

National Building Code of Canada 1990

ARCHIVES

First Revisions and Errata

**Issued by the
Associate Committee on the National Building Code
National Research Council of Canada
Ottawa**

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The attached pages identify revisions and errata to the National Building Code of Canada 1990. The revisions have been approved by the Associate Committee on the National Building Code for immediate implementation.

In accordance with the ACNBC Policies and Procedures, the list of referenced documents in Table 2.7.3.A. of the 1990 NBC is updated annually. The revisions contained herein include updates to 30 June 1990. Where changes to the title have been made, the relevant requirements have also been updated.

The errata are corrections which have been identified and are included to facilitate the use of the Code.

Revisions are identified by an **r** in the margin nearest the change; errata are identified by an **e**.

1991 first revisions and errata

p. ix	4.2.3.9.	9.14.3.1.(1)	Table A-9.7.3.2.B.
1.1.3.2.	4.3.1.1.	9.18.6.1.(3)	Table A-9.10.3.A.
Horizontal exit	6.2.1.4.(1)	9.20.1.1.(1)	Table A-9.10.3.B.
2.3.4.3.(1)	6.2.3.2.(2), (4)	9.20.1.2.	A-9.10.12.5.
2.3.4.6.(1)	6.2.3.16.(2)	9.20.2.4.	A-9.11.1.1.
2.7.3.1.	6.3.1.4.	9.20.6.2.(3)	A-9.15.1.3.(4)
Table 2.7.3.A.		9.20.12.2.(1), (2)	A-9.20.1.2.
Table 3.1.3.A.	9.3.1.3.(1)	9.22.5.2.(2)	A-9.23.4.1.(1)
3.1.5.11.(1), (3), (4), (6)	9.3.1.4.	9.23.4.5.	A-9.23.14.2.(4)
3.1.7.1.(1)	9.3.1.8.(1)	9.23.4.6.	A-9.25.4.3.(2)
3.1.8.4.(1)	Table 9.3.2.A.	Table 9.23.12.B.	Index
3.1.8.5.(1)	9.4.2.3.	Table 9.23.13.A.	Balconies
Table 3.1.8.B.	Table 9.4.4.A.	Table 9.23.13.B.	floor loads
3.1.11.7.(1)	Table 9.5.2.A.	9.24.3.5.(1)	Chimneys
Table 3.1.13.B.	9.6.4.1.	9.25.3.1.(1)	clearances
3.2.3.7.(3)	9.6.66.(1)	9.25.3.2.	Clearances
3.2.3.13.(3)	9.7.2.1.	9.25.3.5.(1)	chimneys
Table 3.2.4.A.	9.7.7.2.	9.25.4.4.	Cooling equipment
3.2.4.12.(1)	9.8.3.1.(3)	9.26.2.1.(1)	Flammable and combustible liquids
3.2.4.22.(5)	9.8.6.2.(2)	9.27.4.2.	Furnace
3.2.6.2.(3)	9.8.9.1.(1), (2)	Table 9.27.5.A.	capacity
3.2.6.6.(1)	Table 9.9.7.A.	9.29.9.2.	Grab bars
3.2.6.9.(6)	9.9.7.2.	9.29.10.5.	Guards
3.2.6.10.(1)	9.9.8.5.(3)	9.31.2.1.	mechanical equipment
3.2.6.11.(1)	9.9.10.4. (Running head)	9.32.3.1.(2)	Lintels
3.2.8.2.(7)	9.10.1.6.	Table 9.32.2.A.	fireplace
Table 3.3.1.A.	Table 9.10.2.A.	9.33.2.1.(1)	steel
3.3.5.9.	9.10.4.1.	9.33.2.2.	Mezzanines
3.4.6.15.(4)	9.10.13.(2)	9.35.3.1.	Plenums
3.5.5.1.(1), (2)	9.10.11.3.	9.35.3.2.(1), (3)	return air
3.5.5.2.	9.10.12.4.(1)	9.35.4.3.	Wood
3.7.3.3.(3)	9.10.12.5.(1)	Span Tables	columns
3.7.3.5.(1)	9.10.14.7.	A-8	Venting
4.4.2. (Table of Contents)	9.10.16.1.(2)	A-9	heating appliances
4.1.4.1.(1)	9.10.19.4.	A-4.3.4.1.	
Table 4.1.9.A.	9.10.20.1.	A-5.7.1.3.(3)	
Table 4.1.9.E.	9.12.2.1.	A-9.3.2.1.	
4.1.9.1.(2)	9.13.1.3.(1)	A-9.6.6.5.(1)	
Table 4.1.10.A.	9.13.2.1.(1)	A-9.7.2.1.	
4.2.3.6.	9.13.6.5.	Table A-9.7.3.2.A.	
	9.14.2.1.		

Relationship between the National Building Code and the National Fire Code

A special relationship exists between the National Building Code and the National Fire Code with respect to fire safety. The contents of both Codes must be considered in building design, construction and maintenance. The role of each Code with respect to fire safety can be summarized as follows:

National Building Code (NBC) — establishes a satisfactory standard of fire safety for the construction of new buildings, the reconstruction of buildings, including extensions, alterations, or changes in occupancy and upgrading of buildings to remove an unacceptable fire hazard.*

National Fire Code (NFC) — establishes a satisfactory standard for fire prevention, fire fighting and life safety in buildings in use, * including standards for the conduct of activities causing fire hazards, maintenance of fire safety equipment and egress facilities, standards for portable extinguishers, limitations on building contents and the establishment of fire safety plans, including the organization of supervisory staff for emergency purposes. In addition, the NFC establishes the standard for prevention, containment and suppression of fires originating outside buildings, which may present a hazard to a community, and sets

- standards for the storage and handling of dangerous goods, and flammable and combustible liquids.

The two Codes have been developed as complementary and coordinated documents in order to reduce to a minimum the possibility of conflict in their respective contents. To aid in their effective application, fire and building officials must be fully conversant with the fire safety standards of both Codes. Such officials should be involved both in the review and the approval of plans with respect to fire safety prior to granting a building permit and with the inspection of buildings for fire safety. This is the only way to determine that all known hazards have been considered and a satisfactory standard of fire safety has been achieved.

* The extent of application of the NBC and the NFC to the upgrading of buildings to remove an unacceptable fire hazard should be based on the judgement of the authority having jurisdiction, who must deal with each case on its merits.



A Guide to the Use of the Code

The National Building Code of Canada is essentially a set of minimum provisions for the safety of buildings with reference to public health, fire protection and structural sufficiency. It is not intended to be a textbook on building design, advice on which should be sought from professional sources. Its primary purpose is the promotion of public safety through the application of appropriate uniform building standards throughout Canada.

The Code is drafted in such a way that it may be adopted or enacted for legal use by any jurisdictional authority in Canada. It is divided into 9 Parts. A decimal numbering system has been used throughout the Code. 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. An Article may be further broken down into Sentences (indicated by numbers in brackets), and the Sentence further divided into Clauses and Subclauses. They are illustrated as follows:

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

A summary of the contents of the Code follows:

Part 1: Scope and Definitions

Part 1 contains the definitions of all words throughout the Code that appear in *italic type*. This Part also contains a list of abbreviations used in the Code.

Part 2: General

Part 2 contains provisions of an administrative nature such as the use of referenced documents, climatic data, plans and specifications, provision for equivalent materials, systems, equipment, and procedures and the construction review process.

Part 3: Use and Occupancy

This Part contains the requirements with respect to health and fire safety, which depend upon the use to which a building is put and its type of occupancy. The first Section contains material relating to occupancy classification and the more general features of fire protection. Sections that follow contain specific requirements relating to building size and occupancy, fire safety within floor areas, exit requirements, requirements for service spaces and health requirements. Section 3.7 contains specific requirements for those buildings required to be accessible to persons with physical or sensory disabilities.

Part 4: Structural Design

This Part is made up of 4 sections. The first deals with the loads to be used in design calculations and the methods of design to be followed. Section 4.2

regulates foundation design and construction. Section 4.3 deals with design in wood, masonry, concrete, steel and aluminum and the structural design of air-supported structures. Section 4.4 contains only short performance requirements referring to the design methods outlined in detail in the relevant CSA standards.

Part 5: Wind, Water and Vapour Protection

This Part includes requirements for the design of building elements to control groundwater, condensation and the penetration of wind and rain.

Part 6: Heating, Ventilating and Air-Conditioning

Part 6 is concerned with the safe functioning of heating, ventilating and air-conditioning equipment installed in a building. The requirements deal mainly with installation.

Part 7: Plumbing

This Part contains only the basic legal statements with reference to Scope, Application and Administration. All detailed technical requirements are contained in the Canadian Plumbing Code, which is published separately. This latter Code contains requirements for the size and quality of fixtures and related pipes and fittings for plumbing systems and, in its Appendix, has explanatory sketches and notes to further clarify these requirements.

Part 8: Safety Measures at Construction and Demolition Sites

Part 8 regulates the precautions that must be taken for fire safety and to protect the public at construction and demolition sites.

Part 9: Housing and Small Buildings

This Part provides detailed requirements for the construction of houses and small buildings up to 600 m² per floor and 3 storeys high, and applies to all occupancies except assembly, institutional and high hazard industrial.

Appendix A: Explanatory Information

Appendix A contains additional explanatory information to assist Code users in understanding the intent of the requirements contained in Parts 1 to 9. It is not a mandatory section of the Code.

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 Appendix A.)

Exit level (as applying to Subsection 3.2.6.) means the level of an enclosed *exit* stair at which an exterior *exit* door or *exit* corridor leads to the exterior.

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

Exposing building face means that part of the exterior wall of a *building* which 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* which faces one direction.

Exterior cladding means those components of a *building* which are exposed to the outdoor environment and are intended to provide protection against wind, water or vapour.

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 which does not contain a *residential occupancy* and which is associated with and located on land devoted to the practice of farming, and used essentially for the housing of equipment or livestock, or the production, storage or processing of agricultural and horticultural produce or feeds. (See Appendix A.)

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 a *soil* or *rock* or organic terrain. It may or may not be compacted.

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* which consists of a normally held open damper installed in an air distribution system or in a wall or floor assembly, and 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 which 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 hours or fraction thereof 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 Code.

Fire-resistance rating means the time in hours or fraction thereof 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 Code.

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 Appendix A.)

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

Firewall means a type of *fire separation* of *noncombustible construction* which subdivides a *building* or separates adjoining *buildings* to resist the spread of fire and which has a *fire-resistance rating* as prescribed in this Code and has structural

1.1.3.2.

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*.

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 Code.

Flammable liquid means any 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.

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.

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 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.

Grade (as applying to the determination of *building height*) means the lowest of the average levels of finished ground adjoining each exterior wall of a *building*, except that localized depressions such as for vehicle or pedestrian entrances need not be considered in the determination of average levels of finished ground. (See *First storey*.)

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.

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 barrier may or may not have openings through it.

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

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

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

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

Horizontal service space means a space such as an attic, duct, ceiling, roof or crawl space oriented

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2.3.4. Structural and Foundation Drawings and Calculations

2.3.4.1. Application. Requirements of this Subsection apply only to *buildings* falling within the scope of Part 4.

2.3.4.2. Professional Seal and Signature of Designer. 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 4.1.1.2.(2).

2.3.4.3. 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

- e 2.3.4.6. and Part 4 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 Code 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 loads due to materials of construction incorporated in the *building* to be determined, and
 - (e) all effects and loads, other than *dead loads*, used for the design of the structural members and *exterior cladding*.

2.3.4.4. Drawings of Parts or Components. 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 person responsible for the design of such parts or components.

2.3.4.5. Design Calculations and Analysis. The calculations and analysis made in the design of the structural members, including parts and compo-

nents, of a *building* shall be available for inspection upon request.

2.3.4.6. 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 *allowable bearing pressures* on the *soil* or *rock*, the *allowable 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.

2.3.4.7. Altered Conditions. Where conditions as described under Sentences 4.2.2.4.(1) and (2) are encountered, or where *foundation units* or their locations are altered, this information shall be recorded on appropriate drawings or new "as constructed" drawings.

2.3.5. Heating, Ventilating and Air-Conditioning Drawings and Specifications

2.3.5.1. Application. Requirements of this Subsection apply only to *buildings* falling within the scope of Part 6.

2.3.5.2. Information Required on Architectural and HVAC Drawings. The information shown on architectural plans and on plans for heating, ventilating and air-conditioning systems shall be clear and legible and shall contain all necessary details to demonstrate conformance with this Code. (See Appendix A.)

Section 2.4 Materials, Appliances, Systems and Equipment

2.4.1. General

2.4.1.1. Characteristics of Materials, Appliances, Systems and Equipment. All materials, *appliances*, systems and equipment installed to meet the requirements of this Code shall possess the necessary characteristics to perform their intended functions when installed in a *building*.

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

2.4.1.3. Used Materials, Appliances and Equipment. Unless otherwise specified, used materials, *appliances* and equipment may be reused when they meet the requirements of this Code for new materials and are satisfactory for the intended use.

Section 2.5 Equivalents

2.5.1. General

2.5.1.1. Alternate Materials, Appliances, Systems and Equipment Permitted. The provisions of this Code are not intended to limit the appropriate use of materials, *appliances*, systems, equipment, methods of design or construction procedures not specifically described herein.

2.5.1.2. Evidence of Equivalent Performance. Any person desirous of providing an equivalent to satisfy one or more of the requirements of this Code shall submit sufficient evidence to demonstrate that the proposed equivalent will provide the level of performance required by this Code.

2.5.1.3. Equivalence Demonstrated by Past Performance, Test or Evaluation.

Materials, *appliances*, systems, equipment, methods of design and construction procedures not specifically described herein, or which vary from the specific requirements in this Code, may be used if it can be shown that these alternatives are suitable on the basis of past performance, tests or evaluations.

2.5.2. Structural Equivalents

2.5.2.1. Structural Equivalents

(1) Provided the design is carried out by a person especially qualified in the specific methods applied and provided the design ensures 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, *buildings* and their structural components within the scope of Part 4 whose designs are not in conformance with Section 4.1 may be designed by

- (a) analysis based on generally established theory,
- (b) evaluation of a full-scale structure or a prototype by a loading test, or
- (c) studies of model analogues.

2.5.3. Equivalent Test Standards

2.5.3.1. The results of tests based on test standards other than as described in this Code may be used provided such alternate test standards will provide comparable results.

Section 2.6 Review

2.6.1. General

2.6.1.1. Requirements of this Section apply only to *buildings* falling within the scope of Part 4, except that Subsection 2.6.5. applies to all *buildings*.

2.6.2. Review of Construction

2.6.2.1. Review of the construction of any *building* or part thereof shall be carried out by the *designer* or by another suitably qualified person to determine whether or not the construction conforms to the design.

2.6.3. Review of Shop Drawings

2.6.3.1. The *designer* or another suitably qualified person shall review all shop drawings and other related documents relevant to the design to determine conformance with the design.

2.6.4. Workmanship and Materials

2.6.4.1. Workmanship, materials and all reports of material tests shall be reviewed by the *designer* or other suitably qualified person during the process of construction.

2.6.5. Off-Site Review

2.6.5.1. Where a *building* or component of a *building* is assembled off the *building* site in such a manner that it cannot be reviewed on site, off-site reviews shall be provided to determine compliance with this Code.

Section 2.7 Referenced Documents

2.7.1. Application

2.7.1.1. The provisions of referenced documents in this Code apply only to the extent that they relate to *buildings*.

2.7.2. Conflicting Requirements

2.7.2.1. In the case of conflict between the provisions of this Code and those of a referenced document, the provisions of this Code shall govern.

2.7.3. Effective Date

2.7.3.1. Unless otherwise specified herein, the documents referenced in this Code shall include all amendments, revisions and supplements effective to 30 June 1990.

2.7.3.2. Where documents are referenced in this Code, they shall be the editions designated in Column 2 of Table 2.7.3.A.

Table 2.7.3.A.

Forming Part of Article 2.7.3.2.

Documents Referenced in the National Building Code of Canada 1990			
Issuing Agency	Document Number	Title of Document	Code Reference
ASTM	A123-89A	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products	Table 9.20.16.A.
ASTM	A-153-82 (1987)	Zinc Coating (Hot-Dip) on Iron and Steel Hardware	Table 9.20.16.A.
ASTM	A252-90	Welded and Seamless Steel Pipe Piles	4.2.3.8.
ASTM	A283/A283M-87	Low and Intermediate Tensile Strength Carbon Steel Plates	4.2.3.8.
ASTM	A525-87	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process	9.3.3.2.
ASTM	A570/A570M-88	Steel, Sheet and Strip, Carbon, Hot Rolled, Structural Quality	4.2.3.8.
ASTM	A611-89	Steel, Cold-Rolled Sheet, Carbon Structural	4.2.3.8.
Column 1	2	3	4

2.7.3.A.

Table 2.7.3.A. (Cont'd)

Issuing Agency	Document Number	Title of Document	Code Reference
ASTM	C4-62 (1986)	Clay Drain Tile	9.14.3.1.(1)
ASTM	C5-79(88)	Quicklime for Structural Purposes	9.20.3.1.(1)
ASTM	C27-84(88)	Classification of Fireclay and High-Alumina Refractory Brick	9.21.3.4.
ASTM	C126-86	Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units	9.20.2.1.(1)
ASTM	C207-79(88)	Hydrated Lime for Masonry Purposes	9.20.3.1.(1)
ASTM	C212-60 (1986)	Structural Clay Facing Tile	9.20.2.1.(1)
ASTM	C315-87 (1983)	Clay Flue Linings	9.21.3.3.(1)
ASTM	C411-82 (1987)	Hot-Surface Performance of High-Temperature Thermal Insulation	6.2.3.6.(3) 6.2.9.2.(2)
ASTM	C412M-90	Concrete Drain Tile	9.14.3.1.(1)
ASTM	C444M-87	Perforated Concrete Pipe (Metric)	9.14.3.1.(1)
ASTM	C700-89	Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated	9.14.3.1.(1)
ASTM	C1002-88	Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases	9.24.1.4. 9.29.5.7.
ASTM	D323-89	Vapour Pressure of Petroleum Products (Reid Method)	1.1.3.2.
ASTM	D2898-81(86)	Test Method for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing	3.1.5.5.(7) 3.1.5.5.(8)
ASTM	E90-90	Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions	9.11.1.1.
ASTM	E336-90	Measurement of Airborne Sound Insulation in Buildings	9.11.1.1.
ASTM	E413-87	Classification for Rating Sound Insulation	9.11.1.1.
ASTM	F476-84	Test Methods for Security of Swinging Door Assemblies	9.6.6.10.
CGA	CAN/CGA-B149.1-M86	Natural Gas Installation Code	6.2.1.4.(1) 8.2.2.11.(1)
CGA	CAN/CGA-B149.2-M86	Propane Installation Code	6.2.1.4.(1) 8.2.2.11.(1)
CGSB	CAN/CGSB-7.1-M86	Cold Formed Steel Framing Components	9.24.1.2.
CGSB	CAN/CGSB-7.2-M88	Adjustable Metal Columns	9.17.3.4.
CGSB	10-GP-3Ma-1981	Refractory Mortar, Air Setting	9.21.3.4. 9.21.3.9.(1) 9.22.2.2.(1)
Column 1	2	3	4

Table 2.7.3.A. (Cont'd)

Issuing Agency	Document Number	Title of Document	Code Reference
CGSB	CAN/CGSB-11.3-M87	Hardboard	9.27.10.1.(2) 9.29.7.1. 9.30.2.2.(1)
CGSB	CAN/CGSB-11.5-M87	Hardboard, Precoated, Factory Finished, for Exterior Cladding	9.27.10.1.(1)
CGSB	CAN2-12.1-M79	Glass, Safety, Tempered or Laminated	3.3.1.18.(2) 3.4.6.14.(3) 9.6.5.2.(2) 9.7.3.1.(1)
CGSB	CAN2-12.2-M76	Glass, Sheet, Flat, Clear	9.7.3.1.(1)
CGSB	CAN2-12.3-M76	Glass, Polished Plate or Float, Flat, Clear	9.7.3.1.(1)
CGSB	CAN2-12.4-M76	Glass, Heat Absorbing	9.7.3.1.(1)
CGSB	CAN2-12.8-M76	Insulating Glass Units	9.7.3.1.(1)
CGSB	CAN2-12.10-M76	Glass, Light and Heat Reflecting	9.7.3.1.(1)
CGSB	CAN2-12.11-M76	Glass, Wired, Safety	3.3.1.18.(2) 3.4.6.14.(3) 9.6.5.2.(2) 9.7.3.1.(1)
CGSB	CAN/CGSB-12.20-M89	Structural Design of Glass for Buildings	4.3.6.1. 9.7.3.2.
e CGSB	19-GP-5M-1976	Sealing Compound, One Component, Acrylic Base, Solvent Curing	9.27.4.2.(2)
CGSB	CAN/CGSB-19.13-M87	Sealing Compound, One-Component, Elastomeric, Chemical Curing	9.27.4.2.(2)
CGSB	19-GP-14M-1976	Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing	9.27.4.2.(2)
r CGSB	CAN/CGSB-19.22-M89	Mildew Resistant Sealing Compound for Tubs and Tile	9.29.10.5.
r CGSB	CAN/CGSB-19.24-M90	Multi-Component, Chemical Curing Sealing Compound	9.27.4.2.(2)
CGSB	CAN/CGSB-34.4-M89	Siding, Asbestos Cement, Shingles and Clapboards	9.27.8.1.(1)
CGSB	CAN/CGSB-34.5-M89	Sheets, Asbestos Cement, Corrugated	9.27.8.1.(1)
e CGSB	CAN/CGSB-34.14-M87	Sheets, Asbestos Cement, Decorative	9.27.8.1.(1)
Column 1	2	3	4

2.7.3.A.

Table 2.7.3.A. (Cont'd)

Issuing Agency	Document Number	Title of Document	Code Reference
CGSB	CAN/CGSB-34.16-M89	Sheets, Asbestos Cement, Flat, Fully Compressed	9.27.8.1.(1)
CGSB	CAN/CGSB-34.17-M89	Sheets, Asbestos-Cement, Flat, Semicompressed	9.27.8.1.(1)
CGSB	CAN/CGSB-34.21-M89	Panels, Sandwich, Asbestos-Cement with Insulating Cores	9.27.8.1.(1)
CGSB	CAN/CGSB-34.22-M87	Pipe, Asbestos-Cement, Drain	9.14.3.1.(1)
e CGSB	CAN/CGSB-37.2-M88	Emulsified Asphalt, Mineral Colloid Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings	9.13.2.1.(1)
r CGSB	CAN/CGSB-37.3-M89	Application of Emulsified Asphalts for Dampproofing or Waterproofing	9.13.1.3.(1)
e CGSB	CAN/CGSB-37.4-M89	Fibrated, Cutback, Lap Cement for Asphalt Roofing	9.26.2.1.(1)
e CGSB	CAN/CGSB-37.5-M89	Cutback Asphalt Plastic Cement	9.26.2.1.(1)
CGSB	37-GP-6Ma-1983	Asphalt, Cutback, Unfilled, for Dampproofing	9.13.2.1.(1)
CGSB	CAN/CGSB-37.8-M88	Asphalt, Cutback, Filled, for Roof Coating	9.26.2.1.(1)
CGSB	37-GP-9Ma-1983	Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing	9.26.2.1.(1)
CGSB	37-GP-12Ma-1984	Application of Unfilled Cutback Asphalt for Dampproofing	9.13.1.3.(1)
r CGSB	CAN/CGSB-37.16-M89	Filled Cutback Asphalt for Dampproofing and Waterproofing	9.13.2.1.(1)
CGSB	37-GP-18Ma-1985	Tar, Cutback, Unfilled, for Dampproofing	9.13.2.1.(1)
CGSB	37-GP-21M-1976	Tar, Cutback, Fibrated, for Roof Coating	9.26.2.1.(1)
r CGSB	CAN/CGSB-37.22-M89	Application of Unfilled Cutback Tar Foundation Coating for Dampproofing	9.13.1.3.(1)
r CGSB	CAN/CGSB-37.50-M89	Hot Applied Rubberized Asphalt for Roofing and Waterproofing	9.26.2.1.(1)
CGSB	37-GP-51M-79	Application of Rubberized Asphalt, Hot Applied for Roofing and Waterproofing	9.26.15.1.
CGSB	37-GP-52M-84	Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric	9.26.2.1.(1)
CGSB	37-GP-54M-79	Roofing and Waterproofing Membrane, Sheet-Applied, Flexible, Polyvinyl Chloride	9.26.2.1.(1)
Column 1	2	3	4

Table 2.7.3.A. (Cont'd)

Issuing Agency	Document Number	Title of Document	Code Reference
CGSB	37-GP-55M-79	Application of Sheet Applied Flexible Polyvinyl Chloride Roofing Membrane	9.26.16.1.
GGSB	37-GP-56M-80	Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing	9.26.2.1.(1)
CGSB	41-GP-6M-1976	Sheets, Thermosetting Polyester Plastics, Glass Fiber Reinforced	9.26.2.1.(1)
CGSB	41-GP-24Ma-1983	Siding, Soffits and Fascia, Rigid Vinyl	9.27.13.1.
CGSB	41-GP-29Ma-1983	Tubing, Plastic, Corrugated, Drainage	9.14.3.1.(1)
CGSB	CAN/CGSB 51.20-M87	Thermal Insulation, Polystyrene, Boards and Pipe Covering	Table 9.23.16.A. 9.25.3.1.(1) 9.25.3.3.
CGSB	51-GP-21M-1978	Thermal Insulation, Urethane and Isocyanurate, Unfaced	Table 9.23.16.A. 9.25.3.1.(1)
CGSB	CAN/CGSB-51.25-M87	Thermal Insulation, Phenolic, Faced	Table 9.23.16.A. 9.25.3.1.(1)
CGSB	CAN/CGSB-51.26-M86	Thermal Insulation, Urethane and Isocyanurate, Boards, Faced	Table 9.23.16.A. 9.25.3.1.(1)
CGSB	51-GP-27M-1979	Thermal Insulation, Polystyrene, Loose Fill	9.25.3.1.(1)
CGSB	CAN2-51.32-M77	Sheathing, Membrane, Breather Type	9.20.13.10.(1) 9.23.17.1. 9.26.2.1.(1)
r CGSB	CAN/CGSB-51.33-M89	Vapor Barrier Sheet, Excluding Polyethylene, for Use in Building Construction	9.25.3.5.(1)
CGSB	CAN/CGSB-51.34-M86	Vapour Barrier, Polyethylene Sheet for use in Building Construction	9.13.2.1.(1) 9.18.6.1.(3) 9.25.3.4.(2) 9.25.3.5.(1)
r CGSB	CAN/CGSB-51.60-M-90	Cellulose Fibre Loose Fill Thermal Insulation	9.25.3.1.(1)
CGSB	CAN/CGSB-63.14-M89	Plastic Skylights	9.7.7.1. 9.7.7.2.
CGSB	CAN/CGSB-82.1-M89	Sliding Doors	9.6.4.2.
CGSB	CAN/CGSB-82.5-M88	Insulated Steel Doors	9.6.4.3.
CGSB	CAN/CGSB-82.6-M86	Doors, Mirrored Glass, Siding or Folding Wardrobe	9.6.5.3.
Column 1	2	3	4

2.7.3.A.

