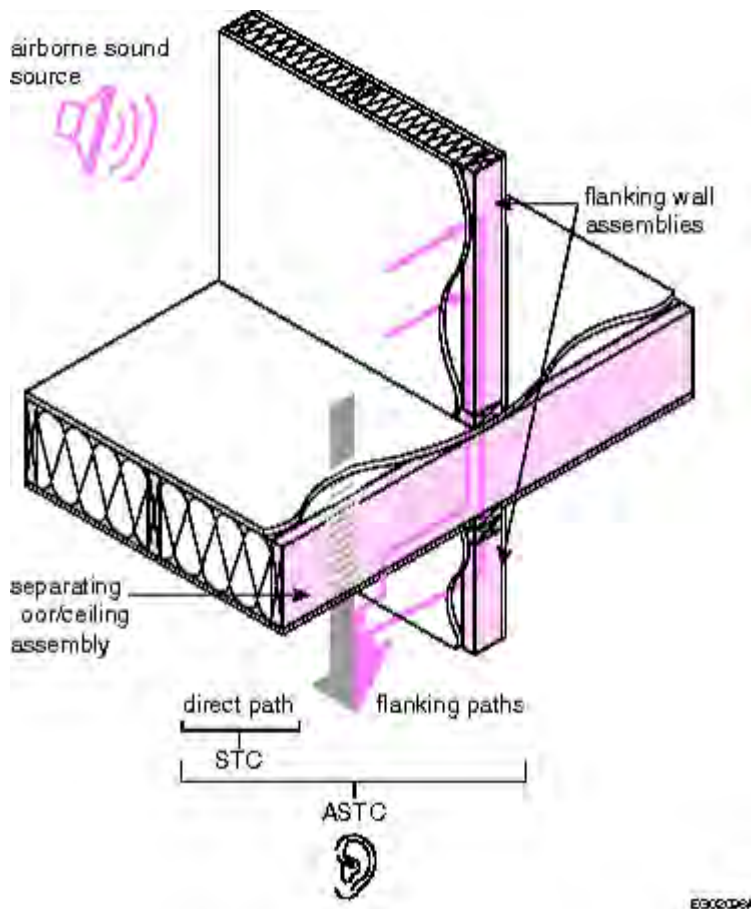


Figure A-9.11.-B

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 Code.

The NRC report entitled "Best Practice Guide on Fire Stops and Fire Blocks and their Impact on Sound Transmission," provides additional information regarding the possible impacts of fire protection measures on sound transmission.

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 E336, "Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings," gives a complete measurement. A simpler and less expensive method is presented in ASTM E597,

“Practice for 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 E336. 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 E492, “Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine,” and ASTM E1007, “Standard Test Method for 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-9.11.1.1.(2) Sound Transmission in Houses with a Secondary Suite. Controlling sound transmission between dwelling units is important to the occupants' health and well-being. Although this may be difficult to achieve in an existing building, it is nevertheless necessary that a minimum level of sound transmission protection be provided between the dwelling units in a house with a secondary suite. A somewhat reduced level of performance is acceptable in the case of secondary suites because the occupants of the house containing a secondary suite are only affected by the sound of one other unit and, in many cases, it is the owner of the house who will decide on the desired level of protection. Sound resistance can be improved by selecting furnishings and finishings that absorb sound, such as carpet.

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.

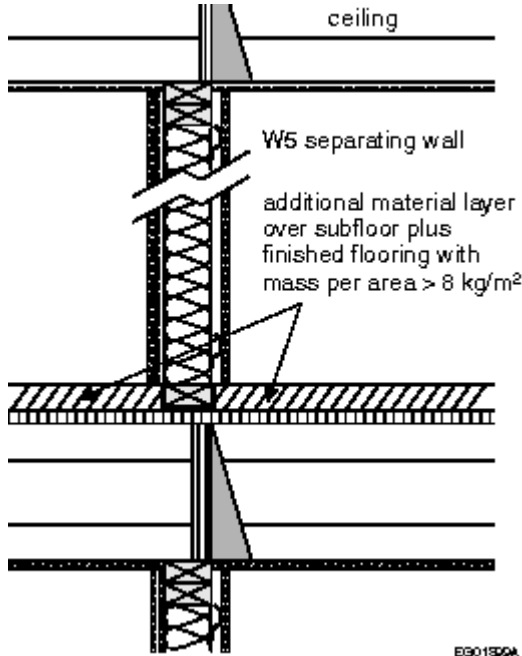
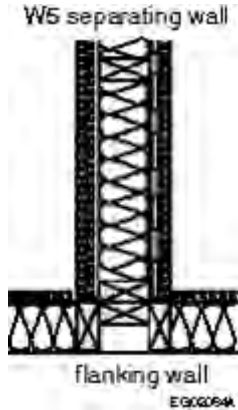
A-9.11.1.4. Adjoining Constructions. Tables A-9.11.1.4.-A to A-9.11.1.4.-D present generic options for the design and construction of junctions between separating and flanking assemblies. Constructing according to these options is likely to meet or exceed an ASTC rating of 47. Other designs may be equally 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.

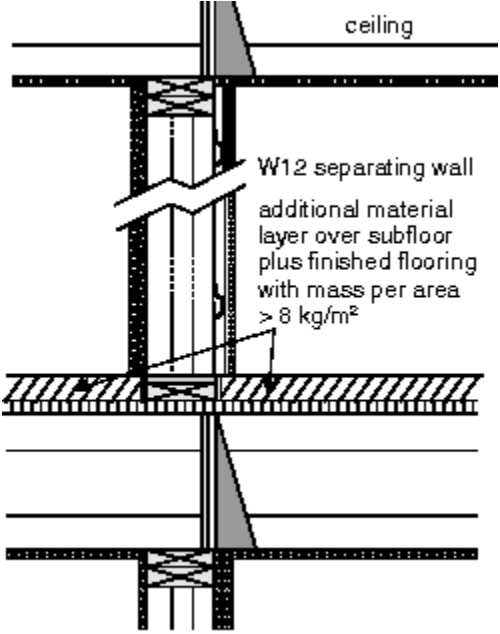
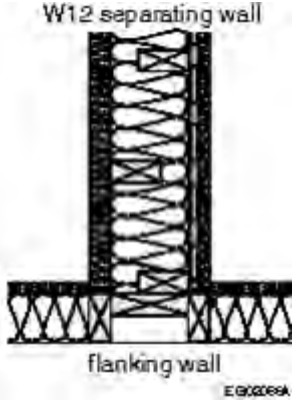
Table A-9.11.1.4.-A presents compliance options for the construction of separating wall assemblies with flanking floor, ceiling and wall assemblies in horizontally adjoining spaces.

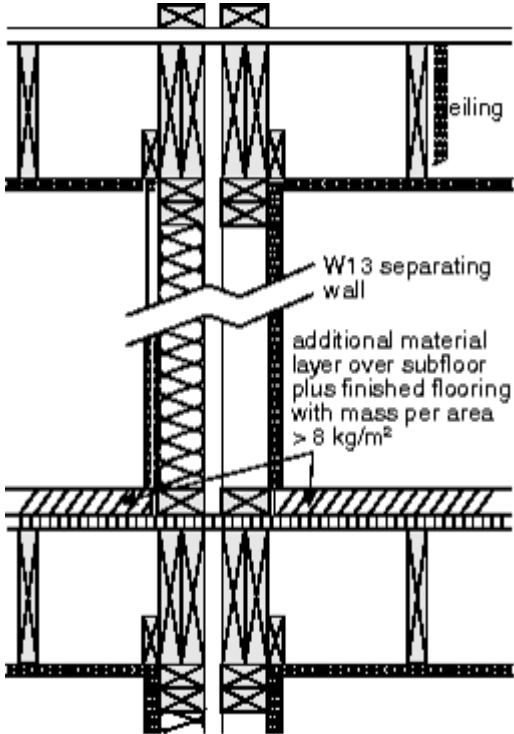
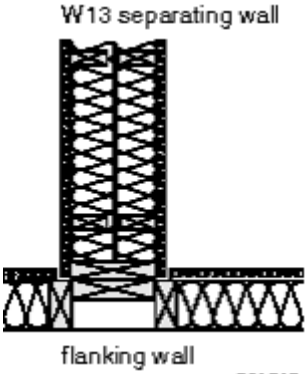
Table A-9.11.1.4.-A

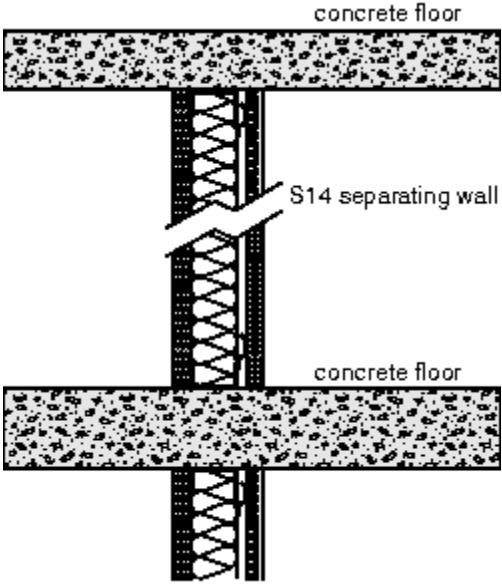
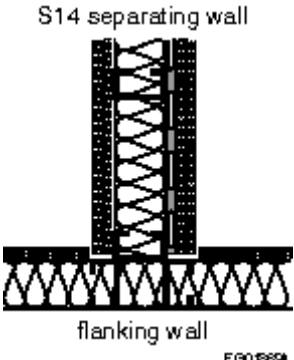
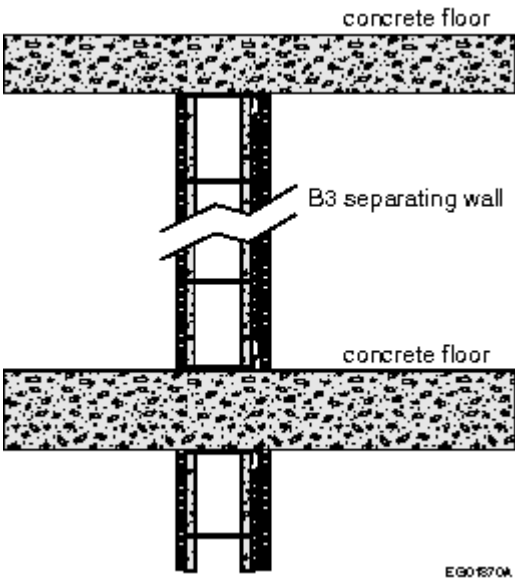
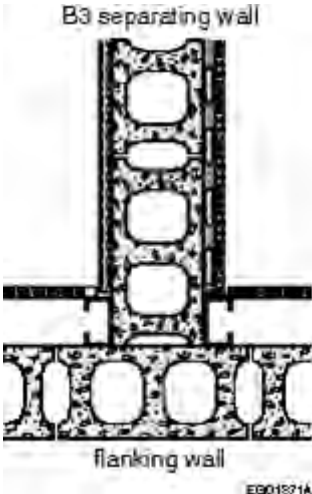
Options for the Design and Construction of Junctions and Flanking Surfaces Between Separating Wall Assemblies in Horizontally Adjoining Spaces for Compliance with Clause 9.11.1.1.(1)(b)

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 ^(a) to Address Horizontal Sound Transmission Paths		
	Bottom Junction (between separating wall	Top Junction (between separating wall and	Side Junctions (between separating wall and flanking

	and flanking floors)	flanking ceiling)	walls)
W4, W5, W6 (single stud) W8, W9, W10, W11, W12 (staggered studs)	- 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^(a) 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)	- ceiling is framed with wood joists, wood I-joists, or wood trusses, with or without absorptive material^(a) in cavities - ceiling joists or trusses are oriented perpendicular to separating wall but are not continuous across junction (loadbearing case) or parallel to junction (non-loadbearing case) - gypsum board ceiling is fastened directly to bottom of ceiling framing or on resilient metal channels^(a)	- gypsum board on flanking walls ends or is cut at separating wall and is fastened directly to framing or on resilient metal channels^(a) - flanking wall is framed with single row of wood studs, staggered studs on a single $38 \text{ mm} \times 140 \text{ mm}$ plate, or 2 rows of $38 \text{ mm} \times 89 \text{ mm}$ wood studs on separate $38 \text{ mm} \times 89 \text{ mm}$ plates, with or without absorptive material^(a) in cavities - flanking wall framing is structurally connected to separating wall and terminates where it butts against framing of separating wall or is continuous across junction
	Example Showing Side View of Bottom and Top Junctions		Example Showing Plan View of Side Junctions
			
	Example Showing Side View of Bottom and Top Junctions		Example Showing Plan View of Side Junctions

	 ceiling W12 separating wall additional material layer over subfloor plus finished flooring with mass per area $> 8 \text{ kg/m}^2$ EG02037A	 W12 separating wall flanking wall EG02038A
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 ($\geq 17 \text{ mm}$ thick) • floor is framed with wood joists, wood I-joists or wood trusses spaced $\geq 400 \text{ mm o.c.}$, with or without absorptive material^(a) 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^(a) 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 on resilient metal channels^(a)
	Example Showing Side View of Bottom and Top Junctions	Example Showing Plan View of Side Junctions

	 ceiling W13 separating wall additional material layer over subfloor plus finished flooring with mass per area $\geq 8 \text{ kg/m}^2$ EGO1596A		 W13 separating wall flanking wall EGO1596A
S1 to S15	- F1 concrete floor assembly from Table 9.10.3.1.-B with mass per area not less than 300 kg/m^2 (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/m^2 (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^(a) - flanking wall consists of steel framing (loadbearing or non-loadbearing steel studs) or concrete blocks with mass per area not less than 200 kg/m^2 (e.g. normal-weight hollow core concrete block units^(a) with a gypsum board lining supported on framing providing a cavity not less than 50 mm deep) - with or without absorptive material^(a) in cavities behind gypsum board of flanking walls
	Example Showing Side View of Bottom and Top Junctions		Example Showing Plan View of Side Junctions

			
B1 to B10	• same options as stated above for walls S1 to S15	• same options as stated above for walls S1 to S15 • junction at top of concrete block assembly is loadbearing or non-loadbearing resilient joint	• same options as stated above for walls S1 to S15
	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/m³. See Table Notes (5) and (8) of Table 9.10.3.1.-A and Table 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 C754, "Standard Specification for 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/m³; 190 mm hollow core units are 53% solid, providing a wall mass per area over 200 kg/m²; 140 mm hollow core units are 75% solid, providing a wall mass per area over 200 kg/m².

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⁽³⁾ • Support gypsum board panels of flanking walls on resilient metal channels⁽³⁾
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⁽³⁾ • Support gypsum board panels of flanking walls on resilient metal channels⁽³⁾ • 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⁽³⁾ 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⁽³⁾ 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 C754, "Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products," describes the installation of resilient metal channels.

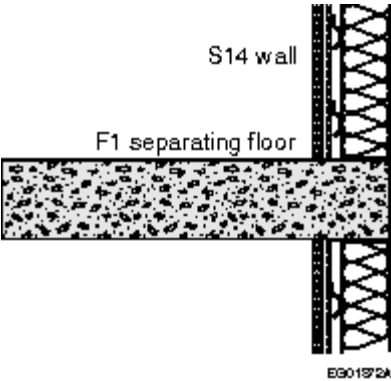
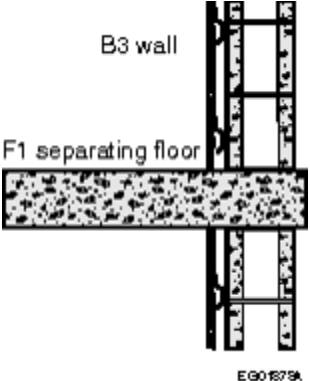
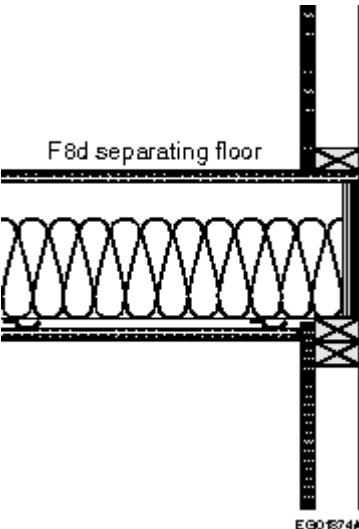
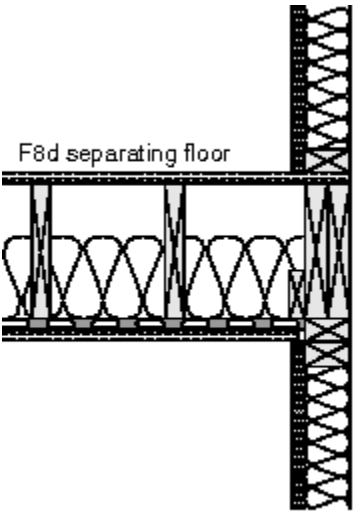
⁽²⁾ Sound absorptive material is porous (closed-cell foam was not tested) and includes fibre processed from rock, slag, glass or cellulose fibre with a maximum density of 32 kg/m³. See Table Notes (5) and (8) of Table 9.10.3.1.-A and Table Note (5) of Table 9.10.3.1.-B for additional information.

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/m³. See Table Notes (5) and (8) of Table 9.10.3.1.-A and Table 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 C754, "Standard Specification for 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/m³; 190 mm hollow core units are 53% solid, providing a wall mass per area over 200 kg/m²; 140 mm hollow core units are 75% solid, providing a wall mass per area over 200 kg/m².

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 Table Notes (5) and (8) of Table 9.10.3.1.-A and Table 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 C754, "Standard Specification for 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-Table 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	700–1 000	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			
Medium-density fibreboard (MDF)	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	2 015–2 380	80.6–119.0
Gypsum concrete	25.0	1 840–1 870	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.

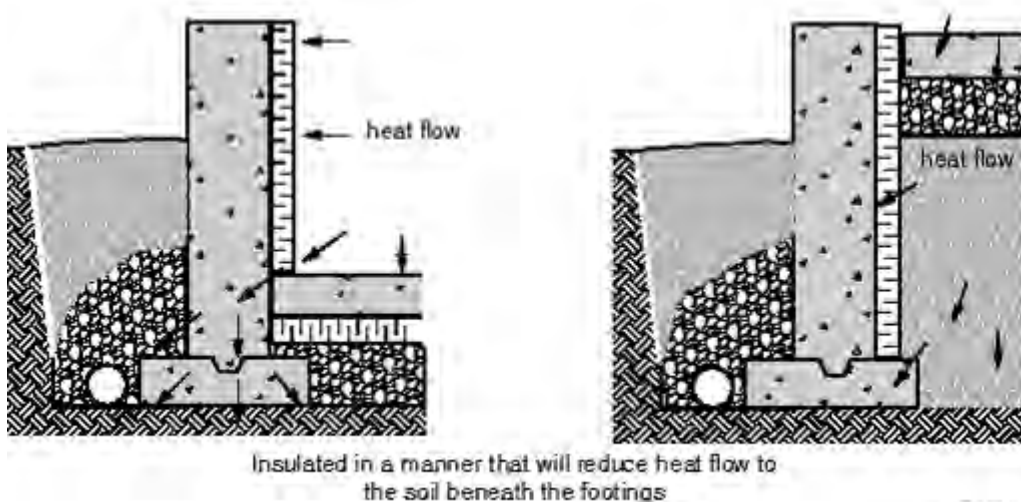
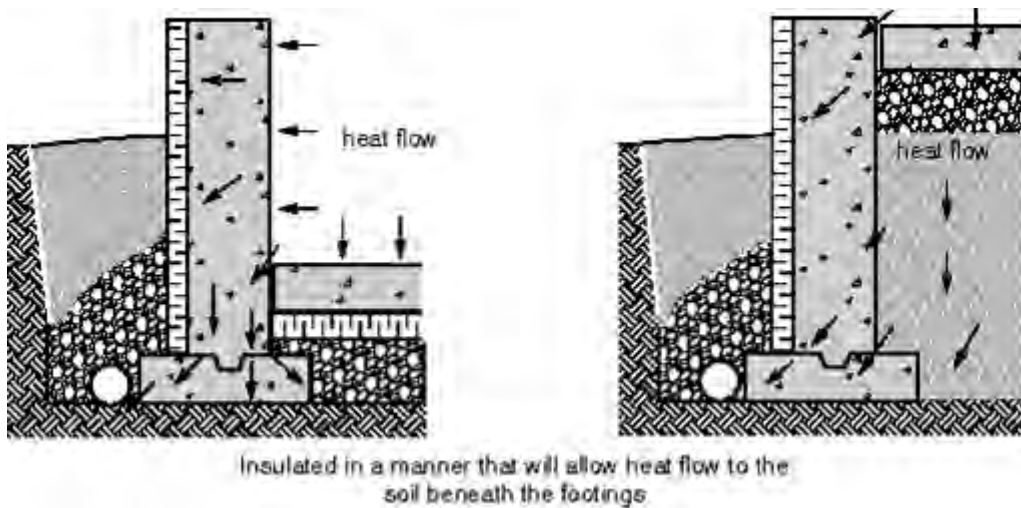


Figure A-9.12.2.2.(2)
Foundation insulation and heat flow to the soil beneath the footings

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 $170 \text{ ng}/(\text{Pa}\times\text{s}\times\text{m}^2)$, 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 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) may therefore 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.