Table 2.7.3.A. (Cont'd)

Issuing Agency	Document Number	Title of Document	Code Reference
CGSB	CAN/CGSB-93.1-M85	Sheet, Aluminum Alloy, Prefinished, Residential	9.27.12.1.(4)
CGSB	93-GP-2Ma-1983	Siding, Soffits and Fascia, Aluminum, Prefinished, Residential	9.27.12.1.(3)
CGSB	93-GP-3M-1978	Sheet, Steel, Galvanized, Prefinished, Residential	9.27.12.1.(2)
CGSB	93-GP-4M-1978	Siding, Soffits and Fascia, Steel, Galvanized, Prefinished, Residential	9.27.12.1.(1)
e	CSA	CAN3-A5-M88	Portland Cement
e	CSA	CAN3-A8-M88	Masonry Cement
r	CSA	CAN/CSA-A23.1-M90	Concrete Materials and Methods of Concrete Construction
r	CSA	CAN/CSA-A23.2-M90	Methods of Test for Concrete
	CSA	CAN3-A23.3-M84	Design of Concrete Structures for Buildings
	CSA	CAN/CSA-A82.1-M87	Burned Clay Brick (Solid Masonry Units Made from Clay or Shale)
	CSA	A82.3-M1978	Calcium Silicate (Sand-Lime) Building Brick
	CSA	A82.4-M1978	Structural Clay Load-Bearing Wall Tile
	CSA	A82.5-M1978	Structural Clay Non-Load-Bearing Tile
	CSA	A82.22-M1977	Gypsum Plasters
	CSA	A82.27-M1977	Gypsum Board Products
	CSA	A82.30-M1980	Interior Furring, Lathing and Gypsum Plastering
	CSA	A82.31-M1980	Gypsum Board Application
	CSA	A82.56-M1976	Aggregate for Masonry Mortar
	CSA	CAN3-A93-M82	Natural Airflow Ventilators for Buildings
	CSA	A101-M1983	Thermal Insulation, Mineral Fibre, for Buildings
	CSA	A123.1-M1979	Asphalt Shingles Surfaced with Mineral Granules
	CSA	A123.2-M1979	Asphalt Coated Roofing Sheets
	CSA	A123.3-M1979	Asphalt or Tar Saturated Roofing Felt
Column 1	2	3	4

Table 2.7.3.A. (Cont'd)

Issuing Agency	Document Number	Title of Document	Code Reference
CSA	A123.4-M1979	Bitumen for Use in Construction of Built-Up Roof Coverings and Dampproofing and Waterproofing Systems	9.13.2.1.(1) 9.26.2.1.(1)
CSA	A123.17-1963	Asphalt-Saturated Felted Glass-Fibre Mat for Use in Construction of Built-Up Roofs	9.26.2.1.(1)
CSA	CAN3-A123.51-M85	Asphalt Shingle Application on Roof Slopes 1:3 and Steeper	9.26.1.2.
CSA	CAN3-A123.52-M85	Asphalt Shingle Application on Roof Slopes 1:6 to less than 1:3	9.26.1.2.
CSA	CAN3-A165.1-M85	Concrete Masonry Units	9.15.2.2. 9.20.2.1.(1) 9.20.2.6.(1)
CSA	CAN3-A165.2-M85	Concrete Brick Masonry Units	9.20.2.1.(1)
CSA	CAN3-A165.3-M85	Prefaced Concrete Masonry Units	9.20.2.1.(1)
CSA	CAN3-A165.4-M85	Autoclaved Cellular Units	9.20.2.1.(1)
CSA	CAN/CSA-A247-M86	Insulating Fibreboard	9.23.15.6.(3) Table 9.23.16.A. 9.25.3.1.(1) 9.29.8.1.
CSA	CAN3-A266.1-M78	Air-Entraining Admixtures for Concrete	9.3.1.9.
CSA	CAN3-A266.2-M78	Chemical Admixtures for Concrete	9.3.1.9.
CSA	CAN3-A371-M84	Masonry Construction for Buildings	9.20.15.2.
CSA	CAN/CSA-A405-M87	Design and Construction of Masonry Chimneys and Fireplaces	9.21.3.5. 9.22.5.2.(2)
CSA	CAN3-A438-M84	Concrete Construction for Housing and Small Buildings	9.3.1.1.
CSA	CAN/CSA-A440-M90	Windows	9.7.2.1. 9.7.6.1.
CSA	CAN/CSA-B44-M90	Safety Code for Elevators, Escalators, Dumbwaiters, Moving Walks, and Freight Platform Lifts	3.5.5.1.(1) 3.5.5.1.(2) 3.5.5.2. 3.7.3.5.(1) Table 4.1.10.A.
CSA	B51-M1986	Boiler, Pressure Vessel and Pressure Piping Code	6.2.1.4.(1)
CSA	B52-M1983	Mechanical Refrigeration Code	6.2.1.4.(1)
CSA	CAN/CSA-B72-M87	Installation Code for Lightning Protection Systems	6.3.1.4.
CSA	B111-1974	Wire Nails, Spikes and Staples	9.23.3.1. 9.26.2.2.(1) 9.29.5.6.
Column 1	2	3	4

2.7.3.A.

Table 2.7.3.A. (Cont'd)

	Issuing Agency	Document Number	Title of Document	Code Reference
r	CSA	CAN/CSA-B139-M91	Installation Code for Oil Burning Equipment	6.2.1.4.(1) 8.2.2.11.(1)
e	CSA	CAN/CSA-B182.1-87	Plastic Drain and Sewer Pipe and Pipe Fittings	9.14.3.1.(1)
	CSA	B228.1-1968	Pipes, Ducts, and Fittings for Residential Type Air Conditioning Systems	6.2.4.2.(2)
	CSA	CAN/CSA-B355-M86	Elevating Devices for the Handicapped	3.7.3.5.(2)
	CSA	CAN/CSA-B365-M87	Installation Code for Solid-Fuel Burning Appliances and Equipment	6.2.1.4.(1) 9.21.1.3.(2) 9.22.10.1. 9.33.1.2.
r	CSA	C22.1-1990	Canadian Electrical Code, Part 1	3.5.1.2. 3.5.2.1.(5) 3.5.2.9.(1) 6.2.1.4.(1) 8.2.2.9.(2) 9.34.1.1.
	CSA	C22.2 No. 0.3-M1985	Test Methods for Electrical Wires and Cables	3.1.4.3.(1) 3.1.5.17.(1) 3.5.4.3.(1)
	CSA	C22.2 No.113-M1984	Fans and Ventilators	9.32.3.3.(2)
	CSA	C22.2 No.141-M1985	Unit Equipment for Emergency Lighting	3.2.7.4.(2) 9.9.11.3.(6)
	CSA	CAN/CSA-C282-M89	Emergency Electrical Power Supply for Buildings	3.2.7.5.
	CSA	CAN/CSA-C444-M87	Installation Requirements for Heat Recovery Ventilators	6.2.1.7.
r	CSA	CAN/CSA-F280-M90	Determining the Required Capacity of Residential Space Heating and Cooling Appliances	6.2.1.2.
	CSA	CAN/CSA-G40.21-M87	Structural Quality Steels	4.2.3.8. 9.23.4.2.(2)
	CSA	CAN3-G401-M81	Corrugated Steel Pipe Products	9.14.3.1.(1)
	CSA	CAN/CSA-O80-M89	Wood Preservation	3.1.4.4.(1)
	CSA	CAN/CSA-O80.1-M89	Preservative Treatment of All Timber Products by Pressure Processes	9.3.2.9.(1)
	CSA	CAN/CSA-O80.2-M89	Preservative Treatment of Lumber, Timber, Bridge Ties, and Mine Ties by Pressure Processes	4.2.3.2. 9.3.2.9.(1)
	Column 1	2	3	4

Table 2.7.3.A. (Cont'd)

Issuing Agency	Document Number	Title of Document	Code Reference
CSA	CAN/CSA-O80.3-M89	Preservative Treatment of Piles by Pressure Processes	4.2.3.2.
CSA	CAN/CSA-O80.9-M1989	Preservative Treatment of Plywood by Pressure Processes	9.3.2.9.(1)
CSA	CAN/CSA-O80.15-M89	Preservative Treatment of Wood for Building Foundation Systems, Basements, and Crawl Spaces by Pressure Processes	4.2.3.2. 9.3.2.9.(1)
CSA	CAN3-O86-M84	Engineering Design in Wood (Working Stress Design)	4.3.1.1.
CSA	CAN/CSA-O86.1-M89	Engineering Design in Wood (Limit States Design)	4.3.1.1.
CSA	O115-M1982	Hardwood and Decorative Plywood	9.27.9.1. 9.30.2.2.(1)
CSA	O118.1-M88	Western Red Cedar Shingles and Shakes	9.26.2.1.(1) 9.27.7.1.(1)
CSA	O121-M1978	Douglas Fir Plywood	9.23.14.2.(1) 9.23.15.1.(1) Table 9.23.16.A. 9.27.9.1. 9.30.2.2.(1)
CSA	CAN/CSA-O122-M89	Structural Glued-Laminated Timber	9.23.4.3.(2)
CSA	CAN/CSA-O132.2-M90	Wood Flush Doors	9.6.4.1.(1)
CSA	O141-1970	Softwood Lumber	3.1.4.6.(2) 9.3.2.6.
CSA	O151- M1978	Canadian Softwood Plywood	9.23.14.2.(1) 9.23.15.1.(1) Table 9.23.16.A. 9.27.9.1. 9.30.2.2.(1)
CSA	O153-M1980	Poplar Plywood	9.23.14.2.(1) 9.23.15.1.(1) Table 9.23.16.A. 9.27.9.1. 9.30.2.2.(1)
CSA	CAN/CSA-O177-M89	Qualification Code for Manufacturers of Structural Glued-Laminated Timber	4.3.1.2.
Column 1	2	3	4

2.7.3.A.

Table 2.7.3.A. (Cont'd)

Issuing Agency	Document Number	Title of Document	Code Reference
CSA	CAN3-O188.1-M78	Interior Mat-Formed Wood Particleboard	9.23.14.2.(3) 9.29.9.1.(1) 9.30.2.2.(1)
CSA	CAN/CSA-O325.0-88	Construction Sheathing	9.23.14.2.(1) 9.23.15.1.(1) Table 9.23.16.B.
CSA	CAN3-O437.0-M85	Waferboard and Strandboard	9.23.14.2.(1) 9.23.15.1.(1) Table 9.23.16.A. 9.27.11.1. 9.29.9.1.(2) 9.30.2.2.(1)
CSA	CAN/CSA-S16.1-M89	Limit States Design of Steel Structures	4.3.4.1.
CSA	CAN/CSA-S136-M89	Cold Formed Steel Structural Members	4.3.4.2.
CSA	CAN3-S157-M83	Strength Design in Aluminum	4.3.5.1.
CSA	S269.1-1975	Falsework for Construction Purposes	4.1.1.3.(3)
CSA	CAN3-S304-M84	Masonry Design for Buildings	4.1.9.3.(6) 4.3.2.1.
CSA	S307-M1980	Load Test Procedure for Wood Roof Trusses for Houses and Small Buildings	9.23.13.11.(9)
CSA	S350-M1980	Code of Practice for Safety in Demolition of Structures	8.1.1.3.
CSA	CAN3-S367-M81	Air Supported Structures	4.4.1.1.
CSA	CAN3-S406-M83	Construction of Preserved Wood Foundations	9.15.1.3.(3)
CSA	CAN/CSA-S413-87	Parking Structures	4.4.2.1.
CSA	CAN/CSA Z32.4-M86	Essential Electrical Systems for Hospitals	3.2.7.6.
CSA	Z305.1-M1984	Non-Flammable Medical Gas Piping Systems	3.6.5.1.
NFPA	13-1989	Installation of Sprinkler Systems	3.2.4.16.(2) 3.2.5.13.(1) 3.2.5.13.(4) 3.2.8.2.(7) 3.3.2.13.(3)
NFPA	14-1990	Installation of Standpipe and Hose Systems	3.2.5.10.(1)
Column 1	2	3	4

Table 2.7.3.A. (Cont'd)

	Issuing Agency	Document Number	Title of Document	Code Reference
r	NFPA	71-1989	Installation, Maintenance and Use of Central Station Signaling Systems	3.2.4.7.(3)
	NFPA	72D-1986	Installation, Maintenance and Use of Proprietary Protective Signaling Systems	3.2.4.7.(3)
r	NFPA	80-1990	Fire Doors and Windows	3.1.8.5.(2) 3.1.8.10.(2) 3.1.8.12.(2) 3.1.8.14.(1) 9.10.13.1. 9.10.13.2.(3)
r	NFPA	82-1990	Incinerators, Waste and Linen Handling Systems and Equipment	6.2.6.1.(1) 9.10.10.5.(2)
	NFPA	96-1987	Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment	6.2.2.6.
	NFPA	211-1988	Chimneys, Fireplaces, Vents, and Solid-Fuel Burning Appliances	6.3.1.2.(2) 6.3.1.3.
	NFPA	214-1988	Water-Cooling Towers	6.2.3.15.(4)
	NLGA	1987	Standard Grading Rules for Canadian Lumber	9.3.2.1. Table 9.3.2.A.
	ULC	C199P-M1988	Guide for the Investigation of Combustible Piping for Sprinkler Systems	3.2.5.14.(2)
r	ULC	CAN/ULC-S101-M89	Standard Methods of Fire Endurance Tests of Building Construction and Materials	3.1.5.11.(3) 3.1.5.11.(4) 3.1.5.11.(6) 3.1.7.1.(1) 3.1.11.7.(1) 3.2.3.7.(3) 3.2.6.9.(6)
	ULC	CAN/ULC-S102-M88	Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies	3.1.12.1.(1)
	ULC	CAN/ULC-S102.2-M88	Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering, and Miscellaneous Materials and Assemblies	3.1.12.1.(2) 3.1.13.4.(1)
	ULC	S102.3-M1982	Standard Method of Fire Test of Light Diffusers and Lenses	3.1.13.4.(1)
	ULC	CAN4-S104-M80	Standard Method for Fire Tests of Door Assemblies	3.1.8.4.(1) 3.2.6.9.(3)
	Column 1	2	3	4

2.7.3.A.

Table 2.7.3.A. (Cont'd)

Issuing Agency	Document Number	Title of Document	Code Reference
ULC	CAN4-S105-M85	Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104	9.10.13.6.
ULC	CAN4-S106-M80	Standard Method for Fire Tests of Window and Glass Block Assemblies	3.1.8.4.(1)
ULC	CAN/ULC-S107-M87	Standard Methods of Fire Tests of Roof Coverings	3.1.15.1.
ULC	CAN/ULC-S109-M87	Standard for Flame Tests of Flame-Resistant Fabrics and Films	3.1.6.5. 6.2.3.4.(1) 6.2.3.5.
ULC	CAN/ULC S110-M86	Standard Methods of Fire Test for Air Ducts	6.2.3.2.(2) 6.2.3.2.(4)
ULC	CAN4-S111-M80	Standard Method of Fire Tests for Air Filter Units	6.2.3.14.(1)
ULC	CAN/ULC-S112-M90	Standard Method of Fire Test of Fire-Damper Assemblies	3.1.8.4.(1)
ULC	CAN4-S113-79	Standard Specification for Wood Core Doors Meeting the Performance Required by CAN4-S104-77 for Twenty Minute Fire Rated Closure Assemblies	9.10.13.2.(1)
ULC	CAN4-S114-M80	Standard Method of Test for Determination of Non-Combustibility in Building Materials	1.1.3.2.
ULC	CAN4-S115-M85	Standard Method of Fire Tests for Fire Stop Systems	3.1.9.1.(1) 3.1.9.1.(2) 3.1.9.4.(4) 9.10.9.7.(3)
ULC	CAN4-S124-M85	Standard Method of Test for the Evaluation of Protective Coverings for Foamed Plastic	3.1.5.11.(2)
ULC	CAN/ULC-S126-M86	Standard Method of Test For Fire Spread under Roof-Deck Assemblies	3.1.14.1.(1) 3.1.14.2.(1)
ULC	S505-1974	Standard for Fusible Links for Fire Protection Service	3.1.8.9.(2)
ULC	CAN/ULC-S524-M86	Standard for the Installation of Fire Alarm Systems	3.2.4.5.(1)
ULC	CAN/ULC-S531-M87	Standard for Smoke Alarms	3.2.4.21.(1) 9.10.18.1.
ULC	CAN/ULC-S537-M86	Standard for the Verification of Fire Alarm Systems	3.2.4.5.(2)
ULC	CAN/ULC-S610-M87	Standard for Factory-Built Fireplaces	9.22.8.1.
ULC	CAN/ULC-S629-M87	Standard for 650°C Factory-Built Chimneys	9.21.1.2.
ULC	CAN/ULC-S639-M87	Standard for Steel Liner Assemblies for Solid-Fuel Burning Masonry Fireplace	9.22.2.3.
Column 1	2	3	4

is not more than 10 per cent of the *floor area* of the *storey* on which they are located, these *major occupancies* need not be considered as *major occupancies* for the purposes of Subsection 3.2.2. provided they are not classified as Group F, Division 1 or 2 *occupancies*.

3.1.3.6. Separation of Major Occupancies

(1) Except as provided in 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.A.

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

(3) In a *building* conforming to the requirements of Articles 3.2.8.2. to 3.2.8.9., 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*.

3.1.3.7. 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) Not more than one *suite* of *residential occupancy* shall be contained within a *building* classified as a Group F, Division 2 *major occupancy*.

Table 3.1.3.A.
Forming Part of Sentence 3.1.3.6.(1)

Major Occupancy	Minimum Fire-Resistance Rating of Fire Separation, ⁽¹⁾ h											
	Adjoining Major Occupancy											
	A-1	A-2	A-3	A-4	B-1	B-2	C	D	E	F-1	F-2	F-3
A-1	—	1	1	1	2	2	1	1	2	(2)	2	1
A-2	1	—	1	1	2	2	1	1	2	(2)	2	1
A-3	1	1	—	1	2	2	1	1	2	(2)	2	1
A-4	1	1	1	—	2	2	1	1	2	(2)	2	1
B-1	2	2	2	2	—	2	2	2	2	(2)	2	2
B-2	2	2	2	2	2	—	2	2	2	(2)	2	2
C	1	1	1	1	2	2	—	1	2 ⁽³⁾	(2)	2 ⁽⁴⁾	1
D	1	1	1	1	2	2	1	—	—	3	—	—
E	2	2	2	2	2	2	2 ⁽³⁾	—	—	3	—	—
F-1	(2)	(2)	(2)	(2)	(2)	(2)	(2)	3	3	—	2	2
F-2	2	2	2	2	2	2	2 ⁽⁴⁾	—	—	2	—	—
F-3	1	1	1	1	2	2	1	—	—	2	—	—
Column 1	2	3	4	5	6	7	8	9	10	11	12	13

Notes to Table 3.1.3.A.:

⁽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 3.1.3.7.(1).

⁽³⁾ See Sentence 3.1.3.6.(2).

⁽⁴⁾ See Sentence 3.1.3.7.(2).

3.1.4. Combustible Construction

3.1.4.1. Combustible Materials Permitted.

Where a *building* is permitted to be of *combustible construction*, it is permitted to be constructed of *combustible* materials described in Part 9, with or without *noncombustible* components.

3.1.4.2. Protection of Foamed Plastics

(1) Foamed plastics which 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 assemblies, by

- (a) one of the interior finishes described in Subsections 9.29.4. to 9.29.9.,
- (b) sheet metal mechanically fastened to the supporting assembly independent of the insulation, not less than 0.38 mm thick and with a melting point not below 650°C provided the *building* does not contain a Group B or Group C *major occupancy*, or
- (c) any thermal barrier that meets the requirements of Sentence 3.1.5.11.(2). (See Appendix A.)

3.1.4.3. Electrical Wires and Cables

(1) 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 in Clause 4.11.1. of CSA C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables," or
- (b) be located in
 - (i) totally enclosed *noncombustible* raceways (see Appendix A),
 - (ii) masonry walls, or
 - (iii) concrete slabs.

(See also Article 3.5.4.3.)

(See Appendix A.)

3.1.4.4. Fire-Retardant Treated Wood

(1) Where *fire-retardant treated wood* is specified in this Part, such wood shall

- (a) be pressure impregnated with fire-retardant chemicals in conformance with

CAN/CSA-O80-M, "Wood Preservation," and

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

3.1.4.5. Heavy Timber Construction

Alternative. Where *combustible construction* is permitted and is required to have a *fire-resistance rating* of not more than 45 min, *heavy timber construction* is permitted to be used provided the construction conforms to Article 3.1.4.6.

3.1.4.6. 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) The actual dimensions of solid-sawn lumber used in *heavy timber construction* in this Article shall conform to CSA O141, "Softwood Lumber."

(3) Except as provided in Sentences (4) to (6), the minimum dimensions of wood elements in *heavy timber construction* shall conform to Table 3.1.4.A.

(4) Roof arches supported on the tops of walls or abutments, roof trusses, roof beams and roof girders shall be spliced where necessary with splice plates not less than 64 mm thick and be

- (a) not less than 64 mm thick where 2 or more spaced members are used for the construction, with intervening spaces blocked solidly throughout or tightly closed by a continuous wood cover plate not less than 38 mm thick secured to the underside of the members, or
- (b) not less than 64 mm thick when protected by automatic sprinklers under the roof deck.

(5) Floors shall be of glued-laminated or solid-sawn plank not less than 64 mm thick, splined or tongued and grooved, or not less than 38 mm wide and 89 mm deep set on edge and well-spiked together

- (a) laid so that no continuous line of end joints will occur except at points of support, and covered with tongued and grooved flooring not less than 19 mm thick laid cross-wise or diagonally, or tongued and grooved phenolic-bonded

gate area of the glazing is not more than 25 per cent of the wall area of the *storey* in which it is located, and

- (a) the glazing is installed in a *building* of 1 *storey* in *building height*, or
- (b) the glazing in the *first storey* is separated from the glazing in the second *storey* by apron walls, spandrel walls or canopies conforming to Article 3.2.3.17.

(3) *Combustible* window sash and frames are permitted in a *building* required to be of *noncombustible construction* provided

- (a) each window in an exterior wall face is an individual unit separated by *noncombustible* wall construction from every other opening in the wall,
- (b) windows in exterior walls in contiguous *storeys* are separated by not less than 1 m of *noncombustible construction*, and
- (c) the aggregate area of openings in an exterior wall face of a *fire compartment* is not more than 40 per cent of the area of the wall face.

3.1.5.5. Combustible Cladding

(1) Except when *noncombustible* cladding is required by Subsection 3.2.3., an exterior non-load-bearing wall assembly that includes *combustible* cladding components is permitted to be used in a *building* required to be of *noncombustible construction* that is not more than 3 *storeys* in *building height*, if not *sprinklered*, and not more than 6 *storeys* in *building height*, if *sprinklered*, provided the interior surfaces of the wall assembly are protected by a thermal barrier conforming to Sentence 3.1.5.11.(3) and the wall assembly satisfies the criteria of Sentences (5) and (6) when subjected to testing in conformance with Sentences (2) to (4). (See Appendix A.)

(2) The fire testing required by Sentence (1) shall be conducted on a wall assembly that

- (a) is not less than 5 m wide and not less than 10 m high with an opening 2.5 ± 0.1 m wide by 1.4 ± 0.1 m high, located in the middle of the assembly not more than 3 m above the lowest edge,
- (b) is representative of the exterior wall construction, except for the interior finish, and

- (c) incorporates horizontal and vertical joints not more than 3 m vertically above the opening.

(3) The wall assembly shall be exposed on its exterior face to a flame issuing from the opening that, on a *noncombustible* wall having a density of not less than 700 kg/m^3 to a depth of 12 mm from the exposed surface, generates an average heat flux between

- (a) 42 and 48 kW/m^2 measured 0.5 m above the opening, and
- (b) 25 and 29 kW/m^2 measured 1.5 m above the opening.

(See A-3.1.5.5.(6) in Appendix A.)

(4) The duration of exposure to the flame specified in Sentence (3) shall be not less than 15 min following a 5 min gradual heat flux increase and preceding a 5 min gradual cooldown period after the flame exposure.

(5) Flaming on or in the wall assembly shall not spread more than 5 m above the opening during or following the flame exposure of 25 min. (See Appendix A.)

(6) The heat flux during the flame exposure on a wall assembly shall be not more than 35 kW/m^2 measured 3.5 m above the opening. (See Appendix A.)

(7) 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, "Test Method for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing."

(8) Wood decorative cladding is permitted to be used on first floor exterior canopy fascias of a *building* required to be of *noncombustible construction* provided it is *fire-retardant treated wood* that has been, before testing, conditioned in conformance with ASTM D2898, "Test Method for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing."

3.1.5.6. Nailing Elements. 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

3.1.5.6.

noncombustible construction provided the concealed space created by the wood elements is not more than 50 mm thick.

3.1.5.7. Combustible Millwork. *Combustible* millwork including interior trim, doors and door frames, show windows together with their frames, aprons and backing, handrails, shelves, cabinets and counters are permitted in a *building* required to be of *noncombustible construction*.

3.1.5.8. 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 support of finished flooring in a *building* required to be of *noncombustible construction* provided the concealed spaces are fire stopped in conformance with Sentence 3.1.11.3.(2).

(3) *Combustible* finished flooring is permitted in a *building* required to be of *noncombustible construction*.

3.1.5.9. Combustible Stairs in Dwelling Units. *Combustible* stairs are permitted in a *dwelling unit* in a *building* required to be of *noncombustible construction*.

3.1.5.10. Combustible Interior Finish

(1) *Combustible* interior finish including paint, wallpaper, and other interior finishes 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, are permitted in a *building* required to be of *noncombustible construction* provided they

- (a) are not more than 25 mm thick, and
- (b) have a *flame-spread rating* of not more than 150 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction.

(3) *Combustible* interior ceiling finishes, other than foamed plastics, are permitted in a *building* required to be of *noncombustible construction* provided they

- (a) are not more than 25 mm thick, except for exposed *fire-retardant treated wood* battens, and
- (b) have a *flame-spread rating* of not more than 25 on any exposed surface or on any surface that would be exposed by cutting through the material in any direction or are of *fire-retardant treated wood*, except that not more than 10 per cent of the ceiling area within each *fire compartment* is permitted to have a *flame-spread rating* of not more than 150.

3.1.5.11. Combustible Insulation and its Protection

(1) *Combustible* insulation, other than foamed plastics, is permitted in a *building* required to be of *noncombustible construction* provided that it has 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, where the insulation is not protected as described in Sentences (2) to (4).

(2) Foamed plastic insulation having 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, 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 *attic* or *roof spaces*, crawl spaces, and 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 CAN4-S124-M, "Standard Method of Test for the Evaluation of Protective Coverings for Foamed Plastic" (see Appendix A).

(3) *Combustible* insulation having a *flame-spread rating* of more than 25 but not more than 500 on an 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* provided the insulation is protected from adjacent space in the *building*, other than adjacent concealed spaces within *attic or roof spaces*, *crawl spaces*, and wall assemblies, by a thermal barrier as described in Sentence (2), except that in unsprinklered *buildings* more than 18 m high or in unsprinklered *buildings* regulated by the provisions of Subsection 3.2.6., the insulation is protected 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-M, "Standard Methods of Fire Endurance Tests of Building Construction and Materials," will not develop an average temperature rise of more than 140°C or a maximum temperature rise at any point of more than 180°C on its unexposed face within 10 min.

(See also Sentence 3.2.3.7.(3).)

(4) *Combustible* insulation having a *flame-spread rating* of 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 of 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 *attic or roof spaces*, *crawl spaces*, and wall assemblies, by a thermal barrier as described in Sentence (2), except that in unsprinklered *buildings* more than 18 m high or in unsprinklered *buildings* regulated by the provisions of Subsection 3.2.6., the insulation is protected by a thermal barrier consisting of

- (a) Type X gypsum board not less than 15.9 mm thick conforming to CSA A82.27-M, "Gypsum Board Products," mechanically fastened to a supporting assembly independent of the insulation and with all joints either backed or taped and filled,
- (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-M, "Standard Methods of Fire Endurance Tests of Building Construction and Materials," will not develop an average temperature rise of more than 140°C or a maximum temperature rise at any point of more than 180°C on its unexposed face within 20 min and will remain in place for not less than 40 min.

(5) *Combustible* insulation, including foamed plastics, installed above roof decks, outside of *foundation* walls below ground level and beneath concrete slabs-on-ground is permitted to be used in a *building* required to be of *noncombustible construction*.

(6) Thermosetting foamed plastic insulation having a *flame-spread rating* of not more than 500 which forms part of a factory-assembled exterior wall panel that does not incorporate an air space is permitted to be used in a *building* required to be of *noncombustible construction* provided

- (a) the foamed plastic is protected on both sides by sheet steel not less than 0.38 mm thick which will remain in place for not less than 10 min when the wall panel is tested in conformance with CAN/ULC-S101-M, "Standard Methods of Fire Endurance Tests of Building Construction and Materials,"
- (b) the *flame-spread rating* of the wall panel, determined by subjecting a sample including an assembled joint to the appropriate test described in Subsection 3.1.12., is not more than the *flame-spread rating* permitted for the room or space which it bounds,
- (c) the *building* does not contain a Group B or Group C *major occupancy*, and

3.1.5.11.

- (d) the *building* is not more than 18 m high, measured between *grade* and the floor level of the uppermost *storey*.

3.1.5.12. Combustible Elements in Partitions

(1) Solid lumber *partitions* not less than 38 mm thick and wood framing in *partitions*, located in *fire compartments* not more than 600 m² in area or in *sprinklered floor areas* are permitted to be used in a *building* required to be of *noncombustible construction* provided the *partitions*

- (a) are not required *fire separations*, and
- (b) are not located in Group B *occupancies*.

3.1.5.13. Storage Lockers in Residential Buildings. Storage lockers in storage rooms are permitted to be constructed of wood in *buildings* of *residential occupancy* required to be of *noncombustible construction*.

3.1.5.14. Combustible Ducts

(1) Except as permitted by Sentence 3.5.4.3.(1), *combustible* ducts, including *plenums* and duct connectors, are permitted to be used in a *building* required to be of *noncombustible construction* provided such ducts and duct connectors

- (a) are used only in horizontal runs, and
- (b) are Class 1 conforming to Article 6.2.3.2.

(2) *Combustible* duct linings, duct coverings, duct insulation, vibration isolation connectors, duct tape, pipe insulation and pipe coverings are permitted to be used in *buildings* required to be of *noncombustible construction* provided they conform to the appropriate requirements in Section 6.2.

3.1.5.15. Combustible Piping Materials

(1) Except as permitted in Clause 3.1.5.2.(1)(e) and Sentence (2), *combustible* totally enclosed raceways, piping and tubing and associated adhesives are permitted to be used in a *building* required to be of *noncombustible construction* provided they

- (a) have a *flame-spread rating* of not more than 25, except when concealed in a wall or a concrete floor slab, and
- (b) when used in *buildings* described in Subsection 3.2.6., have a smoke developed classification of not more than 50, except when concealed in a wall or a concrete floor slab.

(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 3.2.5.14.)

3.1.5.16. Combustible Travelling Cables for Elevators. *Combustible* travelling cables are permitted on elevating devices in *buildings* required to be of *noncombustible construction*.

3.1.5.17. Electrical Wires and Cables

(1) Except as permitted in Article 3.1.5.16., 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 Cabletrough in Clause 4.11.4. of CSA C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables," or
- (b) the wires and cables are located in
 - (i) totally enclosed *noncombustible* raceways (see A-3.1.4.3.(1)(b)(i) in Appendix A),
 - (ii) masonry walls,
 - (iii) concrete slabs, or
 - (iv) a *service room* separated from the remainder of the *building* by a *fire separation* having not less than a 1 h *fire-resistance rating*.

(See Appendix A.)

3.1.5.18. Combustible Plumbing Fixtures. *Combustible* plumbing fixtures, including wall and ceiling enclosures, shall be 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.

3.1.6. Tents and Air-Supported Structures

(See Appendix A.)

3.1.6.1. Means of Egress. Tents and *air-supported structures* shall conform to Sections 3.3 and 3.4.

3.1.6.2. Restrictions

(1) *Air-supported structures* shall not be located above the *first storey* on any *building*.

(2) *Air-supported structures* shall not be used for Groups B, C, or Group F, Division 1 *major occupancies* or for classrooms.

(3) *Air-supported structures* shall be designed as open floor space without interior walls, *mezzanines*, intermediate floors or similar construction.

3.1.6.3. Clearance to Other Structures

(1) Except as provided in Sentences (2), (3) and (4), every tent and *air-supported structure* shall conform to Subsection 3.2.3.

(2) Tents and *air-supported structures* shall not be erected closer than 3 m to other structures on the same property except as provided in Sentences (3) and (4), and 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 need not be separated from one another, and are permitted to be erected less than 3 m from other structures on the same property where such closer 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 such closer spacing does not create a hazard to the public.

3.1.6.4. Clearance to Flammable Material.

The ground enclosed by a tent or *air-supported structure* and for not less than 3 m outside of such structure shall be cleared of all flammable material or vegetation that will carry fire.

3.1.6.5. Flame Resistance. Every tent and *air-supported structure* and all tarpaulins and decorative materials used in connection with such structures shall conform to CAN/ULC S-109-M, "Standard for Flame Tests of Flame-Resistant Fabrics and Films."

3.1.6.6. Emergency Air Supply. An *air-supported structure* used as a place of assembly for more than 200 persons shall have either an automatic emergency engine-generator set capable of powering

one blower continuously for 4 h, or a supplementary blower powered by an automatic internal combustion engine.

3.1.7. Fire-Resistance Ratings

3.1.7.1. Determination of Ratings

(1) Except as provided in Sentence (2) and Article 3.1.7.2., where a material, assembly of materials or a structural member is required to have a *fire-resistance rating*, the rating shall be determined on the basis of the results of tests conducted in conformance with CAN/ULC-S101-M, "Standard Methods 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 Chapter 2, "Fire Performance Ratings" of the Supplement to the NBC 1990.

3.1.7.2. Exception for Exterior Walls. The limitation 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 Article 3.2.3.12.

3.1.7.3. Lay-in Ceiling Panels. Where a ceiling construction has a suspended membrane ceiling with lay-in panels or tiles which contribute to the required *fire-resistance rating* of the assembly, hold-down clips or other means shall be provided to prevent the lifting of such panels or tiles in the event of a fire.

3.1.7.4. 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*.

3.1.7.5. Minimum Fire-Resistance Rating.

The use of materials or assemblies of materials having a greater *fire-resistance rating* than required shall entail no obligation to exceed in whole or in

3.1.7.5.

part the minimum *fire-resistance ratings* required by this Part.

3.1.7.6. Rating of Supporting Construction

(1) Except as provided in Sentence (2) and in Articles 3.2.2.16. to 3.2.2.62. 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 of 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) Where an assembly is required to be of *noncombustible construction* and have a *fire-resistance rating*, it shall be supported by *noncombustible construction*.

3.1.8. Fire Separations and Closures

3.1.8.1. General Requirements

(1) Any wall, *partition* or floor assembly required to be a *fire separation* shall

- (a) except as permitted in Sentence (2), be constructed as a continuous element (see Appendix A), and
- (b) where required in this Part, have a *fire-resistance rating* as specified. (See Appendix A.)

(2) Openings in *fire separations* shall be protected with *closures*, shafts or other means in conformance with Articles 3.1.8.4. to 3.1.8.17. and with Subsections 3.1.9. and 3.2.8.

3.1.8.2. Combustible Construction

Support. *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 provided in Sentence 3.5.4.2.(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*, and the separation shall terminate so that a smoke-tight joint is provided at the point where it abuts on or intersects the floor and the roof slab or deck.

(2) Where a shaft, including *exit enclosures*, penetrates a *fire separation*, it shall extend through any *horizontal service space* or any other concealed space and shall terminate so that a smoke-tight joint is provided at the point where the shaft abuts on or intersects the floor and the roof slab or deck, except as provided in Subsection 3.5.3. where the shaft pierces through a roof assembly.

3.1.8.4. Determination of Ratings

(1) Except as provided in Sentences (2) and 3.1.8.14.(2), where an opening in a *fire separation* is required to be protected with a *closure* having a *fire-protection rating*, the *fire-protection rating* shall be determined on the basis of the results of tests conducted in conformance with the appropriate provisions in CAN4-S106-M, "Standard Method for Fire Tests of Window and Glass Block Assemblies," CAN4-S104-M, "Standard Method for Fire Tests of Door Assemblies," or CAN/ULC-S112-M, "Standard Method of Fire Test of Fire Damper Assemblies." (See Articles 3.1.8.15. to 3.1.8.17. for additional requirements for *closures*.)

(2) Except as provided in Sentence 3.1.8.10.(1), the *fire-protection rating* of *closures* shall conform to Table 3.1.8.A. for the required rating of the *fire separation*.

Table 3.1.8.A.
Forming Part of Sentence 3.1.8.4.(2)

Fire-Resistance Rating of Fire Separation	Required Fire-Protection Rating of Closure
45 min	45 min
1 h	45 min
1.5 h	1 h
2 h	1.5 h
3 h	2 h
4 h	3 h
Column 1	2

3.1.8.5. Installation of Closures

e (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*.

(2) Except as otherwise specified in this Part, every fire door, window assembly or glass block used as a *closure* in a required *fire separation* shall be installed in conformance with Chapters 2 to 14 of NFPA 80, "Fire Doors and Windows."

(3) Where a door is installed so that it could damage the integrity of a *fire separation* if its swing is unrestricted, door stops shall be installed to prevent such damage.

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, 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* required to be protected with a *closure* shall be not more than 22 m², with no dimension more than 6 m, when the *fire compartments* on both sides of the *fire separation* are sprinklered.

3.1.8.7. Fire Dampers

(1) Except as permitted in Article 3.1.8.8., a duct that connects 2 *fire compartments* or that penetrates an assembly required to be a *fire separation* shall be equipped with a *fire damper*.

(2) A *fire damper* required in Sentence (1) or a *fire damper* used as a *closure* in a *fire separation* shall have a *fire-protection rating* conforming to Sentence 3.1.8.4.(2).

3.1.8.8. Fire Dampers Waived

(1) *Fire dampers* need not be provided in *noncombustible* branch ducts that have a melting point above 760°C and that penetrate a required *fire separation* provided such ducts

- (a) serve only air-conditioning units or combined air-conditioning and heating units discharging air at not more than

1.2 m above the floor and have a cross-sectional area of not more than 130 cm², or are connected to *exhaust duct* risers that are under negative pressure and in which the air flow is upward as provided in Article 3.5.3.4. and are carried up inside the riser not less than 500 mm.

(2) A duct piercing a vertical *fire separation* not required to have a *fire-resistance rating* need not be equipped with a *fire damper* at the *fire separation*.

(3) A *noncombustible* duct piercing a horizontal *fire separation* not required to have a *fire-resistance rating* need not be equipped with a *fire damper* at the *fire separation*.

(4) *Noncombustible* ducts that penetrate a *fire separation* that separates a vertical *service space* from the remainder of the *building* need not be equipped with a *fire damper* at the *fire separation* provided the ducts have a melting point above 760°C and each individual duct exhausts directly to the outside at the top of the vertical *service space*.

(5) A continuous *noncombustible* duct having a melting point above 760°C that pierces a vertical *fire separation* as required in Sentence 3.3.1.1.(1) between *suites* of other than *residential* or *institutional occupancy* need not be equipped with a *fire damper* at the *fire separation*.

(6) 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 6.2.2.6.)

3.1.8.9. Installation of Fire Dampers

(1) *Fire dampers* shall conform to the requirements of this Article.

(2) *Fire dampers* shall be arranged to close automatically upon the operation of a fusible link conforming to ULC-S505, "Standard for Fusible Links for Fire Protection Service" or other heat- or smoke-actuated device.

(3) Heat-actuated devices in Sentence (2) shall be located where they are readily affected by an abnormal rise of temperature in the duct and shall have a temperature rating approximately 30°C above the maximum temperature that would exist in the system either with the system in operation or shut down.

3.1.8.9.

(4) *Fire dampers* shall be installed in the plane of the *fire separation* so as to stay in place should the duct be dislodged during a fire.

(5) *Fire dampers* tested in the vertical or horizontal position shall be installed in the manner in which they were tested.

(6) 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 Appendix A.)

3.1.8.10. Twenty-Minute Closures

(1) A door assembly having a *fire-protection rating* of 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*, and
- (b) a *fire separation* not required to have a *fire-resistance rating* more than 45 min, located in a *building* not more than 3 *storeys* in *building height*.

(2) The requirements for *noncombustible* sills and *combustible* floor coverings in NFPA 80, "Fire Doors and Windows" do not apply to doors described in Sentence (1).

(3) Doors described in Sentence (1) shall have a clearance of not more than 6 mm at the bottom and not more than 3 mm at the sides and top.

3.1.8.11. Self-Closing Devices

(1) Except as provided in 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) Self-closing devices need not be provided on doors that are located between

- (a) a corridor providing *access to exit* from classrooms and the adjacent classrooms in a *building* that is not more than 3 *storeys* in *building height*,

- (b) a *public corridor* and adjacent rooms of Group D *occupancy* in a *building* that is not more than 3 *storeys* in *building height* and where the doors are not located in a dead-end portion of the corridor, or
- (c) sleeping rooms, or a corridor and adjacent sleeping rooms, where the doors are within a *fire compartment* described in Sentence 3.3.3.7.(2).

3.1.8.12. Hold-Open Devices

(1) Hold-open devices are permitted on doors in required *fire separations*, other than *exit* doors in a *building* more than 3 *storeys* in *building height* and doors on vestibules required in Article 3.3.5.8., provided they are designed to release the door in conformance with Sentence (2).

(2) Hold-open devices permitted in Sentence (1) shall be designed to release

- (a) upon a signal from a *smoke detector* located as described in Appendix B of NFPA 80, "Fire Doors and Windows," except that hold-open devices on doors other than *exit* doors, doors opening into a *public corridor* and egress doors referred to in Sentence 3.4.2.4.(2) are permitted to be released by a sprinkler system or a heat-actuated device provided the door does not serve a Group A, Group B or Group C *occupancy* and is not required to function as part of a smoke control system, and
- (b) upon a signal from the *building* fire alarm system where a fire alarm system is provided, except that this requirement does not apply to a hold-open device on a door located between a corridor used by the public and an adjacent sleeping room in hospitals and nursing homes or to a hold-open device that is designed to release by a heat-actuated device in conformance with Clause (a).

3.1.8.13. Door Latches. Except as permitted in Subsection 3.3.3., every 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.

3.1.8.14. Wired Glass and Glass Block

(1) Except as provided in Articles 3.1.8.15. to 3.1.8.17. for the separation of *exits*, an opening or openings in a *fire separation* having a *fire-resistance rating* of not more than 1 h may be protected with fixed wired glass assemblies or glass blocks installed in conformance with NFPA 80, "Fire Doors and Windows."

(2) Wired glass assemblies permitted in Sentence (1) which are used in vertical *fire separations* need not be tested in conformance with Sentence 3.1.8.4.(1) provided that the wired glass is

- (a) not less than 6 mm thick,
- (b) reinforced by a steel wire mesh in the form of diamonds, squares or hexagons having dimensions of approximately 25 mm across the flats, using wire of not less than 0.45 mm diam, or approximately 13 mm across the flats, using wire of not less than 0.40 mm diam, the wire to be centrally embedded during manufacture and welded or intertwined at each intersection,
- (c) set in fixed steel frames having a minimum metal thickness of 1.35 mm and providing a glazing stop of not less than 20 mm on each side of the glass, and
- (d) limited in area so that
 - (i) individual panes are not more than 0.84 m², with neither height nor width more than 1.4 m, and
 - (ii) the area not structurally supported by mullions is not more than 7.5 m².

(See Appendix A.)

(3) Where glass blocks are permitted in Sentence (1), they shall be installed in accordance with Subsection 4.3.2. and reinforced with steel reinforcement in each horizontal joint.

3.1.8.15. Temperature Rise Limit for Doors.

Except as provided in Article 3.1.8.17., the maximum temperature rise on the opaque portion of the unexposed side of a door used as a *closure* in a *fire separation*, when tested in conformance with Sentence 3.1.8.4.(1), shall conform to Table 3.1.8.B. when used in the locations shown in the Table.

3.1.8.16. Area Limits for Wired Glass or Glass Block.

Except as provided in Article 3.1.8.17., the maximum area of wired glass in a door

and the maximum area of wired glass panels or glass block not in a door shall conform to Table 3.1.8.B. when used in the locations shown in the Table.

3.1.8.17. Temperature Rise and Area Limits Waived

(1) The temperature rise limits and glass area limits required in Articles 3.1.8.15. and 3.1.8.16. are waived for *closures* 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* of not less than 45 min,
- (b) the separation in Clause (a) contains no wired glass or glass block within 3 m of the *closure* into the *exit* enclosure, and
- (c) the vestibule or corridor contains no *occupancy*.

(See Appendix A.)

3.1.9. Building Services in Fire Separations and Fire Rated Assemblies**3.1.9.1. Fire Stopping of Service Penetrations**

(1) Piping, tubing, ducts, *chimneys*, electrical wires and cables, totally enclosed *noncombustible* raceways, electrical outlet boxes and other similar *building services* that penetrate a membrane forming part of an assembly required to have a *fire-resistance rating*, or a *fire separation*, shall be

- (a) tightly fitted, or
- (b) sealed by a fire stop system that, when subjected to the fire test method in CAN4-S115-M, "Standard Method of Fire Tests of Firestop Systems," has an F rating not less than the *fire-protection rating* required for *closures* in the *fire separation*. (See A-9.10.9.6.(1) in Appendix A.) (See also Article 3.1.9.4. for penetrations involving *combustible* drain, waste and vent piping.)

(2) Piping, tubing, ducts, *chimneys*, electrical wires and cables, totally enclosed *noncombustible* raceways, electrical outlet boxes and other similar *building services* that penetrate a *firewall* or a horizontal *fire separation* that is required to have a *fire-*

3.1.9.1.

Table 3.1.8.B.
Forming Part of Articles 3.1.8.15. and 3.1.8.16.

Location	Minimum Required <i>Fire-Protection</i> <i>Rating</i> of Door	Maximum Temperature Rise on Unexposed Side of Door, °C	Maximum Area of Glass in Door, cm ²	Maximum Aggregate Area of Wired Glass Panels and Glass Block not in Door, cm ²
Between an <i>exit</i> enclosure and the re- mainder of the <i>floor</i> <i>area</i> in <i>buildings</i> not more than 3 <i>storeys</i> in <i>building height</i>	All ratings	No limit	8 000	8 000
Between an <i>exit</i> enclosure and the re- mainder of the <i>floor</i> <i>area</i> (except as permitted above) or between a dead-end corridor and an adjacent <i>occupancy</i> where the corridor provides the only <i>access</i> to <i>exit</i> and is required to have a <i>fire-resistance</i> <i>rating</i>	Less than 45 min	No limit	No limit	No limit
	45 min	250 after 30 min	645	645
	1.5 h	250 after 1 h	645	645
	2 h	250 after 1 h	645	645
In a <i>firewall</i>	1.5 h	250 after 30 min	645	0
	3 h	250 after 1 h	0	0
Column 1	2	3	4	5

resistance rating in conformance with Article 3.2.1.2., shall be sealed at the penetration by a fire stop system that, when subjected to the fire test method in CAN4-S115-M, "Standard Method of Fire Tests of Firestop Systems," has an FT rating not less than the *fire-resistance rating* for the *fire separation*.

3.1.9.2. Combustibility of Service Penetrations. Except as permitted in Articles 3.1.9.3. and 3.1.9.4., pipes, ducts, electrical outlet boxes, totally enclosed *noncombustible* raceways or other similar service equipment that partly or wholly

penetrate an assembly required to have a *fire-resistance rating* shall be *noncombustible* unless the assembly has been tested incorporating such equipment.

3.1.9.3. Penetration by Wires, Cables and Outlet Boxes

(1) Electrical or similar wiring in totally enclosed *noncombustible* raceways is permitted to partly or wholly penetrate an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required in Article 3.1.9.2.

3.1.10.6. Exposure Protection for Adjacent Walls. Where the external walls of 2 buildings meet at a *firewall* at an angle of 135° or less, the requirements of Article 3.2.3.14. shall apply.

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) When buildings are separated by a *firewall*, *combustible* projections on the exterior of one building, such as 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 Stops in Concealed Spaces

3.1.11.1. Separation of Concealed Spaces. 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 stops conforming to Article 3.1.11.7.

3.1.11.2. Fire Stopping in Wall Assemblies

- (1) Except as permitted in Sentence (2), fire stops conforming to Article 3.1.11.7. shall be provided to block off concealed spaces within a wall assembly
- (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 stops 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*, or
 - (c) the exposed construction materials and any insulation within the wall space have

a *flame-spread rating* of not more than 25 on any exposed surface or on any surface that would be exposed by cutting through the material in any direction and fire stops are installed so that the vertical distance between them is not more than 10 m.

3.1.11.3. Fire Stopping between Nailing and Supporting Elements

(1) In buildings required to be of *noncombustible construction*, where the ceiling finish exposed within a concealed space has a *flame-spread rating* of more than 25, fire stops conforming to Article 3.1.11.7. shall be provided between wood nailing elements so that the maximum area of the concealed space is not more than 2 m².

(2) In buildings required to be of *noncombustible construction*, fire stops conforming to Article 3.1.11.7. shall be provided in the concealed spaces created by the wood members permitted in Sentence 3.1.5.8.(2) so that the maximum area of a concealed space is not more than 10 m².

3.1.11.4. Fire Stopping between Vertical and Horizontal Spaces

- (1) Fire stops 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* of 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* of more than 25.

3.1.11.5. Fire Stopping of Roof Spaces, Balconies and Canopies

- (1) Every unsprinklered concealed space within a ceiling or roof assembly of *combustible construction*, including attic spaces, shall be separated by construction conforming to Article 3.1.11.7. into compartments not more than
- (a) 600 m² in area with no dimension more than 60 m where the exposed construction materials within the space have a *flame-*

3.1.11.5.

- (b) *spread rating* of not more than 25, and 300 m² in area with no dimension more than 20 m where the exposed construction materials within the space have a *flame-spread rating* of more than 25.

(2) Every concealed space in exterior cornices, mansard style roofs, balconies and canopies in which the exposed construction materials within the space have a *flame-spread rating* of more than 25 shall be separated by construction conforming to Article 3.1.11.7.

- (a) at the points where such concealed spaces extend across the ends of required vertical *fire separations*, and
- (b) so that the maximum dimension in any concealed space is not more than 20 m.

3.1.11.6. Fire Stopping of Crawl Spaces.

Every unsprinklered crawl space not considered as a *basement* in Article 3.2.2.5. 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 Stop Materials

(1) Except as provided in Sentences (2) to (4), materials used to separate concealed spaces into compartments shall remain in place and prevent the passage of flames for a period of not less than 15 min when subjected to the standard fire exposure in CAN /ULC-S101-M, "Standard Methods 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 *buildings* required to be of *noncombustible construction*, wood nailing elements described in Article 3.1.5.6. need not be tested in conformance with Sentence (1).

(4) In *buildings* permitted to be of *combustible construction* and in *combustible* roof systems permitted by Sentence 3.1.5.3.(2), materials used to separate concealed spaces into compartments are permitted to be

- (a) solid lumber not less than 38 mm thick,
- (b) phenolic bonded plywood, waferboard, or strandboard not less than 12.5 mm thick with joints supported, or

- (c) 2 thicknesses of lumber each not less than 19 mm thick with joints staggered, where the width or height of the concealed space is such that more than one piece of lumber not less than 38 mm thick is necessary to block off the space.

(5) Openings through materials referred to in Sentences (1) to (4) shall be protected to maintain the integrity of the construction.

(6) Where materials referred to in Sentences (1) to (4) are penetrated by construction elements or by service equipment, fire stop materials shall be used to seal the penetration.

3.1.12. Flame-Spread Rating and Smoke Developed Classification

3.1.12.1. Determination of Ratings

(1) Except as provided in Sentences (2) and (3), the *flame-spread rating* and smoke developed classification of a material, assembly of materials or structural member shall be determined on the basis of not less than 3 tests conducted in conformance with CAN/ULC-S102-M, "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 of materials shall be determined on the basis of not less than 3 tests conducted in conformance with CAN/ULC-S102.2-M, "Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering, and Miscellaneous Materials and Assemblies," where the material or assembly of materials

- (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 of materials or a structural member is permitted to be assigned a *flame-spread rating* and smoke developed classification on the basis of Chapter 2, "Fire Performance Ratings" of the Supplement to the NBC 1990.

3.1.13. Interior Finish

3.1.13.1. Interior Finish Description

(1) Interior finish material shall include any material that forms part of the interior surface of a floor, wall, *partition* or ceiling, such as

- (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, when such floor is not intended as the finished floor.

3.1.13.2. Flame-Spread Rating

(1) Except as otherwise provided in 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.A.

(2) Except as permitted in 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* of not more than 200. (See Appendix A.)

(3) Doors within *dwelling units* need not conform to Sentences (1) and (2).

(4) Where a wall or ceiling finish is required to have a *flame-spread rating* of less than 150 in Sentence (1), up to 10 per cent of the total wall area and 10 per cent of the total ceiling area is permitted to have a *flame-spread rating* of not more than 150, except that up to 25 per cent of the total wall area of lobbies described in Sentence 3.4.4.2.(2) is permitted to have a *flame-spread rating* of 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. The *flame-spread rating* of interior wall and ceiling finishes for bathrooms within *suites* of Group C *occupancy* shall be not more than 200.

Table 3.1.13.A.
Forming Part of Sentence 3.1.13.2.(1)

Occupancy, Location or Element	Maximum <i>Flame-Spread</i> <i>Rating</i> for Walls and Ceilings	
	<i>Sprinklered</i>	<i>Unsprinklered</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 such passageways	25	25
<i>Vertical service spaces</i>	25	25
Column 1	2	3

Note to Table 3.1.13.A.:

⁽¹⁾ See Articles 3.1.13.8. and 3.1.13.10.

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 *occupancies* 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* of not more than 250 and a smoke developed classification of not more than 600 when tested in conformance with CAN/ULC-S102.2-M, "Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering, and Miscellaneous Materials and Assemblies,"

3.1.13.4.

- (b) fall to the bottom of the test apparatus before igniting when tested in conformance with ULC-S102.3-M, “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 corridors that are required to be separated from the remainder of the building by a fire separation or in exit shafts 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. Individual *combustible* skylights in corridors that are 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 where the building is sprinklered, the interior wall finish of public corridors, corridors used

by the public in assembly and institutional occupancies and corridors serving classrooms or sleeping rooms in institutional occupancies, including occupancies in such corridors, shall have a maximum flame-spread rating of not more than

- (a) 75, or
- (b) 25 on the upper half of the wall and 150 on the lower half of the wall.

(2) Except where the building is sprinklered, the interior ceiling finish of corridors and occupancies in Sentence (1) shall have a flame-spread rating of not more than 25.

3.1.13.7. High Buildings

(1) Except as permitted in 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 Article 3.1.13.2. and to the flame-spread rating and smoke developed classification values in Table 3.1.13.B.

(2) Except for buildings of Group B major occupancy and elevator cars, the flame-spread rating

Table 3.1.13.B.
Forming Part of Sentence 3.1.13.7.(1)

Location or Element	Maximum Flame-Spread Rating			Maximum Smoke Developed Classification		
	Wall Surface	Ceiling Surface ⁽¹⁾	Floor Surface	Wall Surface	Ceiling Surface ⁽¹⁾	Floor Surface
Exit stairways, vestibules to exit stairs and lobbies described in Sentence 3.4.4.2.(2)	25	25	25	50	50	50
Corridors not within suites	—	—	300	100	50	500
Elevator cars and vestibules	25	25	300	100	100	300
Service spaces and service rooms	25	25	25	50	50	50
Other locations and elements	—	—	No limit	300	50	No limit
Column 1	2	3	4	5	6	7

Note to Table 3.1.13.B.:

⁽¹⁾ See Sentence 3.1.13.4.(1) for lighting elements.

3.2.2.51. Industrial Buildings, Division 2, 1 and 2 Storeys

- (1) A building classified as Group F, Division 2 shall conform to Sentence (2) provided the building
- (a) is not more than 2 storeys in building height, and
 - (b) has a building area not more than the value in Table 3.2.2.S.

Table 3.2.2.S.
Forming Part of Sentence 3.2.2.51.(1)

No. of Storeys	Uns sprinklered Maximum Area, m ²		
	Facing 1 Street	Facing 2 Streets	Facing 3 Streets
1	1 000	1 250	1 500
2	600	750	900
Sprinklered Maximum Area, m ²			
1	3 000	3 750	4 500
2	1 200	1 500	1 800
Column 1	2	3	4

- (2) The building shall be of combustible or noncombustible construction used either singly or in combination, and
- (a) floor assemblies shall be fire separations and, if of combustible construction, shall have a fire-resistance rating of not less than 45 min, and
 - (b) all loadbearing walls, columns and arches supporting an assembly required to have a fire-resistance rating shall have a fire-resistance rating of not less than 45 min or shall be of noncombustible construction.

3.2.2.52. Industrial Buildings, Division 2, up to 4 Storeys

- (1) A building classified as Group F, Division 2 shall conform to Sentence (2) provided the building
- (a) is not more than 4 storeys in building height,
 - (b) if unsprinklered, has a building area not more than the value in Table 3.2.2.T., and
 - (c) if sprinklered, is not more than twice the area limits of Clause (b).

Table 3.2.2.T.
Forming Part of Sentence 3.2.2.52.(1)

No. of Storeys	Uns sprinklered Maximum Area, m ²		
	Facing 1 Street	Facing 2 Streets	Facing 3 Streets
1	3 200	4 000	4 800
2	1 600	2 000	2 400
3	1 070	1 340	1 600
4	800	1 000	1 200
Column 1	2	3	4

- (2) The building shall be of combustible or noncombustible construction used either singly or in combination, and
- (a) floor assemblies shall be fire separations with a fire-resistance rating of not less than 45 min,
 - (b) mezzanines shall have, if of combustible construction, a fire-resistance rating of not less than 45 min,
 - (c) roof assemblies shall have, if of combustible construction, a fire-resistance rating of not less than 45 min, except that in buildings 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., and
 - (i) if unsprinklered, the building area is not more than
 - 1 600 m² if facing 1 street,
 - 2 000 m² if facing 2 streets, or
 - 2 400 m² if facing 3 streets, and
 - (ii) if sprinklered, the building area is not more than twice the area limits of Subclause (i) (see Article 3.2.2.12. for supervised sprinkler systems), and
 - (d) all loadbearing walls, columns and arches supporting an assembly required to have a fire-resistance rating shall have a fire-resistance rating of not less than 45 min or shall be of noncombustible construction, except that such members and assemblies

3.2.2.52.

supporting a *fire separation* shall have a *fire-resistance rating* not less than that required for the supported assembly.

e (See also Article 3.2.2.53.)

3.2.2.53. Industrial Buildings, Division 2, up to 4 Storeys

(1) A *building* classified as Group F, Division 2 shall conform to Sentence (2) provided the *building*

- (a) is not more than 4 *storeys* in *building height*,
- (b) if *unsprinklered*, has a *building area* not more than the value in Table 3.2.2.U., and
- (c) if *sprinklered*, is not more than twice the area limits of Clause (b).

Table 3.2.2.U.

Forming Part of Sentence 3.2.2.53.(1)

No. of Storeys	Unsprinklered Maximum Area, m ²		
	Facing 1 Street	Facing 2 Streets	Facing 3 Streets
1	6 000	7 500	9 000
2	3 000	3 750	4 500
3	2 000	2 500	3 000
4	1 500	1 875	2 250
Column 1	2	3	4

(2) The *building* shall be of *noncombustible construction*, and

- (a) floor assemblies shall be *fire separations* with a *fire-resistance rating* of not less than 1 h,
- (b) *mezzanines* shall have a *fire-resistance rating* of not less than 1 h,
- (c) roof assemblies shall have a *fire-resistance rating* of not less than 1 h, and
- (d) all *loadbearing walls*, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

e (See also Article 3.2.2.52.)

3.2.2.54. Industrial Buildings, Division 2, up to 6 Storeys

(1) A *building* classified as Group F, Division 2 shall conform to Sentence (2) provided the *building*

- (a) is not more than 6 *storeys* in *building height*,
- (b) if *unsprinklered*, has a *building area* not more than the value in Table 3.2.2.V., and
- (c) if *sprinklered*, is not more than twice the area limits of Clause (b).

Table 3.2.2.V.

Forming Part of Sentence 3.2.2.54.(1)

No. of Storeys	Unsprinklered 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
Column 1	2	3	4

(2) The *building* shall be of *noncombustible construction*, and

- (a) floor assemblies shall be *fire separations* with a *fire-resistance rating* of not less than 2 h,
- (b) *mezzanines* shall have a *fire-resistance rating* of not less than 1 h,
- (c) roof assemblies shall have a *fire-resistance rating* of not less than 1 h, and
- (d) all *loadbearing walls*, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.55. Industrial Buildings, Division 2, Any Height, Any Area, Sprinklered

(1) A *building* classified as Group F, Division 2 shall conform to Sentence (2) provided the *building*

- (a) is not limited in *building height*,
- (b) is *sprinklered*, and
- (c) is not limited in *building area*.

(2) The *building* shall be of *noncombustible construction*, and

in conformance with CAN/ULC-S101-M, "Standard Methods of Fire Endurance Tests of Building Construction and Materials."