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.(2)(b) and (3)(b) Effective Depressurization. To allow effective depressurization of the space between the air barrier 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 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). 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. If an area is segregated by a footing (for example), a through-footing pipe can join the area so that a single suction point can depressurize both areas. However, for large buildings, it may be preferable to have multiple suction points.

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-9.14.5.3.(2) Siting Requirements for On-Site Infiltration Systems. Figure A-9.14.5.3.(2) shows minimum setbacks for on-site infiltration systems from buildings and neighbouring properties. Also shown is the 0.9 m firefighters' access to an ancillary residential building (see Sentence 9.10.20.3.(3)) and the 4.9 m separation between a laneway home and the principal residence (see Zoning and Development By-law section 11.3.8). Setbacks from the

street, lane and utilities infrastructure are at the discretion of the City Engineer and other authorities. (This figure is not a comprehensive summary of all potentially applicable setback regulations.)

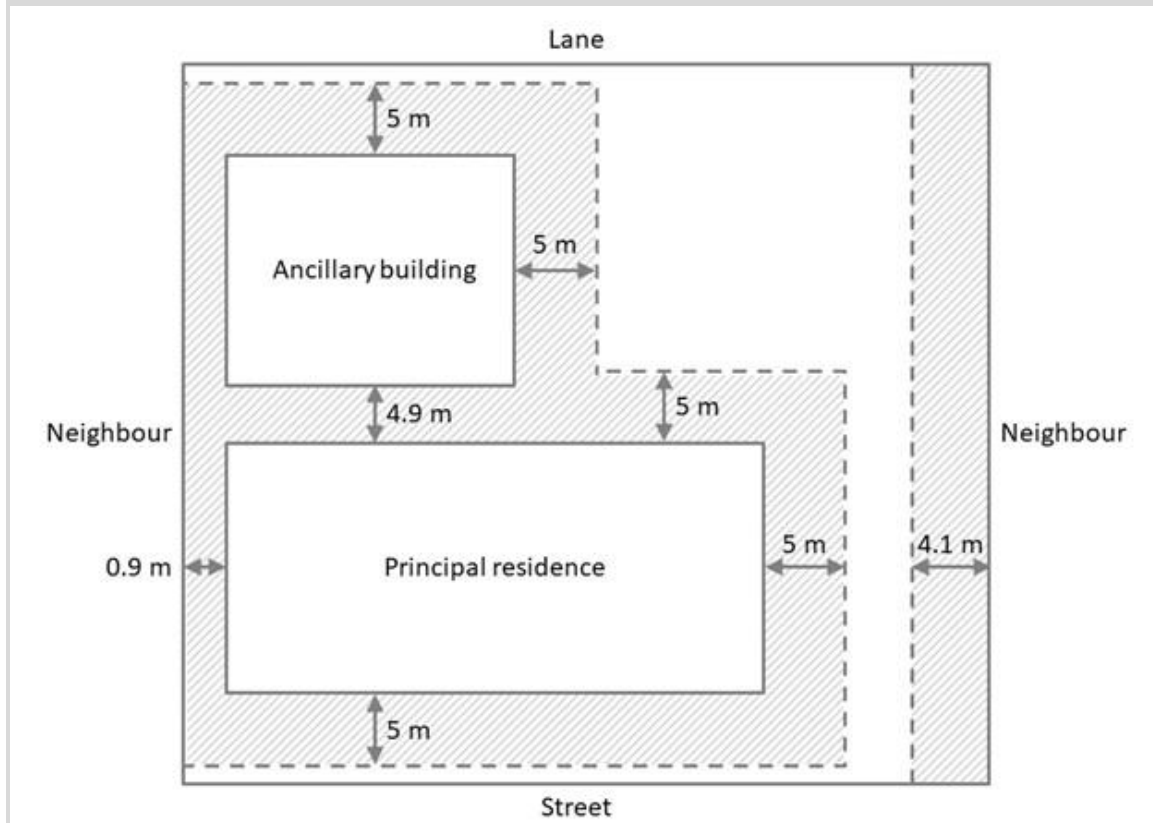


Figure A-9.14.5.3.(2) Minimum setbacks for on-site infiltration systems from buildings and neighbouring properties. Not to scale.

The intent of this requirement is to limit harm to persons and damage to buildings from excessive moisture loading on foundation walls, basement floors and the soil immediately beneath footings.

The minimum setbacks apply to any system to which water is directed for infiltration, such as infiltration trenches, swales and basins; rain gardens; rock and soak-away pits; and proprietary modular units designed for subsurface infiltration. The setbacks do not apply to landscaping. Certain ancillary buildings need not conform to the drainage requirements of Section 9.14 when Sentence 9.35.3.3.(1) applies.

An overflow is required for infiltration systems.

Professionals should be consulted when infiltration constraints exist such as contaminated soils, unstable soils, peat, shallow bedrock or cemented layers in soils, steep slopes, a high water table, a land use with a groundwater pollution risk, a nearby drinking water well, or an area of protected habitat. For drainage requirements near retaining walls, EGBC's "Professional Practice Guidelines — Retaining Wall Design" should be consulted.

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 manufactured insulating forms, which remain in place after the concrete has cured.

Flat wall insulating concrete forms do not fall within the scope of CSA S269.1, "Falsework and formwork," which addresses temporary falsework for concrete structures.

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, “Specification of 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 (sum₁).
- (b) Determine the product of the number of storeys times 4.9 m (sum₂).
- (c) Determine the ratio of sum₁ to sum₂.
- (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) $\text{sum}_1 = 6 + 6 = 12 \text{ m}$
- (b) $\text{sum}_2 = 4.9 \times 2 = 9.8 \text{ m}$
- (c) $\text{ratio } \text{sum}_1/\text{sum}_2 = 12/9.8 = 1.22$
- (d) $\text{required minimum footing size} = 1.22 \times 350 \text{ mm (minimum footing size provided in Table 9.15.3.4.)} = 427 \text{ mm.}$

A-Table 9.15.4.2.-A Flat Insulating Concrete Form Walls as Foundation Walls. Article 9.15.4.2. allows insulating concrete forms (ICFs) to be used to form both laterally supported and laterally unsupported flat, plain (unreinforced) concrete foundation walls intended to support wood-frame walls, floors and roofs under the conditions stipulated in Table 9.15.4.2.-A. Where the limits stated in the Table are exceeded, or where the ICF foundation wall is intended to support one or two storeys of concrete walls formed with flat wall ICFs above ground, Article 9.15.4.5. applies.

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 NBC 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. See also Article [10.2.2.6](#).

A-9.20.1.2. Seismic Information. Information on spectral 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.

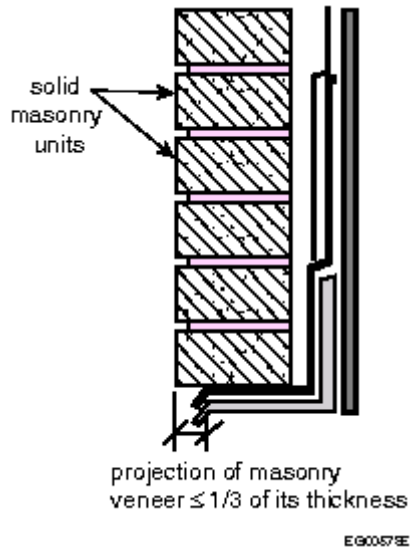


Figure A-9.20.8.5.(1)

Maximum projection of masonry veneer beyond its support

A-9.20.12.2.(2) Corbelling of Masonry Foundation Walls.

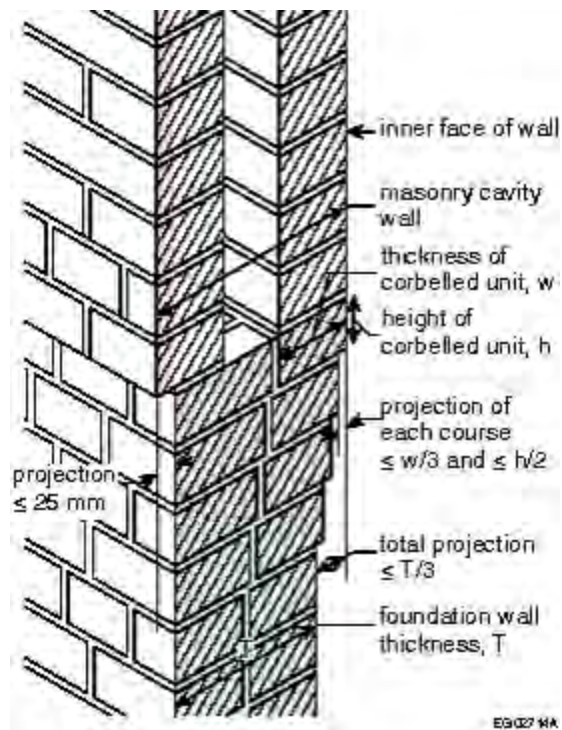


Figure A-9.20.12.2.(2)

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.

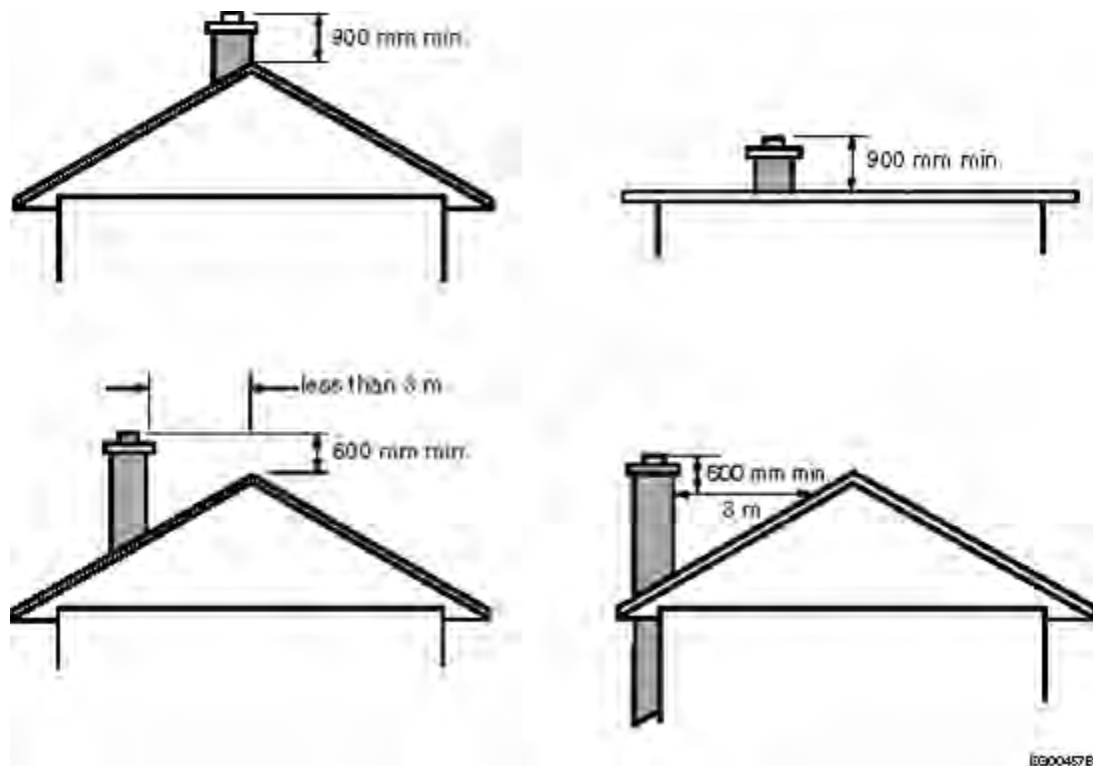


Figure A-9.21.4.4.(1)

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 CAN/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 Code, 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-9.23.2.4.(3) Dry Interior Environment for Interior Construction. Interior construction, which includes sill plates, that is not in contact with the ground, but is exposed to occasional sources of moisture, is considered to be a dry interior environment for the purpose of Sentence 9.23.2.4.(3).

A-9.23.3.1.(2) Alternative Nail Sizes. Where power nails or nails with a diameter smaller than that required by Tables 9.23.3.1. or 9.23.3.5.-C 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:

$$S_{adj} = S_{table} \times (D_{red}/D_{table})^2$$

where

S_{adj} = adjusted nail spacing $\geq 20 \times$ nail diameter,

S_{table} = nail spacing required by Table 9.23.3.4. or 9.23.3.5.-A to 9.23.3.5.-C,

D_{red} = nail diameter smaller than that required by Table 9.23.3.1., or 9.23.3.5.-C, and

D_{table} = nail diameter required by Table 9.23.3.1. or 9.23.3.5.-C.

The number of nails can be increased using the following equation:

$$N_{adj} = N_{table} \times (D_{table}/D_{red})^2$$

where

N_{adj} = adjusted number of nails,

N_{table} = number of nails required by Table 9.23.3.4. or 9.23.3.5.-A to 9.23.3.5.-C,

D_{table} = nail diameter required by Table 9.23.3.1. or 9.23.3.5.-C, and

D_{red} = nail diameter smaller than that required by Table 9.23.3.1. or 9.23.3.5.-C.

Note that nails should be spaced 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.”

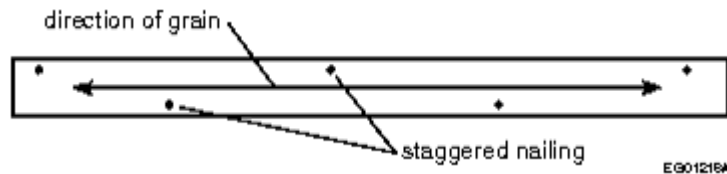


Figure A-9.23.3.3.(1)

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 ^(a)	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

Notes to Table A-Table 9.23.3.5.-B:

^(a) For alternative nail lengths of 63 mm or longer.

Note A-Table 9.23.3.5.-C Factored Shear Resistances and Framing Adjustment Factors. Table 9.23.3.5.-C describes the fastening of sheathing elements for each reference framing type available for use as a braced wall panel. There are three categories of framing type: wood-sheathed braced wall panels (WSP), diagonal (lumber) wood boards (DWB), and gypsum board (GWB). Table A-9.23.3.5.-C provides the factored shear resistances as per CSA O86 and framing adjustment factors of the framing types listed in Table 9.23.3.5.-C, and can be used to calculate the minimum required length of braced wall panels using the alternative calculation procedures in Note A-9.23.13.7.(3) and A-9.23.13.7.(4).

Table A-Table 9.23.3.5.-C
Factored Shear Resistances and Framing Adjustment Factors of Framing Types

Reference Framing Type	Minimum Sheathing Element ⁽¹⁾ and maximum	Minimum Specification of Fasteners, mm		Minimum Number or Maximum Spacing of	$K_{wframe}^{(3)}$	$K_{sframe}^{(4)}$	Factored shear resistance, kN/m
		Common,	Screws				

stud spacing		Spiral or Ring Thread		Fasteners ⁽²⁾ at Panel Edges to Framing			
GWB-O (interior side of WSP framing types)	12.5 mm gypsum for 600 mm stud spacing	2.48 mm diameter ring thread with 20 mm penetration into support framing ⁽⁵⁾	3.45 mm shank diameter Type W with 20 mm penetration into support framing ⁽⁶⁾	200 mm o.c. for nail 300 mm o.c. for screw	n/a	n/a	0.61 ⁽⁷⁾
GWB-A	12.5 mm gypsum for 600 mm stud spacing			200 mm o.c. for nail 300 mm o.c. for screw	2.85	4.28	1.15 ⁽⁸⁾
GWB-B	12.5 mm gypsum for 400 mm stud spacing			150 mm o.c. Or 200 mm o.c. for blocked	1.65	2.148	1.98 ⁽⁸⁾
GWB-C	12.5 mm gypsum for 400 mm stud spacing or 12.5 mm gypsum for 600 mm stud spacing, blocked ⁽⁹⁾			150 mm o.c. or 200 mm o.c. for blocked	1.23	1.84	2.67 ⁽⁸⁾
GWB-D	12.5 mm gypsum for 400 mm stud spacing			100 mm o.c.	1.00	1.50	3.28 ⁽⁸⁾
WSP-A	9.5 mm plywood, OSB or waferboard for 400 mm stud spacing	2.84 mm x 51 mm ⁽¹⁰⁾	NP ⁽¹¹⁾	150 mm o.c.	1.00	1.00	3.28 ⁽⁷⁾
WSP-B	11 mm plywood, OSB or waferboard, blocked ⁽⁹⁾ for 600 mm stud spacing	3.25 mm x 63 mm ⁽¹⁰⁾	NP ⁽¹¹⁾	150 mm o.c.	0.53	0.53	6.22 ⁽⁷⁾
WSP-C	11 mm plywood, OSB or waferboard, blocked ⁽⁹⁾ for 600 mm stud spacing	3.25 mm x 63 mm ⁽¹⁰⁾	NP ⁽¹⁰⁾	100 mm o.c.	0.46	0.46	7.15 ⁽⁷⁾
WSP-D	11 mm plywood, OSB or waferboard, blocked ⁽⁹⁾ for 600 mm stud	3.25 mm x 63 mm ⁽¹⁰⁾	NP ⁽¹¹⁾	75 mm o.c.	0.42	0.42	7.85 ⁽⁷⁾

	spacing						
WSP-E	15,5 mm plywood, OSB or waferboard, blocked ⁽⁹⁾ for 600 mm stud spacing	3.66 mm x 63 mm ⁽¹⁰⁾	NP ⁽¹¹⁾	75 mm o.c.	0.38	0.38	8.71 ⁽⁷⁾
DWB	19 mm diagonal lumber board	3.25 mm x 63 mm ⁽¹⁰⁾	3.25 mm x 51 mm ⁽¹¹⁾	2 per support framing where lumber width ≤ 184 mm 3 per support framing where lumber width > 184 mm	0.57	0.57	5.77 ⁽⁷⁾

Notes to Table A-Table 9.23.3.5.-C:

⁽¹⁾ Plywood, OSB, waferboard and board lumber may be installed vertically or horizontally and shall conform to the material standards specified in Subsection 9.23.17. Gypsum sheathing shall meet the requirements of gypsum board in Subsection 9.29.5.

⁽²⁾ For plywood, OSB or waferboard panel sheathing, the maximum fastener spacing along intermediate supports shall be 300 mm o.c. For gypsum sheathing, the maximum spacing along intermediate supports shall conform to Sentence 9.29.5.8.(4) for nails and Sentence 9.29.5.9.(4) for screws.

⁽³⁾ See A-9.23.13.7.(3).

⁽⁴⁾ See A-9.23.13.7.(4).

⁽⁵⁾ Nails for GWB framing types shall meet the requirements of Article 9.29.5.6.

⁽⁶⁾ Screws for GWB framing types shall meet the requirements of Article 9.29.5.7.

⁽⁷⁾ All framing types are based on resistances derived from CSA O86. Factored shear resistances of WSP and DWB framing types include a contribution of 0.61 kN/m from GWB-O on opposite face of the *braced wall panel*. DWB resistance based on Spruce-Pine-Fir (SPF) studs and Northern Species diagonal lumber boards. Compared to CSA O86, WSP-C was reduced by a factor of 0.20, WSP-D was reduced by a factor of 0.30, and WSP-E was reduced by a factor of 0.40, to account for no hold-downs.

⁽⁸⁾ GWB framing types are derived from allowable stress shear resistances (average peak shear divided by safety factor of 3) and soft converting to specified shear resistances consistent with practice used in CSA O86. The resulting factored resistance value is determined same as WSP framing types, except a resistance factor of 0.7 is applied for GWB instead of 0.8 applicable to WSP. The K_{frame} factor also accounts for difference in seismic force modifiers for WSP ($R_d = 3$) and GWB ($R_d = 2$).

⁽⁹⁾ Where blocking is required, horizontal panel sheathing joints shall occur over and be fastened to blocking of not less than 38 mm x 89 mm lumber oriented either edgewise or flatwise.

⁽¹⁰⁾ Nails for WSP and DWB framing types shall meet the requirements of Article 9.23.3.1.