3.2.3.8. Protection of Structural Members

(1) Structural members, such as beams, columns and arches placed wholly or partly outside an exterior face of a *building* and 3 m or more from the property line or centreline of a public thoroughfare need not be protected from exterior fires.

(2) Structural members in Sentence (1) that are less than 3 m from the property line or centreline of a public thoroughfare shall be protected from exterior fire by fire protection having a *fire-resistance rating* not less than that required for their protection from inside fires in conformance with Articles 3.2.2.16. to 3.2.2.62., or by fire protection having a *fire-resistance rating* of not less than 1 h, whichever is the greater.

(3) Structural members of *heavy timber construction* such as beams, columns and arches placed wholly or partly outside an exterior face of a *building* and 3 m or more from the property line or centreline of a public thoroughfare need not be covered with *noncombustible* cladding.

3.2.3.9. 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* of 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.

3.2.3.10. Low Fire Load, 1 Storey Building

(1) For any *building* of Group F, Division 3 *occupancy*, any non-loadbearing wall comprising an *exposing building face* is permitted to be of *noncombustible construction* without a *fire-resistance rating* provided the *building*

- (a) is not more than 1 *storey* in *building height*,
- (b) is used for low fire load *occupancies* such as described in Sentence 3.2.2.59.(1), and
- (c) is located so that the *limiting distance* is not less than 3 m.

3.2.3.11. Increased Openings Permitted

(1) The maximum area of *unprotected openings* in any *exposing building face* is permitted to be doubled where the *building* is *sprinklered*.

(2) The maximum area of *unprotected openings* in any *exposing building face* is permitted to be doubled where such openings are glazed with glass block or with wired glass conforming to the requirements of Article 3.1.8.14. (See Appendix A.)

3.2.3.12. Equivalent Opening Factor.

Where the surface temperature on the unexposed surface of a wall assembly exceeds the limitation of a standard fire test as permitted in 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 limitation of the standard test is exceeded, and

F_{EO} = an equivalent opening factor derived from the following expression:

$$F_{EO} = \frac{(T_u + 273)^4}{(T_e + 273)^4}$$

where

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, and

T_e = 892°C for a *fire-resistance rating* of not less than 45 min, 927°C for a *fire-resistance rating* of not less than 1 h, and 1010°C for a *fire-resistance rating* of not less than 2 h.

3.2.3.13. Protection of Exit Facilities

(1) Except as required in Sentence (3), where an *exit* enclosure has exterior walls that may be exposed to fire from openings in the exterior walls of the *building* it serves, the openings in either the exterior walls of the *exit* or the exterior walls of the *building* shall be protected with wired glass in fixed steel frames or glass block conforming to Article 3.1.8.14. where the openings in the exterior walls of the *building* are within 3 m horizontally and

- (a) less than 10 m below openings in the exterior walls of the *exit*, or
- (b) less than 2 m above openings in the exterior walls of the *exit*.

(2) Where an unenclosed exterior *exit* stair or ramp may be exposed to fire from openings in the exterior walls of the *building* it serves, the openings in the exterior walls of the *building* shall be protected with wired glass in fixed steel frames or glass block conforming to Article 3.1.8.14. where the openings in the exterior walls of the *building* are within 3 m horizontally and

- (a) less than 10 m below the *exit* stair or ramp, or
- (b) less than 5 m above the *exit* stair or ramp.

(3) Except as provided in Sentence 3.4.4.3.(1), where an exterior *exit* door in one *fire compartment* is within 3 m horizontally of an *unprotected opening* in another *fire compartment* and the exterior walls of these *fire compartments* intersect at an exterior angle of less than 135°, the opening shall be protected with wired glass in fixed steel frames or glass block conforming to Article 3.1.8.14.

3.2.3.14. Wall Exposed to Another Wall

(1) Except as provided in Sentences 3.2.3.13.(1) and 3.2.3.20.(4), where an opening in an exterior wall of a *fire compartment* is exposed to an opening in the exterior wall of another *fire compartment*, and the planes of the 2 walls are parallel or at an angle of 135° or less, measured from the exterior of the *building*, the openings in the 2 *fire compartments* shall be separated by a distance of not less than D_o , where

$$D_o = 2D - \left(\frac{\theta}{90} \times D \right), \text{ but in no case less than 1m,}$$

where

- 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 Appendix A.)

(2) The exterior wall of each *fire compartment* 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 compartment and the remainder of the *building*.

3.2.3.15. Wall Exposed to Adjoining Roof.

Except as permitted in Sentence 3.2.3.20.(4), where a wall in a *building* is exposed to a fire hazard from an adjoining roof of a separate unsprinklered *fire compartment* in the same *building*, and the exposed wall contains windows within 3 storeys vertically and 5 m horizontally of such roof, the roof shall contain no skylights within 5 m of the exposed wall.

3.2.3.16. Protection of Soffits

(1) 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 2.5 m of a window or door opening shall be protected by

- (a) *noncombustible* material not less than 0.38 mm thick and 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 in Sentence (1) shall extend the full width of the opening and to not less than 1.2 m on either side of it, with no *unprotected opening* into the soffit within this limit.

(3) Where an eave overhang is completely separated from the remainder of the *attic or roof space* by fire stopping, the requirements in Sentence (1) do not apply.

3.2.3.17. Apron, Canopy or Spandrel Protection for Vertically Separated Openings.

Where any storey of a building classified as a Group E or Group F, Division 1 or 2 major occupancy is required to be separated from the storey above or below by a fire separation, every opening in an exterior wall located vertically above another opening shall be separated by apron or spandrel walls not less than 1 m high or by a canopy not less than 1 m wide at each floor level and the apron, spandrel or canopy shall have a fire-resistance rating not less than that of the construction required for the floor assembly but need not be more than 1 h, except as required elsewhere in this Subsection.

3.2.3.18. Roof Coverings

(1) Except as provided in Sentence (2), every building shall have a Class A, B or C roof covering as described in Subsection 3.1.15.

(2) Roof coverings are not required to have a Class A, B or C rating for

- (a) tents and air-supported structures, and
- (b) buildings 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.

3.2.3.19. Covered Vehicular Passageway

- (1) A covered vehicular passageway shall
- (a) be of noncombustible construction when constructed below grade, and
 - (b) be separated from every building or part of a building adjoining it by a fire separation having a fire-resistance rating of not less than 1.5 h where it is designed as a receiving or shipping area.

3.2.3.20. Walkway between Buildings

(1) Except as provided in Sentence 3.2.3.21.(2), where buildings are connected by a walkway, each building shall be separated from the walkway by a fire separation with a fire-resistance rating of not less than 45 min.

(2) Except as provided in Sentence (3), a walkway connected to a building required to be of noncombustible construction shall also be of noncombustible construction.

(3) A walkway connected to a building required to be of noncombustible construction is permitted to be of heavy timber construction provided

- (a) not less than 50 per cent of the area of any enclosing perimeter walls is open to the outdoors, and
- (b) the walkway is at ground level.

(4) A walkway of noncombustible construction used only as a pedestrian thoroughfare need not conform to the requirements of Articles 3.2.3.14. and 3.2.3.15.

3.2.3.21. Underground Walkway

(1) An underground walkway shall not be designed or used for any purpose other than pedestrian travel unless such other purpose is acceptable to the authority having jurisdiction and any space in the walkway containing an occupancy is sprinklered.

(2) Buildings connected by an underground walkway shall be separated from the walkway by a fire separation with a fire-resistance rating of not less than 1 h.

(3) An underground walkway shall be of noncombustible construction suitable for underground location.

(4) Smoke barrier doors shall be installed in underground walkways at intervals of not more than 100 m, or 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 for any of the adjacent occupancies as prescribed in Sentence 3.4.2.5.(1).

3.2.4. Fire Alarm and Detection Systems

(See Appendix A.)

3.2.4.1. Determination of Requirement for a Fire Alarm System

(1) Except as provided in Sentences (2) to (4), a fire alarm system shall be installed when the occupant load in Table 3.2.4.A. for any major occupancy is exceeded, and in buildings containing

- (a) a contained use area,
- (b) an impeded egress zone,
- (c) an interconnected floor space required to conform to Articles 3.2.8.3. to 3.2.8.9.,

3.2.4.1.

- (d) more than 3 storeys, including storeys below grade,
- (e) a total occupant load of more than 300, other than in open air seating areas,
- (f) an occupant load of more than 150 above or below the first storey, other than in open air seating areas, or
- (g) a child care facility, including a day care facility, with an occupant load of more than 40.

Table 3.2.4.A.

Forming Part of Sentence 3.2.4.1.(1)

Major Occupancy Classification	Occupant Load Above which a Fire Alarm System Is Required
Group A, Division 2 (licensed beverage establishments and restaurants only)	150
Group A, Division 2 (schools and colleges only)	40
Group A, Division 4	300 below the seating area
Group B, Division 2	10 receiving care or treatment
Group C	10 having sleeping accommodation
Group F, Division 1	25
Group F Division 2 and 3	75 above or below the first storey
Column 1	2

(2) A fire alarm system is not required in apartment buildings where not more than 4 dwelling units share a common means of egress, or in buildings 3 storeys or less in building height where each dwelling unit is served by an exterior exit facility leading to ground level.

(3) A fire alarm system is not required in hotels or motels 3 storeys or less in building height where each suite is served by an exterior exit facility leading to ground level.

(4) A fire alarm system is not required in a storage garage conforming to Article 3.2.2.60. provided there are no other occupancies in the building.

3.2.4.2. Continuity of Fire Alarm System

(1) Where 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 provided in Sentence (4), where 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 provided in Sentence (4), where a fire alarm system is required in any portion of a building, it shall be installed throughout the building.

(4) Except as provided in Sentence (5), in a building not more than 3 storeys in building height, where a vertical fire separation having a fire-resistance rating of not less than 1 h separates a portion of the building from the remainder of the building and there are no openings through the fire separation, other than those for piping, tubing, wiring and totally enclosed noncombustible raceways, the requirements in this Subsection are permitted to be applied to each portion so separated as if it were a separate building.

(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.

3.2.4.3. Types of Fire Alarm Systems

- (1) Fire alarm systems shall be
- (a) single stage systems in Group F, Division 1 occupancies,
 - (b) 2 stage systems in Group B occupancies other than those described in Clause (c),
 - (c) single or 2 stage systems in buildings 3 storeys or less in building height used for children's custodial homes, convalescent homes or orphanages, and
 - (d) single or 2 stage systems 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 pull station or fire detector, cause an alarm signal to sound on all audible signal appliances in the system. (See Appendix A.)

(2) A 2 stage fire alarm system shall

- (a) cause an *alert signal* to sound upon the operation of any manual pull station 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 each manual pull station equipped so that the use of a key or other similar device causes an *alarm signal* to sound and continue to sound upon the removal of the key or similar device from the manual pull station.

(See Appendix A.)

(3) Fire alarm systems in Sentences (1) and (2) are permitted to be zone coded so that, upon the operation of any manual pull station or *fire detector*,

- (a) a coded *alarm signal* is sounded for a single stage system or a coded *alert signal* is sounded for a 2 stage system indicating the zone of alarm initiation,
- (b) the coded *alert signal* or *alarm signal* is repeated in its entirety not less than 4 times, and
- (c) a continuous *alert signal* or *alarm signal* is sounded upon completion of the coded signals in Clause (b) and Sentence (4).

(4) When a second manual pull station or *fire detector* is operated in a system in Sentence (3), in a zone other than that for which the first *alert signal* or *alarm signal* was sounded, the coded *alert signal* or *alarm signal* for the first zone shall be completed before the coded *alert signal* or *alarm signal* for the second zone is repeated not less than 4 times.

3.2.4.5. Installation and Testing of Fire Alarm Systems

(1) Fire alarm and voice communication systems shall be installed in conformance with CAN/ULC-S524-M, "Standard for the Installation of Fire Alarm Systems."

(2) Fire alarm systems shall be tested to ensure satisfactory operation in conformance with CAN/ULC-S537-M, "Standard for the Verification of Fire Alarm Systems."

3.2.4.6. Silencing of Alarm Signals

(1) Required fire alarm systems shall be designed so that when an *alarm signal* is actuated, it cannot be silenced automatically for at least

- (a) 5 min for *buildings* not required to be equipped with an annunciator, and
- (b) 20 min for all other *buildings*.

(2) Except as permitted in Sentence 3.2.4.22.(2), a required fire alarm system shall not incorporate manual silencing switches other than those installed inside the fire alarm control unit. (See Appendix A.)

3.2.4.7. Signals to Fire Department

(1) Where a fire alarm system is required to be installed, and a single stage system is provided, the system shall be designed to notify the fire department in conformance with Sentence (3) that an *alarm signal* has been initiated in

- (a) Group A *occupancies* having an *occupant load* of more than 300,
- (b) Group B *occupancies*,
- (c) Group F, Division 1 *occupancies*,
- (d) *buildings* regulated by the provisions of Subsection 3.2.6., or
- (e) *buildings* containing *interconnected floor space* required to conform to Articles 3.2.8.3. to 3.2.8.9.

(2) Where a fire alarm system is required to be installed and a 2 stage system is provided, the system shall be designed to notify the fire department in conformance with Sentence (3) that an *alert signal* has been initiated.

(3) Except as permitted in Sentence (4), signals to the fire department shall be by way of

- (a) the municipal fire alarm system,
- (b) an independent central station conforming to NFPA-71, "Installation, Maintenance, and Use of Central Station Signaling Systems," or
- (c) a proprietary control centre conforming to NFPA-72D, "Installation, Maintenance, and Use of Proprietary Protective Signaling Systems."

(4) When the facilities in Sentence (3) are not available in the municipality in which the *building* is to be built, an independent system is permitted to be used to transmit signals to the fire department.

(5) Where a required fire alarm system has been installed with no provisions to transmit a signal to the fire department as indicated in Sentences (2), (3) and (4), a legible, permanently-mounted notice

3.2.4.7.

shall be posted at each manual pull station requesting that the fire department be notified and including the telephone number of that department.

3.2.4.8. Annunciator and Zone Indication

(1) Except as permitted in Sentences (2) to (4), 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 3.2.5.6.(1) and the annunciator shall have separate zone indicators of the actuation of the alarm initiating devices in each

- (a) *floor area* so that the area of coverage for each zone is not more than 2 000 m²,
- (b) *fire compartment* required to be separated by vertical *fire separations* having a *fire-resistance rating* of not less than 2 h, other than *dwelling units* described in Subsection 3.3.4.,
- (c) shaft required to be equipped with *fire detectors*,
- (d) air handling system required to be equipped with *smoke detectors*,
- (e) *contained use area*, and
- (f) *impeded egress zone*.

(See Appendix A.)

(2) An annunciator need not be provided for a fire alarm system when not more than one zone indicator is required in Sentence (1).

(3) When an annunciator is not installed as part of a required fire alarm system in conformance with Sentence (1), a visual and audible trouble signal device shall be provided inside the main entrance of the *building*.

(4) The requirements in Sentence (1) are waived in a *building* that has an aggregate area for all *storeys* of not more than 2 000 m² and is not more than 3 *storeys* in *building height*.

(5) Where a sprinkler system is used in lieu of *heat detectors* in conformance with Article 3.2.4.16., the requirements for zone indication in Clauses (1)(a) and (b) are waived provided the actuation of the alarm initiating devices is indicated on the annunciator in conformance with the zone indication requirements for the sprinkler system. (See Appendix A.)

3.2.4.9. Electrical Supervision. Electrical supervision shall be provided for required fire alarm systems.

3.2.4.10. Fire Detectors

(1) *Fire detectors* required in this Article shall be connected to the fire alarm system.

(2) Except as provided in Article 3.2.4.16., where a fire alarm system is required, *fire detectors* shall be installed in

- (a) storage rooms not within *dwelling units*,
- (b) *service rooms* not within *dwelling units*,
- (c) janitors' rooms,
- (d) elevator and dumbwaiter shafts, and
- (e) rooms where hazardous products are to be used or stored.

3.2.4.11. Heat Detectors

(1) Except as provided in Article 3.2.4.16., where a fire alarm system is required, *heat detectors* shall be installed

- (a) in every room in portions of *buildings* classified as Group A, Division 1 or Group B *major occupancy* other than sleeping rooms, and
- (b) in every *suite* and every room not located within a *suite*, in portions of *buildings* classified as Group C *major occupancy* and more than 3 *storeys* in *building height*. (See also Article 3.2.4.21. for *smoke alarms*.)

3.2.4.12. Smoke Detectors

(1) Where a fire alarm system is required, *smoke detectors* shall be installed in

- (a) every sleeping room and every corridor serving as part of a *means of egress* from sleeping rooms in portions of *buildings* classified as Group B *major occupancy*,
- (b) every room in a *contained use area* and corridors serving those rooms,
- (c) every corridor in portions of *buildings* classified as Group A, Division 1 *major occupancy*,
- (d) every *public corridor* in portions of *buildings* classified as Group C *major occupancy*,
- (e) every *exit stair shaft*, and
- (f) the vicinity of draft stops required by Article 3.2.8.7. (See Appendix A.)

3.2.4.13. Prevention of Smoke Circulation

(1) Where a fire alarm system is required, every recirculating air handling system shall be designed to prevent the circulation of smoke upon a signal from a duct-type *smoke detector* where the air handling system

- (a) serves more than one *storey*,
- (b) serves more than one *suite* in a *storey*,
- (c) serves more than one zone required in Sentence 3.3.3.6.(6), or
- (d) serves more than one *fire compartment* required in Sentence 3.3.3.7.(2).

3.2.4.14. Vacuum Cleaning System Shutdown.

Central vacuum cleaning systems in *buildings* required to be equipped with a fire alarm system shall be designed to shut down upon actuation of the fire alarm system.

3.2.4.15. Elevator Emergency Return

(1) Except as permitted in Sentence (3), in *buildings* having elevators that serve *storeys* above the *first storey* and that are equipped with an automatic emergency recall feature, *smoke detectors* shall be installed in the elevator lobbies on the recall level so that when these detectors are actuated, the elevators will automatically return directly to an alternate floor level. (See A-3.2.6.8.(6)(a) in Appendix A.)

(2) *Smoke detectors* required in Sentence (1) shall be designed as part of the *building* fire alarm system.

(3) The alternate floor recall feature specified in Sentence (1) is not required if the *floor area* containing the recall level is *sprinklered*.

3.2.4.16. Sprinklers in Lieu of Heat Detectors

(1) *Heat detectors* in Articles 3.2.4.10. and 3.2.4.11. need not be provided where an automatic sprinkler system conforming to Sentences (2) to (5) and Article 3.2.5.13. is installed throughout the *floor area*.

(2) If an annunciator is required by Article 3.2.4.8., automatic sprinkler systems referred to in Sentence (1) shall be equipped with waterflow detecting devices so that each device serves

- (a) not more than one *storey*, and
- (b) an area on each *storey* that is not more

than the system area limits as specified in NFPA 13, "Installation of Sprinkler Systems."

(3) Waterflow detecting devices required by Sentence (2) shall be connected to initiate an *alert signal* or an *alarm signal* on the fire alarm system. (See A-3.2.4.8.(5) in Appendix A.)

(4) The actuation of each waterflow detecting device required by Sentence (2) shall be indicated separately on the fire alarm system annunciator.

(5) The sprinkler system referred to in Sentence (1) shall be electrically supervised to indicate a trouble signal on the *building* fire alarm system annunciator for each of the following:

- (a) movement of a control valve handle,
- (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 fire fighting purposes,
- (f) loss of electrical power to any automatically starting electrical fire pump (see Appendix A), and
- (g) a temperature approaching the freezing point in any dry pipe valve enclosure or water storage container used for fire fighting purposes.

3.2.4.17. Manual Pull Stations. A manual pull station shall be installed in every *floor area* near every required *exit*. (See Appendix A.)

3.2.4.18. Alert and Alarm Signals

(1) *Alert signals* and *alarm signals* shall be readily distinguishable from each other and from other signals which may be sounded in the *building*.

(2) In a 2 stage fire alarm system described in Sentence 3.2.4.4.(2), the same audible signal appliances are permitted to be used to sound the *alert signals* and the *alarm signals*.

(3) If audible signal appliances 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.

3.2.4.18.

(4) Audible signal appliances forming part of a fire alarm or voice communication system shall not be used for playing music or background noise.

(5) In a *building* or portion thereof intended for use primarily by persons with hearing impairments, visual signal appliances shall be installed in addition to audible signal appliances.

3.2.4.19. Audibility of Alarm Systems

(1) Audible signal appliances forming part of a required fire alarm system shall be installed in a *building* so that *alert signals*, *alarm signals* and voice messages can be heard intelligibly throughout the *floor area* in which they are installed.

(2) If a fire alarm system is required, audible signal appliances shall be located in a *service space* referred to in Sentence 3.2.1.1.(7) and shall be connected to the fire alarm system.

3.2.4.20. Visual Signals

(1) Visual signal appliances required in Sentence 3.2.4.18.(5) shall be installed in a *building* so that the signal from not less than one appliance is visible throughout the *floor area* or portion thereof in which they are installed.

(2) In addition to the requirements for fire alarm and detection systems in this Subsection, visual signals from *smoke detectors* required in sleeping rooms of Group B *occupancy* shall be provided so that staff serving those rooms can easily identify the room or location of fire alarm initiation. (See Appendix A.)

3.2.4.21. Smoke Alarms

(1) *Smoke alarms* conforming to CAN/ULC-S531-M, "Standard for Smoke Alarms" shall be installed in each *dwelling unit* and, except for *institutional occupancies* required to have a fire alarm system, in each sleeping room not within a *dwelling unit*.

(2) *Smoke alarms* within *dwelling units* shall be installed between each area containing sleeping rooms and the remainder of the *dwelling unit*, and where the sleeping rooms are served by hallways, the *smoke alarms* shall be installed in the hallways.

(3) *Smoke alarms* shall be installed on or near the ceiling.

(4) *Smoke alarms* shall be installed with permanent connections to an electrical circuit and shall have no disconnect switches between the overcurrent device and the *smoke alarm*.

(5) Where more than one *smoke alarm* is required in a *dwelling unit*, they shall be wired so that the actuation of one alarm will cause all alarms within the *dwelling unit* to sound.

3.2.4.22. Voice Communication Systems

(1) A voice communication system required in Subsection 3.2.6. shall consist of

- (a) a 2-way communication system in each floor area, with connections to the central alarm and control facility and to the mechanical control centre, and
- (b) loudspeakers operated from the central alarm and control facility which are designed and located so as to be audible in all parts of the *building*, except that this requirement does not apply to elevator cars.

(2) The voice communication system referred to in Sentence (1) shall include provision for silencing the *alarm signal* in a single stage fire alarm system when voice messages are being transmitted, but only after the *alarm signal* has sounded initially for not less than 1 min.

(3) The voice communication system referred to in Sentence (1) shall include provision for silencing the *alert signal* and the *alarm signal* in a 2 stage fire alarm system when voice messages are being transmitted, but only after the *alert signal* has sounded initially for not less than 1 min.

(4) The voice communication system referred to in Clause (1)(b) shall be designed so that voice instructions can be transmitted selectively to any zone or zones while maintaining an *alert signal* or *alarm signal* to the other zones in the *building*.

(5) The 2-way communication system referred to in Clause (1)(a) shall be installed so that emergency telephones are located in each *floor area* near *exit* stair shafts.

3.2.5. Provisions for Fire Fighting

(See A-3, Fire Fighting Assumptions, in Appendix A.)

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- (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 450 kPa at the topmost outlet of the standpipe and hose system. (See Appendix A.)

3.2.5.11. Hose Stations and Cabinets

(1) Required hose stations shall be located in or near *exits*, and where a pressurized vestibule is provided adjacent to *exit* stairs, the hose station shall be located within the pressurized vestibule.

(2) A hose station located on one side of a *horizontal exit* shall be considered to serve only the *floor area* on that side of such *exit*.

(3) Every hose cabinet shall be located so that its door, when fully opened, will not obstruct the required width of a *means of egress*.

(4) Hose connections shall be provided with sufficient clearance to permit the use of a standard fire department hose key.

(5) Fire hose stations in a Group B, Division 1 *major occupancy* are permitted to be located in secure areas, or in lockable cabinets provided that

- (a) identical keys for all cabinets are located at all guard stations, or
- (b) electrical remote release devices are provided and are connected to an emergency power supply.

3.2.5.12. Trouble Signal Annunciation for Valves.

In *buildings* where a fire alarm system 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 and hose 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.

3.2.5.13. Automatic Sprinkler Systems

(1) Except as provided in Sentences (2) and (3), where a sprinkler system is required, it shall be designed, constructed, installed and tested in conformance with NFPA 13, "Installation of Sprinkler Systems." (See Appendix A.)

(2) Where a *building* contains fewer than 9 sprinklers, the water supply for such 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.

(3) Where a water supply serves both a sprinkler system and a system serving other equipment, control valves shall be provided so that either system can be shut off independently.

(4) Open grid and translucent ceilings located below sprinkler systems shall be installed in conformance with NFPA 13, "Installation of Sprinkler Systems," paragraphs 4-4.14 and 4-4.15.

3.2.5.14. Combustible Sprinkler Piping

(1) *Combustible* sprinkler piping shall be used only for wet systems in *residential occupancies* and other light hazard *occupancies*. (See Appendix A.)

(2) *Combustible* sprinkler piping shall meet the requirements of ULC C199P-M, "Guide for the Investigation of Combustible Piping for Sprinkler Systems."

(3) *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, lath and plaster, gypsum board not less than 9.5 mm thick, plywood not less than 13 mm thick, or a suspended membrane ceiling with lay-in panels or tiles and steel suspension grids, with the lay-in panels or tiles having a mass of at least 1.7 kg/m².

(4) Where *combustible* sprinkler piping is located above a ceiling, an opening through the ceiling that is not protected in conformance with Sentence (3) shall be located so that the distance between the edge of the opening and the nearest sprinkler is not more than 300 mm.

3.2.5.15. Sprinklered Service Space

(1) An automatic sprinkler system shall be installed in a *service space* referred to in Sentence 3.2.1.1.(7) 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, if required, to

- (a) initiate an *alert signal* or an *alarm signal*, and
- (b) indicate separately on the fire alarm system annunciator the actuation of each device.

3.2.5.16. Fire Department Connections

(1) Fire department connections for standpipe and hose systems shall be located so that the distance from a fire department connection to a hydrant is not more than 45 m and is unobstructed.

(2) Fire department connections for sprinkler systems shall be located so that the distance from a fire department connection to a hydrant is not more than 45 m and is unobstructed.

3.2.5.17. Portable Fire Extinguishers

(1) Portable extinguishers shall be provided and installed in accordance with the appropriate provincial, territorial or municipal regulations or, in the absence of such regulations, the National Fire Code of Canada 1990.

(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 that

- (a) identical keys for all cabinets are located at all guard stations, or
- (b) electrical remote devices are provided and are connected to an emergency power supply.

3.2.5.18. Protection from Freezing. 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 adequately protected from freezing.

3.2.6. Additional Requirements for High Buildings

(See Appendix A.)

3.2.6.1. Application

- (1) This Subsection applies to every *building* 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) every *building* 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* or every *building* containing a *floor area* or part of a *floor area* located above the third *storey* designed or intended as a Group B, Division 2 *occupancy*, and
- (c) every *building* containing a Group C *major occupancy* whose floor level is more than 18 m above *grade*.

3.2.6.2. Limits to Smoke Movement

(1) Every *building* shall be designed to limit the danger to occupants and fire fighters from exposure to smoke in a *building* fire, as provided in Sentences (2) to (4) and Articles 3.2.6.3. to 3.2.6.7.

(2) Except as provided in Articles 3.2.6.4. to 3.2.6.6., every *building* shall be designed so that during a period of 2 h after the start of a fire all *floor areas* that are above the lowest *exit storey* will not contain more than 1 per cent by volume of contaminated air from the fire floor, assuming an outdoor temperature equal to the January design temperature on a 2.5 per cent basis determined in conformance with Subsection 2.2.1. (See Appendix A.)

(3) Except as provided in Articles 3.2.6.4. and 3.2.6.6., every *building* shall be designed so that during a fire the limit described in Sentence (2) on the movement of contaminated air into other *floor areas* is not exceeded in

- (a) each *exit* stair serving *storeys* above the lowest *exit level*, and
- (b) each *exit* stair serving *storeys* below the lowest *exit level*.

(See Appendix A.)

(4) Except as provided in Articles 3.2.6.4. and 3.2.6.6., every *building* shall be designed so that during a fire the limit described in Sentence (2) on the movement of contaminated air into other *floor areas* is

not exceeded in a shaft that contains an elevator for use by fire fighters, as required by Article 3.2.6.9. (See Appendix A.)

3.2.6.3. Areas of Refuge

(1) Except in *buildings* of Group B *major occupancy* classification, the requirements of Sentence 3.2.6.2.(2) are waived in *buildings* where occupants above the *first storey* can enter and be safely accommodated in *floor areas* or parts of *floor areas* that

- (a) are designated as areas of refuge on the plans and are identified as such in the *building*,
- (b) are located on every fifth *storey*, except that in *buildings* of Group C *major occupancy* classification that are more than 75 m high, measured between *grade* and the floor level of the top *storey*, are located on every *storey*,
- (c) provide not less than 0.5 m² of floor space per ambulatory occupant and 1.5 m² of floor space per non-ambulatory occupant,
- (d) have access corridors and doors leading to each designated part of a *floor area* on the same *storey* sufficient to provide 3.67 mm of width for every person who may have to use these passages to reach the designated part of a *floor area*,
- (e) have access stairs from intervening *storeys* leading to each designated part of a *floor area* sufficient to provide 5.5 mm of width for every person who may have to use these stairs to reach the designated part of a *floor area*, and
- (f) during a period of 2 h after the start of a fire do not contain more than 1 per cent by volume of contaminated air from the fire floor, assuming an outdoor temperature equal to the January design temperature on a 2.5 per cent basis determined in conformance with Subsection 2.2.1.