⁽¹¹⁾ NP = Not permitted

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 Code 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 modeling. 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:

$$\ln(K) = A - B \times \ln(S_i/S_{184}) + G$$

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 K_3 , 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 K_3 , 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

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

Subfloor Thickness, mm	Joists with Ceiling Attached to Wood Furring ⁽¹⁾						Joists with Concrete Topping ⁽²⁾		
	Without Bridging			With Bridging			With or Without 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

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 1

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-9.23.6.1.(3) Anchorage of Building Frames.

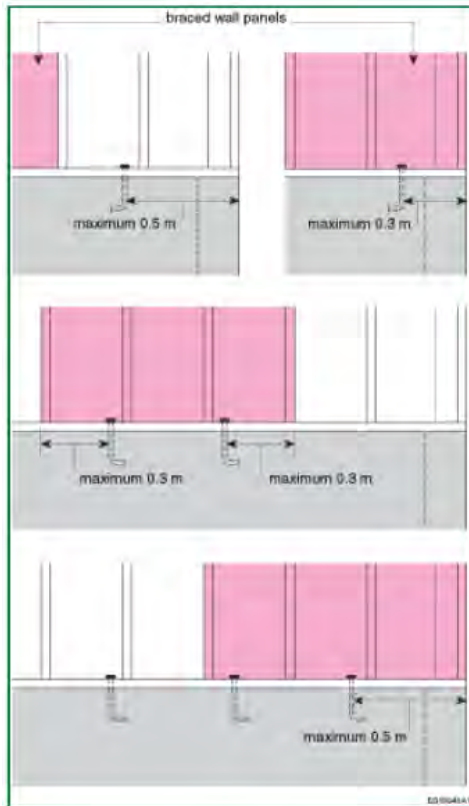


Figure A-9.23.6.1(3)

Anchorage of Building Frames

A-9.23.8.3. Joint Location in Built-Up Beams.

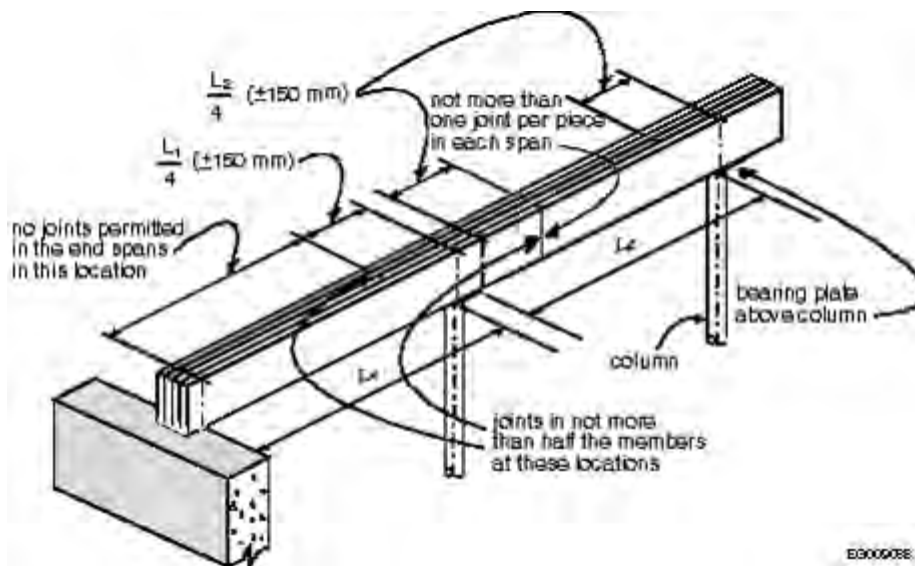


Figure A-9.23.8.3.

Joint location in built-up beams

A-9.23.10.4.(1) Fingerjoined Lumber. NLGA 2017, "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.

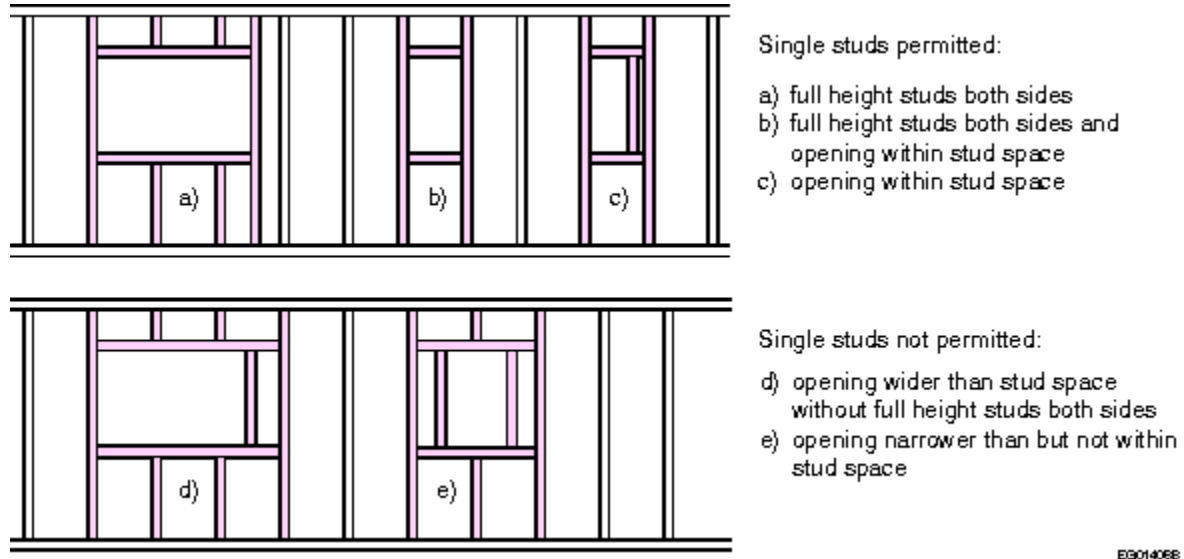


Figure A-9.23.10.6.(3)-A

Single studs on sides of openings in non-loadbearing interior walls not required to have a fire-resistance rating

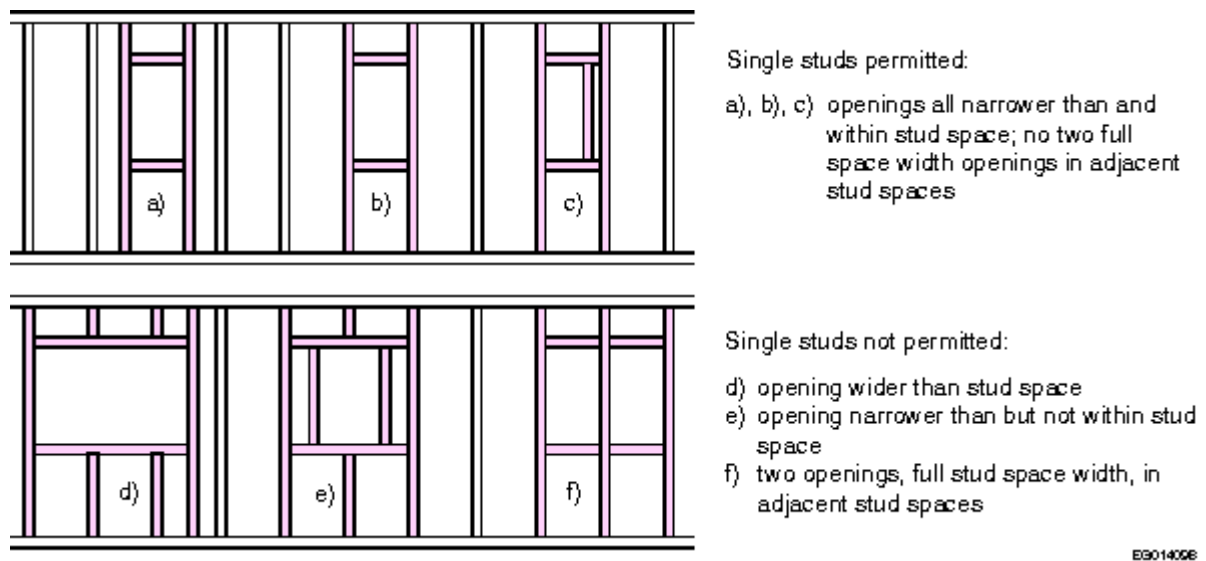


Figure A-9.23.10.6.(3)-B

Single studs on sides of openings in all other walls

A-9.23.13. Bracing for Resistance to Lateral Loads. Subsection 9.23.13. along with Articles 9.4.2.5., 9.23.3.4., 9.23.3.5., 9.23.6.1., 9.23.9.8., 9.23.11.4., 9.23.15.5., 9.29.5.8., 9.29.5.9., 9.29.6.3. and 9.29.9.3. contain design and bracing provisions that address the resistance of light wood-frame structures and non-structural components to wind and earthquake loads.

The bracing provisions were developed based on a combination of performance history and engineering calculations, as are most Part 9 provisions. The placement and construction methods for braced walls were determined by the following approach. The lateral forces were analyzed in accordance with Part 4 for various configurations of buildings in different locations across Canada. The lateral resistance of walls was established using an approach adapted from CSA O86, "Engineering Design in Wood." Construction details and required lengths for braced walls were determined based on location, building height, wind exposed class and construction weight. This approach relied on the following assumptions:

- A short-term load duration factor, K_D , of 1.25 was used for the calculation of resistance to wind and seismic shear forces.
- The ductility- and overstrength-related seismic force modification factors, R_d and R_o , were assumed to have the values listed in the following table:

Seismic Force Resisting System (SFRS)	R_d	R_o
Nailed or screwed wood-based shear walls in combination with gypsum board	3.0	1.7
Nailed or screwed diagonal lumber board shear walls in combination with gypsum board	3.0	1.7
Nailed or screwed gypsum board shear walls	2.0	1.7

- A level of resistance of up to 50% of the wind or seismic lateral load demand was assumed to be provided by interior partitions, and other non-structural components, such as cabinetry and cladding.

It is important to note that not all buildings satisfying the bracing provisions will have the configurations or details assumed in the calculations, which are necessary to provide adequate resistance against lateral loads. For example, buildings that have limited interior partitions and other non-structural components may have a lower lateral resistance than predicted. In such cases, the Part 9 provisions for bracing to resist lateral loads may not be adequate to satisfy the objectives of the British Columbia Building Code, and bracing requirements should instead be determined in accordance with Part 4. See Note A-9.4.2.5. for more information on the seismic design parameter, S_{max} , used in the seismic design provisions.

A-9.23.13.1.

Bracing to Resist Lateral Loads in Low Load Locations

For locations identified in Appendix C, where the seismic spectral acceleration, $S_a(0.2)$, is less than or equal to 0.70 and the 1-in-50 hourly wind pressure is less than 0.80, 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.(3) Weights of Construction.

Normal Weight Construction

Normal-weight floor construction (0.5 kPa) accommodates ceramic tile, hardwood, carpet and other finishes weighing no more than 0.25 kPa. Normal-weight roof construction (0.5 kPa) accommodates asphalt shingles, wood shingles, steel roofing and other roofing weighing no more than 0.12 kPa. Normal-weight wall construction (0.4 kPa) accommodates fibre cement board, wood, vinyl, lightweight metal panels weighing no more than 0.10 kPa.

These cladding weights are based on the typical light wood frame construction:

- Floor assembly: plywood subfloor, 2×2 lumber floor joists at 400 mm o.c. and gypsum board ceiling;
- Roof assembly: plywood roof sheathing, trusses, R60 insulation, gypsum board ceiling;
- Wall assembly: OSB exterior sheathing, strapping, 2×6 studs at 400 mm o.c., insulation, gypsum board interior finish

Heavy Weight Construction

In a building of “heavy weight construction,” the average dead weight per storey of floors, roof or exterior walls is permitted to exceed the value stated in Clause 9.23.13.2.(3)(a), but must not exceed the maximum average dead weights per storey stated in Clause 9.23.13.2.(3)(b). The heavy weight floor construction provisions account for an additional total dead load of 1.0 kPa compared to the normal weight floor construction, accommodating, for example, a 38 mm normal-weight concrete topping. Heavy-weight roof construction, accommodates lighter roofing materials to be replaced with slate or clay tile shingles weighing up to 0.65 kPa (provided the heavy roofing is not installed over existing normal weight roofing). The heavy-weight roof construction provisions also accommodate the installation of solar panels over normal weight roofing such as asphalt shingles. Solar panels add approximately 0.12 kPa to the roof. Heavy-weight wall construction provisions account for cladding weighing up to 0.85 kPa, when this heavier cladding replaces normal weight cladding. This accommodates cementitious stucco, heavier weight metal panels, and, if averaged with lighter claddings, adhered manufactured or natural stone veneer. Heavy weight wall construction does not accommodate masonry or stone veneer except where advantage can be made of “Area-weighted Average”. The maximum average dead weights per storey for the three cases are listed in Table A- 9.23.13.2.(3).

Table A-9.23.13.2.(3)

Maximum Average Dead Weights per Storey for Heavy Weight Construction

Forming Part of Note A-9.23.13.2.(3)

Description of Heavy Weight Construction	Maximum Average Dead Weight per Storey, kPa			
	Floors	Partitions and Interior Walls	Roof	Exterior Walls
Normal weight floors and roof with heavy weight exterior walls	0.5	0.5	0.5	1.2
Normal weight floors and exterior walls with heavy weight roof	0.5	0.5	1.0	0.4
Normal weight exterior walls and roof with heavy weight floors	1.5	0.5	0.5	0.4

Masonry and Stone Veneer Wall Cladding

Braced wall panels that run perpendicular to masonry- and stone veneered walls are required to have a comparatively higher lateral strength to resist increased lateral loading due to the relatively higher wall mass of the masonry. The effects of mass are accounted for using the K_{weight} factor listed in Table 9.23.13.7-D. Under seismic action, lateral load due to the mass of a masonry or stone veneer is transferred into the wall immediately behind the veneer, which under the load path and by diaphragm action, is transferred into the roof and floors and is resisted by the braced wall panels oriented parallel to the seismic motion (perpendicular to the veneer). Therefore, only braced wall panels running perpendicular to the masonry or stone veneered walls are required to be adjusted by the K_{weight} adjustment factor. If the entire building is clad with masonry or stone veneer, all braced wall panels are required to be adjusted by the appropriate masonry or stone “both faces” K_{weight} adjustment factor. If only two parallel faces of a four-sided building are clad with masonry or stone veneer, only the side-yard braced wall panels are required to be adjusted using the appropriate masonry or stone “both faces” K_{weight} adjustment factor. If only one face of the building is clad with masonry or stone veneer, the side-yard braced wall panels are required to be adjusted with the “one face” K_{weight} adjustment factor.

For buildings clad with masonry veneer, the following veneer products with a bed thickness of not more than 90 mm are considered to meet the weight limit of 1.9 kPa:

- clay brick masonry veneer
- concrete block masonry veneer
- concrete brick masonry veneer
- concrete stone masonry veneer
- calcium silicate masonry veneer

For buildings clad with stone veneers, natural stone veneer of limestone and sandstone, excluding granite, with a bed thickness of not more than 125 mm are considered to meet the weight limit of 3.2 kPa.

Area-weighted Average

The concept of area-weighted average is an important consideration for cost-effective construction and wall bracing compliance. Depending upon the relative weights and areas of materials, less rigorous bracing requirements could apply to the structure using the concept of 'area-weighted average'. It is based on averaging the cumulative sum of material weights over their respective areas. Averaging of material weights applies per assembly. Using area-weighted average, for example, wall cladding weights can be averaged for the entire building's wall areas to determine if normal or heavy construction apply under the per storey average dead weight limits stated in Table A-9.23.13.2.(3). A building with walls partially clad with comparatively heavier materials may qualify as normal weight construction if the area-weight contribution of the normal weight cladding materials combined with that of heavy weight cladding materials, such as stucco, masonry veneer or stone veneer, does not exceed the average dead weight limit of 0.4 kPa for normal weight construction. Similarly, a building with walls partially clad with masonry or stone veneer may qualify as heavy weight construction if the area-weighted average contribution of the normal or heavy weight cladding materials combined with that of masonry or stone veneer does not exceed the average dead weight limit of 1.2 kPa for heavy weight construction. This same concept applies to floor and roof assemblies.

Example: Area-weighted average floor calculation

For example, if a building has 400 m² of floor area, and 25 m² of that floor area has a concrete topping (floor assembly = 1.25 kPa), and the remaining 375 square metres has hardwood floors (floor assembly = 0.45 kPa), the area-weighted average dead weight is:

$$\frac{(1.25 \text{ kPa})(25 \text{ m}^2) + (0.45 \text{ kPa})(375 \text{ m}^2)}{400 \text{ m}^2} = 0.5 \text{ kPa}$$

Therefore, qualifies as normal weight construction.

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.

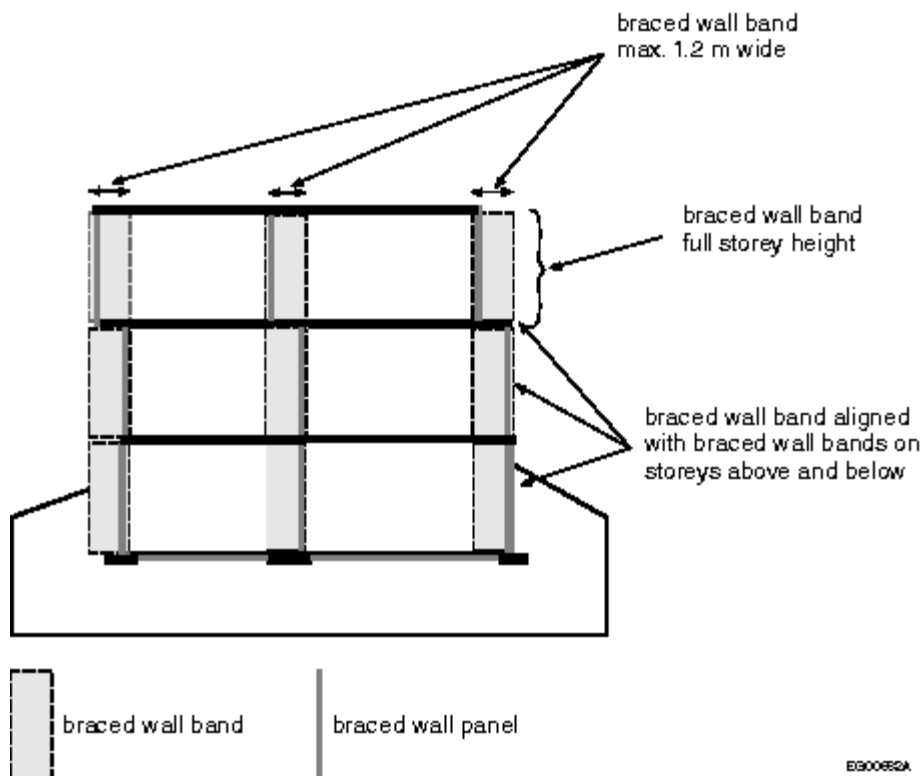


Figure A-9.23.13.4.-A

Braced wall bands in an example building section [Clauses (a), (b), (c) and (d)]