(See Appendix A.)

3.2.6.4. Sprinklered Buildings

(1) The requirements of Sentences 3.2.6.2.(2) and (4), and Clause 3.2.6.2.(3)(a) are waived when a *building* is *sprinklered*, and

- (a) the sprinkler system is equipped with a

waterflow and supervisory signal system that will

- (i) transmit automatically a waterflow signal directly to the fire department, or through an independent central station,
- (ii) transmit automatically other supervisory signals to a proprietary control centre or to an independent central station, and
- (iii) actuate a signal at the central alarm and control facility described in Article 3.2.6.12.,
- (b) each stairway that serves *storeys* above the lowest *exit* level is vented to the outdoors at or near the bottom of the stair shaft,
- (c) measures are taken to limit movement of smoke from a fire in a *floor area* below the lowest *exit storey* into upper *storeys*, and
- (d) except for exhaust fans in kitchens, washrooms and bathrooms in *dwelling units*, and except for fans used for smoke venting in Article 3.2.6.10., air moving fans are designed and installed so that in the event of a fire such fans can be stopped by means of a manually operated switch at the central alarm and control facility where the system serves more than 2 *storeys*.

(See Appendix A.)

3.2.6.5. Exception for Lower Buildings

(1) The requirements of Sentence 3.2.6.2.(2) are waived in a *building* of Group A, C, D, E or F *major occupancy* classification where

- (a) the *building* is not more than 75 m high measured between *grade* and the floor level of the top *storey*, and
- (b) the number of occupants of *storeys* above *grade* is not more than 3.6 times the area in square metres of treads and landings in the *exit* stairs serving these *storeys*.

(See Appendix A.)

3.2.6.6. Residential Building Balconies

(1) The requirements of Sentences 3.2.6.2.(2) and (4), and Clause 3.2.6.2.(3)(a) are waived in a *building* of Group C *major occupancy* classification

- (a) where each *suite* above *grade* has direct

access to an exterior balcony that

- (i) is not less than 1.5 m deep from the outside face of the exterior wall to the inside edge of the balcony, and
- (ii) provides not less than 0.5 m² of balcony space for each occupant of the *suite*,

- e (b) where each stairway that serves *storeys* above the lowest *exit level* is vented to the outdoors at or near the bottom of the stair shaft,
- (c) where measures are taken to limit movement of smoke from a fire in a *floor area* below the lowest *exit storey* into upper *storeys*, and
- (d) where, except for exhaust fans in kitchens, washrooms and bathrooms in *dwelling units*, air moving fans are designed and installed so that in the event of a fire such fans can be stopped by means of a manually operated switch at the central alarm and control facility where the system serves more than 2 *storeys*.

(See Appendix A.)

3.2.6.7. Connected Buildings. Where a *building* described in Sentence 3.2.6.1.(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 Appendix A.)

3.2.6.8. Emergency Operation of Elevators

(1) Manual emergency recall shall be provided for all elevators serving *storeys* above the *first storey*.

(2) Key-operated switches for emergency recall described in Sentence (1) shall be provided in a conspicuous location at each elevator lobby on the recall level and at the central alarm and control facility required in Article 3.2.6.12.

(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 provided in a suitably identified box conspicuously located on the outside of an elevator shaft near the central alarm and control facility required by Article 3.2.6.12., and an additional key, or keys, shall be kept at the central alarm and control facility.

(5) Automatic emergency recall shall be provided for all elevators serving *storeys* above the *first storey* in unsprinklered *buildings*.

(6) The automatic emergency recall feature required in Sentence (5) shall be actuated by

- (a) *smoke detectors* installed in each elevator lobby on each *storey* (see Appendix A) or
- (b) the *building* fire alarm system.

(7) *Smoke detectors* required in Sentence (6) shall be designed as part of the *building* fire alarm system.

3.2.6.9. Elevator for Use by Fire Fighters

(1) Not less than one elevator shall be provided for use by fire fighters in conformance with Sentences (2) to (5).

(2) The elevator required 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 from a *street* floor landing to the top floor that it serves in 1 min.

(3) Except when Measure K of Chapter 3, “Measures for Fire Safety in High Buildings” of the Supplement to the NBC 1990 is used, each elevator for use by fire fighters shall

- (a) be provided with a *closure* at each shaft opening so that the interlock mechanism and associated wiring is operational for a period of not less than 1 h when the assembly is subjected to the standard fire exposure described in CAN4-S104-M, “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* of 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* of not less than 1 h.

(4) Except as provided in Sentence (5), an elevator required in Sentence (1) shall be capable of providing transportation from the *street* floor to every floor normally served by the elevator system that is above *grade* in the *building*.

(5) Where 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 from a *street* floor to any floor in the *building*.

(6) Electrical conductors for the operation of the elevator referred to in Sentence (1) shall be

- (a) installed in *service spaces* conforming to Section 3.5 that do not contain other *combustible* material, or
- (b) protected against exposure to fire from the service entrance of the emergency power supply, or the normal service entrance of the normal power supply to the equipment served, to ensure operation for a period of 1 h when subjected to the standard fire exposure described in CAN/ULC-S101-M, "Standard Methods of Fire Endurance Tests of Building Construction and Materials." (See Appendix A.)

3.2.6.10. Venting to Aid Fire Fighting

(1) Means of venting each *floor area* to the outdoors shall be provided by windows, wall panels or smoke shafts, except that in a *sprinklered floor area*, the *floor area* is permitted to be vented by the *building* exhaust system.

(2) Venting described in Sentence (1) shall conform to the requirements in Section 3 of Chapter 3, "Measures for Fire Safety in High Buildings" of the Supplement to the NBC 1990.

(3) Fixed glass windows shall not be used for venting described in Sentence (1) where the breaking of such windows may endanger pedestrians below.

(4) Openable windows used for venting described in Sentence (1) shall be permanently marked so that they are easily identifiable.

(5) Elevator shafts shall not be designed for venting described in Sentence (1).

3.2.6.11. Sprinklers

(1) The following spaces shall be *sprinklered*:

- (a) every *storey*, or part thereof, intended for a Group E or Group F, Division 1 or Division 2 *occupancy*,
- (b) every restaurant or licensed beverage establishment,
- (c) every *storey* or part thereof intended for the

storage or handling of hazardous substances (see Sentence 3.3.1.2.(1)), and

- (d) every *floor area* more than 1 000 m², except when the *floor area* is divided into *fire compartments* not more than 1 000 m² in area and separated from the remainder of the *floor area* by *fire separations* having a *fire-resistance rating* of not less than 1 h. (See also Article 3.2.2.11.)

3.2.6.12. Central Alarm and Control Facility

(1) On the *street* entrance floor, a central alarm and control facility shall be provided

- (a) in a location that is readily accessible to fire fighters entering the *building*, and
- (b) that 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 such conditions.

(2) The central alarm and control facility required in Sentence (1) shall include

- (a) means to control the voice communication system required by Article 3.2.6.13., and provisions to enable messages to be sent to all loudspeakers simultaneously and to individual *floor areas* and *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* and to silence these signals in conformance with Sentences 3.2.4.22.(2) and (3), and
- (h) means to actuate auxiliary equipment or means to communicate with a continually

staffed auxiliary equipment control centre, as appropriate to the measure for fire safety provided in the *building*.

3.2.6.13. Voice Communication System.

When the height of a *building*, measured between *grade* and the floor of the top *storey*, is more than 36 m, or in *buildings* containing a *floor area* or part of a *floor area* located above the third *storey* and designed or intended as a Group B, Division 2 *occupancy*, a voice communication system or systems conforming to Article 3.2.4.22. shall be provided.

3.2.6.14. Protection of Electrical Conductors

(1) Where installed in *service spaces* containing *combustible* material, electrical conductors used in connection with fire alarm systems and emergency equipment described in Articles 3.2.6.2. to 3.2.6.13. shall be separated from the remainder of the space by a *fire separation* having a *fire-resistance rating* of not less than 1 h, or shall be protected against fire exposure from the source of power supply to the branch circuits serving the equipment to ensure continued operation for a period of not less than 1 h.

(2) Where the central alarm and control facility and the fire alarm control unit are in different *fire compartments*, the electrical conductors connecting the fire alarm control unit to the central alarm and control facility shall be protected against fire exposure to ensure continued operation for a period of not less than 1 h.

3.2.6.15. Testing. The systems for control of smoke movement and mechanical venting required in Articles 3.2.6.2. and 3.2.6.10. shall be tested to ensure satisfactory operation in accordance with the procedures described in Appendix C to Chapter 3, "Measures for Fire Safety in High Buildings" of the Supplement to the NBC 1990.

3.2.7. Lighting and Emergency Power Systems

3.2.7.1. Minimum Lighting Requirements

(1) Every *exit*, *public corridor* and 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 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) Rooms and spaces used by the public shall be illuminated as described in Article 9.34.2.7.

(3) 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. Recessed lighting fixtures shall not be located in insulated ceilings unless the fixture is designed for such an installation.

3.2.7.3. Emergency Lighting

(1) Emergency lighting shall be provided to average levels of not less than 10 lx at floor or tread level in

- (a) *exits*,
- (b) principal routes providing *access to exit* in an open *floor area*,
- (c) corridors used by the public,
- (d) corridors serving patients' sleeping rooms,
- (e) corridors serving classrooms,
- (f) underground *walkways*,
- (g) *public corridors*, and
- (h) *floor areas* or parts thereof where the public may congregate in
 - (i) Group A, Division 1 *occupancies*, or
 - (ii) Group A, Division 2 and 3 *occupancies* having an *occupant load* of 60 persons or more.

(2) Emergency lighting to provide an average level of illumination at floor or catwalk level of not less than 10 lx shall be included in a *service space* referred to in Sentence 3.2.1.1.(7).

3.2.7.4. Emergency Power for Lighting

(1) An emergency power supply shall be 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 be so designed and installed that upon failure of the regular power it will assume the electrical load automatically for a period of

- (a) 2 h for all *buildings* within the scope of Subsection 3.2.6.,

- (c) the *interconnected floor space* contains only Group A, Division 1 or 2, Group D, Group E or Group F, Division 3 *major occupancies*, and
- (d) the *building area* is not more than one half of the area permitted in Subsection 3.2.2.

(7) Openings permitted by Sentence (6) through a floor assembly in a *sprinklered interconnected floor space* are not required to conform to the requirements in Section 4-4.7.2.3. of NFPA 13, "Installation of Sprinkler Systems."

3.2.8.3. Construction Requirements. *Buildings* constructed in conformance with Articles 3.2.8.4. to 3.2.8.9. shall be of *noncombustible construction*, except that *heavy timber construction* is permitted where Subsection 3.2.2. permits *buildings* to be constructed of *combustible construction*.

3.2.8.4. Vestibules

(1) *Exits* opening into *interconnected floor space* shall be protected at each floor level in the *interconnected floor space* by vestibules

- (a) with doorways that are not less than 1.8 m apart,
- (b) which are separated from the remainder of the *floor area* by a *fire separation* which is not required to have a *fire-resistance rating* (See A-3.1.8.1.(1)(b) in Appendix A), and
- (c) which are designed to limit the passage of smoke so that the level of contamination in *exit* stair shafts does not exceed the limits described in Measure E in Chapter 3, "Measures for Fire Safety in High Buildings" of the Supplement to the NBC 1990.

(2) *Exits* opening into *interconnected floor space* shall conform to Sentence 3.4.3.4.(2).

(3) Where an elevator shaft opens into an *interconnected floor space* and into *storeys* above such 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) For the purposes of this Subsection, the term protected floor space applies to that part of a

floor area 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* on which it is located and in which openings through such vertical *fire separation* are protected by vestibules conforming to Sentence 3.2.8.4.(1).

(2) Protected floor space defined in Sentence (1) shall be designed so that it is not necessary to enter the *interconnected floor space* to reach an *exit*.

3.2.8.6. Sprinklers

(1) *Buildings* containing *interconnected floor space* shall be *sprinklered*.

(2) In *buildings* containing *interconnected floor space*

- (a) operation of waterflow detecting devices for sprinkler systems shall cause a signal to be transmitted to the fire department in conformance with Sentence 3.2.4.7.(3), and
- (b) sprinkler systems shall be electrically supervised as required in Sentence 3.2.4.16.(5).

3.2.8.7. Draft Stops. *Buildings* with *interconnected floor space* shall be provided with a draft stop at each floor level, immediately adjacent to and surrounding the opening, that is not less than 500 mm deep measured from ceiling level down to the underside of the draft stop.

3.2.8.8. Mechanical Exhaust System

(1) A mechanical exhaust system shall be provided to remove air from the *interconnected floor space* at a rate of 4 air changes per hour. (See Appendix A.)

(2) The mechanical exhaust system required in Sentence (1) shall be actuated by a switch located on the *street* entrance floor near the annunciator for the fire alarm system.

3.2.8.9. Combustible Content Limits. 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*.

Section 3.3 Safety Requirements within Floor Areas

(See Appendix A.)

3.3.1. Requirements Applying to All Floor Areas

3.3.1.1. Separation of Suites

(1) Except 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 1 h, except that a *fire-resistance rating* of not less than 45 min is permitted where the *fire-resistance rating* of the floor assembly is not required in Subsection 3.2.2. to be more than 45 min. (See also Subsection 3.3.3. for *institutional occupancies*, Article 3.3.4.2. for *residential occupancies* and Article 3.1.8.7. for *fire dampers*.)

(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.(1)(c) are not required to be separated from each other by *fire separations*.

3.3.1.2. Hazardous Substances, Equipment and Processes

(1) Where hazardous substances are used in connection with the activities of any *occupancy* other than as provided in Subsection 3.3.5. for a Group F, Division 1 *occupancy*, the storage, handling and use of such substances shall be in conformance with the appropriate provincial, territorial or municipal regulations or, in the absence of such regulations, in conformance with the National Fire Code of Canada 1990. (See Appendix A.)

(2) In kitchens containing commercial cooking equipment used in processes producing grease-laden vapours, the equipment shall be designed and installed in conformance with Part 6.

(3) Fuel-fired *appliances* shall not be installed in any corridor serving as *access to exit*.

3.3.1.3. Means of Egress

(1) An *access to exit* shall be provided from every roof which is intended for *occupancy*, and from

every podium, terrace, platform or contained open space.

(2) *Access to exits* within *floor areas* shall conform to Subsections 3.3.2. to 3.3.5. in addition to the requirements of this Subsection.

(3) Where a roof is used or intended for an *occupant load* of more than 60 persons, at least 2 separate *means of egress* shall be provided from the roof to stairs, designed in conformance with the requirements for *exit* stairs, located so that the distance between such stairs conforms to the requirements in Article 3.4.2.3. for *exits*.

(4) Where a podium, terrace, platform or contained open space is provided, egress requirements shall conform to the appropriate requirements for rooms and *suites* in Sentence 3.3.1.5.(1).

(5) A roof top enclosure shall be provided with an *access to exit* that leads to an *exit* at the roof level or to an *exit* on the *storey* immediately below the roof.

(6) A roof top enclosure which is more than 200 m² in area shall be provided with not less than 2 *means of egress*.

(7) Two points of egress shall be provided from a *service space* referred to in Sentence 3.2.1.1.(7) if the area of the *service space* is more than 200 m², and the travel distance measured from any point in the *service space* to a point of egress is more than 25 m.

(8) Except as permitted in Sentences 3.3.4.4.(5) and (6), each *suite* in a *floor area* that contains more than one *suite* shall have an exterior *exit* doorway or a doorway into a *public corridor* or to an exterior passageway.

(9) Except as permitted in this Section and in Sentence 3.4.2.1.(2), at the point where a doorway referred to in Sentence (8) opens to 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 in this Part, *public corridors* shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* of not less than 1 h, except that

- (a) the *fire-resistance rating* need not be more than 45 min when the *fire-resistance rating* of the floor assembly is not required to be more than 45 min,

- (b) no *fire-resistance rating* is required when the *floor area* is *sprinklered* and the corridor does not serve an *institutional occupancy* or a *residential occupancy*,
- (c) no *fire separation* is required where the corridor is more than 5 m in unobstructed width, the *floor area* is *sprinklered* and the corridor does not serve an *institutional occupancy* or a *residential occupancy*, and
- (d) a floor assembly above a crawl space that conforms to Sentence 3.2.2.5.(2) is not required to be a *fire separation*.

(See A-3.1.8.1.(1)(b) and A-3.3.1.4.(1) in Appendix A.)

(2) The sprinkler system referred to in Clauses (1)(b) and (c) shall be electrically supervised in conformance with Sentence 3.2.4.16.(5) and, upon operation, shall cause a signal to be transmitted to the fire department in conformance with Sentence 3.2.4.7.(3) when the corridor serves a Group E or Group F, Division 1 or 2 *occupancy*.

3.3.1.5. Egress Doorways

(1) Every room and every *suite* shall have 2 egress doorways placed in such a manner that one doorway could provide egress from the room or *suite* as required in Article 3.3.1.3. if the other doorway becomes inaccessible to the occupants due to a fire which might originate in the room or *suite*

- (a) where the *occupancy* is classified as Group F, Division 1,
- (b) which is intended for an *occupant load* of more than 60 persons, or
- (c) where, except for *dwelling units*, the area of a room or *suite*, or the distance measured from any point within the room or *suite* to the nearest egress doorway is more than the values shown in Table 3.3.1.A.

3.3.1.6. Travel Distance. Where more than one egress doorway is required from a room or *suite* referred to in Sentence 3.3.1.5.(1), the travel distance within the room or *suite* to the nearest egress doorway shall not exceed the maximum travel distances described in Article 3.4.2.5. for *exits*.

3.3.1.7. Protection on Floor Areas with a Barrier-Free Path of Travel

(1) Where a *barrier-free* path of travel is provided above or below the *first storey* in a *building*

Table 3.3.1.A.
Forming Part of Sentence 3.3.1.5.(1)

<i>Occupancy of Room or Suite</i>	<i>Maximum Area of Room or Suite, m²</i>	<i>Maximum Distance to Egress Doorway, m</i>
Group A	150	15
Group B, Division 1	75	10
Group B, Division 2 sleeping rooms	75	10
Group B, Division 2 other than sleeping rooms	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
Column 1	2	3

Note to Table 3.3.1.A.:

⁽¹⁾ See Article 3.3.4.4. for *dwelling units*.

that is not *sprinklered*, every *floor area* having a *barrier-free* path of travel shall

- (a) be served by an elevator conforming to Sentences 3.2.6.9.(4) to (6), protected against fire in conformance with Clauses 3.2.6.9.(3)(b) or (c) and, in a *building* over 3 *storeys* in *building height*, protected against smoke movement in conformance with Sentence 3.2.6.2.(4),
- (b) be divided into not less than 2 zones by *fire separations* conforming to Sentences 3.3.3.6.(8) and (9) so that
 - (i) persons with physical disabilities can be accommodated in each zone, and
 - (ii) the travel distance from any point in one zone to a doorway leading to another zone shall be not more than the value for travel distance permitted by Sentence 3.4.2.5.(1) for the *occupancy* classification of the zone,
- (c) in the case of *residential occupancies*, be provided with balconies conforming to Sentence 3.2.6.6.(1), except on the *storey* containing the access entrance described in Article 3.7.1.2., or

3.3.1.7.

- (d) have an exterior *exit* at ground level or a ramp leading to ground level.

(See Appendix A.)

3.3.1.8. Headroom Clearance. Except within the *floor area* of a *storage garage*, the minimum headroom clearance in every *access to exit* shall conform to the requirements in Article 3.4.3.7. for *exits*. (See also Sentence 3.3.5.5.(5).)

3.3.1.9. Corridors

(1) The minimum width of every *public corridor* shall be 1 100 mm.

(2) Except as provided in Sentence 3.3.3.3.(2), the minimum unobstructed width of every corridor used by the public and every corridor serving classrooms or patients' sleeping rooms shall be 1 100 mm.

(3) Except as provided in Sentence (4), obstructions located within 1 980 mm of the floor shall not project more than 100 mm horizontally into *exit* passageways, *public corridors*, corridors used by the public or corridors serving classrooms or patients' sleeping rooms in a manner that would create a hazard for visually impaired persons traveling adjacent to walls.

(4) The horizontal projection of an obstruction described in Sentence (3) is permitted to be more than 100 mm where it extends to less than 680 mm above the floor. (See Appendix A.)

(5) Where a *public corridor*, corridor used by the public or a corridor serving classrooms or patients' sleeping rooms contains an *occupancy*, such *occupancy* shall not reduce the unobstructed width of the corridor to less than its required width.

(6) If a *public corridor* conforming to Clause 3.4.2.5.(1)(d) contains an *occupancy*, the *occupancy* shall be located so that there is an unobstructed width for pedestrian travel of not less than 3 m at all times adjacent and parallel to all rooms and *suites* that front onto the *public corridor* and the combined area of all *occupancies* in a *public corridor* shall be not more than 15 per cent of the area of the *public corridor*.

(7) Except for a dead end corridor that is entirely within a *suite* or as permitted in Sentence 3.3.4.4.(6), a dead end corridor is permitted provided it is not more than 6 m long.

3.3.1.10. Door Swing

(1) Except as provided in Article 3.3.1.11., every 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, and where a room or *suite* is used or intended for an *occupant load* of more than 60 persons or for a Group F, Division 1 *occupancy*, the door shall swing in the direction of *exit* travel.

(2) Every door that divides a corridor where such corridor is required to be separated from the remainder of the *floor area* by a *fire separation* shall swing on a vertical axis in the direction of *exit* travel.

3.3.1.11. Sliding Doors

(1) Except as permitted in Sentence (2), a sliding door provided in the locations described in Sentence 3.3.1.10.(1) shall

- (a) be designed and installed to swing on the vertical axis in the direction of *exit* travel 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 3.3.1.10.

(3) Movable *partitions* which are open during normal working hours and used to separate a *public corridor* from an adjacent Group D or E *occupancy* need not conform to Sentences (1) and 3.3.1.10.(1).

3.3.1.12. Doors

(1) Every door that opens into or is located within a *public corridor* or other facility that provides *access to exit* from a *suite* shall

- (a) be not less than 810 mm wide where there is only one door leaf,
- (b) have no single leaf in any multiple leaf door less than 610 mm wide,
- (c) not open onto a step, and
- (d) be readily openable in travelling to an *exit* without requiring keys, special devices or specialized knowledge of the door opening mechanism, except that this requirement does not apply to doors serving a *contained use area*, or an *impeded egress zone*,

(3) A single *exit* is permitted from a *dwelling unit* provided the *exit* is an exterior doorway not more than 1.5 m above adjacent ground level and

- (a) it is not necessary to travel up or down more than 1 *storey* to reach the *exit* door, or
- (b) 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* in a *dwelling unit*, as required in Sentence (2), need not be provided where 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* of not less than 45 min.

(5) In *buildings 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 such *dwelling unit* has a second and separate *means of egress*.

(6) A doorway from a *dwelling unit* is permitted to open onto an interior corridor served by a single *exit*, or an exterior balcony served by a single *exit* stairway, or an exterior passageway served by a single *exit* stairway provided each *dwelling unit* has a second and separate *means of egress*.

3.3.4.5. Automatic Locking Prohibition.

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 Appendix A.)

3.3.4.6. Sound Transmission. *Dwelling units* shall be designed and constructed to restrict sound transmission in conformance with Article 9.11.2.1.

3.3.4.7. Guards for Residential Occupancies. *Guards* around balconies in *buildings of residential occupancy* shall be designed so that no member, attachment or opening located between 100 mm and 900 mm above the balcony will facilitate climbing.

3.3.4.8. Stairs, Handrails and Guards for Dwelling Units. Stairs, handrails and *guards*

within *dwelling units* shall conform to the appropriate requirements in Section 9.8.

3.3.5. Industrial Occupancy

3.3.5.1. Scope. This Subsection applies to *floor areas* or parts thereof used or intended for use as *industrial occupancies*.

3.3.5.2. Fire Extinguishing Systems. In addition to other requirements in this Code for the installation of automatic fire extinguishing systems, in a Group F, Division 1 *major occupancy*, an appropriate automatic fire extinguishing system shall be installed in every *floor area* to provide protection if required by provincial, territorial or municipal regulations or, in the absence of regulations, if required by the National Fire Code of Canada 1990.

3.3.5.3. Basements

(1) *Basements* 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 *basements* and rooms containing *building services* in a *building* where the storage, manufacture or handling of volatile materials can generate explosive air-vapour mixtures or where processes that produce explosive dusts can occur shall be separate from the remainder of the *building*.

(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. Cutting and Welding. Where a room in other than a Group F *major occupancy* is used for cutting and welding operations, it shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* of not less than 1 h, except that this requirement does not apply to a room that is protected by an automatic fire extinguishing system.

3.3.5.5. Repair and Storage Garages

(1) Where access is provided from a *storage garage* to a stair tower or elevator serving *occupancies* above the level of the *storage garage*, such access shall be through a vestibule conforming to Sentence 3.3.5.8.(3).

3.3.5.5.

(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) Mechanical *storage garages* of not more than 4 *storeys* in *building height*, where 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) Every garage shall be provided with natural or mechanical ventilation in conformance with the requirements of Subsection 6.2.2. 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) A continuous curb not less than 150 mm high and a *guard* not less than 1 070 mm high shall be provided at every garage floor opening and around the perimeter of every floor where the exterior walls are omitted.

(7) Only 2 *exits* located remote from each other need be provided in *storage garages* conforming to Article 3.2.2.60. provided persons other than parking attendants are not permitted above the *street* floor level.

(8) Except for open-air *storeys*, every *storey* of a *storage garage* or *repair garage* located below *grade* shall be *sprinklered*.

3.3.5.6. Repair Garage Separation. A *repair garage* or 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* of not less than 2 h.

3.3.5.7. Storage Garage Separation. A *storage garage* shall be separated from other *occupancies* by a *fire separation* with a *fire-resistance rating* of not less than 1.5 h.

3.3.5.8. Vestibules

(1) Where access is provided through a *fire separation* between a *storage garage* and a Group A, Division 1 or Group B *occupancy*, such access shall be through a vestibule conforming to Sentence (3).

(2) In *buildings* more than 3 *storeys* in *building height*, where access is provided through a *fire separation* between a *storage garage* and a Group A, Division 2, 3 or 4, or a Group C *occupancy*, such access shall be through a vestibule conforming to Sentence (3).

(3) Where access is provided through a vestibule, as required in Sentences (1), (2) and 3.3.5.5.(1), the vestibule shall

- (a) be not less than 1.8 m long,
- (b) be naturally ventilated 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 be mechanically ventilated at a rate of 14 m³/h for each square metre of vestibule floor surface area, and
- (c) have the openings between the vestibule and an adjoining *occupancy* provided with self-closing doors having no hold-open devices.

3.3.5.9. 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*. e

(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 per cent of its perimeter. e

Section 3.4 Requirements for Exits

3.4.1. General Requirements

3.4.1.1. Scope. *Exit* facilities complying with this Section shall be provided from every *floor area* which is intended for *occupancy*. (See Appendix A.)

3.4.1.2. Separation of Exits

(1) Except as permitted by the requirements of Sentence (2), where more than one *exit* is required from a *floor area*, each *exit* shall be separate from every other *exit* leading from that *floor area*.

- e
- (a) the *building* is equipped with a fire alarm system,
 - (b) the locking device releases immediately
 - (i) upon initiation of a fire *alarm signal*,
 - (ii) in the event of a power failure, and
 - (iii) upon actuation of a manually operated switch accessible only to authorized personnel,
 - (c) 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 relock until the door has been opened,
 - (d) upon release, the locking device must be reset manually by the actuation of the switch in Subclause (b)(iii), and
 - (e) a legible sign is permanently mounted on the *exit* door to indicate that the locking device will release within 15 s of applying pressure to the door-opening hardware.

(See Appendix A.)

3.4.6.16. Emergency Access to Floor Areas

- (1) In *buildings* more than 6 storeys in building height,
- (a) doors providing access to *floor areas* from *exit* stairs shall not have locking devices to prevent entry into
 - (i) any *floor area* designated as an area of refuge, and
 - (ii) any *floor area* from which the travel distance up or down to an unlocked door is more than 2 storeys,
 - (b) doors required in Clause (a) that provide access into the *floor area* shall be identified by a sign on the stairway side to indicate that they are openable from that side, and
 - (c) a master key to fit all door locking devices that are intended to prevent entry into a *floor area* from an *exit* stair shall be provided in a designated location accessible to fire fighters, or the door shall be provided with a wired glass panel not less than 645 cm² in area and located not more than 300 mm from the door opening hardware.

(2) Where access to *floor areas* through unlocked doors is required in Clause (1)(a), it shall be

possible for a person entering such *floor area* to have access through unlocked doors within the *floor area* to at least one other *exit*.

3.4.6.17. Floor Numbering

- (1) Arabic numerals indicating the assigned floor number shall
- (a) be mounted permanently on the stair side of the wall at the latch side of doors to *exit* stair shafts,
 - (b) be not less than 60 mm high, raised approximately 0.7 mm above the surface,
 - (c) be located 1 500 mm from the finished floor and not more than 300 mm from the door, and
 - (d) be contrasting in colour with the surface on which they are applied. (See Appendix A.)

3.4.7. Fire Escapes

3.4.7.1. Scope

(1) Except as provided in Sentence (2), fire escapes shall not be erected on *buildings*.