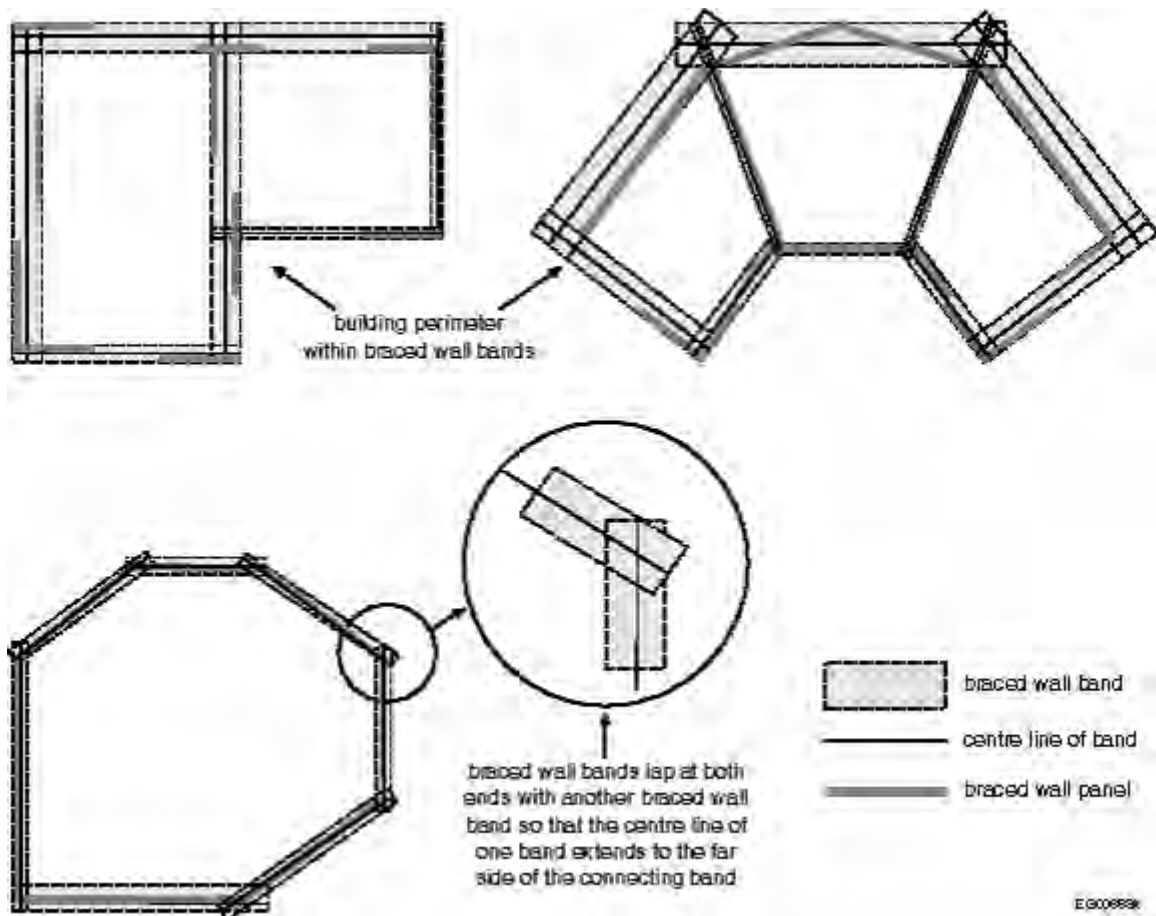


Figure A-9.23.13.4.-B

Lapping bands and building perimeter within braced wall bands [Clauses 9.23.13.4.(1)(a) and (c)]

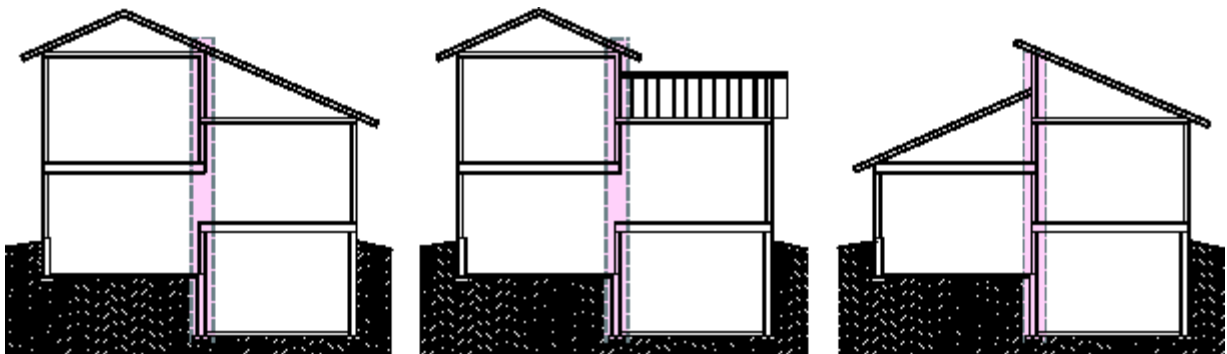


Figure A-9.23.13.4.-C

Braced wall bands at changes in floor level in split-level buildings [Sentence 9.23.13.4.(2)]

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.

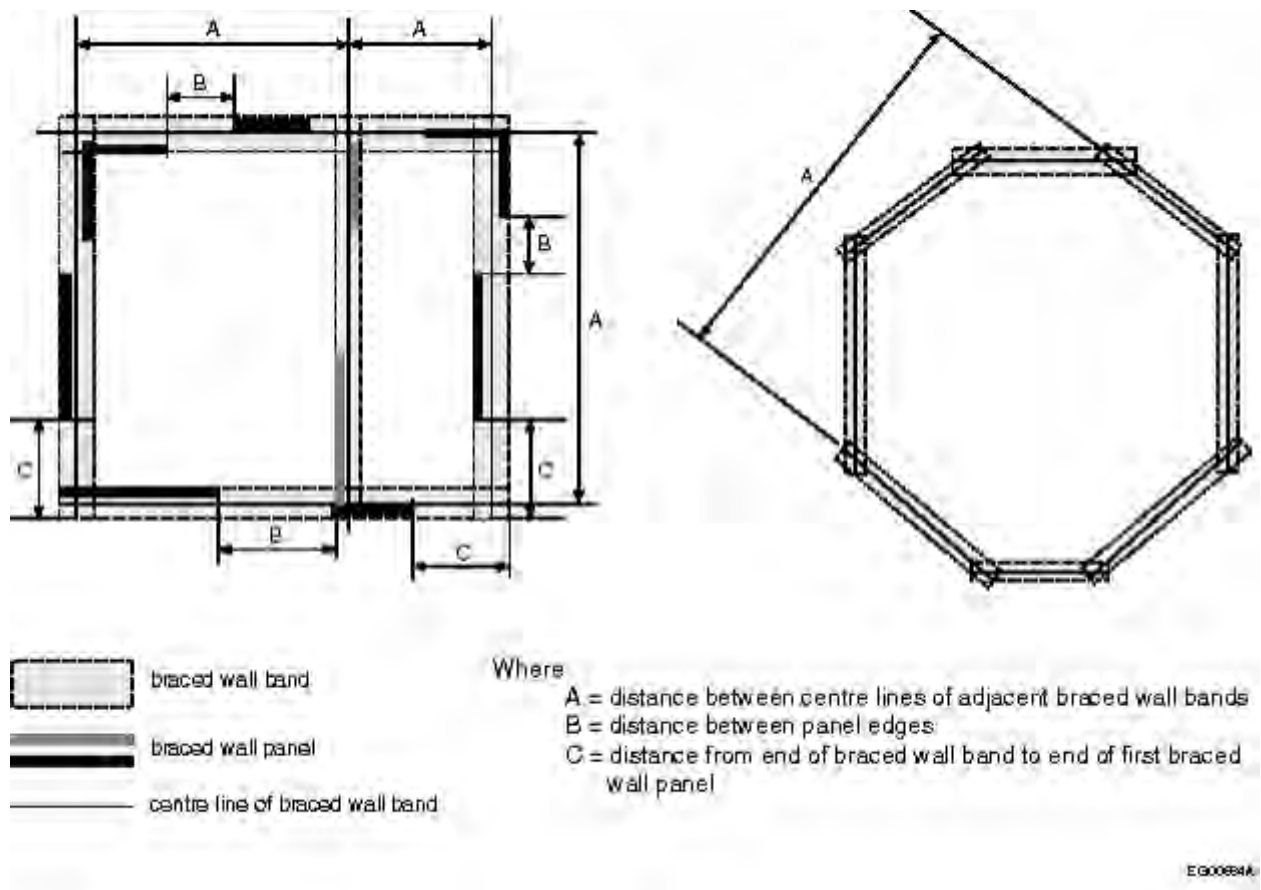


Figure Table A-9.23.13.5.-A

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.

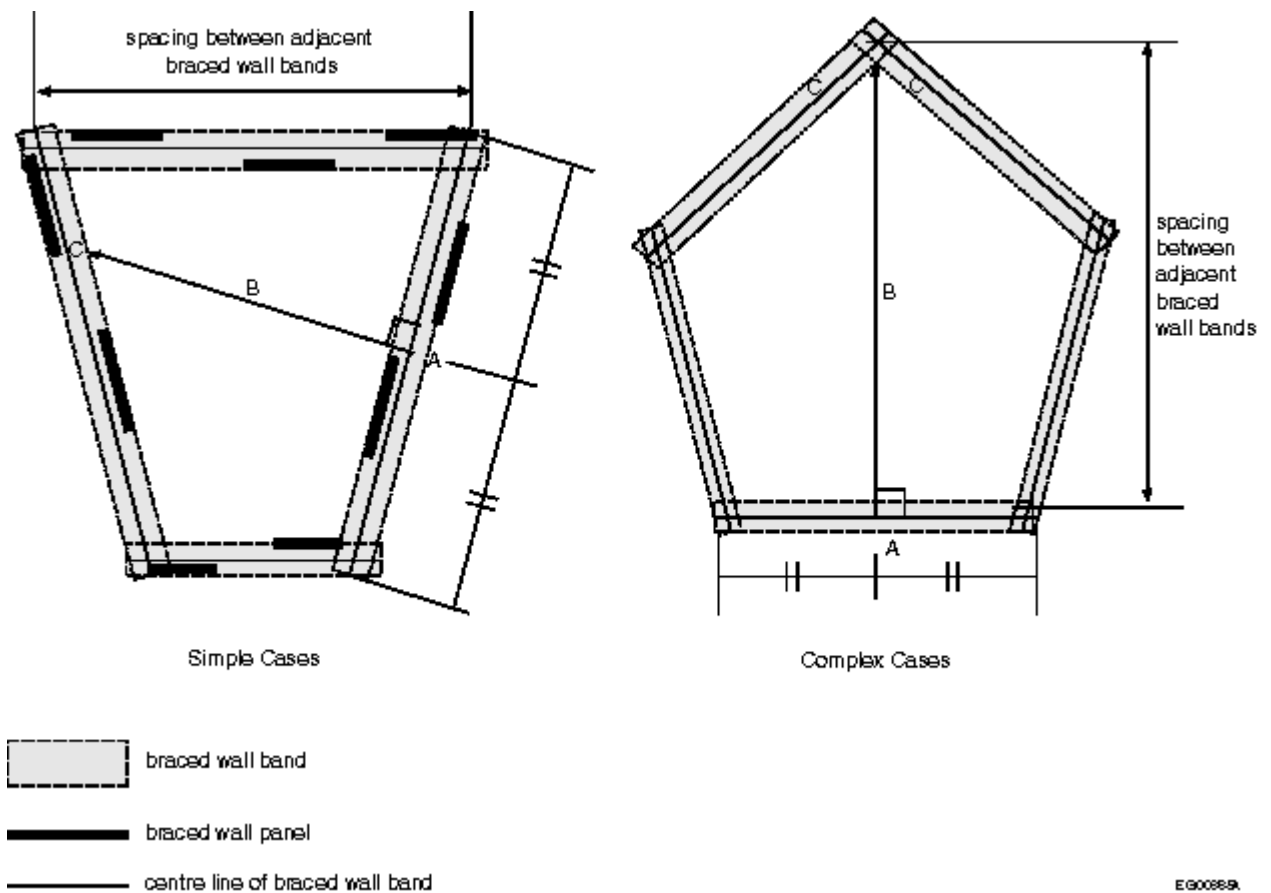


Figure Table A-9.23.13.5.-B

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).

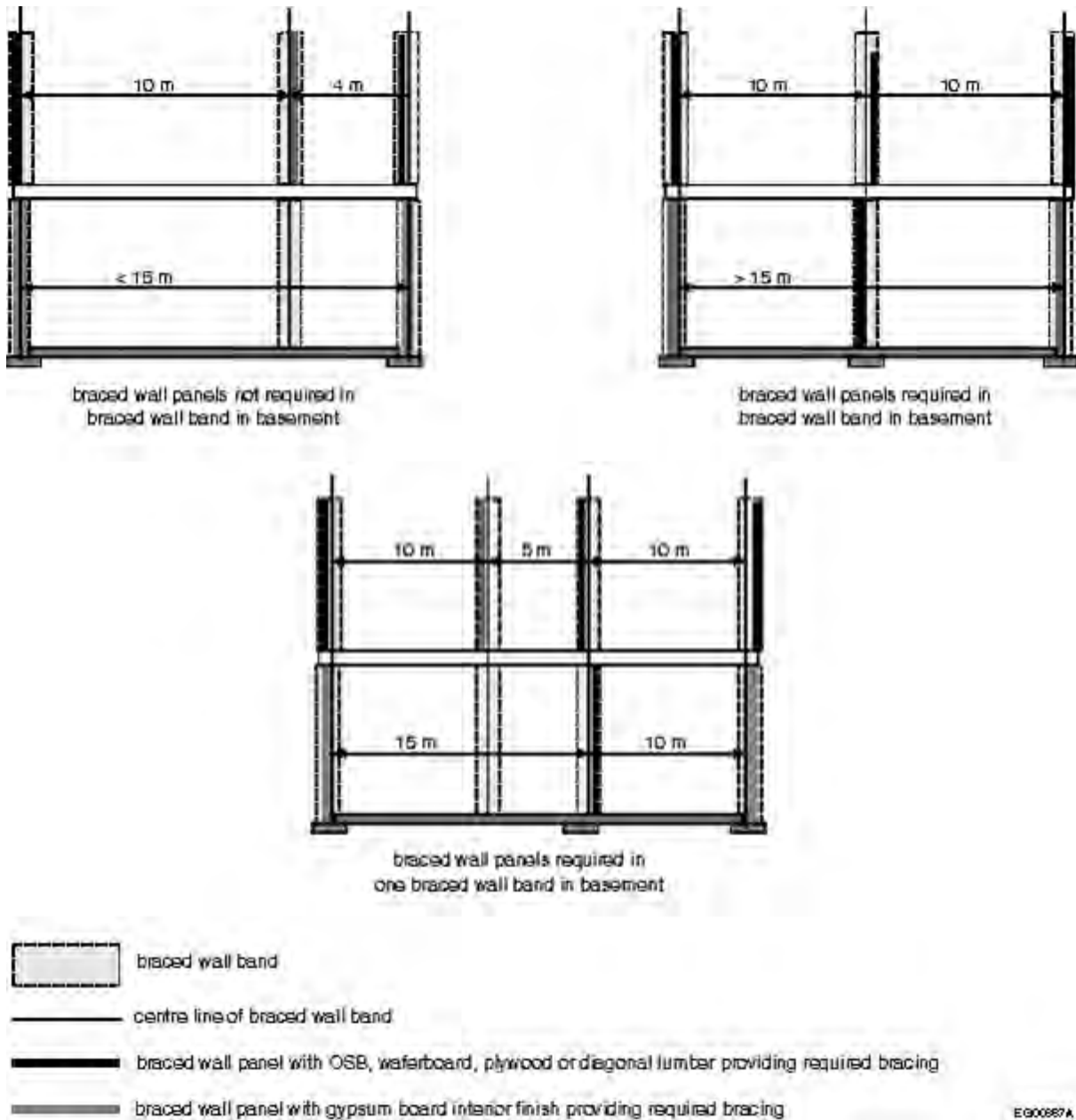


Figure A-9.23.13.5.(2)

Braced wall bands in basements or crawl spaces with optional and required braced wall panels

A-9.23.13.5.(3) and (4) Connection of Braced Wall Panels to Roof Framing. Braced wall panels that are sheathed with gypsum board alone have a significantly lower lateral resistance than woodsheathed braced wall panels. For gypsum-sheathed braced wall panels, the typical lateral bracing of trusses is usually adequate to transfer the lateral loads from the bottom chords to the top chords of the truss.

The connection of interior gypsum-sheathed braced wall panels to trusses also needs to accommodate vertical movement of the roof framing in order to facilitate "truss uplift" and to prevent the gypsum board from cracking.

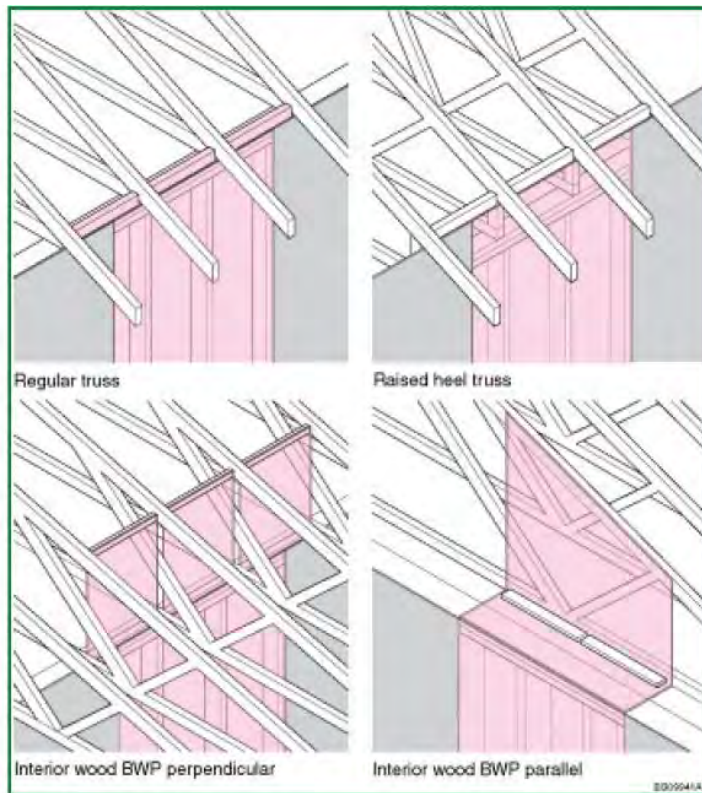


Figure A-9.23.13.5.(3) and (4)

Wood-sheathed braced wall panel to roof framing connection details (Sentence 9.23.13.5.(3)(a) and (b))

A-9.23.13.6.(1) Materials in Braced Wall Panels. Clause 9.23.13.6.(1)(a) describes wood-based exterior braced wall panels, which includes gypsum board on the interior, 'regularly attached' according to Subsection 9.29.5. This corresponds with framing types WSP-A, WSP-B, WSP-C, WSP-D, WSP F and DWB, with GWB-O on the interior, as described in 9.23.3.5.(3). Clause 9.23.13.6.(1)(b) describes exterior braced wall panels sheathed with gypsum board only, typically applied to the interior side of the exterior walls, accommodating the option of no wood-based structural sheathing on the exterior side of the braced walls. This corresponds to framing types GWB-O, GWB-A, GWB-B, GWB-F, and GWB-H.

A-9.23.13.6.(3) Use of Gypsum Board to Provide Required Bracing. Braced wall panels constructed with gypsum board alone provide less resistance to lateral loads than panels constructed with OSB, waferboard, plywood or diagonal lumber board; Sentence 9.23.13.6.(3) 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 in basements and crawl spaces be constructed with braced wall panels made of wood-based sheathing at braced wall band intervals of not more than 15 m apart. See Figure A-9.23.13.6.(3).

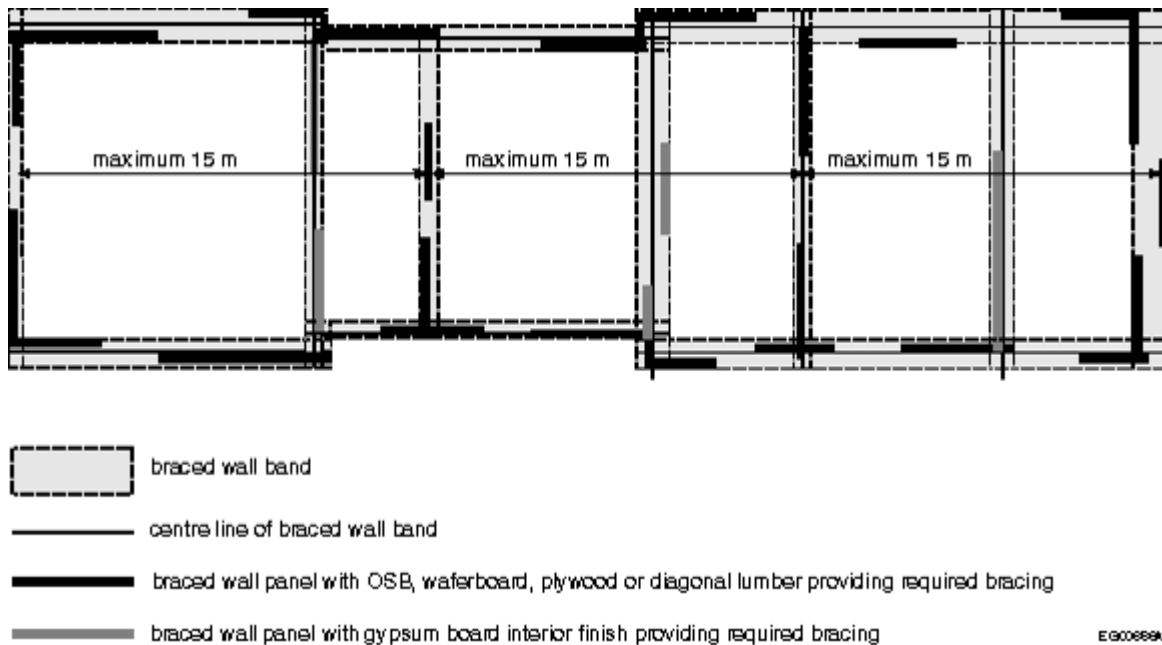


Figure A-9.23.13.6.(3)

Braced wall panels constructed of wood-based material

A-9.23.13.6.(5) Mixed Braced Wall Panel Framing Types in Braced Wall Bands.