(2) Where it is impracticable to provide one or more of the *exit* facilities in Article 3.4.1.4., fire escapes conforming to Articles 3.4.7.2. to 3.4.7.6. are permitted to serve *floor areas* in existing *buildings* provided the *floor areas* served are not more than

- (a) 2 storeys above ground level in Group B occupancies, and
- (b) 5 storeys above ground level in other occupancies.

3.4.7.2. Fire Escape Construction. 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

3.4.7.3.

of 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) Where doors open onto fire escape balconies, such balconies shall have a clear area of not less than 1 m².

3.4.7.4. Protection of Fire Escapes. Where a fire escape serves any *storey* above the second, openings, 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. where they are located within 3 m horizontally of, 3 storeys or 10 m below, or 1.8 m above any balcony, platform or stairway of a fire escape.

3.4.7.5. Stairs

(1) Stairs shall be inclined at an angle of not more than 45° with the horizontal, and 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 Sentence 3.4.3.1.(1), except that the fire escape shall be not less than 550 mm wide when serving

- (a) not more than 3 *storeys*, and
- (b) not more than 15 persons.

(4) Where the 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 shall be protected by *guards* not less than 920 mm high measured vertically above the nosing of any tread or platform.

(2) Two equally spaced rails not more than 460 mm apart, parallel to stair stringers and to platform edges, shall be the minimum protection provided, and the top rail is permitted to serve as a handrail if free from obstructions which could break a hand hold.

(3) A wall handrail shall be installed where the fire escape is more than 550 mm wide.

Section 3.5 Service Facilities

3.5.1. General

3.5.1.1. Scope. The provisions of this Section apply to attic, duct, crawl and shaft spaces and *service rooms*, mechanical penthouses and facilities contained therein.

3.5.1.2. Electrical Wiring and Equipment. Electrical wiring and electrical equipment shall be installed in conformance with the requirements of the appropriate provincial, territorial, or municipal legislation or, in the absence of such legislation, to the requirements of CSA C22.1, "Canadian Electrical Code, Part I."

3.5.1.3. Storage Use Prohibition. *Service spaces* provided to contain service facilities shall not be designed to facilitate subsequent use as storage space.

3.5.2. Service Rooms

3.5.2.1. Fire Separations around Service Rooms

(1) Except as provided in Article 3.5.2.2., fuel-fired *appliances* shall be located in a *service room* separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* of not less than

- (a) 2 h in *buildings* classified as Group B or Group F, Division 1 *occupancy* where such *buildings* are more than 2 *storeys* in *building height* or 400 m² in *building area*, and
- (b) 1 h in *buildings* other than as described in Clause (a).

(See Appendix A.)

(2) A solid-fuel fired *appliance* shall not be located in a *repair garage*, a *storage garage* or any other location where the *appliance* could be exposed to flammable vapours or gases unless

- (a) it is enclosed in a *service room* which is
 - (i) separated from the remainder of the

(4) Every *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 *service space* walls.

(5) Vents from *vertical service spaces* 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 *service space* walls.

(6) Only openings that are necessary for the use of the *vertical service space* shall be permitted in the *service space* enclosure.

3.5.3.2. Foamed Plastic Protection.

Foamed plastic insulation in *vertical service spaces* shall be protected in conformance with Article 3.1.5.11.

3.5.3.3. Linen and Refuse Chutes

(1) Every linen 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) Every shaft containing a linen or refuse chute shall have a *fire-resistance rating* conforming to Sentence 3.5.3.1.(1), but not less than

- (a) 1 h where 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 where no *closure* is provided at the chute outlet into the discharge room.

(3) Every interior linen 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 linen or refuse chutes shall

- (a) have an area not more than 60 per cent 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 linen or refuse chutes 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* of 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 and 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* of not less than 1 h.

(8) Every 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* of 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) Rooms into which refuse chutes discharge shall contain no service equipment that is not related to refuse handling and disposal.

3.5.3.4. Exhaust Duct Negative Pressure.

When 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, and such individual *fire compartments* shall not have individual fans that exhaust directly into the duct in the *vertical service space*.

3.5.4.1.

3.5.4. Horizontal Service Spaces and Service Facilities

3.5.4.1. Scope. This applies to *horizontal service spaces* and service facilities, including ceiling spaces, duct spaces, crawl spaces and *attic or roof spaces*.

3.5.4.2. Fire Separations for Horizontal Service Spaces

(1) 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) 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 at the *fire separation* as required in Article 3.1.8.3. provided the construction between such space and the space below is constructed as a *fire separation* at least equivalent to that required for the vertical *fire separation*, except that where the vertical *fire separation* is not required to have a *fire-resistance rating* of more than 45 min, the *fire-resistance rating* is permitted to be not less than 30 min. (See Appendix A.)

3.5.4.3. Plenum Requirements

(1) The concealed space between the ceiling and floor or ceiling and roof used as a *plenum* need not conform to Sentence 3.1.5.14.(1) and Article 6.2.3.2. provided

- (a) all materials within the ceiling space have a *flame-spread rating* of not more than 25 and a smoke developed classification of not more than 50, except for
 - (i) tubing for pneumatic controls,
 - (ii) electrical wires and cables that exhibit a vertical char of not more than 1.5 m when tested in conformance with the Vertical Flame Test – Cables in Cabletrough in Clause 4.11.4. of CSA C22.2 No. 0.3-M, “Test Methods for Electrical Wires and Cables,” and
 - (iii) electrical wires and cables that are located in totally enclosed *noncombustible* raceways (see A-3.1.4.3.(1)(b)(i) in Appendix A), and

- (b) the supports for the ceiling membrane are of *noncombustible* material having a melting point not below 760°C.

(2) When the 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* which shall

- (a) stop the flow of air into the concealed space in the event of a fire,
- (b) be 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*, and
- (c) conform to the appropriate requirements of Chapter 2, “Fire Performance Ratings” of the Supplement to the NBC 1990.

3.5.4.4. Attic or Roof Space Access. Every *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.

3.5.4.5. Horizontal Service Space Access. *Horizontal service spaces* consisting of ceiling and duct spaces which are more than 1 200 mm high and 600 mm wide shall have access doors not less than 600 mm in both horizontal and vertical dimensions, or 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.

3.5.4.6. Crawl Space Access. Every crawl space shall have at least one access opening not less than 550 mm by 900 mm.

3.5.5. Elevators, Dumbwaiters and Escalators

3.5.5.1. Elevator, Dumbwaiter and Escalator Standards

(1) The design, construction, installation and *alteration* of every elevator, dumbwaiter and escalator shall conform to appropriate provincial, territorial, or municipal requirements or, in the absence of such

- requirements, to CAN/CSA-B44-M, “Safety Code for Elevators, Escalators, Dumbwaiters, Moving Walks and Freight Platform Lifts.” (See Appendix A.)

(2) Before being placed in service, every elevator, dumbwaiter or escalator installation, including safety and control devices, shall be inspected and tested in accordance with appropriate provincial, territorial, or municipal requirements or, in the absence of such requirements, in conformance with CAN/CSA-B44-M, “Safety Code for Elevators, Escalators, Dumbwaiters, Moving Walks and Freight Platform Lifts.”

(3) Elevators in *buildings* within the scope of Subsection 3.2.6. shall conform to Articles 3.2.6.8. and 3.2.6.9.

3.5.5.2. Floor Numbering. 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 CAN/CSA-B44-M, “Safety Code for Elevators, Escalators, Dumbwaiters, Moving Walks and Freight Platform Lifts.”

Section 3.6 Health Requirements

3.6.1. Height and Area of Rooms

3.6.1.1. Room and Space Height

(1) The height of every room and space shall be such that adequate light and air may be provided for the intended *occupancy*, and that no obstruction to movement or activities below is caused by the ceiling or ceiling fixtures.

(2) The unobstructed height in *dwelling units* shall conform to Subsection 9.5.2.

3.6.1.2. Residential Room Dimensions. The areas and width of rooms in *dwelling units*, dormitories, boarding houses and rooming houses shall conform to Section 9.5.

3.6.2. Windows

3.6.2.1. Window Areas. Every sleeping room in any *building*, and every principal room such as living room, dining room or combination thereof in

dwelling units, shall be provided with windows having areas conforming to Subsection 9.7.1. (See Appendix A.)

3.6.3. Ventilation

3.6.3.1. Ventilation shall conform to Part 6.

3.6.4. Plumbing Facilities

(See also Section 3.7 for plumbing facility requirements for persons with disabilities.)

3.6.4.1. Plumbing and Drainage Systems

(1) Each *building* situated on property that abuts on a *street* in which a public or municipal water main is located shall be provided with or have accessible to its occupants a *plumbing system* including a potable water supply, a *sanitary drainage system* and toilet fixtures.

(2) When 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.

3.6.4.2. Water Closets

(1) Water closets shall be provided for each sex in accordance with the anticipated proportion of each sex in the *occupancy* when this can be determined with reasonable accuracy, except that when such a determination cannot be made with reasonable accuracy, it shall be assumed that the *occupancy* is equally divided between the sexes.

(2) Where water closets are required in this Subsection, urinals may be substituted for two thirds of the required number of water closets and may be counted as water closets, except that where only 2 water closets are required, one urinal may be substituted for one of the water closets.

(3) The number of water closets required for Group A, Division 1, 3, and 4 *occupancies* and for auditoria, gymnasia, lecture halls, secondary schools, nonresidential colleges and similar *occupancies* shall conform to Table 3.6.4.A.

(4) Except as provided in Sentence (11), the number of water closets required for Group D *occupancies* and for restaurants, nonresidential clubs, bowling alleys, community halls, lodge rooms,

3.6.4.2.

Table 3.6.4.A.

Forming Part of Sentence 3.6.4.2.(3)

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 — 150	3	5
151 — 200	4	6
201 — 300	5	7
301 — 400	6	8
Over 400	7 plus 1 for each additional increment of 200 males in excess of 400	9 plus 1 for each additional increment of 150 females in excess of 400
Column 1	2	3

passenger stations and depots, art galleries, exhibition halls, libraries, museums, courtrooms and similar *occupancies* shall conform to Table 3.6.4.B.

Table 3.6.4.B.

Forming Part of Sentence 3.6.4.2.(4)

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
Column 1	2

(5) The number of water closets required for primary schools and day-care centres shall be at least one fixture for each 30 males and one fixture for each 25 females.

(6) The number of water closets required for places of worship and undertaking premises shall be at least one fixture for each 150 persons of each sex.

(7) The number of water closets required for *institutional occupancies* shall be determined on the basis of the special needs of such *occupancies*.

(8) Except as provided in Sentence (11), the number of water closets required for *residential occupancies* shall be at least one fixture for each 10 persons of each sex, except that *dwelling units* shall conform to the requirements in Part 9.

(9) Except as provided in Sentence (11), the number of water closets required for *mercantile occupancies* shall be at least one fixture for each 300 males and one fixture for each 150 females.

(10) Except as provided in Sentence (11), the number of water closets required for *industrial occupancies* shall conform to Table 3.6.4.C.

Table 3.6.4.C.

Forming Part of Sentence 3.6.4.2.(10)

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
Column 1	2

(11) Where the *occupant load* in an *occupancy* described in Sentences (4), (8), (9) and (10) is not more than 10 persons, or where the total area in a Group E *occupancy* is not more than 100 m², both sexes may be served by one water closet.

3.6.4.3. Lavatories

(1) Except as provided in Sentence (2), at least one lavatory shall be provided in a room containing 1 or 2 water closets or urinals, and at least one additional lavatory shall be provided for each additional 2 such fixtures.

3.7.2.3. Washrooms Required to be Barrier-Free

(1) Except as permitted in Sentence (2), where washrooms are provided in a *storey* to which a *barrier-free* path of travel is required in conformance with Article 3.7.2.1., these washrooms shall be *barrier-free* in conformance with the appropriate requirements in Articles 3.7.3.8. to 3.7.3.11.

(2) Washrooms need not conform to the requirements in Sentence (1) provided

- (a) they are located within *suites* of *residential occupancy*,
- (b) other *barrier-free* washrooms are provided on the same *floor area* within 45 m, or
- (c) they are located in an individual *suite* having an area of less than 500 m² in *buildings* where such *suite* is completely separated from the remainder of the *building* so that there is no access to the remainder of the *building*.

(3) In *buildings* where a washroom is required in accordance with Subsection 3.6.4., a *barrier-free* washroom shall be provided in the entrance *storey*, except if a *barrier-free* path of travel is provided to a *barrier-free* washroom in another *storey*.

(4) Where *alterations* are made to existing *buildings*, special washrooms conforming to Article 3.7.3.11. are permitted to be provided in lieu of facilities for disabled persons in washrooms used by the general public.
(See Appendix A.)

3.7.3. Design Standards

3.7.3.1. Accessibility Signs

(1) Where a *building* is required to have an entrance to accommodate disabled persons, signs incorporating the international symbol of accessibility for disabled persons shall be installed where necessary to indicate the location of that entrance.

(2) Where a washroom, elevator or parking area is required to accommodate disabled persons, it shall be identified by a sign consisting of the international symbol of accessibility for disabled persons and such other graphic or written directions as are needed to indicate clearly the type of facility available.

(3) Where a washroom is not designed to accommodate disabled persons in a *storey* to which a *barrier-free* path of travel is required, signs shall be provided to indicate the location of *barrier-free* facilities.

(See Appendix A.)

3.7.3.2. Exterior Walks

(1) Exterior walks that form part of a *barrier-free* path of travel shall

- (a) have a slip-resistant, continuous and even surface,
- (b) be not less than 1 100 mm wide, and
- (c) have a level area adjacent to the entrance doorway conforming to Clause 3.7.3.4.(1)(c).

3.7.3.3. Doorways and Doors

(1) Every doorway that is located in a *barrier-free* path of travel shall have a clear width of not less than 800 mm when the door is in the open position.

(2) The doorway to at least one bathroom within a *suite* of *residential occupancy* shall have a clear width of not less than 760 mm when the door is in the open position. (See Appendix A.)

(3) Door operating devices shall be of a design which does not require tight grasping and twisting of the wrist as the only means of operation.
(See Appendix A.)

(4) Thresholds for doorways referred to in Sentences (1) and (2) shall be not more than 13 mm higher than the finished floor surface and shall be bevelled to facilitate the passage of wheelchairs.

(5) Except as permitted in Sentence (6), the door for the entrance described in Article 3.7.1.2. shall be equipped with a power door operator in

- (a) hotels,
- (b) *buildings* of Group B, Division 2 *major occupancy*, and
- (c) *buildings* of Group A, D or E *major occupancy* more than 500 m² in *building area*.

(See Appendix A.)

(6) The requirements in Sentence (5) do not apply to an individual *suite* having an area of less than 500 m² in *buildings* having only *suites* of Group A, D or E *occupancy* where such *suite* is completely separated from the remainder of the *building* so that there is no access to the remainder of the *building*.

3.7.3.3.

(7) Except as permitted in Sentence (8) and except for doors with power door operators, closers for doors in a *barrier-free* path of travel shall be designed to permit doors to open when a force of not more than 38 N is applied to the handles, push plates or latch-releasing devices in the case of exterior doors and 22 N in the case of interior doors.

(8) Sentence (7) does not apply to doors at the entrances to *dwelling units*, or where greater forces are required in order to close and latch the doors against prevailing differences in air pressures on opposite sides of the doors. (See Appendix A.)

(9) Except for doors at the entrances to dwelling units, closers for interior doors in a *barrier-free* 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 Appendix A.)

(10) Every door equipped with a closer in a *barrier-free* path of travel shall have a clear space beyond the latch side of not less than

- (a) 600 mm where the door swings towards the approach side, and
- (b) 300 mm where the door swings away from the approach side.

(See Appendix A.)

(11) Vestibules located in a *barrier-free* 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 1 200 mm plus the width of any door that swings into the space in the path of travel from one door to another.

3.7.3.4. Ramps

(1) Ramps located in a *barrier-free* path of travel shall

- (a) have a width of not less than 870 mm between handrails,
- (b) have a gradient of not more than 1 in 12 (see Appendix A),
- (c) have a level area not less than 1 500 by 1 500 mm at the top and bottom and at intermediate levels of a ramp leading to a door, so that the level area extends not less than 600 mm beyond the latch side of the

door opening, except that where the door opens away from the ramp, the area extending beyond the latch side of the door opening may be reduced to 300 mm (see Appendix A),

- (d) have a level area not less than 1 200 mm long and at least the same width as the ramp
 - (i) at intervals of 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 Sentence (2) be equipped with handrails and *guards* conforming to Articles 3.4.6.4. and 3.4.6.5.

(2) Where a ramp serves as an aisleway for fixed seating, the requirement for handrails in Clause 3.7.3.4.(1)(e) need not apply.

(3) Floors or walks in a *barrier-free* path of travel having a slope steeper than 1 in 20 shall be designed as ramps.

3.7.3.5. Elevators

(1) Passenger elevators which are required to be *barrier-free* shall conform to Appendix E of CAN/CSA-B44-M, "Safety Code for Elevators, Escalators, Dumbwaiters, Moving Walks and Freight Platform Lifts."

(2) The passenger elevating device referred to in Article 3.7.2.1. shall conform to CAN/CSA-B355-M, "Elevating Devices for the Handicapped."

3.7.3.6. Spaces in Seating Area

- (1) Spaces designated for wheelchair use referred to in Sentence 3.7.2.1.(2) shall be
 - (a) clear and level, or level with removable seats,
 - (b) not less than 840 mm wide and 1 525 mm long to permit wheelchairs to enter from a side approach and 1 220 mm long where the wheelchair enters from the front or rear of the space,
 - (c) arranged so that at least 2 designated spaces are side by side,
 - (d) located adjoining a *barrier-free* path of travel without infringing on egress from any row of seating or any aisle requirements, and

Part 4

Structural Design

Section 4.1	Structural Loads and Procedures	
4.1.1.	General	139
4.1.2.	Specified Loads and Effects	140
4.1.3.	Working Stress Design	140
4.1.4.	Limit States Design	141
4.1.5.	Dead Loads	142
4.1.6.	Live Loads Due to Use and Occupancy	142
4.1.7.	Live Loads Due to Snow, Ice and Rain	147
4.1.8.	Live Loads Due to Wind	148
4.1.9.	Live Loads Due to Earthquakes	150
4.1.10.	Other Effects	157
Section 4.2	Foundations	
4.2.1.	General	158
4.2.2.	Subsurface Investigations, Drawings and Reviews	158
4.2.3.	Materials Used in Foundations	159
4.2.4.	Design Requirements	160
4.2.5.	Excavations	161
4.2.6.	Shallow Foundations	161
4.2.7.	Deep Foundations	162
4.2.8.	Special Foundations	163
Section 4.3	Design Requirements for Structural Materials	
4.3.1.	Wood	163
4.3.2.	Plain and Reinforced Masonry	163
4.3.3.	Plain, Reinforced and Prestressed Concrete	163

	4.3.4.	Steel	163
	4.3.5.	Aluminum	163
	4.3.6.	Glass	163
Section	4.4	Design Requirements for Special Structures	
	4.4.1.	Air-Supported Structures ...	163
	4.4.2.	Parking Structures	164 e

in which Q is the specified wind load or two-thirds of the specified earthquake load.

4.1.3.2. Load Combination Factors

(1) The total of the combined load effects may be multiplied by the following load combination factors:

- (a) 1.0 for the combinations in Clauses 4.1.3.1.(1)(a) to (d),
- (b) 0.75 for the combinations in Clauses 4.1.3.1.(1)(e) to (g), and
- (c) 0.66 for the combination in Clause 4.1.3.1.(1)(h).

4.1.3.3. Stress Reversal. When loads other than D counteract D in a structural member or joint, special caution shall be exercised by the *designer* to ensure adequate safety for possible stress reversal. (See Appendix A.)

4.1.3.4. Overturning and Sliding

(1) A *building* shall be proportioned to resist an overturning moment and sliding force of not less than twice that due to the loads acting on the structure when the structure is considered as an entire unit acting on or anchored to its bearing stratum or supporting structure.

(2) The resistance to overturning shall be calculated as the sum of the stabilizing moment of the *dead load* only, plus the ultimate resistance of any anchoring devices.

4.1.4. Limit States Design

(See Appendix A.)

4.1.4.1. Definitions

- e (1) In this Subsection, the term
- (a) limit states means those conditions of a *building* structure in which the *building* ceases to fulfil the function for which it was designed, (Those states concerning safety are called ultimate limit states and include exceeding the load carrying capacity, overturning, sliding, fracture and fatigue, while those states which restrict the intended use and *occupancy* of the *building* are called serviceability limit states, and include deflection, vibration, permanent deformation and cracking.)

- (b) specified loads (D , L , Q and T) mean those loads defined in Article 4.1.2.1. and given in this Section,
- (c) load factor, α , means a factor in Sentence 4.1.4.2.(4) applied to a specified load which, for the limit states under consideration, takes into account the variability of the loads and load patterns and analysis of their effects,
- (d) factored load means the product of a specified load and its load factor,
- (e) load combination factor, ψ , means a factor in Sentences 4.1.4.2.(5) and (6) applied to the factored loads other than *dead load* to take into account the reduced probability of a number of loads from different sources acting simultaneously,
- (f) importance factor, γ , means a factor in Sentence 4.1.4.2.(7) applied to the factored loads other than *dead load* to take into account the consequences of collapse as related to the use and *occupancy* of the *building*,
- (g) resistance, R , of a member, connection or structure is based on the dimensions and on the specified properties of the structural materials,
- (h) resistance factor, ϕ , means a factor applied to a specified material property or to the resistance of a member, connection or structure which 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
- (i) factored resistance means the product of resistance and the applicable resistance factor.

4.1.4.2. Safety Check for Strength and Stability

(1) A *building* and its structural components shall be designed to have sufficient strength and stability so that the factored resistance is greater than or equal to the effect of factored loads, as required in Sentence (3).

(2) In cases of overturning, uplift and sliding, anchorage is required if the effect of loads tending to

4.1.4.2.

cause overturning, uplift or sliding, multiplied by load factors greater than 1.0 given in Sentence (4), is greater than the stabilizing effect of *dead load* multiplied by a load factor of 0.85 as given in Sentence (4).

(3) The effect of factored loads is the structural effect due to the specified loads multiplied by load factors, α , in Sentence (4), a load combination factor, ψ , in Sentences (5) and (6) and an importance factor, γ , in Sentence (7), and the factored load combinations shall be taken as

$$\alpha_D D + \gamma \psi [\alpha_L L + \alpha_Q Q + \alpha_T T]$$

(4) The load factors, α , shall be equal to

- (a) $\alpha_D = 1.25$, except that when the *dead load* resists overturning, uplift or reversal of load effect, $\alpha_D = 0.85$,
- (b) $\alpha_L = 1.5$,
- (c) $\alpha_Q = 1.5$ for wind or 1.0 for earthquake, and
- (d) $\alpha_T = 1.25$.

(5) The load combination factor, ψ , shall be equal to

- (a) 1.0 when only one of the loads, **L**, **Q** and **T** in Sentence 4.1.2.1.(1) acts,
- (b) 0.70 when 2 of the loads, **L**, **Q** and **T** in Sentence 4.1.2.1.(1) act, and
- (c) 0.60 when all of the loads, **L**, **Q** and **T** in Sentence 4.1.2.1.(1) act.

(6) The most unfavourable effect shall be determined by considering the loads **L**, **Q** and **T** in Sentence 4.1.2.1.(1) acting alone with $\psi = 1.0$ or in combination with $\psi = 0.70$ or 0.60.

(7) The importance factor, γ , shall be not less than 1.0 for all *buildings*, except that for *buildings* where it can be shown that collapse is not likely to cause injury or other serious consequences, it shall be not less than 0.8.

4.1.4.3. Serviceability and Fatigue

(1) A *building* and its structural components shall be checked for serviceability limit states as defined in Clause 4.1.4.1.(1)(a) and fatigue under the effect of the specified loads as required in the standards described in Section 4.3.

(2) Where more than one load contributes to the stress in a member, the combination of loads shall be assumed to be

$$D + \psi [L + Q + T]$$

where ψ is in conformance with Sentences 4.1.4.2.(5) and (6).

4.1.5. Dead Loads

4.1.5.1. 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) forces due to prestressing.

(2) Except as provided in Sentence (5), in areas of a *building* where *partitions* other than permanent *partitions* are shown on the drawings, or where *partitions* might be added in the future, allowance shall be made for the weight of such *partitions*.

(3) The *partition* weight allowance in Sentence (2) shall be determined from the actual or anticipated weight of the *partitions* placed in any probable position, but shall be not less than 1 kPa over the area of floor being considered.

(4) *Partition* loads used in design shall be shown on the drawings as provided in Clause 2.3.4.3.(1)(d).

(5) In cases where the *dead load* is counteractive, the load allowances as provided in Sentences (2) and (3) shall not be included in the design calculations.

4.1.6. Live Loads Due to Use and Occupancy

4.1.6.1. Loads Due to Use of Floors and Roofs. The specified *live load* on an area of floor or roof depends on the intended use and *occupancy*, and

- probability of being exceeded in any one year of 1 in 10,
- (c) for all *buildings*, except those listed in Clause (d), the reference velocity pressure, q , for the design of structural members for strength shall be based on a probability of being exceeded in any one year of 1 in 30, and
 - (d) the reference velocity pressure, q , for the design of structural members for strength for *post-disaster buildings* shall be based on a probability of being exceeded in any one year of 1 in 100.
- (5)** The exposure factor C_e shall be
- (a) the value shown in Table 4.1.8.A. for the appropriate reference height for the surface or part of the surface,
 - (b) the value of the function $(h/10)^{1/5}$ but not less than 0.9 where h is the reference height above *grade* in metres for the surface or part of the surface, or
 - (c) if a dynamic approach to the action of wind gusts is used, an appropriate value depending on both height and shielding. (See Appendix A.)

Table 4.1.8.A.
Forming Part of Sentence 4.1.8.1.(5)

Exposure Factors, C_e			
Height, m			Exposure Factor
Over	0	to 6	0.9
"	6	to 12	1.0
"	12	to 20	1.1
"	20	to 30	1.2
"	30	to 44	1.3
"	44	to 64	1.4
"	64	to 85	1.5
"	85	to 140	1.6
"	140	to 240	1.8
"	240	to 400	2.0
Column 1			2

- (6)** The gust effect factor C_g is one of the following values:
- (a) 1.0 or 2.0 for internal pressures as appropriate (see Appendix A),
 - (b) 2.0 for the *building* as a whole and main

- structural members,
- (c) 2.5 for small elements including cladding, or
- (d) if a dynamic approach to the action of wind gusts is used, an appropriate value depending on the turbulence of the wind and the size and natural frequency of the structure. (See Appendix A.)

4.1.8.2. Dynamic Effects of Wind

(1) *Buildings* whose height is greater than 4 times their minimum effective width or greater than 120 m and other *buildings* whose light weight, low frequency and low damping properties make them susceptible to vibration shall be

- (a) designed by experimental methods for the danger of dynamic overloading and vibration and the effects of fatigue, or
- (b) designed using a dynamic approach to the action of wind gusts. (See Appendix A.)

4.1.8.3. Full and Partial Loading

(1) *Buildings* and structural members shall be capable of withstanding the effects of

- (a) the full wind loads acting along each of the two principal horizontal axes considered separately,
- (b) the wind loads as described in (a) but with 25 per cent of the load removed from any portion of the area,
- (c) the wind loads as in (a) but considered simultaneously at 75 per cent of their full value, and
- (d) the wind loads as described in (c) but with 25 per cent of these loads removed from any portion of the area.

(See Appendix A.)

4.1.8.4. 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*.

4.1.9. Live Loads Due to Earthquakes

4.1.9.1. Analysis

(1) The specified loading due to earthquake motion shall be determined by the analysis given in this Subsection.

(2) In this Subsection

A_r = response amplification factor to account for type of attachment of mechanical/electrical equipment, as defined in Sentence 4.1.9.1.(17).

A_x = amplification factor at level x to account for variation of response of mechanical/electrical equipment with elevation within the *building*, as defined in Sentence 4.1.9.1.(17).

C_p = seismic coefficient for mechanical/electrical equipment, as defined in Sentence 4.1.9.1.(17).

D = dimension of the *building* in a direction parallel to the applied forces.

D_n = plan dimension of the *building* in the direction of the computed eccentricity.

D_s = dimension of wall or braced frame which constitutes the main lateral load-resisting system in a direction parallel to the applied forces.

e = distance between the location of the resultant of all forces at and above the level being considered and the centre of rigidity at the level being considered.

e_x = design eccentricity at level x .

F = foundation factor as given in Sentence 4.1.9.1.(11).

F_t = portion of V to be concentrated at the top of the structure, as defined in Sentence 4.1.9.1.(13).

F_x = lateral force applied to level x .

h_i, h_n, h_x = the height above the base ($i = 0$) to level " i ," " n ," or " x ," respectively.

h_s = interstorey height ($h_i - h_{i-1}$).

I = seismic importance factor of the structure, as described in Sentence 4.1.9.1.(10).

J = numerical reduction coefficient for base overturning moment as defined in Sentence 4.1.9.1.(20).

J_x = numerical reduction coefficient for moment at level " x " as defined in Sentence 4.1.9.1.(21).

Level i = any level in the *building*, $i = 1$ for first level above the base.

Level n = that level which is uppermost in the main portion of the structure.

Level x = that level which is under design consideration.

M_{tx} = torsional moment at level x .

N = total number of *storeys* above exterior *grade* to level " n ." (N is usually numerically equal to n).

R = force modification factor that reflects the capability of a structure to dissipate energy through inelastic behaviour, as given in Sentence 4.1.9.1.(8).

S = seismic response factor, for unit value of zonal velocity ratio, as defined in Sentence 4.1.9.1.(6).

S_p = horizontal force factor for architectural part or portion of a *building* and its anchorage, as given in Table 4.1.9.D. and Sentence 4.1.9.1.(16).

T = fundamental period of vibration of the *building* or structure in seconds in the direction under consideration.

U = factor representing level of protection based on experience, as specified in Sentence 4.1.9.1.(4).

v = zonal velocity ratio = the specified zonal horizontal ground velocity expressed as a ratio to 1 m/s.

V = minimum lateral seismic force at the base of the structure, to be used with a load factor $\alpha_Q = 1.0$.

e

V_e = equivalent lateral force at the base of the structure representing elastic response, as specified in Sentence 4.1.9.1.(5).

V_p = lateral force on a part of the structure.

W = *dead load* plus the following:

25 per cent of the design snow load specified in Subsection 4.1.7.,

60 per cent of the storage load for areas used for storage and the full contents of any tanks.

W_i, W_x = that portion of W which is located at or is assigned to level "i" or "x," respectively.

W_p = the weight of a part or portion of a structure, e.g. cladding, partitions and appendages.

Z_a = acceleration-related seismic zone.

Z_v = velocity-related seismic zone.

(3) Earthquake forces shall be assumed to act in any horizontal direction, except that independent design about each of the principal axes shall be considered to provide adequate resistance in the structure for earthquake forces applied in any direction. (See Appendix A.)

(4) The minimum lateral seismic force, V , shall be calculated in accordance with the following formula:

$$V = (V_e / R)U$$

where $U = 0.6$.

(5) The equivalent lateral seismic force representing elastic response, V_e , shall be calculated in accordance with the following formula:

$$V_e = v \cdot S \cdot I \cdot F \cdot W$$

where v is the zonal velocity ratio determined in conformance with Subsection 2.2.1., except when $Z_v = 0$ and $Z_a > 0$ the value of Z_v shall be taken as 1 and v as 0.05.

(6) The seismic response factor, S , shall conform to Table 4.1.9.A.:

Table 4.1.9.A.
Forming Part of Sentence 4.1.9.1.(6)

Seismic Response Factors		
T	Z_a/Z_v	S
	> 1.0	4.2
≤ 0.25	1.0	3.0
	< 1.0	2.1
> 0.25 but	> 1.0	4.2 – 8.4 (T – 0.25)
< 0.50	1.0	3.0 – 3.6 (T – 0.25)
	< 1.0	2.1
≥ 0.50	All values	1.5/√T
Column 1	2	3

(7) The fundamental period, T , in Sentence (6) shall be determined by

- the formula $0.1 N$ where the lateral force-resisting system consists of a moment-resisting space frame which resists 100 per cent of the required lateral forces and the frame is not enclosed by or adjoined by more rigid elements that would tend to prevent the frame from resisting lateral forces,
- the formula $0.09h_n / \sqrt{D_s}$ for other structures, where h_n and D_s are in metres and D_s = length of wall or braced frame which constitutes the main lateral load resisting system in the direction parallel to the applied forces; if the main lateral load resisting system does not have a well-defined length then D shall be used in lieu of D_s , or
- other established methods of mechanics provided they do not result in a value that exceeds 1.2 times the period calculated in Clause (a) or (b).

(8) Except as provided for in Sentences 4.1.9.3.(1), (2) and (3), values of the force modification factor, R , shall conform to Table 4.1.9.B. (See Appendix A.)

4.1.9.1.

- (9) For the purpose of applying Table 4.1.9.B.
- (a) a space frame shall mean a 3 dimensional structural system composed of interconnected members laterally supported so as to function as a completed self-contained unit with or without horizontal diaphragms;
 - (b) a ductile moment-resisting space frame shall mean a space frame that is designed to resist the specified seismic forces and that, in addition, has adequate ductility or energy-absorptive capacity;
 - (c) for combinations of different types of lateral-load-resisting systems acting in the same direction, R shall be taken as the lowest value of R corresponding to these systems except as given in Clause (d).
 - (d) if one of the lateral-load-resisting systems of the structure is designed to take 100 per cent of the lateral force, R can be selected as appropriate for the system; the components of the structure not considered to be part of the lateral-load-resisting system must be capable of resisting their gravity

Table 4.1.9.B.
Forming Part of Sentence 4.1.9.1.(8)

Force Modification Factors		
Case	Type of Lateral Load Resisting System	R
	Steel Structures Designed and Detailed According to CAN/CSA-S16.1-M	
1	ductile moment-resisting space frame	4.0
2	ductile eccentrically braced frame	3.5
3	ductile braced frame	3.0
4	moment-resisting space frame with nominal ductility	3.0
5	braced frame with nominal ductility	2.0
6	other lateral-force-resisting systems not defined in Cases 1 to 5	1.5
	Reinforced Concrete Structures Designed and Detailed According to CAN3-A23.3-M	
7	ductile moment-resisting space frame	4.0
8	ductile flexural wall	3.5
9	moment-resisting space frame with nominal ductility	2.0
10	wall with nominal ductility	2.0
11	other lateral-force-resisting systems not defined in Cases 7 to 10	1.5
	Timber Structures Designed and Detailed According to CAN/CSA-O86.1-M	
12	nailed shear panel with plywood, waferboard or strandboard	3.0
13	concentrically braced heavy timber space frame with ductile connections	2.0
14	moment-resisting wood space frame with ductile connections	2.0
15	other systems not included in 12 to 14	1.5
	Masonry Structures Designed and Detailed According to CAN3-S304-M	
16	reinforced masonry	1.5
17	unreinforced masonry	1.0
18	Other Lateral Load-resisting Systems not Defined in Cases 1 to 17	1.0
Col. 1	2	3

(See Appendix A.)

loads under seismically induced deformations.

- (e) if it can be demonstrated through research or experience that the seismic performance of a structural system is at least equivalent to one of Cases 1-5, 7-10, 12-14 or 16 in Table 4.1.9.B., then such a structural system will qualify for a value of R corresponding to the equivalent case in that Table.

(10) The seismic importance factor, I, shall equal 1.5 for *post-disaster buildings*, 1.3 for schools and 1.0 for all other *buildings*.

(11) The foundation factor, F, shall conform to Table 4.1.9.C., except that the product $F \cdot S$ need not exceed 3.0 where Z_a does not exceed Z_v and need not exceed 4.2 where Z_a is greater than Z_v . (See Appendix A.)

(12) The weight, W, of the structure shall be calculated in accordance with the following formula:

$$W = \sum_{i=1}^n W_i$$

(13) The total lateral seismic force, V, shall be distributed as follows:

- (a) a portion, F_t , shall be assumed to be concentrated at the top of the structure and equal to $0.07 TV$, except that F_t need

not exceed $0.25 V$ and may be considered as zero where T does not exceed 0.7 s; the remainder, $V - F_t$, shall be distributed along the height of the *building*, including the top level, in accordance with the formula

$$F_x = (V - F_t) W_x h_x / \left(\sum_{i=1}^n W_i h_i \right); \text{ or}$$

- (b) by dynamic analysis. (See Appendix A.)

(14) The total shear in any horizontal plane shall be distributed to the various elements of the lateral force-resistant system in proportion to their rigidities according to rational analysis, with due regard to the capacities and stiffnesses of the non-structural elements and to the effects of torsion as required by Sentence 4.1.9.1.(22).

(15) Parts of *buildings* as described in Table 4.1.9.D. and 4.1.9.E. and their anchorage shall be designed for a lateral force, V_p , equal to $v \cdot S_p \cdot W_p$, distributed according to the distribution of mass of the element under consideration, where v is determined in conformance with Subsection 2.2.1., except when Z_v equals zero and Z_a is greater than zero, v shall be taken as 0.05.

(16) Except as provided for in Sentence (18), the values of S_p in Sentence (15) for architectural components shall conform to Table 4.1.9.D.

Table 4.1.9.C.
Forming Part of Sentence 4.1.9.1.(11)

Foundation Factors		
Categories	Type and Depth of Soil Measured from the Foundation or Pile Cap Level	F
1	Rock, dense and very dense coarse-grained soils, very stiff and hard fine-grained soils; compact coarse-grained soils and firm and stiff fine-grained soils from 0 to 15 m deep	1.0
2	Compact coarse-grained soils, firm and stiff fine-grained soils with a depth greater than 15 m; very loose and loose coarse-grained soils and very soft and soft fine-grained soils from 0 to 15 m deep	1.3
3	Very loose and loose coarse-grained soils with depth greater than 15 m	1.5
4	Very soft and soft fine-grained soils with depth greater than 15 m	2.0
Col. 1	2	3

(See Appendix A.)

Table 4.1.9.D.
Forming Part of Sentence 4.1.9.1.(16)

Values of S_p for Architectural Parts or Portions of Buildings			
Category	Architectural Part or Portion of <i>Building</i>	Direction of Force	Value of S_p
1	All exterior and interior walls except those of Categories 2 and 3	Normal to flat surface	1.5
2	Cantilever parapet and other cantilever walls except retaining walls; horizontally cantilevered floors, balconies, beams, etc.	Normal to flat surface	6.5
3	Exterior and interior ornamentations and appendages	Any direction	6.5
4	Connections/attachments for Categories 1, 2 and 3	Any direction	15
5	Floors and roofs acting as diaphragms	Any direction	0.7 ⁽¹⁾
6	Towers, <i>chimneys</i> , smokestacks and penthouses when connected to or forming part of a <i>building</i> having $h_n/D < 5$ $h_n/D \geq 5$ (See Appendix A.)	Any direction	2.0 3.0
Column 1	2	3	4

Note to Table 4.1.9.D.:

⁽¹⁾ See Sentence 4.1.9.1.(18).

Table 4.1.9.E.
Forming Part of Sentence 4.1.9.1.(17)

Values of C_p for Mechanical/Electrical Parts or Portions of Buildings			
Category	Mechanical/Electrical Part or Portion of <i>Building</i>	Direction of Force	Value of C_p
1	Machinery, fixtures, equipment and pipes that are both rigid and rigidly connected to or forming part of a <i>building</i> . Tanks or bins containing non-liquids, rigidly connected.	Any direction	1.0
2	Tanks plus contents when resting on the ground within a <i>building</i> .	Any direction	0.7
3	Tanks plus contents when resting on the ground within a <i>building</i> and containing toxic or explosive materials or fire fighting fluids.	Any direction	1.0
4	Machinery, fixtures, equipment, pipes and tanks including contents other than those listed above. (See Appendix A.)	Any direction	1.0
5	Pipes and containers plus contents for toxic or explosive materials, for materials having a <i>flash point</i> below 38°C or for fire fighting fluids.	Any direction	1.5
Column 1	2	3	4

(5) Except in velocity-related seismic Zones 0 and 1, *basement* walls shall be designed to resist seismic lateral pressures from backfill or natural ground. (See Appendix A.)

4.1.10. Other Effects

4.1.10.1. Loads on Guards

(1) The minimum specified load applied horizontally and normal to the span at the top of every required *guard* shall be

- (a) 0.6 kN/m for exterior balconies of individual residential units and a concentrated load of 0.9 kN applied concurrently,
- (b) 1.5 kN/m for *exits* and stairs,
- (c) 3.6 kN/m for grandstands and stadia including ramps,
- (d) 4.4 kN/m for vehicle guardrails for parking garages applied 500 mm above the roadway but not less than 11 kN uniformly distributed over each vehicle space applied 500 mm above the roadway,
- (e) a concentrated load of 0.55 kN applied at any point for access walkways to equipment platforms, contiguous stairs and similar areas where the gathering of many people is improbable, and
- (f) 2.2 kN/m for locations other than described in Clauses (a) to (e).

(2) Individual elements within the *guard*, including solid panels and pickets, shall be designed for 1 kPa or 0.45 kN of concentrated load at any point in the element, whichever results in the more critical loading condition.

(3) The loads in Sentence (2) need not be considered to act simultaneously with the loads provided for in Sentences (1) and (4).

(4) The minimum specified load applied vertically at the top of every required *guard* shall be 1.5 kN/m and need not be considered to act simultaneously with the horizontal load provided for in Sentence (1).

4.1.10.2. Loads on Walls. Where the floor elevation on one side of a wall, including a wall around a shaft, is not less than 600 mm greater than the elevation of the floor or ground on the other side, the wall shall be designed to resist the appropriate

lateral design loads prescribed elsewhere in this Section or 0.5 kPa, whichever produces the greatest effect.

4.1.10.3. Firewalls

(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, when the *fire-resistance rating* of the structure is less than that of the *firewall*, lateral support shall be assumed to be provided by the structure on one side only. (See Appendix A.)

4.1.10.4. Vibrations and Impact of Machinery and Equipment

(1) Where vibration effects, such as resonance and fatigue resulting from machinery or equipment, are likely to be significant, a dynamic analysis shall be carried out.

(2) 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 4.1.10.A.

Table 4.1.10.A.
Forming Part of Sentence 4.1.10.4.(2)

Factors for the Calculation of Impact Loads	
Impact Due to	Factor
Operation of motor driven cranes	1.25
Operation of hand driven cranes	1.10
Operation of elevators	See CAN/CSA-B44-M, Clauses 2.6.2. and 2.10(c)
Supports for light machinery, shaft or motor driven	1.20
Supports for reciprocating machinery (e.g. compressors) or power driven units (e.g. piston engines)	1.50
Column 1	2

(3) Crane runway rails shall be designed to resist a lateral force applied normal to the top of the rails equal to not less than 20 per cent of the sum of the weights of the lifted load and the crane trolley (excluding other parts of the crane) in the case of power operated trolleys, and equal to not less than 10 per cent of the sum of the weights in the case of hand operated trolleys.

(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 rails shall be designed to resist a lateral force applied parallel to the top of the rail equal to not less than 10 percent of the maximum wheel loads of the crane.

4.1.10.5. Resonance and Sway Forces

(1) 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 Appendix A.)

(2) The floor assembly and other structural elements that support fixed seats in any *building* used for *assembly occupancies* to accommodate 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, assuming such forces to be acting independently of each other.

4.1.10.6. Bleachers

(1) Bleachers shall be checked by the erector after erection to ensure that all structural members including bracing specified in the design have been installed.

(2) Telescopic bleachers shall be provided with locking devices to ensure stability while in use.

Section 4.2 Foundations

4.2.1. General

4.2.1.1. This Section applies to *excavations* and *foundation* systems for *buildings*.

4.2.2. Subsurface Investigations, Drawings and Reviews

4.2.2.1. Subsurface Investigation. A *sub-surface investigation* shall be carried out, which shall include *groundwater* conditions. (See Appendix A.)

4.2.2.2. Drawings. Drawings associated with *foundations* and *excavations* shall conform to the appropriate requirements of Part 2. (See Article 2.3.4.6.)

4.2.2.3. Review

(1) A review shall be carried out by the *designer* or by another suitably qualified person to ensure 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 Appendix A.)

(2) The review required in 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 unit, and
 - (ii) during the installation and removal of retaining structures and related backfilling operations, and
- (b) as required, unless otherwise directed by the *authority having jurisdiction*,
 - (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) Where 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) Where during construction climatic or any other conditions have changed 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. Wood used in *foundations* or in support of *soil* or *rock* shall conform with the appropriate requirements of Subsection 4.3.1.

4.2.3.2. Preservation Treatment of Wood

(1) Wood exposed to *soil* or air above the lowest anticipated *groundwater* table shall be treated with preservative in conformance with CAN/CSA O80, "Wood Preservation" and the requirements of the appropriate commodity standard as follows:

- (a) CAN/CSA O80.2-M, "Preservative Treatment of Lumber, Timber, Bridge Ties, and Mine Ties by Pressure Processes,"
- (b) CAN/CSA O80.3-M, "Preservative Treatment of Piles by Pressure Processes," or
- (c) CAN/CSA O80.15-M, "Preservative Treatment of Wood for Building Foundation Systems, Basements and Crawl Spaces by Pressure Processes."

(2) Where timber has been treated as set forth in Sentence (1), it shall be cared for as provided in CSA O80-M4, "Care of Preservative Treated Wood Products."

4.2.3.3. Plain and Reinforced Masonry.

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.

Where plain or reinforced masonry in *foundations* or in structures supporting *soil* or *rock* may be subject to conditions conducive to deteriora-

tion, protection shall be provided to prevent such deterioration.

4.2.3.5. Concrete. 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. Chemical Attack of Concrete.

Where concrete in *foundations* may be subject to chemical attack, it shall be treated in conformance with the requirements in CAN/CSA-A23.1, "Concrete Materials and Methods of Concrete Construction."

4.2.3.7. Steel. Steel used in *foundations* or in support of *soil* or *rock* shall conform with the appropriate requirements of Subsections 4.3.3. or 4.3.4., unless otherwise specified in Section 4.2.

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) CAN/CSA-G40.21-M, "Structural Quality Steels,"
- (b) ASTM A252, "Welded and Seamless Steel Pipe Piles,"
- (c) ASTM A283/A283M, "Low and Intermediate Tensile Strength Carbon Steel Plates"
- (d) ASTM A570/570M, "Steel, Sheet and Strip, Carbon, Hot Rolled, Structural Quality," or
- (e) ASTM A611, "Steel, Cold-Rolled Sheet, Carbon, Structural."

4.2.3.9. High Strength Steel Tendons.

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 CAN/CSA-A23.1, "Concrete Materials and Methods of Concrete Construction."

4.2.3.10. Corrosion of Steel. Where conditions are corrosive to steel, adequate protection of exposed steel shall be provided. (See Subsection 2.5.1. for other materials.)

4.2.4.1.

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 by a person competent in this field of work, and one of the following:

- (a) application of generally accepted geotechnical and civil engineering principles by a person 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 Appendix A.)

4.2.4.2. Subsurface Investigation. 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. 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. Loads on Foundations. The *foundation* of a *building* shall be capable of resisting all loads as stipulated in Section 4.1.

4.2.4.5. Differential Movements. The *foundation* of a *building* shall be proportioned so that the estimated total and differential movements of the *foundation* are not greater than the movements that the *building* is designed to accommodate.

4.2.4.6. 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 Appendix A.)

(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*.

4.2.4.7. Sloping Ground. Where a *foundation* is to rest on, in or near sloping ground, this particular condition shall be provided for in the design.

4.2.4.8. Eccentric and Inclined Loads. Where there is eccentricity or inclination of loading in *foundation units*, this effect shall be fully investigated and provided for in the design.

4.2.4.9. Dynamic Loading. Where dynamic loading conditions apply, *allowable loads* or *allowable bearing pressures* shall be assessed by a special investigation of these conditions.

4.2.4.10. Hydrostatic Uplift. Where a *foundation* or any part of a *building* is subject to hydrostatic uplift, the effects shall be provided for in the design.

4.2.4.11. Groundwater Level Change. Where proposed construction will result in a temporary or permanent change in the *groundwater level*, the effects of this change on adjacent property shall be fully investigated and provided for in the design.

4.2.4.12. Permafrost. Where conditions of permafrost or perennially frozen *soil* or *rock* 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.

4.2.4.13. Swelling and Shrinking Soils. 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.

4.2.7.7. Damaged Deep Foundation Units.

Where inspection shows that a *deep foundation unit* is damaged or not consistent with design or good engineering practice, the *allowable load* of such a unit shall be reassessed by the person responsible for the design, any necessary changes made and action taken as required in Article 2.3.4.7.

4.2.8. Special Foundations

4.2.8.1. General. Where special *foundation* systems are used, such systems shall conform to Subsection 4.2.4. and Section 2.5.

4.2.8.2. Use of Existing Foundations.

Existing *foundations* may be used to support new or altered *buildings* provided they comply with all pertinent requirements of Section 4.2.

Section 4.3 Design Requirements for Structural Materials

4.3.1. Wood

4.3.1.1. Design Basis for Wood. *Buildings* and their structural members made of wood shall conform to CAN3-O86, "Engineering Design in Wood (Working Stress Design)" or CAN/CSA-O86.1-M, "Engineering Design in Wood (Limit States Design)."

4.3.1.2. Glued-Laminated Members. Glued-laminated members shall be fabricated in plants conforming to CAN/CSA O177-M, "Qualification Code for Manufacturers of Structural Glued-Laminated Timber."

4.3.1.3. Termites. In areas known to be infested by termites, the requirements in Articles 9.3.2.9., 9.12.1.1., 9.15.5.1. and 9.18.4.1. shall apply.

4.3.2. Plain and Reinforced Masonry

4.3.2.1. Design Basis for Plain and Reinforced Masonry. *Buildings* and their structural

members made of plain and reinforced masonry shall conform to CAN3-S304-M, "Masonry Design for Buildings."

4.3.3. Plain, Reinforced and Prestressed Concrete

4.3.3.1. Design Basis for Plain, Reinforced and Prestressed Concrete. *Buildings* and their structural members made of plain, reinforced and prestressed concrete shall conform to CAN3-A23.3-M, "Design of Concrete Structures for Buildings." (See Appendix A.)

4.3.4. Steel**4.3.4.1. Design Basis for Structural Steel.**

Buildings and their structural members made of structural steel shall conform to CAN/CSA-S16.1-M, "Limit States Design of Steel Structures." (See Appendix A.)

4.3.4.2. Design Basis for Cold Formed Steel.

Buildings and their structural members made of cold formed steel shall conform to CAN/CSA-S136-M, "Cold Formed Steel Structural Members."

4.3.5. Aluminum

4.3.5.1. Design Basis for Aluminum. *Buildings* and their structural members made of aluminum shall conform to CAN3-S157-M, "Strength Design in Aluminum."

4.3.6. Glass

4.3.6.1. Design Basis for Glass. Glass shall be designed in conformance with CAN/CGSB-12.20-M, "Structural Design of Glass for Buildings." (See Appendix A.)

Section 4.4 Design Requirements for Special Structures

4.4.1. Air-Supported Structures

4.4.1.1. Design Basis for Air-Supported Structures. The structural design of *air-supported structures* shall conform to CAN3-S367-M, "Air-Supported Structures."

4.4.2.1.

4.4.2. Parking Structures

4.4.2.1. Design Basis for Parking

Structures. Parking structures shall be designed in conformance with CAN/CSA-S413, "Parking Structures."

Part 6

Heating, Ventilating and Air-Conditioning

Section 6.1 General

6.1.1. Scope

6.1.1.1. The scope of this Part shall be as described in Section 2.1.

6.1.2. Application

6.1.2.1. This Part applies to systems and equipment for heating, ventilating and air-conditioning services.

6.1.3. Definitions

6.1.3.1. Words that appear in italics are defined in Part 1.

6.1.4. Plans and Specifications

6.1.4.1. Plans, specifications and other information for heating, ventilating and air-conditioning systems shall conform to Subsection 2.3.5.

Section 6.2 Design and Installation

6.2.1. General

6.2.1.1. Good Engineering Practice. Heating, ventilating and air-conditioning systems, including mechanical refrigeration equipment, shall be designed, constructed and installed to conform to good engineering practice such as described in the ASHRAE Handbooks and Standards, the HRA Digest, the Hydronics Institute Manuals, the SMACNA Manuals and the Industrial Ventilation

Manual published by the American Conference of Governmental Industrial Hygienists.

6.2.1.2. Capacity of Heating Appliances in Dwelling Units. The required capacity of heating appliances located in a *dwelling unit* and serving only that *dwelling unit*, shall be determined in accordance with CAN/CSA-F280, "Determining the Required Capacity of Residential Space Heating and Cooling Appliances," except that the outside winter design temperatures shall conform to Subsection 2.2.1.

6.2.1.3. Structural Movement. Mechanical systems and equipment shall be designed and installed to accommodate the maximum amount of relative structural movement provided for in the construction of the *building*.

6.2.1.4. Installation Standards

(1) Except as provided in 6.2.1.5., 6.2.1.6. and 6.2.1.7., the installation of heating and air-conditioning equipment, including mechanical refrigeration equipment, and including provisions for mounting, clearances and air supply, shall conform to appropriate provincial requirements or, in the absence of such requirements, to the requirements of

- (a) CAN/CSA-B139-M, "Installation Code for Oil Burning Equipment,"
- (b) CAN/CGA-B149.1, "Natural Gas Installation Code,"
- (c) CAN/CGA-B149.2, "Propane Installation Code,"
- (d) CSA C22.1, "Canadian Electrical Code, Part I,"
- (e) CSA B51, "Boiler, Pressure Vessel and Pressure Piping Code,"
- (f) CSA B52, "Mechanical Refrigeration Code," and

6.2.1.4.

- (g) CAN/CSA B365, "Installation Code for Solid-Fuel Burning Appliances and Equipment."

6.2.1.5. Solid-Fuel Burning Stoves, Ranges and Space Heaters. The design and installation of solid-fuel burning *stoves, ranges* and *space heaters* shall conform to the requirements of Section 9.33.

6.2.1.6. Fireplaces. Fireplaces shall conform to the requirements of Section 9.22.

6.2.1.7. Heat Recovery Ventilators. 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 CAN/CSA-C444, "Installation Requirements for Heat Recovery Ventilators."

6.2.1.8. Outside Design Conditions. The outside conditions to be used in designing heating, ventilating and air-conditioning systems shall be determined in conformance with Subsection 2.2.1.

6.2.1.9. Installation – General

(1) Equipment forming part of a heating, ventilating 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) Mechanical equipment shall be guarded to prevent injury to the public or maintenance staff.

(3) 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.

6.2.1.10. Expansion, Contraction and System Pressure. 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.

6.2.1.11. Asbestos. Asbestos shall not be used in air distribution systems or equipment in a form or in a location where asbestos fibres could enter the air supply or return systems.

6.2.1.12. Access Openings. 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.

6.2.2. Ventilation

6.2.2.1. Required Ventilation

(1) Except as provided in Sentences (2) and 6.2.2.2.(2), all rooms and spaces in *buildings* shall be ventilated in accordance with this Part.

(2) Self-contained mechanical ventilation systems, such as kitchen and bathroom exhaust fans, serving only one *dwelling unit* shall conform to the requirements of Section 9.32.

6.2.2.2. Natural Ventilation

(1) The ventilation of rooms and spaces in *occupancies* other than *residential occupancies* by natural methods shall be permitted in lieu of mechanical ventilation where such ventilation will provide sufficient air change to provide healthful conditions in that *occupancy*.

(2) The ventilation of rooms or spaces by natural methods in *residential occupancies* shall conform to Section 9.32.

6.2.2.3. Ventilation of Storage Garages

(1) Except as provided in Sentences (4) and (6), an enclosed *storage garage* 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 when measured between 900 mm and 1200 mm from the floor, or
- (b) provide, during operating hours, a continuous supply of fresh air at a rate equal to not less than 3.9 L/s for each square metre of floor area. (See also Article 3.3.1.19. and Sentence 3.3.5.5.(4).)

(2) Mechanical ventilation systems provided in accordance with Clause (1)(a) shall be controlled by carbon monoxide monitoring devices.

(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*.

6.2.2.4. Air Contaminants

(1) Air contaminants released within *buildings* shall be removed insofar as possible at their points of origin and shall not be permitted to accumulate in unsafe concentrations.

(2) Systems serving spaces that contain sources of contamination shall be designed in such a manner as to prevent spreading of such contamination to other occupied parts of the *building* and surrounding areas.

6.2.2.5. Hazardous Gases, Dusts or Liquids.

Systems serving spaces that contain hazardous gases, dusts or liquids such as grain elevators, metal powder plants and ammonium nitrate storage shall be designed, constructed and installed to conform to the requirements of the appropriate provincial legislation or, in the absence of such legislation, to good engineering practice such as is described in the publications of the National Fire Protection Association and in the National Fire Code of Canada 1990. (See Appendix A.)

6.2.2.6. Commercial Cooking Equipment.

Systems for the ventilation of restaurant and other commercial cooking equipment shall be designed, constructed and installed to conform to NFPA 96, "Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment," except as required by Sentence 3.5.3.1.(1) and Article 3.5.4.2.

6.2.2.7. Crawl Spaces and Attic or Roof Spaces.

Every crawl space and every *attic or roof space* shall be ventilated by natural or mechanical means.

6.2.3. Air Duct Systems

6.2.3.1. Application. Where ducts serve a heating system with a rated heat input not more than 120 kW, the requirements of Subsection 6.2.4. shall apply in addition to those in this Subsection.

6.2.3.2. Materials in Air Duct Systems

(1) Except as provided in Sentences (2) to (4) and in Article 3.5.4.3., all ducts, duct connectors, associated fittings and *plenums* used in air duct systems shall be constructed of steel, aluminum alloy, copper, clay, asbestos-cement or similar *noncombustible* material.

(2) Ducts, associated fittings and *plenums* may contain limited amounts of *combustible* material provided they

- (a) conform to the appropriate requirements for Class 1 duct materials in CAN/ULC-S110-M, "Standard Methods of Fire Test for Air Ducts," **e**
- (b) conform to Article 3.1.5.14. and Subsection 3.1.9., **e**
- (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-M, "Standard Methods of Fire Test for Air Ducts," **e**
- (b) be limited to 4 m in length,
- (c) be used only in horizontal runs, and
- (d) not penetrate required *fire separations*.

(5) Materials in Sentences (1) to (4) when used in a location where they may be subjected to excessive moisture shall have no appreciable loss of strength when wet and shall be corrosion-resistant.

6.2.3.3.

6.2.3.3. Connections and Openings in Air Duct Systems

(1) Air duct systems shall have tight-fitting connections throughout, and shall have no openings other than those required for proper operation and maintenance of the system.

(2) Except for systems that serve one *dwelling unit* only, access openings shall be provided in duct systems where lint, grease, debris, paper or other combustible material may accumulate in *plenums* and ducts.

6.2.3.4. Connectors

(1) Vibration isolation connectors in air duct systems shall be *noncombustible*, except that *combustible* fabric connectors are permitted provided they

- (a) do not exceed 250 mm in length,
- (b) comply with the flame-resistance requirements of CAN/ULC-S109, "Standard 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 may cause the exposed surface to exceed a temperature of 120°C.