The primary reason for mixed braced wall panel framing types is to accommodate where an interior GWB-sheathed braced wall panel framing type aligns with an exterior WSP braced wall panel framing type, along the same braced wall panel as shown in the plan view below. This permission is restricted to GWB- and 'low strength' WSP-sheathed framing types A and B. Mixing high strength or very stiff walls with low strength or less stiff walls has not been sufficiently studied and therefore requires analysis based on engineering principles.

This appendix note provides examples of complying with the requirements of Sentence 9.23.13.6.(5) when mixed braced wall panels are present along a braced wall band. Example 1 is the reference case without mixed sheathing types. Compliance to requirements in Clause 9.23.13.6.(5)(a) is demonstrated in Example 2, for the same braced wall band in Example 1.

Example 1 – One sheathing type in all braced wall panels

A braced wall band (B) consists of an exterior wall of 1 meter (at braced wall band 2) which continues into the building as an interior wall of 3 m and another interior wall 5 m for a total length = $1 + 3 + 5 = 9$ m. The wall construction along B qualifies as GWB-B braced wall panel type. It is determined that a total braced wall panel length of 8 m is required if constructed as GWB-B. Therefore, there is sufficient wall length for the GWB-B braced wall panel along braced wall band B.



Figure A-9.23.13.6.(5)-A

One sheathing type in all braced wall panels

Example 2 – Mixed sheathing types in all braced wall panels using direct length substitution approach

The exterior walls are constructed with wood sheathing, and qualify as WSP-A braced wall panels. The builder would like to substitute the 1m portion of GWB-B braced wall panel construction with WSP-A exterior braced wall panel. Clause 9.23.13.6.(5)(a) permits a direct substitution, determined using the longest calculated braced wall panel length of all sheathing types in the braced wall band. In this case, the required length of braced wall panel is 8 m of GWB-B or 5.5 m of WSP-A. Therefore in this scenario, 5 m (GWB-B) + 3 m (GWB-B) + 1 m (WSP-A) = 9 m > 8 m, meets the requirement in Clause 9.23.13.6.(5)(a).



Figure A-9.23.13.6.(5)-B

Mixed sheathing types in all braced wall panels using direct length substitution approach

A-9.23.13.7.(3) Alternate Procedure to Calculate Wind-related Required Braced Wall Panel Length. To facilitate calculations of prescribed braced wall panel lengths, the wind-related minimum total unadjusted braced wall panel lengths, L_{uw} , are provided in Table 9.23.13.7.-A for categories of 1-in-50-year hourly wind pressure (HWP). The values

provided within each HWP category are based on the highest HWP in the category, and must be adjusted by the factors provided in Table 9.23.13.7.-C. In lieu of the method given in Sentence 9.23.13.7.(3), the minimum required total braced wall length for wind, L_w is permitted to be calculated directly using the following equation:

$$L_w = C_{Wstorey} K_{Wframe} HWP (K_{exp} K_{roof} K_{Wspacing} K_{Wnumber} K_{gyp} K_{sheath}) \geq BWP_{min}$$

Where:

$C_{Wstorey}$ = coefficient for storey location, for wind

= 3.84 for braced wall panels supporting roof only

= 7.89 for braced wall panels supporting roof + 1 floor

= 11.93 for braced wall panels supporting roof + 2 floors

K_{Wframe} = adjustment factor for framing type used in lieu of the unadjusted length for wind

braced L_{uw} , given in Table A-9.23.13.7.(3)

HWP = 1-in-50 year hourly wind pressure, kPa

K_{exp} = wind exposure adjustment

= 1.0 for 7.6 m braced wall band spacing

K_{roof} = roof eave-to-ridge height adjustment, for wind

= 1.0 for 3 m

$K_{Wspacing}$ = braced wall band spacing adjustment for wind per building plan direction

= 1.0 for 7.6 m braced wall band spacing

$K_{Wnumber}$ = number of braced wall bands adjustment for wind per building plan direction

= 1.0 for no intermediate braced wall bands between exterior walls

K_{gyp} = interior gypsum board adjustment

= 1.0 for braced wall panels with interior gypsum board

K_{sheath} = intermittent braced wall panels adjustment

= 1.0 for braced wall bands with continuously wood-sheathed exterior walls

BWP_{min} = Minimum length of individual braced wall panels as per Table 9.23.13.5.

Values for adjustment factors, K_{exp} , K_{roof} , $K_{Wspacing}$, $K_{Wnumber}$, K_{gyp} and K_{sheath} are provided in Table 9.23.13.7.-B

Table A-9.23.13.7.(3)

Wind-related Framing Adjustment Factor, K_{Wframe}

Reference Framing Type	K_{Wframe}
GWB-O	5.36
GWB-A	3.59
GWB-B	3.06
GWB-C	2.88
GWB-D	2.71
GWB-E	2.54
GWB-F	2.04
GWB-G	1.96

GWB-H	1.72
WSP-A	1.00
WSP-B	0.53
WSP-C	0.37
WSP-D	0.29
WSP-E	0.25
WSP-F	0.23
DWB	0.61

When wind acts on the building width, the length of the building (dimension parallel to the wind) is irrelevant to determining the bracing required to resist that wind force. A short building receives the same wind force as a long building with an equivalent width. This concept is illustrated in Figure A-9.23.13.7.(3)-A. As a result, in calculating the length of required wind bracing, the input is the braced wall band spacing (the building width), regardless of building length.

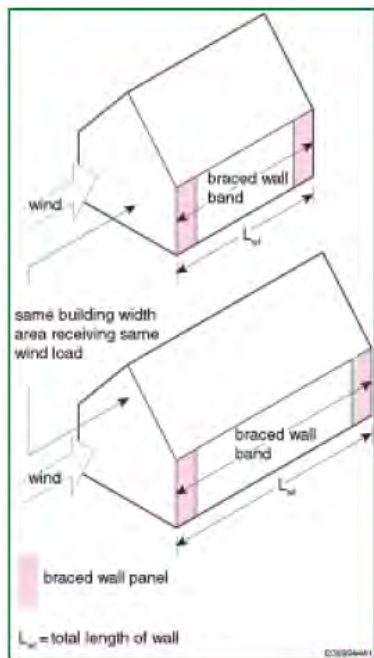


Figure A-9.23.13.7.(3)-A

Wind Force on Different Length Buildings

The equation provided in Sentence 9.23.13.7.(3) is used to calculate the required length of braced wall panels, L_w , within a braced wall band to resist wind acting on the surface perpendicular to the wall line. The unadjusted length, L_{UW} , provided in Table 9.23.13.7.-A, refers to a reference building with an eave-to-ridge height of 3 m and two exterior braced wall bands spaced 7.6 m apart, located in an urban location. Adjustment factors are applied to account for deviations from the reference building. These adjustment factors are explained below and their values are provided in Table 9.23.13.7.-B.

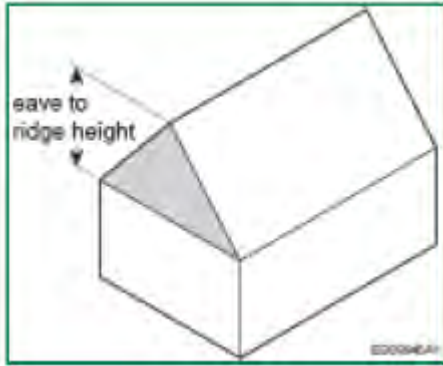


Figure A-9.23.13.7.(3)-B

Eave-to-ridge Height

K_{roof} accounts for the effect of eave-to-ridge height, as defined in Figure A-9.23.13.7.(3)-B.

K_{exp} adjusts for wind loading on a building caused by the effects of local terrain. Wind blows at a lower speed in rough terrain and a higher speed in smooth terrain. Rough terrain, such as an urban or suburban setting or wooded terrain extending upwind for a least one km, offers a comparatively sheltered exposure for a building. For rough terrain, K_{exp} is assigned the value 1.0 and no exposure adjustment is needed for a building located in rough terrain. A building located in an open terrain, sheltered from wind only by the presence of adjacent scattered trees and buildings or other obstacles, or located near open water or shorelines, will experience a higher wind load than would the same building located in rough terrain.

$K_{Wspacing}$ accounts for the change in lateral load resistance when the spacing between braced wall bands, X , differs from 7.6 m. When more than two braced wall bands resist lateral load, the increase in resistance is not directly proportional to the increase in the number of braced wall bands.

$K_{Wnumber}$ accounts for the distribution of forces when more than two braced wall bands resist wind load, Figure A-9.23.13.5.(3)-C. The same explanation in Note A-9.23.13.7.(4) for $K_{Snumber}$ applies here for $K_{Wnumber}$, except that under wind load the forces are not evenly distributed due to the critical load case occurring when the wind blows at an angle to the building. As a result, $K_{Wnumber}$ factor differs slightly from the $K_{Snumber}$ factor. When the spacing of the parallel braced wall bands is not uniform, the average spacing value, as illustrated in Figure A-9.23.13.7.(3)-D, shall be used. Refer to $K_{Snumber}$ for additional information.

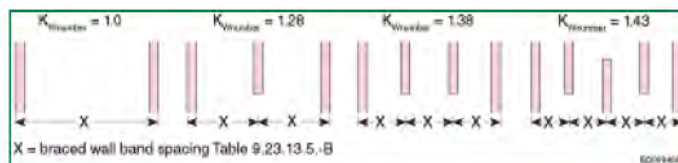


Figure A-9.23.13.7.(3)-C

Adjustment for number of braced wall bands resisting wind load

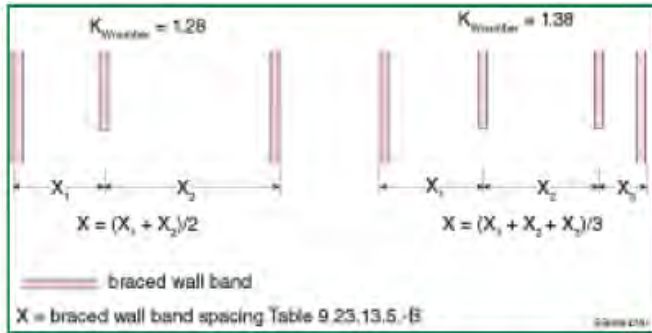


Figure A-9.23.13.7.(3)-D

Calculation of mean braced wall band spacing for wind when the spacings between adjacent braced wall bands are not uniform

Where the braced wall band is intermittently sheathed, the lengths of braced wall panels listed in Table 9.23.13.7.-A. shall be increased by the K_{sheath} factor. Braced wall bands with intermittent braced wall panels permit the use of nonstructural sheathing in areas of the wall where bracing is not required. This factor accounts for a lack of additional resistance otherwise provided by structural sheathing above and below openings and on other non-designated braced wall panels within the braced wall band (Figure A-9.23.13.7.(3)-E), as there would be when the entire braced wall line is continuously sheathed (Figure A-9.23.13.7.(3)-F).



Figure A-9.23.13.7.(3)-E

Intermittent braced wall panels (Source: A guide to 2018 Wood Wall Bracing Provisions.)

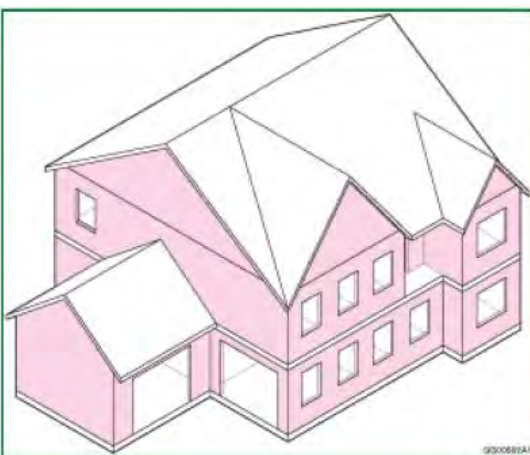


Figure A-9.23.13.7.(3)-F

Continuously sheathed braced wall panels (default) (Source: A guide to 2018 Wood Wall Bracing Provisions.)

Non-designated wall segments within continuously-sheathed braced wall bands are required to be constructed with wood sheathing, but are not required to use the same sheathing and fastening as used in the designated braced wall panels along the braced wall band. Instead, the non-designated wall segments may be constructed with any of the plywood, OSB, or waferboard element options and corresponding fastening in accordance with Table 9.23.3.5.-A, and anchored in accordance with Sentence 9.23.6.1.(2). Note that when the calculated L_w exceeds the available length of the wall line, a stronger framing type or a closer braced wall band spacing may be considered.

A-9.23.13.7.(4) Alternative Procedure to Calculate the Seismic-related Braced Wall Panel Length. To facilitate calculations of prescribed braced wall panel lengths, the seismic-related minimum total unadjusted braced wall panel lengths, L_{us} , are provided in Table 9.23.13.7.-C for categories of the seismic design parameter, S_{max} . The values provided within each S_{max} category are based on the highest S_{max} in the category, and must be adjusted by the factors provided in Table 9.23.13.7.-D. In lieu of the method given in Sentence 9.23.13.7.(4), the adjusted braced wall panel length, the minimum required total braced wall length for seismic, L_s , is permitted to be calculated directly using the following equation:

$$L_s = (C_{storey} C_{walls} C_{roof} S) (K_{Sframe} S_{max} K_{weight} K_{Sspacing} K_{Snumber} K_{gyp} K_{sheath}) \geq BWP_{min}$$

where:

- C_{storey} = coefficient of storey location, for seismic
 - = 1 for braced wall panels supporting roof only
 - = 3 for braced wall panels supporting roof + 1 floor
 - = 5 for braced wall panels supporting roof + 2 floors
- C_{walls} = coefficient accounting for the seismic weight based on the depth of the building, for walls, given in Table A-9.23.13.7.(4)-A
- C_{roof} = coefficient accounting for the seismic weight based on the depth of the building, for roof, given in Table A-9.23.13.7.(4)-A
- S = specified roof snow load, kPa (See Article 9.4.2.2)
- K_{Sframe} = adjustment factor for framing type given in Table A-9.23.13.7.(4)-B
- S_{max} = seismic design parameter, listed in Table 9.4.1.1
- K_{weight} = weight of construction and cladding adjustment, for seismic
 - = 1.0 for normal weight construction (See Sentence 9.23.13.2.(3))
- K_{snow} = roof snow load adjustment, for seismic
 - = 1.0 for 2 kPa roof snow load (as calculated in accordance with Article 9.4.2.2.)
- $K_{Sspacing}$ = braced wall band spacing adjustment for seismic per building plan direction (See Sentence 9.23.13.7.(5))
 - = 1.0 for 7.6 m braced wall band spacing
- $K_{Snumber}$ = number of braced wall bands adjustment for seismic per building plan direction
 - = 1.0 for no intermediate braced wall bands between exterior walls
- K_{gyp} = interior gypsum board adjustment
- K_{sheath} = intermittent braced wall panels adjustment
 - = 1.0 for continuously wood-sheathed braced wall bands
- BWP_{min} = minimum length of individual braced wall panels as per Table 9.23.13.5.

Table A-9.23.13.7.(3)-A

Seismic Related Coefficients, C_{walls} and C_{roof}

Building dimension parallel to braced wall band, m	C _{walls} ⁽¹⁾	C _{roof}
3.1.	0.38	0.09
6.1	0.60	0.17
9.1	0.83	0.26
12.2	1.06	0.35
15.5	1.29	0.43
18.3	1.52	0.52

Note to Table A-9.23.13.7.(4)-A :

⁽¹⁾ Linear interpolation is permitted

Table A-9.23.13.7.(4)-B

Seismic Related Framing Adjustment Factor, K_{Sframe}

Reference Framing Type	K _{Wframe}
GWB-O	8.04
GWB-A	5.39
GWB-B	4.58
GWB-C	4.32
GWB-D	4.07
GWB-E	3.81
GWB-F	3.07
GWB-G	2.95
GWB-H	2.58
WSP-A	1.00
WSP-B	0.53
WSP-C	0.46
WSP-D	0.42
WSP-E	0.41
WSP-F	0.38
DWB	0.57

The force demand exerted on a building by seismic motion is directly proportional to the mass of the building. When determining the amount of bracing required to resist seismic forces, the length of the building parallel to the direction of loading is the most important consideration, because mass is generally evenly distributed along the length and width of a building. For a given building width, a longer building has more mass – and thus receives greater seismic forces – than a shorter building. As a result, the longer building requires a greater amount of bracing. For this reason, in the seismic bracing table, Table 9.23.13.7.-C, the amount of braced wall panel required in a wall line is dependent on the available building depth parallel to the braced wall band being considered, and is less dependent of the width of the building (perpendicular to the direction of the seismic force). This is illustrated in Figure A-9.23.13.7.(4)-A.

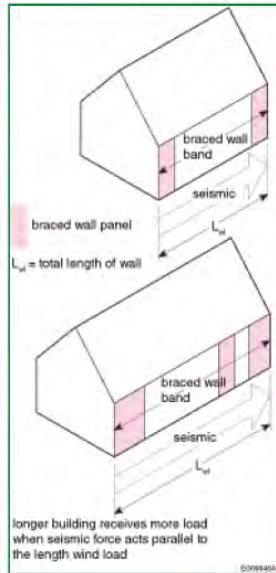


Figure A-9.23.13.7.(4)-A

Seismic Force on Different Length Buildings

The equation provided in Sentence 9.23.13.7.(4) is used to calculate the total required length of braced wall panels, L_s , within a braced wall band to resist seismic force applied in that direction. The unadjusted length, L_{us} , provided in Table 9.23.13.7.-C, refers to a reference building with an eave-to-ridge height of 3 m and two braced wall bands spaced 7.6 m apart, with a roof snow load of 2 kPa. Adjustment factors are applied to account for construction that deviates from the reference building. The values of the adjustment factors are presented in Table 9.23.13.7.-D. The adjustment factors are explained below.

K_{snow} accounts for specified roof snow load larger than 2 kPa.

$K_{spacing}$ accounts for the change in lateral load resistance when the spacing between braced wall bands differs from 7.6 m. When more than two braced wall bands resist lateral load, the increase in resistance is not directly proportional to the increase in the number of braced wall bands.

K_{number} accounts for the distribution of forces when more than two braced wall bands resist seismic load, Figure A-9.23.13.7.(4)-B. At first glance, it may seem counter-intuitive for the factor to increase when there are additional braced wall bands. However, since the braced wall panel lengths are determined based on the braced wall band spacing, the factor is needed to account for the actual distributed loads. Consider a 15 m building with a uniform seismic load of 10 kN/m horizontally applied to the width of a building with two exterior braced wall bands and one interior braced wall band. Equally distributing the seismic load to the three braced wall bands results in an actual force distribution of $(15 \text{ m} \times 10 \text{ kN/m}) / 3 \text{ braced wall bands} = 50 \text{ kN per braced wall band}$. However, based on the braced wall band spacing, each braced wall band would receive only $(10 \text{ kN/m} \times 7.5 \text{ m braced wall band spacing}) / 2 \text{ braced wall bands} = 37.5 \text{ kN}$. K_{number} corrects the calculated braced wall panel length by applying, for 3 braced wall bands, a factor of $50 \text{ kN} / 37.5 \text{ kN} = 1.33$. Note that in this case, K_{number} is applied to the unadjusted braced wall panel length for a 7.5 m braced wall band spacing to obtain the total braced wall panel length for each of the three braced wall bands in the 15 m wide building. As the amount of braced wall bands increases, the effect diminishes, and therefore the highest K_{number} factor applied to 5 braced wall bands is also sufficient for more than 5 braced wall bands. When the spacing of the parallel braced wall bands is not uniform, the average spacing value, as illustrated in Figure A.9.23.13.7.(4)-C, may be used in lieu of the largest spacing.

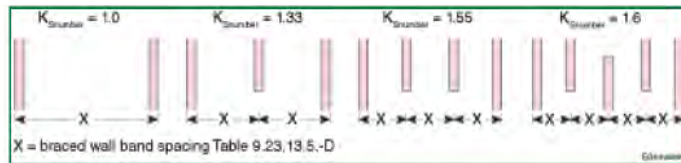


Figure A-9.23.13.7.(4)-B

Adjustment for Number of Braced Wall Bands Resisting Seismic Load

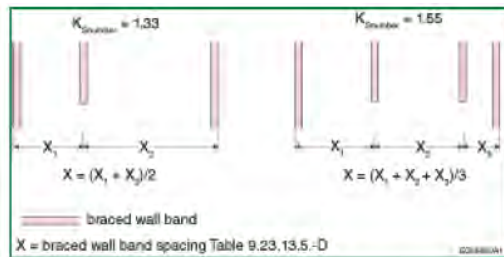


Figure A-9.23.13.7.(4)-C

Calculation of Mean Braced Wall Band Spacing for Seismic When the Spacings between Adjacent Braced Wall Bands are Not Uniform

As stated above, heavy buildings generate high seismic loads. For buildings that have construction weights higher than normal construction, the total length of braced wall panels needs to be adjusted by the weight of construction factor, K_{weight} . The value of K_{weight} depends on whether the building is classified as heavy construction, or it is clad with masonry veneer or stone veneer on one or two building faces, as illustrated in Figure A-9.23.13.7.(4)-D. Note that in the case of masonry veneer or stone veneer clad buildings, only the veneer located on the building faces perpendicular to the direction of seismic load are assumed to contribute to the seismic mass.

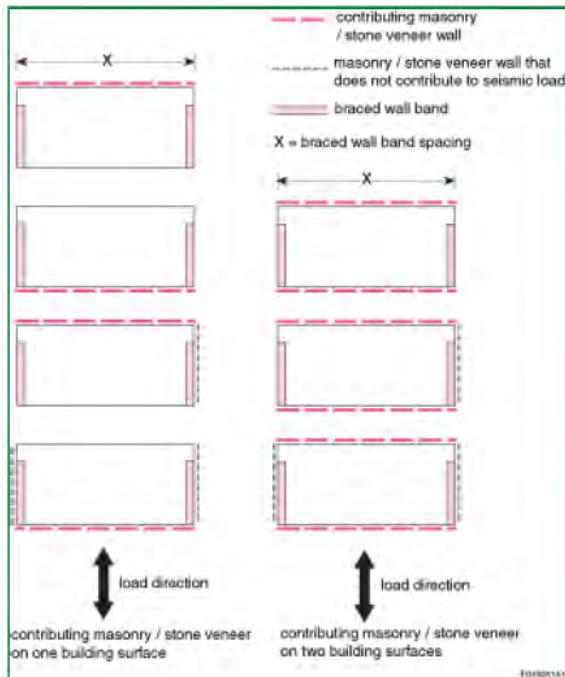


Figure A-9.23.13.7.(4)-D

Masonry Veneer or Stone Veneer Walls that Contribute to Seismic Force Applied on a Building

The minimum braced wall panel lengths provided in Table 9.23.13.7.-D assume that gypsum board is attached to the interior face of braced wall panels. If gypsum board is omitted, the braced wall panels are to be adjusted by the K_{gyp} factor.

Where the braced wall band is intermittently sheathed, the minimum lengths of braced wall panels listed in Table 9.23.13.7.-C must be increased by the K_{sheath} factor. Braced wall bands with intermittent braced wall panels permit the use of non-structural sheathing in areas of the wall where bracing is not required. This factor accounts for a lack of additional resistance otherwise provided by structural sheathing above and below openings and on other non-designated braced wall panels within the braced wall band (Figure A-9.23.13.7.(3)-E), as there would be when the entire braced wall band is continuously wood-sheathed (Figure A-9.23.13.7.(3)-F).

Non-designated wall segments within continuously-sheathed braced wall bands are required to be constructed with wood sheathing, but are not required to use the same sheathing and fastening as used in the designated braced wall panels along the braced wall band. Instead, the non-designated wall segments may be constructed with any of the plywood, OSB, or waferboard element options and corresponding fastening in accordance with Table 9.23.3.5.-A, and anchored in accordance with Sentence 9.23.6.1.(2).

The calculation procedure provided in this appendix note may be used to determine the minimum total required braced wall panel lengths for those cases designated as design required (DR) in Table 9.23.13.7.-C. Note that when the calculated L_s exceeds the available length of the wall line, a stronger framing type or a closer braced wall band spacing may be considered.

A-9.23.13.8. Foundation Cripple Walls. Cripple walls are also known as “pony walls” or “knee walls.” In Section 9.23., the term “cripple walls” refers to short wood-frame stud walls extending from the top of the foundation wall to the underside of the lowest floor framing.

Studies have demonstrated that wood-frame foundation walls with low racking resistance, such as unbraced or insufficiently braced cripple walls, do not have adequate capacity to resist seismic loading. Such walls have led to the failure of buildings in earthquakes. Where cripple walls do not meet the conditions of Sentences 9.23.13.8.(2) to (4), they need to be considered as an additional storey, or designed in accordance with Part 4 to ensure that they resist both in-plane and out-of-plane forces. Information on cripple walls can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User’s Guide – NBC 2020: Part 4 of Division B).”

A-9.23.13.8.(2) Foundation Cripple Walls Where $S_{max} \leq 0.60$.

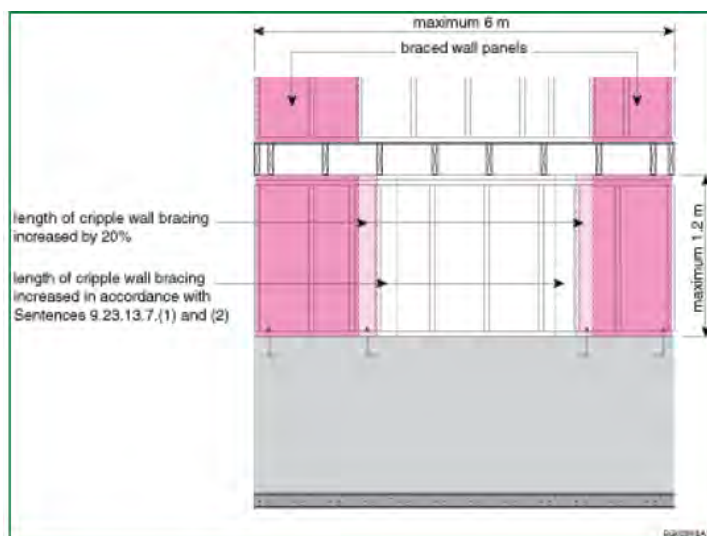


Figure A-9.23.13.8.(2)

Foundation cripple wall where $S_{max} \leq 0.60$

A-9.23.13.8.(3). Foundation Cripple Walls Where $S_{max} > 0.60$.

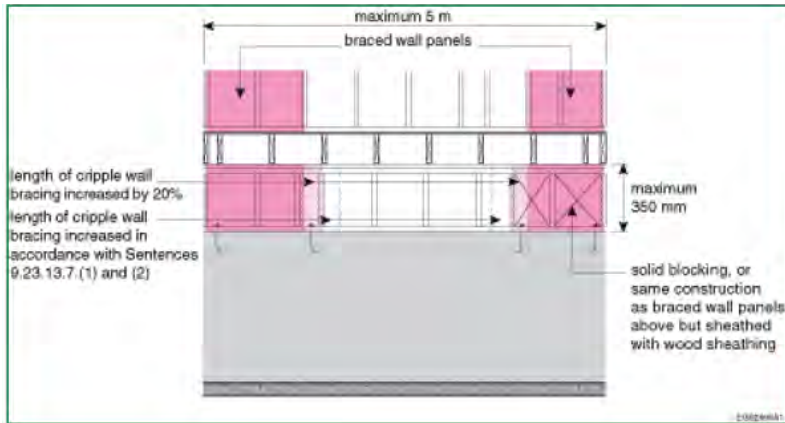


Figure A-9.23.13.8.(3)

Foundation cripple wall where $S_{max} > 0.60$

A-9.23.13.9.(1) Cripple Walls in Stepped Foundations. The conditions of Sentence 9.23.13.9.(1) are intended to establish whether the stepped foundation provides sufficient bracing for the braced wall band it supports. If the bracing is not considered to be sufficient, the provisions of Sentences 9.23.13.8.(2) to (4) for the appropriate value of S_{max} apply.

Where the foundation is less than 2.4 m in length, the attachment to the foundation is insufficient to complete the lateral load path for the first-storey braced wall band. In this case, the cripple wall needs to be braced, and there is no need for the top plate to be anchored to the foundation, although it would be good practice.

Where the foundation is at least 2.4 m in length and the top plate of the cripple wall is adequately anchored to the foundation wall, the cripple wall itself does not need to be braced, provided its height does not exceed 1.2 m.

Where the cripple wall exceeds 1.2 m in height, it must be considered as a storey or designed in accordance with Part 4 (see Sentence 9.23.13.8.(1)), regardless of the adequacy of the bracing it provides.

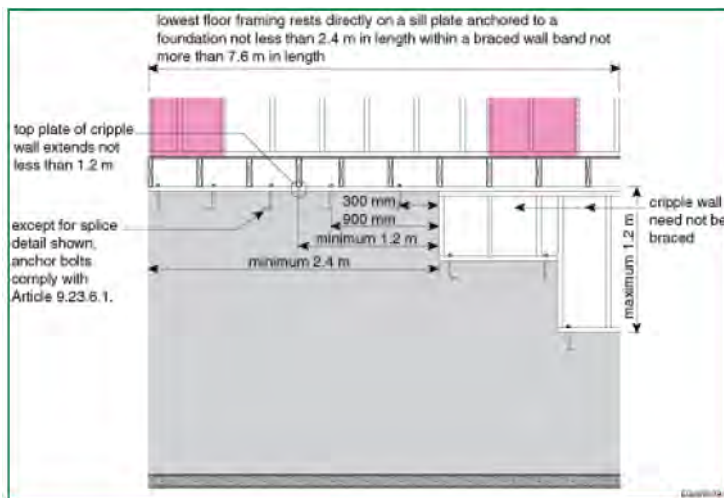


Figure A-9.23.13.9.(1)

Cripple wall in a stepped foundation

A-9.23.13.10.(2) Attachment of a Porch Roof to Exterior Wall Framing.

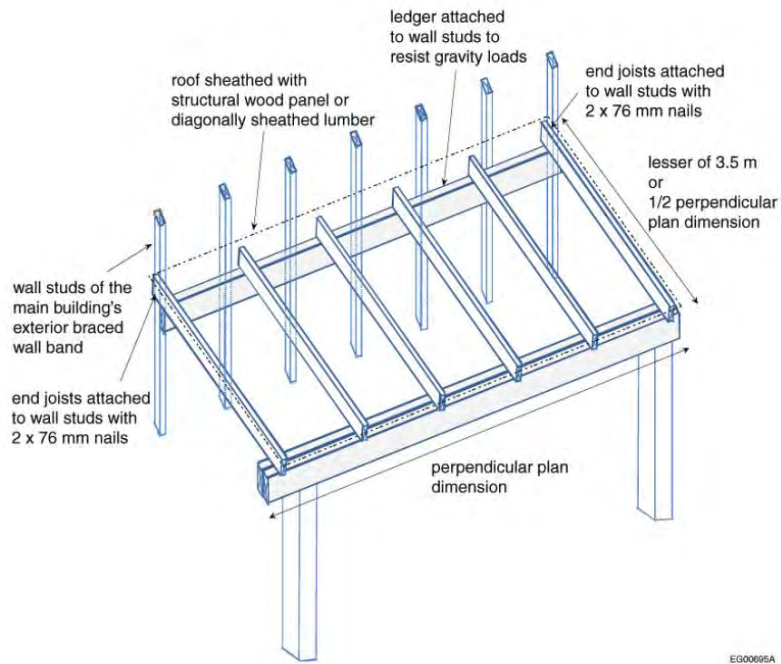


Figure A-9.23.13.10.(2)-A
Framing perpendicular to plane of wall (balloon construction)

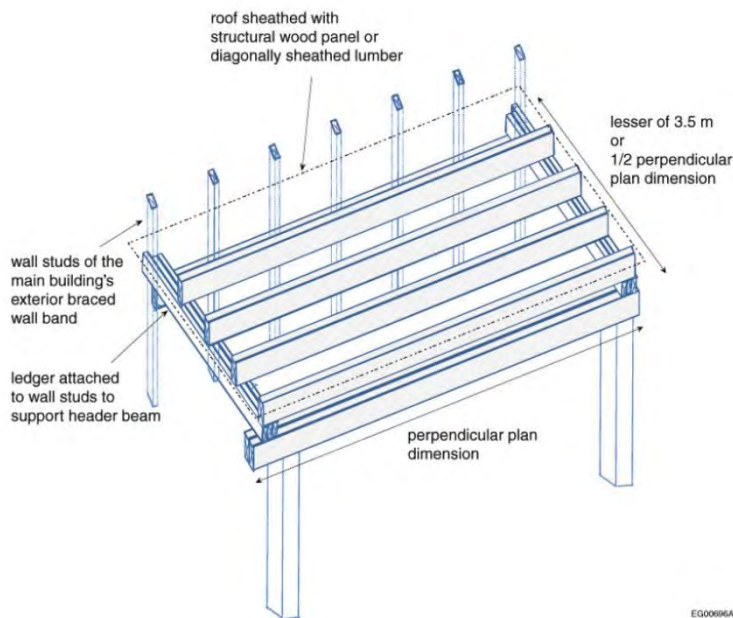


Figure A-9.23.13.10.(2)-B
Framing parallel to plane of wall

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 D1037, "Standard Test Methods for 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.

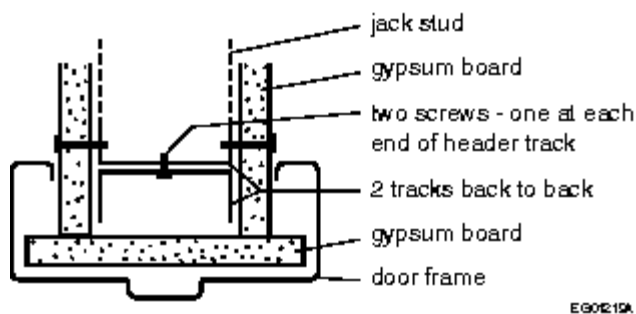


Figure A-9.24.3.2.(3)

Steel stud header detail

A-9.25.1.1.(2) Difference Between a Vapour Barrier and an Air Barrier. It is important to understand the difference between the functions of a vapour barrier and an air barrier. Some materials perform both functions, while others are only intended to perform one of the two.

Vapour barrier materials are intended to restrict the movement of water vapour due to vapour pressure differentials, which are created by differences in temperature and moisture content, while air barrier materials are intended to restrict the movement of air due to air pressure differentials.

A vapour barrier does not have to be continuous or sealed to perform its function of reducing the amount of water vapour that moves across an assembly, but an air barrier must be continuous and fully sealed to prevent the movement of air across the assembly.

Further information can be found in "The difference between a vapour barrier and an air barrier," by Quirouette, R. L., Building Performance Section, Division of Building Research, National Research Council Canada, BPN 54, July 1985.

A-9.25.2.2.(2) Flame-Spread Ratings of Insulating Materials. Part 9 has no requirements for flame-spread ratings of insulating 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 C516, "Standard Specification for 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.

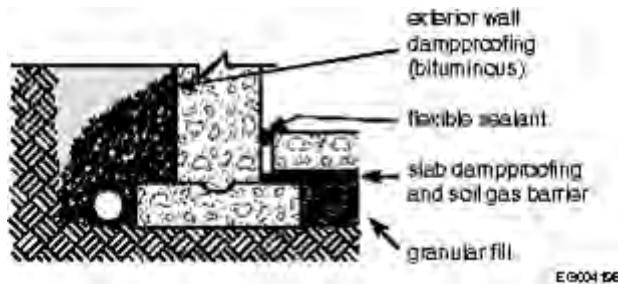


Figure A-9.25.3.4. and 9.25.3.6.-A

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.

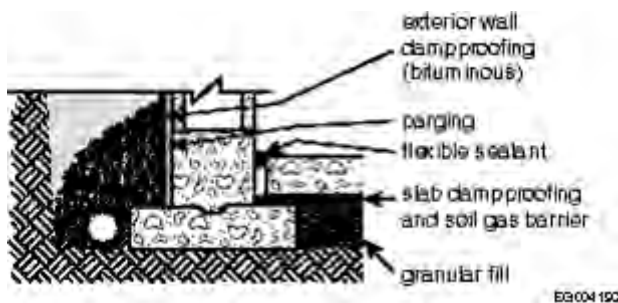


Figure A-9.25.3.4. and 9.25.3.6.-B

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) Vapour Barrier Materials in Foundation Wall Assemblies Enclosing Basements or Heated Crawl Spaces. In the summer, solar heating can cause condensation to form on the wall-facing side of polyethylene membranes that are installed on the warm side of foundation wall assemblies enclosing a basement or heated crawl space. Moisture in the foundation wall due to wind-driven rain is driven to the interior when the above-ground portion of the wall is exposed to solar heating. Variable-permeance vapour barrier materials allow moisture to dissipate into the basement or heated crawl space during the summer and have thus been shown to minimize the formation of condensation in foundation wall assemblies. These materials have proven effective whether installed continuously over the full area of the foundation wall or continuously over not less than the top half of the full height of the wall area, starting from the above-ground portion, with a polyethylene membrane installed over the remaining bottom portion.

Sentence 9.25.4.2.(2) is not intended to preclude the use of variable-permeance vapour barriers in above-grade wall assemblies. However, when contemplating their use in such an application, consideration should be given to the climatic conditions at the building's location.

A-9.25.4.2.(3) Normal Conditions. The requirement for a $60 \text{ ng}/(\text{Pa} \times \text{s} \times \text{m}^2)$ 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-9.25.4.2.(6) Protection of Vapour Barriers. The requirements of CAN/CGSB-51.33-M, "Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction," were developed for paper-based vapour barriers, which are not susceptible to deterioration under prolonged exposure to direct ultraviolet (UV) radiation. Since the publication of the last edition of this standard in 1989, non-polyethylene vapour barriers have become available that are susceptible to UV-induced deterioration. These vapour barriers must be protected by a covering or installed in locations where they will not be exposed to direct UV radiation after the completion of construction. In addition, the vapour barrier manufacturer's guidance regarding the maximum allowable time of exposure to direct UV radiation should be followed where provided. Exposure to direct UV radiation most commonly occurs around window openings.

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 can be found in "Performance Guidelines for Basement Envelope Systems and Materials," published by NRC.

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 $60 \text{ ng}/(\text{Pa}\times\text{s}\times\text{m}^2)$. 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 $60 \text{ ng}/(\text{Pa}\times\text{s}\times\text{m}^2)$, 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⁾

Material	Air Leakage Characteristic, L/(s×m²) at 75 Pa (Air Permeance)	Water Vapour Permeance, (Dry Cup) ng/(Pa×s×m²)
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.” Taron 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 Performance 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 (m²×K)/W and a water vapour permeance between 30 and 1 800 ng/(Pa×s×m²) 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)).

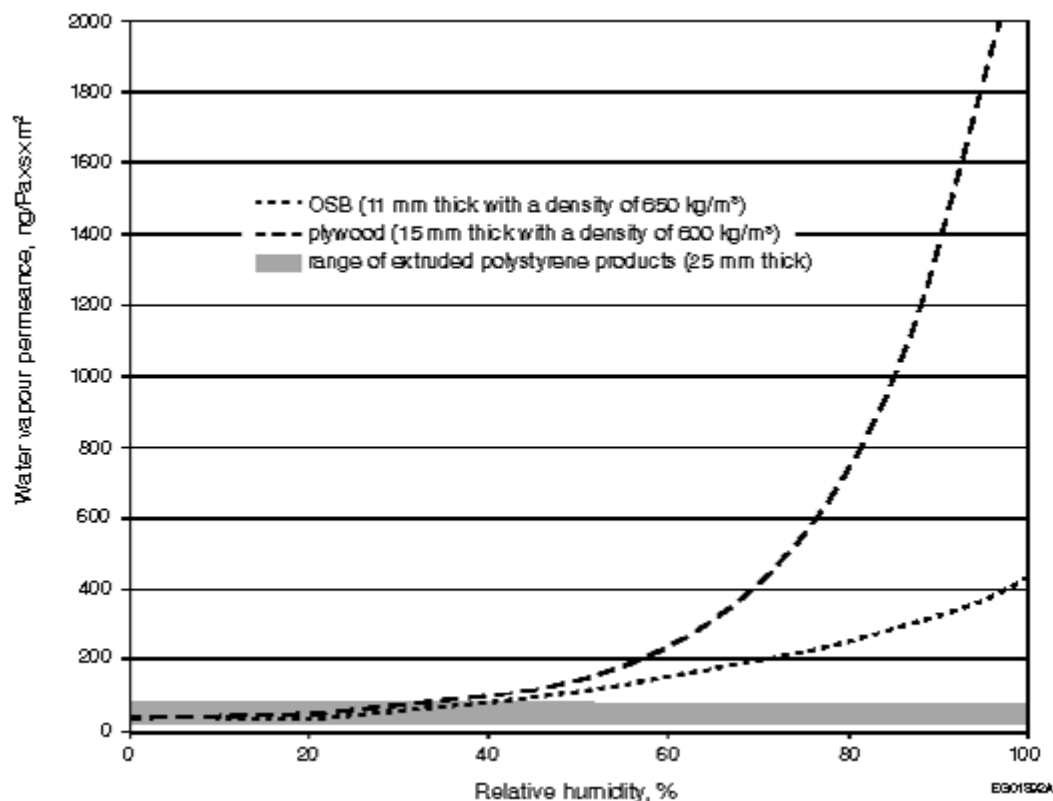


Figure A-9.25.5.1.(3)

Adaptive water vapour permeance of wood-based sheathing materials

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.

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·m²) vapour barrier, and an air barrier (values between 0.024 and 0.1 L/sm² 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 modeling 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.

Calculating Inboard to Outboard Thermal Resistance

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.

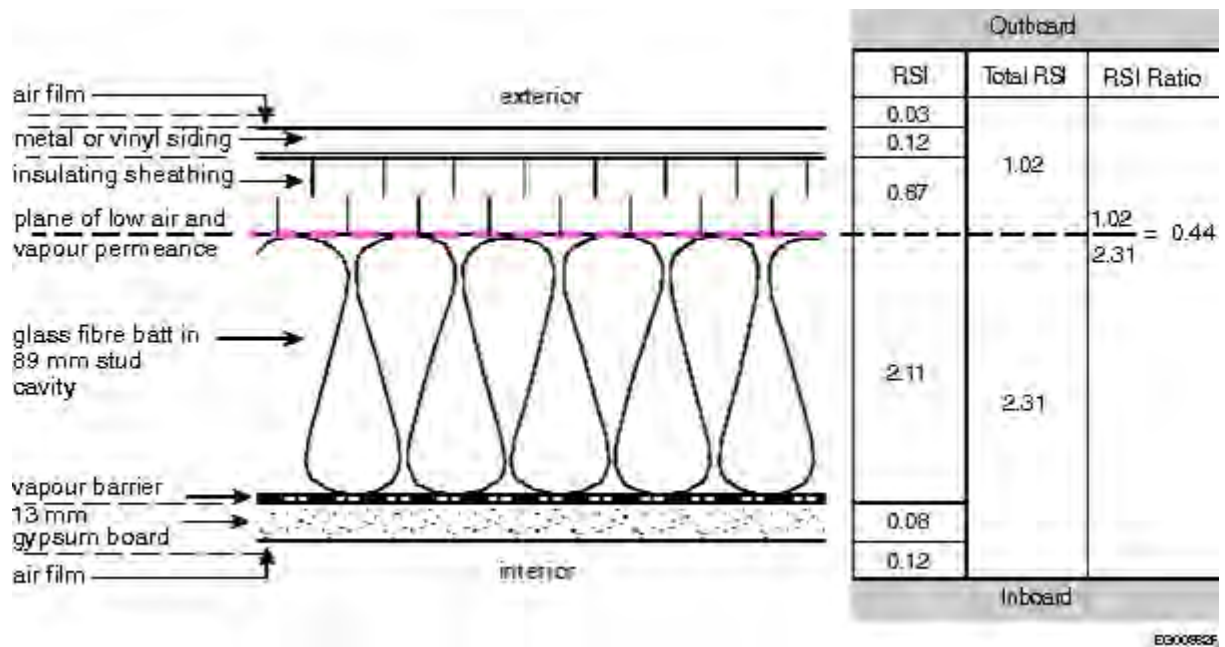


Figure A-9.25.5.2.

Example of a wall section showing thermal resistance inboard and outboard of a plane of low air and vapour permeance

Table A-9.25.5.2.

Minimum Thicknesses of Low-Permeance Insulating Sheathing

Celsius Heating Degree-days	Min. RSI Ratio	38 × 89 Framing					38 × 140 Framing				
		Min. Outboard Thermal Resistance, RSI	Min. Sheathing Thickness, mm				Min. Outboard Thermal Resistance, RSI	Min. Sheathing Thickness, mm			
			Sheathing Thermal Resistance, RSI/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	10	10	9	8	0.72	19	17	16	14
5000 to 5999	0.30	0.69	18	17	16	14	1.07	31	28	26	23
6000 to 6999	0.35	0.81	22	20	19	16	1.25	37	34	32	28
7000 to 7999	0.40	0.92	26	24	22	19	1.43	43	39	37	32
8000 to 8999	0.50	1.16	34	31	29	25	1.79	55	50	47	41
9000 to 9999	0.55	1.27	37	34	32	28	1.97	61	56	52	45
10000 to 10999	0.60	1.39	41	38	35	31	2.15	67	61	57	50
11000	0.65	1.50	45	42	39	34	2.33	73	67	62	54

to 11999											
≥ 12000	0.75	1.73	53	49	45	40	2.69	85	78	72	63

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 **Building By-law** 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.)

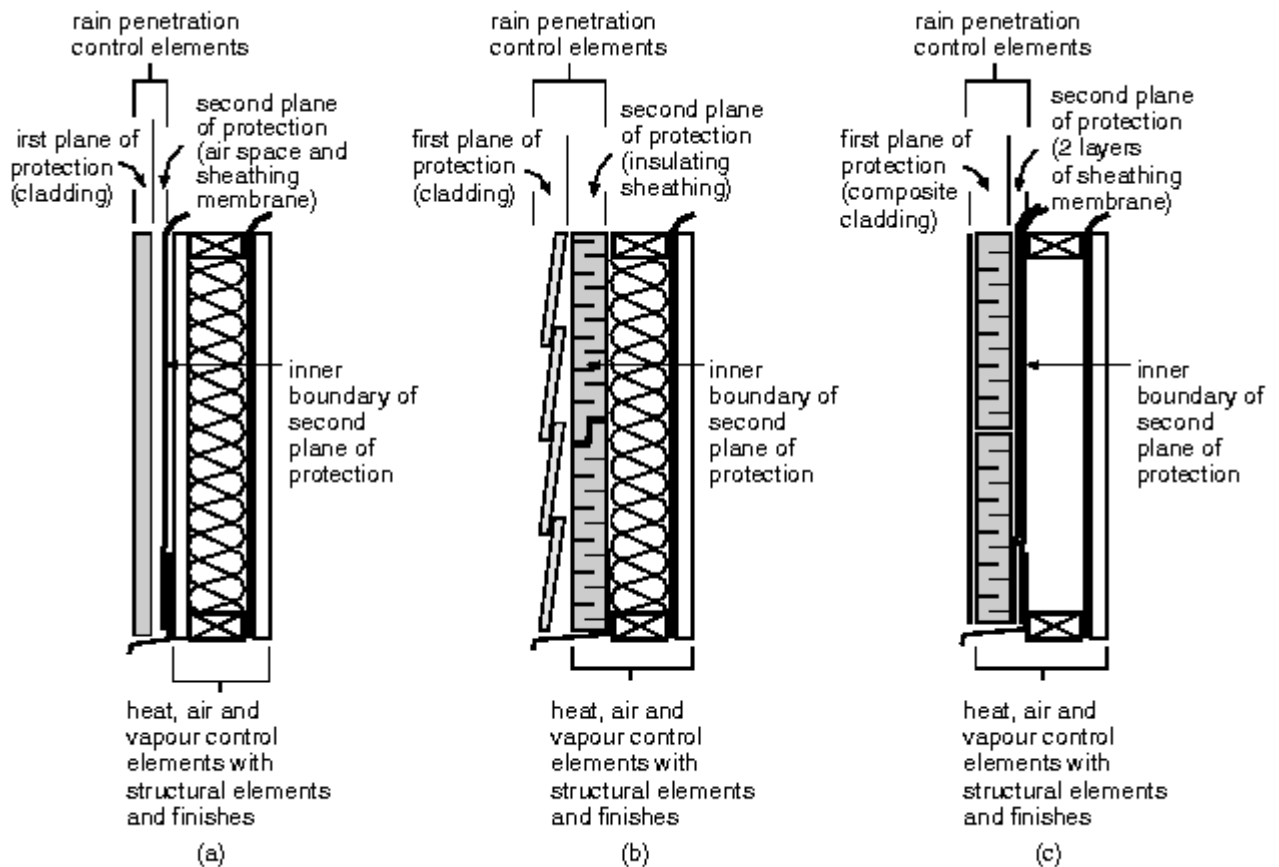


Figure A-9.27.2.

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 **Building 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 **Building 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 10 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. 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.

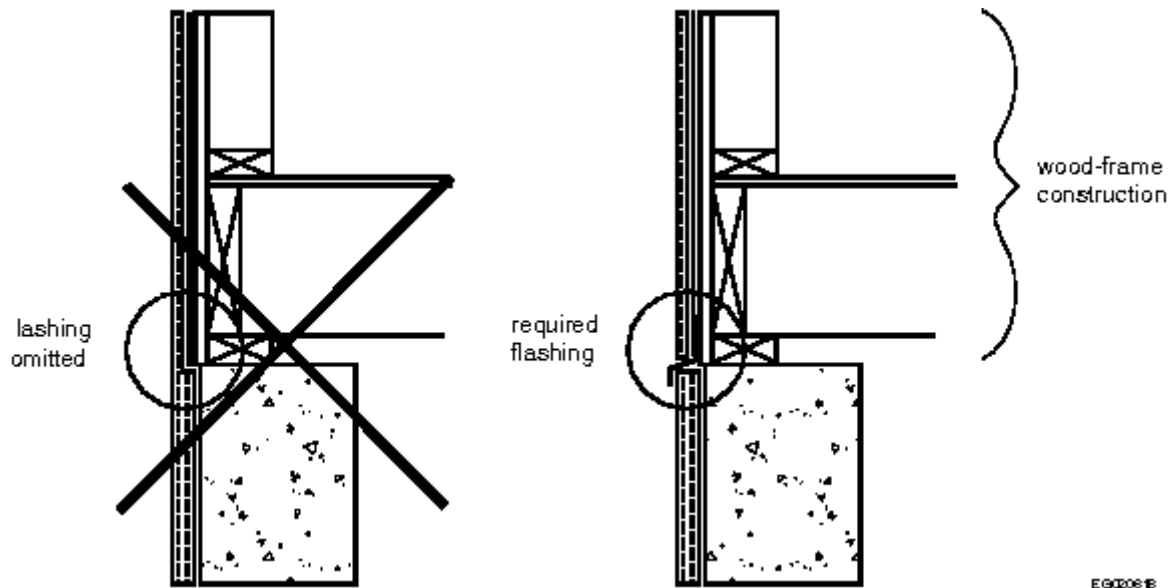


Figure A-9.27.3.8.(1)

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).)

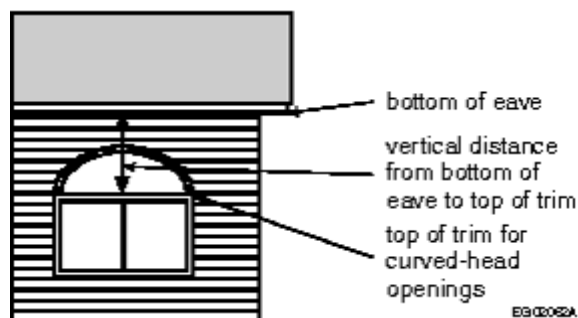


Figure A-9.27.3.8.(3)

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.

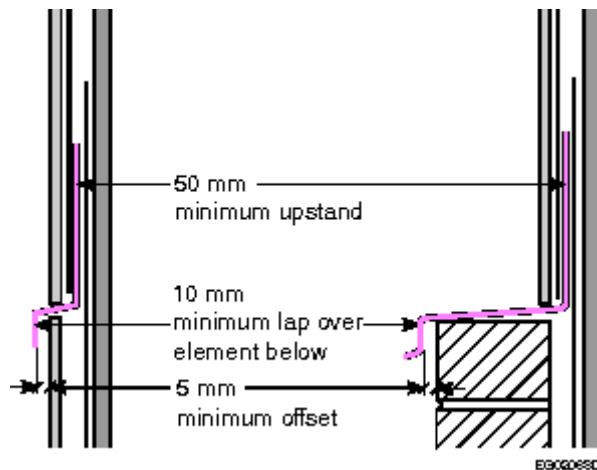


Figure A-9.27.3.8.(4)

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

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"):

$$\text{Shrinkage} = (\text{total horizontal member height}) \times (\text{initial MC} - \text{equilibrium MC}) \times (.002)$$

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.

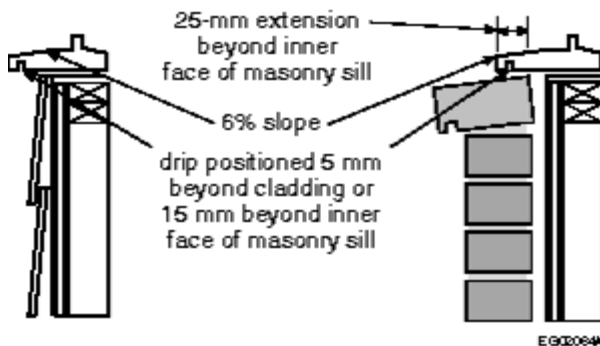


Figure A-9.27.3.8.(5)

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 C1193, "Standard Specification for Use of Joint Sealants,"
- ASTM C1299, "Standard Guide for Use in Selection of Liquid-Applied Sealants," and
- ASTM C1472, "Standard Guide for 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-9.27.5.4.(2) **Attachment of Cladding to Flat Wall ICF Units where the 1-in-50 HWP Exceeds 0.60 kPa.** For locations where the 1-in-50 hourly wind pressure is greater than 0.60 kPa, the results of testing fasteners to ASTM D1761, "Standard Test Methods for Mechanical Fasteners in Wood and Wood-Based Materials," must be obtained from a testing facility or from the insulating concrete form manufacturer to confirm their ultimate strengths for both direct withdrawal and lateral shear. In accordance with limit states design as described in Subsection 4.1.3., the factored resistances of the fastener must be equal to or greater than the factored loads on the fastener at the spacing proposed by the designer. In order to align with the limit states design procedures used to develop Table 9.27.5.4.-B, the factored resistances must be calculated by applying a reduction factor of $\Phi = 0.35$ to the fastener's ultimate strengths, and the factored loads must lie within the area under the line of linear interaction in a diagram that plots the factored lateral shear resistance of the fastener against its factored direct withdrawal resistance.

A-9.27.5.7. **Penetration of Fasteners.** Where cladding is applied to sheathing that is not suitable for fastening, the fastener length must be increased to maintain the minimum fastener penetration depth into the nail-holding base substrate, as specified in Article 9.27.5.7.

A-9.27.9.2.(2) **Grooves in Hardboard Cladding.** Grooves deeper than that specified may be used in thicker cladding, provided they do not reduce the thickness to less than the required thickness minus 1.5 mm.

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.(1) **Steel Sheet Products.** The minimum thickness of 0.33 mm stated in Sentence 9.27.11.1.(1) refers to the total thickness of the materials, i.e., the combination of the minimum thickness of the base steel (0.29 mm) and the minimum coating thickness required by CSSBI 23M, “Standard for Residential Steel Cladding.” Note that the terms “siding” and “cladding” are often used interchangeably.

A-9.27.11.1.(2) and (3) **Material Standards for Aluminum Cladding.** Compliance with Sentence 9.27.11.1.(2) 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.(3) and CAN/CGSB-93.1-M, “Sheet, Aluminum Alloy, Prefinished, Residential,” is required for aluminum cladding that is installed in large sheets.

A-9.27.14.1.(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 9.27.14.1.(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.

A-9.27.14.2.(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, “Standard for 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 C1177/C1177M, “Standard Specification for 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-9.29.5.1.(3) **Application of Gypsum Board to Flat ICF Walls.** ASTM C840, “Standard Specification for Application and Finishing of Gypsum Board,” specifies requirements for the anchorage of gypsum board panels to flat wall ICF units in the section on System XVI. While the standard practice for the application of gypsum board panels over traditional vertical wood studs or metal framing members is to align the vertical joints of the panels on a supporting member, ASTM C840 requires that the vertical joints between the panels be positioned halfway between the web fastening strips of the flat wall ICF units to minimize damage to the edges of the panels during screw anchorage. The full surface of the flat wall ICF insulation panels (backed by the concrete cores) provides solid, continuous support of the taped gypsum board panel joints, which protects them from potential deflection, cracking and impact damage.

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.

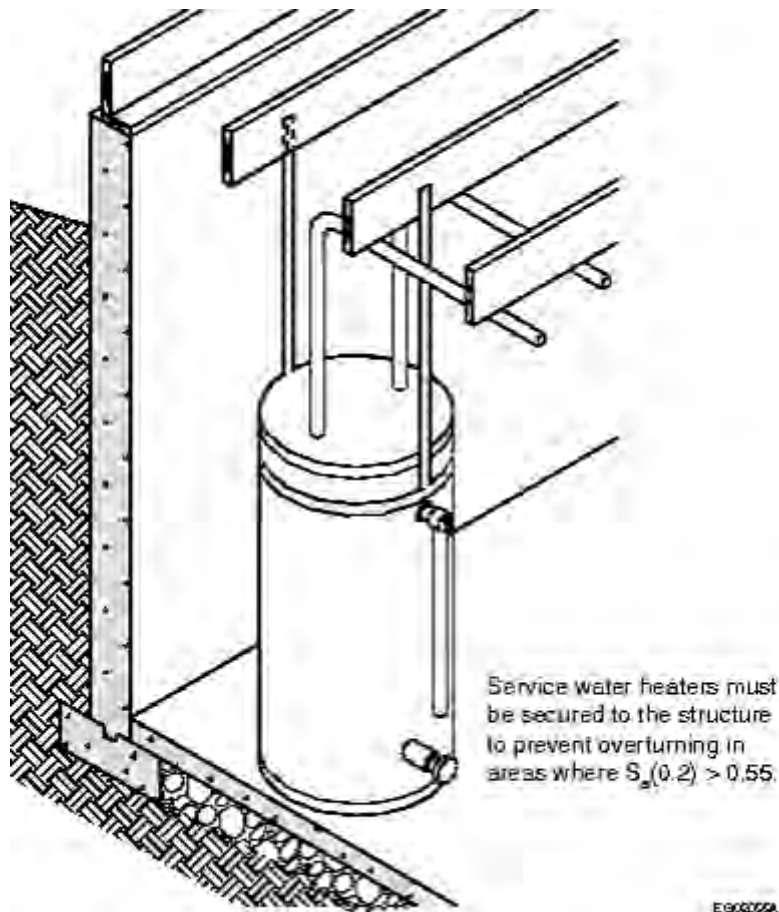


Figure A-9.31.6.2.(3)

Securement of service water heater using strapping fastened to floor joists overhead

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-9.32.1.2.(2) Application of Subsection 9.32.3. and Ventilation of Houses Containing a Secondary Suite.

Ventilation for Smoke Control

The control of smoke transfer between dwelling units in a house with a secondary suite, or between the dwelling units and other spaces in the house, is a critical safety issue. Although providing a second ventilation system to serve the

two dwelling units is expensive—and potentially difficult in an existing building—it is an ideal solution for achieving a minimum acceptable level of fire safety.

Other solutions to providing separate ventilation systems for the dwelling units must address smoke control. Although smoke dampers restrict the spread of smoke by automatically closing in the event of a fire, their installation in a ventilation system that serves both dwelling units in a house with a secondary suite is not considered to be an ideal solution because they are very expensive, require regular inspection and maintenance, and must be reset after every activation.

Ventilation for Air Exchange

The provision of a ventilation system for the purpose of maintaining acceptable indoor air quality is a critical health issue. However, Sentence 9.32.1.2.(3) allows exits and public corridors in houses with a secondary suite to be unventilated. Lack of active ventilation of these spaces is considered acceptable because occupants do not spend long periods of time there and because exits are somewhat naturally ventilated when doors are opened.

Considering the cost of installing separate ventilation systems, Sentence 9.32.1.2.(4) also exempts ancillary spaces in houses with a secondary suite from the requirement to be ventilated, provided that make-up air is supplied in accordance with Article 9.32.3.4.

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 CO₂, 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-9.32.3.1.(1) Required Ventilation.

Performance Approach [Clause 9.32.3.1.(1)(a)]

CAN/CSA-F326-M, “Residential Mechanical Ventilation Systems,” is a comprehensive performance standard. It gives experienced ventilation system designers the flexibility to design a variety of residential ventilation systems that satisfy those requirements.

Prescriptive Approach [Clause 9.32.3.1.(1)(b)]

The prescriptively described systems are intended to provide a level of performance approaching that provided by systems complying with CAN/CSA-F326-M, “Residential Mechanical Ventilation Systems.” They are included in the **Building By-law** for use by those less experienced in ventilation system design. Code users who do not find these prescriptively described systems satisfactory for their purposes, or who find them too restrictive, are free to use any other type of ventilation system that satisfies the performance requirements of CAN/CSA-F326-M.

A-9.32.3.2.(4) Duct Systems Serving More Than One Space. Sentence 9.32.3.2.(4) requires heating or ventilation duct systems that serve any space in addition to a single dwelling unit to prevent the circulation of smoke upon a signal

from a duct-type smoke detector. A duct system that serves a dwelling unit and a common space must be designed and installed to prevent the circulation of smoke.

A-9.32.3.4. Principle Ventilation System Supply Air.

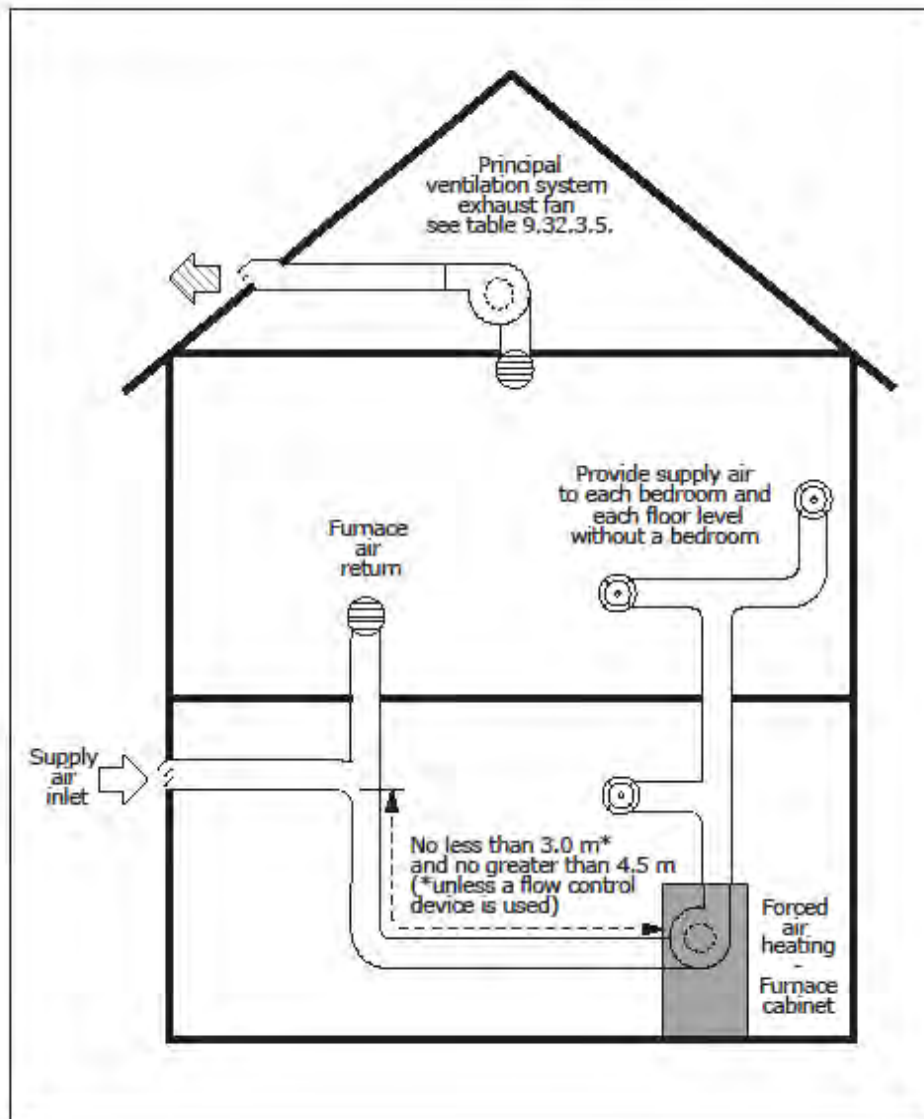


Figure A-9.32.3.4.(2)
Forced-Air Heating System Supply Air Distribution

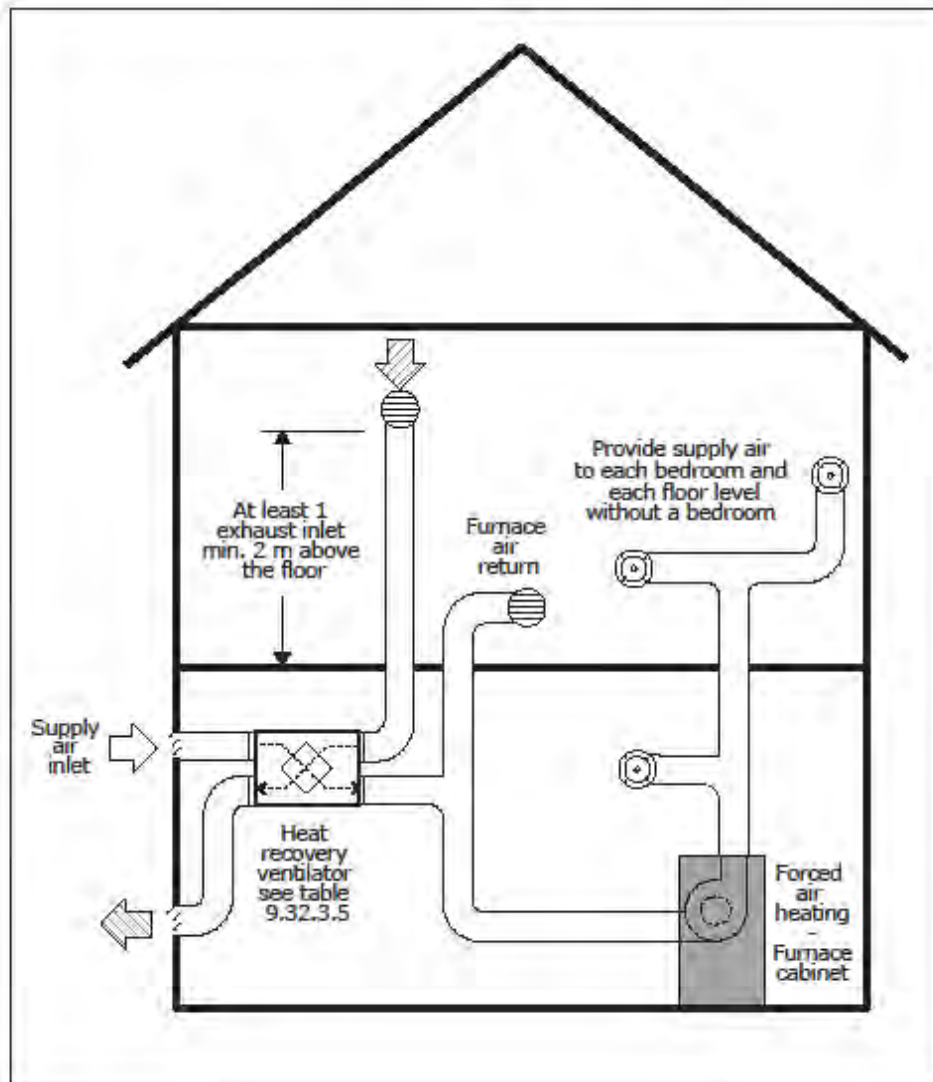


Figure A-9.32.3.4.(3)
Forced-Air Heating System with Heat Recovery Ventilator Supply Air Distribution

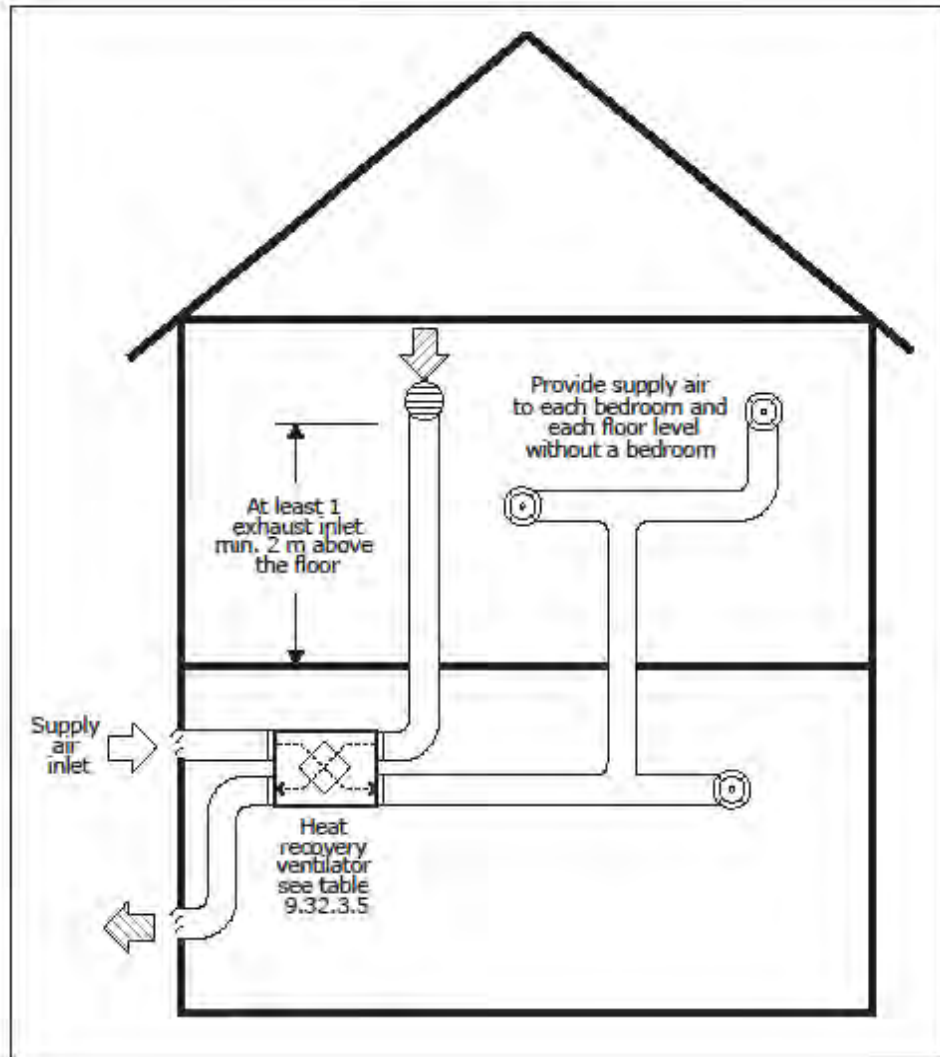


Figure A-9.32.3.4.(4)
Heat Recovery Ventilator Supply Air Distribution

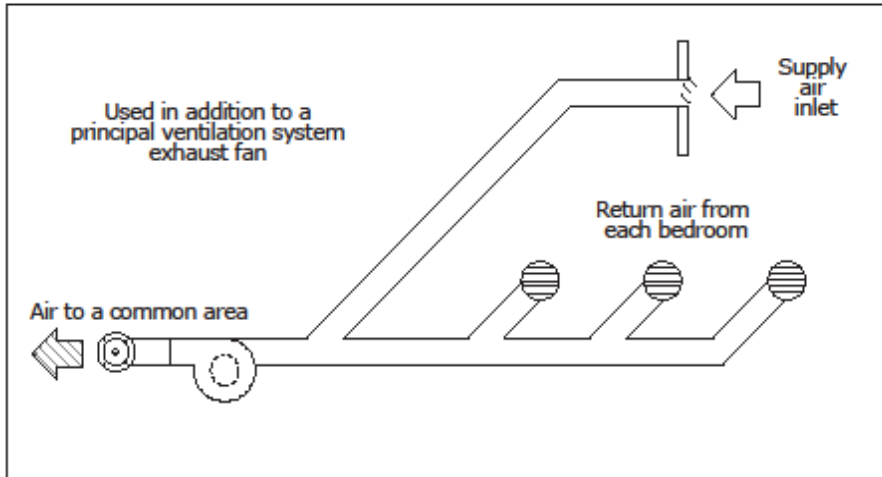


Figure A-9.32.3.4.(5)(b)(i)
Central Recirculation System Supply Air Distribution

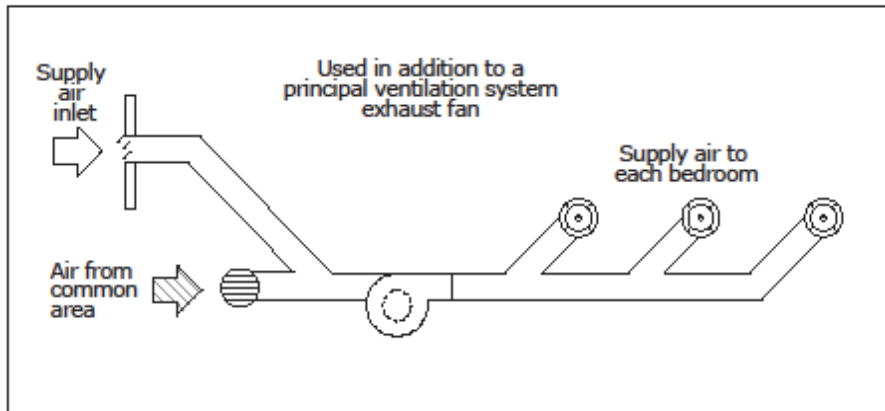


Figure A-9.32.3.4.(5)(b)(ii)
Central Recirculation System Supply Air Distribution

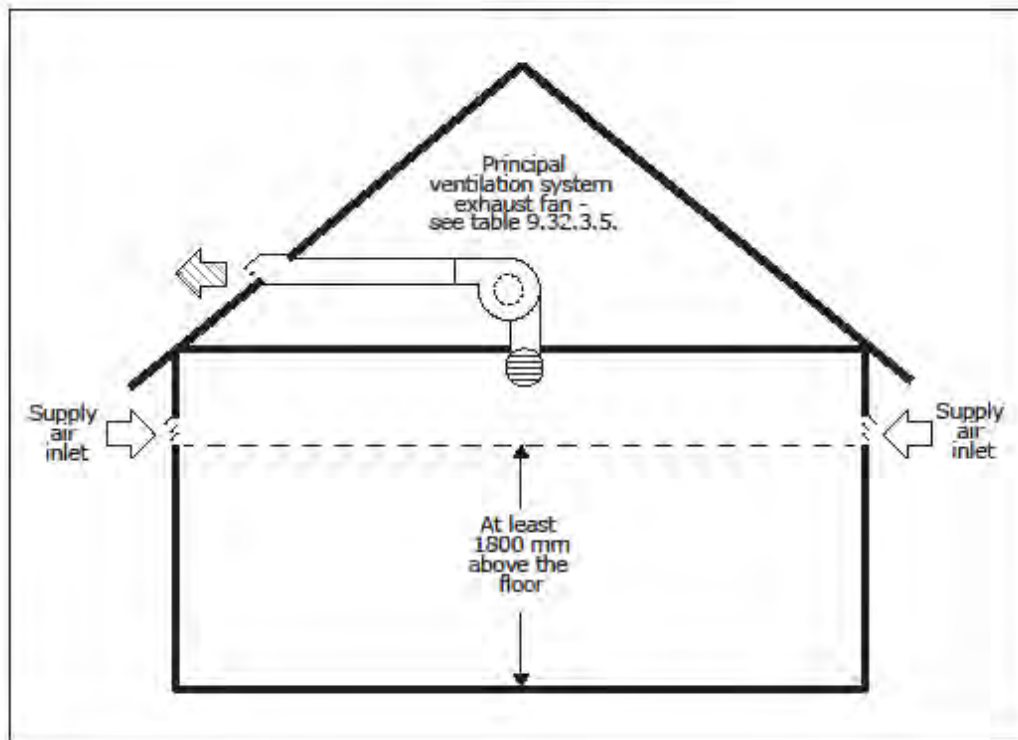


Figure A-9.32.3.4.(6)
Passive Supply Air Distribution

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
- mid-efficient forced air furnaces equipped with induced draft fans and exhaust proving switch, and
 - 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 9.10.9.18. 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-9.33.1.1.(2) Combustion Air and Tight Houses. The operation of an air exhaust system or of a fuel-burning appliance removes the air from a house, creating a slight negative pressure inside. In certain cases the natural flow of air up a chimney can be reversed, leading to a possible danger of carbon monoxide poisoning for the inhabitants.

Newer houses are generally more tightly constructed than older ones because of improved construction practices, including tighter windows, weather stripping and caulking. This fact increases the probability that infiltration may not be able to supply enough air to compensate for simultaneous operation of exhaust fans, fireplaces, clothes dryers, furnaces and space heaters. It is necessary, therefore, to introduce outdoor air to the space containing the fuel-burning appliance. Information regarding combustion air requirements for various types of appliances can be found in the installation standards referenced in Sentences 6.2.1.5.(1) and 9.33.5.2.(1). In the case of solid-fuel-burning stoves, ranges and space heaters, CSA B365, "Installation Code for Solid-Fuel-Burning Appliances and Equipment," suggests that the minimum size of openings be determined by trial and error to accommodate the flue characteristics, the firing rate, the building characteristics, etc., and that, as a guide, the combustion air opening should be 0.5 times the flue collar area.

Further information can be found in CBD 222, "Airtight houses and carbon monoxide poisoning," which is available from NRC.

A-9.33.2.1.(2) **Cooling.** Passive cooling designs can also be used to help reduce cooling loads to achieve the indoor design temperature specified in Sentence 9.33.3.1.(2).

A-9.33.4.3.(1) **Heating System Controls.** Where a single heating system serves two dwelling units and common spaces in a house with a secondary suite, it must be possible for the occupants to control the temperature in their own suites. Sentence 9.33.4.3.(1), which applies only to electric, fuel-fired or unitary heaters and hydronic heating systems, specifies that separate temperature controls must be provided in each dwelling unit in a house with a secondary suite; however, the controls for shared spaces may be located in those spaces or in one of the suites.

A-9.33.4.4. **Access to Equipment.** Mechanical equipment installed into a building is typically expected to undergo regular maintenance and testing so that the equipment remains at peak operational efficiency and can maintain a healthy air quality. Such maintenance may include flushing and cleaning, filter and part replacement, lubrication of moving components, and various safety checks. Building equipment should be located and oriented to provide adequate space for maintenance personnel to conduct all regular maintenance work without unreasonable effort. Confined spaces should be avoided, as should the creation of conditions that would dissuade regular maintenance, and sufficient clearances and headroom should be provided to reduce the risk of injury.

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" 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. By-law 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” 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 9.10.9.18.(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 9.10.9.18.(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.

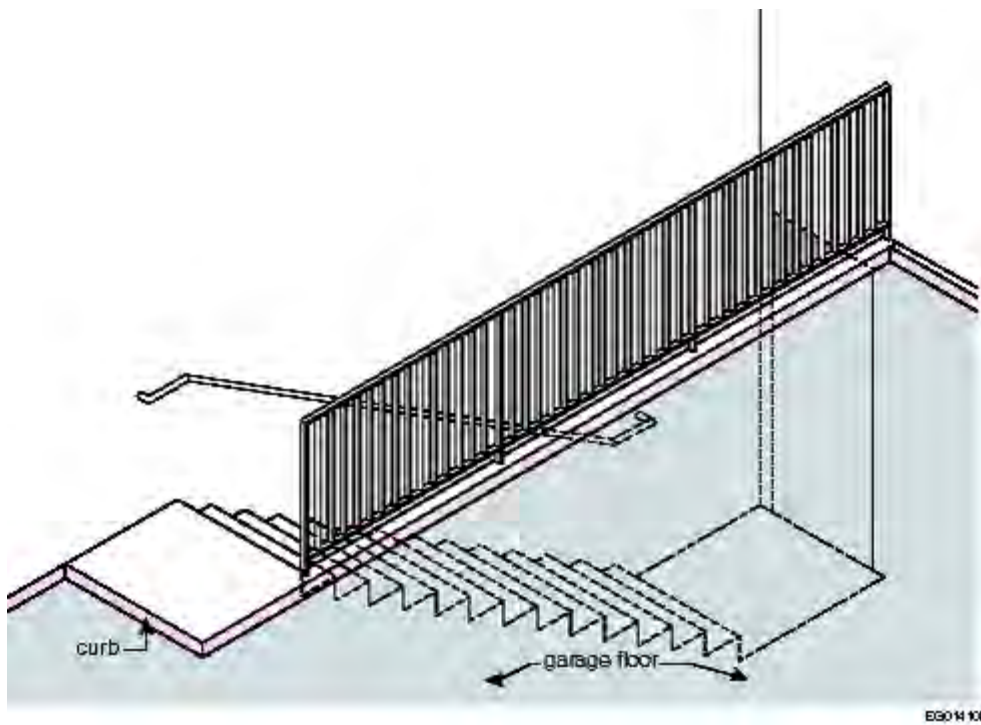


Figure A-9.35.2.2.(1)

Curb around garage floor at stairs

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).

Vancouver Building By-law 2025

Book II: Plumbing Systems

Refer to the 2020 National Plumbing Code of Canada with amendments as described in Part 7 of Division B, Subsection 7.1.5.