6.2.3.5. Tape. Tape used for sealing 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 for Flame Tests of Flame-Resistant Fabrics and Films."

6.2.3.6. 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) When *combustible* coverings and linings, including associated adhesives and insulation, are used, they shall have 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 a smoke developed classification of not more than 50, except that the outer covering of ducts, *plenums* and other parts of air duct systems

used within an assembly of *combustible construction* may have an exposed surface *flame-spread rating* of not more than 75 and may have a smoke developed classification greater than 50.

(3) *Combustible* coverings and linings in Sentence (2) shall not flame, glow, smoulder or smoke when tested in accordance with the method of test in ASTM C411, "Hot-Surface Performance of High-Temperature Thermal Insulation" at the maximum temperature to which the coverings and linings are to be exposed in service.

(4) Except as provided in Sentence (5), foamed plastic insulation shall not be used as part of an air duct or for insulating an air duct.

(5) Foamed plastic insulation may 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 3.1.5.11.

(6) *Combustible* coverings and linings of ducts, including associated adhesives and insulation, shall be interrupted 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 where the duct penetrates a *fire separation*.

(7) 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*.

6.2.3.7. Underground Ducts. Underground ducts shall be constructed to provide interior drainage from and access to all low points and shall not be connected directly to a sewer.

6.2.3.8. Clearances. The clearances from *combustible* material and supply *plenums*, supply ducts, boots and register boxes of heating systems shall conform to the requirements of Subsection 6.2.4.

6.2.3.9. Fire Dampers. *Fire dampers* shall conform to the requirements of Article 3.1.8.9.

6.2.3.10. Exhaust Ducts and Outlets

(1) Except as provided in Sentence (2), *exhaust ducts* of nonmechanical ventilating systems serving separate rooms or spaces shall not be combined.

(2) *Exhaust ducts* of nonmechanical ventilating systems serving similar *occupancies* may be combined immediately below the point of final delivery to the outside, such as 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 back draft under wind conditions.

(5) *Exhaust ducts* directly connected to laundry drying equipment shall be independent of other *exhaust ducts*.

(6) Except as provided in Sentence (8) 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*.

(7) Except as provided in Sentence (8) 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*.

(8) Two or more exhaust systems described in Sentences (6) and (7) may be interconnected or connected with *exhaust ducts* serving other areas of the *building* provided the connections are made at the inlet of an exhaust fan and all interconnected systems are equipped with suitable back pressure devices to prevent passage of odours from one system to another when the fan is not in operation.

(9) Where *exhaust ducts* containing air from heated spaces pass through or are adjacent to unheated spaces, the ducts shall be insulated to prevent moisture condensation in the ducts.

6.2.3.11. Interconnection of Systems

(1) Air duct systems serving garages shall not be directly interconnected with other parts of the *building*.

(2) In a *residential occupancy*, air from one *suite* shall not be circulated to any other *suite* nor to a *public corridor*.

6.2.3.12. Make-up Air. In ventilating systems that exhaust air to the outdoors, provision shall be made for the admission of a supply of make-up air in sufficient quantity so that the operation of the exhaust

system and other exhaust equipment or combustion equipment is not adversely affected. (See Appendix A.)

6.2.3.13. Supply, Return, Intake and Exhaust Air Openings

(1) Supply, return and exhaust air openings in rooms or spaces in *buildings* 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 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) Outdoor air intakes and exhaust outlets at the *building* exterior shall be designed or located so that the air entering the *building* system will not contain more contaminants than the normal exterior air of the locality in which the *building* is situated.

(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 not larger than 15 mm, except where climatic conditions may require larger openings.

(5) Screens required in Sentence (4) shall be accessible for maintenance.

6.2.3.14. 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 CAN4-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 circulating 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

6.2.3.14.

- (b) protected from dust accumulation by air filters installed on the inlet side.

(4) Facilities for flushing and drainage shall be provided where filters are designed to be washed in place.

6.2.3.15. Air Washers and Evaporative Cooling Sections or Towers

(1) The filter and water evaporation medium of every air washer and evaporative cooling section enclosed within a *building* shall be made of *noncombustible* material.

(2) Sumps for air washer and evaporative cooling sections shall be constructed and installed so that they can be flushed and drained.

(3) Evaporative cooling sections or towers of *combustible* material located on or outside *buildings* shall have a clearance of not less than 12 m from sources of ignition such as *chimneys* or incinerators when the tower exterior construction is *noncombustible*, and a clearance of not less than 30 m when the tower exterior construction is *combustible*.

(4) Evaporative cooling sections or towers the main structure of which exceeds a volume of 55 m³ shall comply with the requirements of NFPA 214, "Water-Cooling Towers."

6.2.3.16. 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.

6.2.4. Air Ducts for Low Capacity Heating Systems

6.2.4.1. Application. 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 and Subsection 6.2.3.

6.2.4.2. Galvanized Steel or Aluminum Supply Ducts

(1) Galvanized steel or aluminum *supply ducts* shall conform to Table 6.2.4.A.

(2) The design of fittings for ducts shall conform to CSA B228.1, "Pipes, Ducts, and Fittings for Residential Type Air Conditioning Systems," except that metal thickness requirements shall conform to those in Table 6.2.4.A.

6.2.4.3. Construction and Installation of Ducts and Plenums

(1) Rectangular panels in *plenums* and ducts more than 300 mm wide shall be shaped to provide sufficient stiffness.

(2) Where the installation of heating *supply ducts* in walls and floors creates a space between the duct and construction material, the space shall be fire stopped with *noncombustible* material at each end.

(3) Ducts shall be securely supported by metal hangers, straps, lugs or brackets, except that, where zero clearance is permitted, wooden brackets may be used.

(4) All round duct joints shall be tight-fitting and lapped not less than 25 mm.

(5) Rectangular duct connections shall be made with S and drive cleats or equivalent mechanical connections.

(6) Trunk *supply ducts* shall not be nailed directly to wood members.

(7) Branch ducts shall be supported at suitable spacings to maintain alignment and prevent sagging.

6.2.11. Storage Bins

6.2.11.1. 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 fuel cannot be stored in contact with it.

(3) A storage bin for solid fuel shall not be located above a sewer opening or drain opening.

(4) Solid fuels shall not be stored where the air temperature in the bin or the surface temperature of any part of the floor or walls is 50°C or above.

6.2.11.2. Ash Storage Bins

(1) Every ash storage bin shall be constructed of *noncombustible* material and, where the bin is not covered, the ceiling of the room in which it is located shall be 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.

Section 6.3 Chimneys and Venting Equipment

6.3.1. General

6.3.1.1. Requirement for Venting. Except as provided in Articles 6.3.1.2. and 6.3.1.3., 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 Sentence 6.2.1.4.(1).

6.3.1.2. Masonry or Concrete Chimneys

(1) Rectangular *masonry or concrete chimneys* not more than 12 m in height that serve *appliances* with a combined total rated heat output of 120 kW or less, or that serve fireplaces, shall conform to Part 9.

(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."

6.3.1.3. Metal Smoke Stacks. 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."

6.3.1.4. Lightning Protection Systems. A lightning protection system, when provided, shall conform to the requirements of the appropriate provincial legislation or, in the absence of such legislation, to CAN/CSA-B72-M, "Installation Code for Lightning Protection Systems."

6.3.1.5. 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.

Part 9

Housing and Small Buildings

Section 9.1 General

9.1.1. Scope

9.1.1.1. The scope of this Part shall be as described in Section 2.1.

Section 9.2 Definitions

9.2.1. General

9.2.1.1. Words in *italics* are defined in Part 1.

Section 9.3 Materials, Systems and Equipment

9.3.1. Concrete

9.3.1.1. Concrete. Concrete shall be designed, mixed, placed, cured and tested in accordance with CAN3-A438, "Concrete Construction for Housing and Small Buildings."

9.3.1.2. Cement. Cement shall meet the requirements of CAN3-A5, "Portland Cements."

9.3.1.3. Concrete in Contact with Sulphate Soil

(1) Concrete in contact with sulphate *soil* deleterious to normal cement shall conform to the requirements in Section 16 of CAN/CSA-A23.1, "Concrete Materials and Methods of Concrete Construction."

(2) Sulphate-resisting cement shall be used for concrete referred to in Sentence (1).

9.3.1.4. Aggregates. Aggregates shall consist of sand, gravel, crushed rock, crushed air-cooled blast furnace slag, expanded shale or expanded clay conforming to CAN/CSA-A23.1, "Concrete Materials and Methods of Concrete Construction" and shall be clean, well-graded and free of injurious amounts of organic and other deleterious material.

9.3.1.5. Water. 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. Unless specifically required elsewhere in this Part, the compressive strength of unreinforced concrete shall be not less than 15 MPa after 28 days. (See also Articles 9.3.1.7., 9.12.4.1., 9.15.4.1. and 9.18.6.1.)

9.3.1.7. Concrete for Garage and Carport Floors and Exterior Steps. When concrete is used for garage and carport floors and exterior steps, it shall have a minimum compressive strength of 20 MPa after 28 days and shall have air entrainment of 5 to 8 per cent.

9.3.1.8. Concrete Mixes

(1) The concrete mixes described in Table 9.3.1.A. shall be considered acceptable if the slump does not exceed 100 mm when measured according to the slump test described in CAN/CSA-A23.2-M, "Methods of Test for Concrete."

(2) Aggregate for mixes referred to in Sentence (1) shall not exceed 50 mm in size.

9.3.1.9. Admixtures. Admixtures shall conform to CAN3-A266.1, "Air Entraining Admixtures for Concrete" or CAN3-A266.2, "Chemical Admixtures for Concrete," as applicable.

Table 9.3.1.A.
Forming Part of Sentence 9.3.1.8.(1)

Concrete Mixes (by volume)			
Concrete Strength, MPa	Cement, parts	Sand, parts	Coarse Aggregate, parts
15	1	2	4
	1	—	6, pit run gravel
20	1	1.75	3, up to 40 mm in size
	1	—	4.75 pit run gravel
Column 1	2	3	4

9.3.1.10. Reinforced Concrete. Reinforced concrete shall be designed to conform to the requirements of Part 4.

9.3.1.11. Cold Weather Requirements

(1) When the air temperature is below 5°C, concrete shall be kept at a temperature of not less than 10°C or more than 25°C while being mixed and placed, and 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. Lumber for joists, rafters, trusses and beams and for the uses listed in Table 9.3.2.A. shall be identified by a grade stamp to indicate its grade as determined by the NLGA "Standard Grading Rules for Canadian Lumber." (See Appendix A.)

Table 9.3.2.A.
Forming Part of Article 9.3.2.1.

Minimum Lumber Grades for Specific End Uses				
Use	Boards ⁽¹⁾			Framing
	Paragraph in the NLGA grading rules under which boards are graded			
	All Species		Eastern White Pine & Red Pine	All Species
	Para 113	Para 114	Para 118	
Stud wall framing (loadbearing members)	—	—	—	Standard Stud, No. 2
Stud wall framing (non-loadbearing members)	—	—	—	Stud, Utility, No. 3
Plank frame construction (loadbearing members)	No. 3 Common	—	No. 3 Common	No. 2
Plank frame construction (non-loadbearing members)	No. 5 Common	—	No. 5 Common	Economy, No. 3
Posts and beams less than 114 mm in thickness	—	—	—	Standard, No. 2
Posts and beams not less than 114 mm in thickness	—	—	—	Standard
Roof sheathing	No. 3 Common	Standard	No. 4 Common	—
Subflooring	No. 3 Common	Standard	No. 3 Common	—
Wall sheathing when required as a nailing base	No. 4 Common	Utility	No. 4 Common	—
Wall sheathing not required as a nailing base	No. 5 Common	Economy	No. 5 Common	—
Column 1	2	3	4	5

Note to Table 9.3.2.A.:

⁽¹⁾ See Appendix A.

9.3.2.2. Lumber Grades. Except for joists, rafters, trusses and beams, visually graded lumber shall conform to the grades in Table 9.3.2.A. (See Article 9.23.4.1. for joists, rafters and beams and Article 9.23.13.11. for trusses).

9.3.2.3. Machine Stress Rated Lumber. Machine stress rated lumber shall conform to the requirements of Subsection 4.3.1.

9.3.2.4. Waferboard, Strandboard and Plywood Marking. Waferboard, strandboard 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. Moisture content of lumber shall be not more than 19 per cent at the time of installation.

9.3.2.6. Lumber Dimensions. Lumber dimensions referred to in this Part are actual dimensions determined in conformance with CSA O141, "Soft-wood Lumber."

9.3.2.7. Panel Thickness Tolerances. The thicknesses specified in this Part for plywood, hardboard, particleboard, waferboard and strandboard shall be subject to the tolerances permitted in the standards referenced for these products unless specifically indicated herein.

9.3.2.8. Undersized Lumber. Joist, rafter, lintel and beam members up to 5 per cent less than the actual Canadian standard sizes may be used provided the allowable spans for the grade and species of lumber under consideration are reduced 5 per cent from those shown in the span tables for full size members. (See Appendix A.)

9.3.2.9. Termite Resistance

(1) Where wood is pressure treated to resist termites, such treatment shall be in accordance with the requirements of

- (a) CAN/CSA O80.1, "Preservative Treatment of All Timber Products by Pressure Processes,"

- (b) CAN/CSA O80.2, "Preservative Treatment of Lumber, Timber, Bridge Ties and Mine Ties by Pressure Processes,"
- (c) CAN/CSA O80.9, "Preservative Treatment of Plywood by Pressure Processes," or
- (d) CAN/CSA O80.15, "Preservative Treatment of Wood for Building Foundation Systems, Basements and Crawl Spaces by Pressure Processes."

9.3.3. Metal

9.3.3.1. Sheet Metal Thickness. Minimum thicknesses for sheet metal material given in this Part refer to the actual minimum thicknesses measured at any point of the material, and in the case of galvanized steel, includes the thickness of the coating unless otherwise indicated.

9.3.3.2. Galvanized Sheet Metal. Where galvanized sheet metal 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 coating designation in ASTM A525, "Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process."

Section 9.4 Structural Requirements

9.4.1. General

9.4.1.1. Structural Design

(1) Except as provided in Sentence (2), Sentence 9.23.4.1.(2) and Subsections 9.4.2. to 9.4.4., structural members and their connections shall be designed in conformance with Part 4.

(2) Where structural members and their connections conform to the requirements listed elsewhere in this Part, it shall be deemed that the structural design requirements have been met.

9.4.1.2. Post, Beam and Plank Construction.

Except for columns described in Section 9.17 and beams described in Subsection 9.23.4., wood-frame post, beam and plank construction with the *loadbearing* framing members spaced more than 600 mm apart shall be designed in conformance with Subsection 4.3.1.

9.4.2.1.

9.4.2. Snow Loads

9.4.2.1. Application. This Subsection applies to wood frame assemblies with clear spans not exceeding 12.20 m and members spaced not more than 600 mm apart.

9.4.2.2. Design Snow Loads

(1) Except as provided in Sentences (2) and (3), design snow loads shall be not less than calculated using the following formula:

$$S = C_b \cdot S_s + S_r$$

Where

- S = the design snow load,
- C_b = the basic snow load roof factor, which is 0.5 where the entire width of a roof does not exceed 4.3 m and 0.6 for all other roofs,
- S_s = the ground snow load listed in Chapter 1 of the Supplement to the NBC 1990, and

S_r = the associated rain load listed in Chapter 1 of the Supplement to the NBC 1990.

(2) In no case shall the design 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 Section 4.1.

9.4.2.3. Balconies. Residential balconies not used as passageways shall be designed to carry the design roof snow load or 1.9 kPa, whichever is greater.

9.4.3. Deflections

9.4.3.1. Deflections

(1) The maximum deflection of structural members shall conform to Table 9.4.3.A.

(2) *Dead loads* need not be considered in computing deflections referred to in Sentence (1).

Table 9.4.3.A.
Forming Part of Sentence 9.4.3.1.(1)

Maximum Deflections		
Structural Members	Type of Ceiling Supported	Maximum Allowable Deflection Expressed as a Ratio of the Clear Span
Roof rafters, roof joists, roof beams and roof decking of plank and beam construction	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 of plank and beam construction for floor areas other than bedrooms in <i>dwelling units</i>	No ceiling	1/360
	Other than plaster or gypsum board	1/360
	Plaster or gypsum board	1/360
Floor beams, floor joists and floor decking of plank and beam construction for floor areas of bedrooms in <i>dwelling units</i>	No ceiling	1/240
	Other than plaster or gypsum board	1/240
	Plaster or gypsum board	1/360
Column 1	2	3

9.4.4. Foundation Conditions

9.4.4.1. Allowable Bearing Pressures.

Where footing sizes for *shallow foundations* are not determined in conformance with Section 9.15, footings may be designed using maximum *allowable bearing pressures* in Table 9.4.4.A.

Table 9.4.4.A.
Forming Part of Article 9.4.4.1.

Allowable Bearing Pressure for Soil or Rock	
Type and Condition of Soil or Rock	Maximum Allowable Bearing Pressure, kPa
Dense or compact sand or gravel ⁽¹⁾	150
Loose sand or gravel ⁽¹⁾	50
Dense or compact silt ⁽¹⁾	100
Stiff clay ⁽¹⁾	150
Firm clay ⁽¹⁾	75
Soft clay ⁽¹⁾	40
Till	200
Clay shale	300
Sound rock	500
Column 1	2

Note to Table 9.4.4.A.:

⁽¹⁾ See Appendix A

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. 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 per cent of that determined in Article 9.4.4.1.

9.4.4.4. Soil Movement. Where a *foundation* is located in an area in which *soil* movement caused by changes in *soil* moisture content is known to occur to the extent that it will cause significant damage to a *building*, measures shall be taken to minimize the effect of such movement on the *building*.

9.4.4.5. Retaining Walls. Walls shall be designed to resist the lateral pressure of the retained material.

9.4.4.6. Walls Supporting Drained Earth

(1) Walls supporting drained earth may be designed for pressure equivalent to that exerted by a fluid with a density of not less than 480 kg/m³ and having a depth equal to that of the retained earth.

(2) Any surcharge shall be in addition to the equivalent fluid pressure specified in Sentence (1).

Section 9.5 Room and Space Dimensions

9.5.1. General

9.5.1.1. Application. Unless otherwise specifically indicated, this Section applies only to *dwelling units* that are intended for use on a continuing or year-round basis as the principal residence of the occupant.

9.5.1.2. Method of Measurement. Unless otherwise indicated herein, the areas, dimensions and heights of rooms or spaces shall be measured between finished wall surfaces and between finished floor and ceiling surfaces.

9.5.1.3. Floor Areas. Minimum floor areas specified in this Section do not include closets or built-in bedroom cabinets unless otherwise indicated.

9.5.1.4. Combination Rooms. Two or more areas are considered as a combination room if the dividing wall occupies less than 60 per cent of the separating plane.

9.5.1.5.

9.5.1.5. Lesser Areas and Dimensions.

Areas and dimensions of rooms and spaces may be less than required in this Section provided it can be shown that the rooms and spaces are adequate for their intended use, such as by the provision of built-in furniture to compensate for reduced sizes.

9.5.2. Ceiling Heights

9.5.2.1. Heights of Rooms or Spaces.

Heights of rooms or spaces in *residential occupancies* shall conform to Table 9.5.2.A.

9.5.2.2. Mezzanines. The clear height above and below a *mezzanine* floor assembly in all *occupancies* shall be not less than 2.1 m.

9.5.2.3. Storage Garages. The clear height in a *storage garage* shall be not less than 2 m.

9.5.3. Living Rooms or Spaces within Dwelling Units

9.5.3.1. Areas and Dimensions of Living Rooms and Spaces

(1) Living areas within *dwelling units*, either as separate rooms or in combination with other spaces, shall have an area not less than 13.5 m² and no dimension less than 3 m within the required area.

(2) Where the area of a living space is combined with a kitchen and dining area, the living area alone in a *dwelling unit* that contains sleeping accommodation for not more than 2 persons shall be not less than 11 m².

9.5.4. Dining Rooms or Spaces within Dwelling Units

9.5.4.1. Area of Dining Rooms or Spaces

(1) A dining space in combination with other space shall have an area not less than 3.25 m².

(2) Dining rooms not combined with other space shall have an area not less than 7 m².

9.5.4.2. Dimensions of Dining Rooms or Spaces

(1) Except as permitted in Sentence (2), a dining room or space combined with other space shall have no dimension less than 2.3 m within the required area measured between wall faces or a wall face and a built-in cabinet or appliance.

(2) When a required dining area is provided in a kitchen or serves a *dwelling unit* that contains sleeping accommodation for not more than 2 persons, the minimum dimension of such space may be reduced to 1.7 m.

Table 9.5.2.A.
Forming Part of Article 9.5.2.1.

Room Heights	
Room or Space	Minimum Heights
Living room or space, dining room or space, kitchen or kitchen space	2.3 m over not less than 75 per cent of the required floor area with a clear height of 2.1 m at any point over the required area
Bedroom or bedroom space	2.3 m over not less than 50 per cent of the required floor area or 2.1 m over all of the required floor area. Any part of the floor having a clear height of less than 1.4 m shall not be considered in computing the required floor area.
Unfinished <i>basement</i> including laundry area therein	1.95 m under beams in laundry areas and in any location that would normally be used for passage to laundry and storage areas
Bathroom, water-closet room or laundry area above <i>grade</i>	2.1 m in any area where a person would normally be in a standing position
Passage, hall or main entrance vestibule and finished rooms not specifically mentioned above	2.1 m
Column 1	2

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9.5.5. Kitchens within Dwelling Units

9.5.5.1. Kitchen areas within *dwelling units* either separate from or in combination with other spaces, shall have an area not less than 4.2 m² including the area occupied by the base cabinets, except that in *dwelling units* containing sleeping accommodation for not more than 2 persons, the minimum area shall be 3.7 m².

9.5.6. Bedrooms or Spaces in Dwelling Units and Dormitories

9.5.6.1. Area and Dimension of Bedrooms

(1) Except as provided in Articles 9.5.6.2. and 9.5.6.3., bedrooms in *dwelling units* shall have an area not less than 7 m² where built-in cabinets are not provided and not less than 6 m² where built-in cabinets are provided.

(2) The minimum dimension within the required area specified in Sentence (1) shall be 2 m.

9.5.6.2. Areas and Dimensions of Master Bedrooms

(1) Except as provided in Article 9.5.6.3., not less than one bedroom in every *dwelling unit* shall have an area not less than 9.8 m² where built-in cabinets are not provided and not less than 8.8 m² where built-in cabinets are provided.

(2) The minimum dimension within the required area specified in Sentence (1) shall be 2.7 m.

9.5.6.3. Areas and Dimensions of Combination Bedrooms. Bedroom spaces in combination with other spaces in *dwelling units* shall have an area not less than 4.2 m² and have no dimension less than 2 m within the required area.

9.5.6.4. Areas and Dimensions of Other Sleeping Rooms

(1) Sleeping rooms other than in *dwelling units* shall have an area not less than 7 m² per person for single occupancy and not less than 4.6 m² per person for multiple occupancy.

(2) The minimum dimension within the required area specified in Sentence (1) shall be 2 m.

9.5.7. Bathrooms and Water-Closet Rooms

9.5.7.1. In every *dwelling unit* an enclosed space of sufficient size shall be provided to accommodate a bathtub, water closet and lavatory.

9.5.8. Hallways

9.5.8.1. The width of a hallway within a *dwelling unit* shall be at least 860 mm, except that in *buildings* not more than 4.3 m wide the hallway width may be 710 mm where a second *exit* is provided near the end of the hallway farthest from the living area.

Section 9.6 Doors

9.6.1. General

9.6.1.1. This Section applies to doors, to glazed areas in doors and to sidelights for doors. (See also Sections 3.7, 9.9 and 9.10.)

9.6.2. Required Doors

9.6.2.1. A door shall be provided at each entrance to a *dwelling unit* and to each room containing a water closet within a *dwelling unit*.

9.6.3. Doorway Sizes

9.6.3.1. Doorway Opening Sizes. Except as provided in Articles 9.6.3.3. and 9.9.6.4., doorway openings within *dwelling units* shall be designed to accommodate not less than the door sizes in Table 9.6.3.A. for swing-type doors or folding doors.

9.6.3.2. Doors to Public Water-Closet Rooms. Doors to public water-closet rooms shall be not less than 810 mm wide and 2030 mm high.

9.6.3.3. Doors to Bathrooms. A doorway to not less than one bathroom as described in Article 9.5.7.1. shall accommodate a door not less than 760 mm wide.

9.6.4. Exterior Doors

9.6.4.1. Exterior Wood Doors

(1) Exterior wood doors shall conform to CAN/CSA O132.2, "Wood Flush Doors."

9.6.3.A.

Table 9.6.3.A.
Forming Part of Article 9.6.3.1.

Minimum Size of Doors		
At Entrance to:	Width, mm	Height, mm
<i>Dwelling unit</i> (required entrance) Vestibule or entrance hall	810	1 980
Stairs to a floor level that contains a finished space All doors in not less than one line of passage from the exterior to the <i>basement</i> Utility rooms	810	1 980
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
Column 1	2	3

Note to Table 9.6.5.A.:

⁽¹⁾ See Article 9.6.3.3.

Table 9.6.5.A.
Forming Part of Article 9.6.5.1.

Maximum Glass Area for Doors, m ² ⁽¹⁾						
Glass Thickness, mm	Type of Glass					
	Annealed	Annealed Multiple- Glazed Factory- Sealed Units	Laminated	Wired	Heat Strength- ened	Fully Tempered
3	0.50	0.70	⁽²⁾	⁽²⁾	1.00	1.00
4	1.00	1.50	⁽²⁾	⁽²⁾	1.50	4.00
5	1.50	1.50	⁽²⁾	⁽²⁾	1.50	No limit
6	1.50	1.50	1.20	1.00	1.50	No limit
Column 1	2	3	4	5	6	7

Note to Table 9.6.5.A.:

⁽¹⁾ See Appendix A.

⁽²⁾ Not generally available.

(2) Each door described in Sentence (1) shall indicate legibly the name of the manufacturer, the standard to which it is produced and that it is of an exterior type.

9.6.4.2. Sliding Doors. Sliding doors shall conform to CAN/CGSB 82.1-M, "Sliding Doors."

9.6.4.3. Insulated Steel Doors. Insulated steel doors shall conform to CAN/CGSB 82.5-M "Insulated Steel Doors."

9.6.5. Glass

9.6.5.1. Maximum Area of Glass. The maximum area of individual panes of glass for doors shall conform to Table 9.6.5.A.

9.6.5.2. Glass in Doors and Sidelights

(1) Glass in doors and in sidelights for doors shall conform to Sentence 9.7.3.1.(1).

(2) Glass sidelights 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 glass of the laminated or tempered type conforming to CAN2-12.1, "Glass, Safety, Tempered or Laminated," or shall be of wired glass conforming to CAN2-12.11, "Glass, Wired, Safety."

(3) Except as provided in Article 9.7.5.3., glass in entrance doors to *dwelling units* and in public areas, other than the entrance doors described in Sentence (2), shall be safety glass or wired glass of the type described in Sentence (2) where the glass area exceeds 0.5 m² and extends to less than 900 mm from the bottom of the door.

9.6.5.3. Mirrored Glass Doors. Mirrored glass doors may be used only at the entrance to clothes closets and shall conform to the requirements of CAN/CGSB-82.6, "Doors, Mirrored Glass, Sliding or Folding Wardrobe." (See Appendix A.)

9.6.5.4. Visibility of Glass or Transparent Doors. Except as provided in Article 9.7.5.3., every glass or transparent door accessible to and used by the public shall be equipped with hardware, bars or other permanent fixtures designed so that the existence and position of such door will be readily apparent.

9.6.5.5. Glass for Shower or Bathtub Enclosures. Glass other than safety glass shall not be used for a shower or bathtub enclosure.

9.6.5.6. Double Glazing

(1) Except where a separate storm door is provided, in *buildings* intended for use on a continuing basis during the winter months, exterior glass doors and glass in doors and adjacent sidelights separating heated space from unheated space or from the exterior shall be equipped with double glazing. (See A-9.7.1.5. in Appendix A.)

(2) Metal frames for doors or glazing described in Sentence (1) shall incorporate a thermal break.

9.6.6. Resistance to Forced Entry

9.6.6.1. Application

(1) Except as permitted in Sentence (2), this Subsection applies to

- (a) swinging entrance doors to *dwelling units*,
- (b) swinging doors between *dwelling units* and attached garages or other ancillary spaces, and
- (c) swinging doors which provide access directly or indirectly from a *storage garage* to a *dwelling unit*.

(2) Sentence (1) does not apply to exterior doors to garages and to other ancillary spaces. (See Appendix A.)

9.6.6.2. Wood Doors

(1) Except as permitted in Article 9.6.6.10., wood doors as described in Sentence 9.6.6.1.(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 panel type, have a panel thickness of not less than 19 mm, with a total panel area not more than half of the door area.

9.6.6.3. Deadbolt Lock. Except as permitted in Article 9.6.6.10., doors described in Sentence 9.6.6.1.(1) shall be provided with a deadbolt lock with a cylinder having not less than 5 pins and a bolt throw not less than 25 mm, protected with a solid or hardened free-turning ring or bevelled cylinder housing.

9.6.6.4. Double Doors. Except as permitted in Article 9.6.6.10., an inactive leaf in double doors used in locations specified in Sentence 9.6.6.1.(1) shall be provided with heavy duty bolts top and bottom having an engagement of not less than 15 mm.

9.6.6.5. Fastening of Hinges

(1) Except as permitted in Article 9.6.6.10., hinges for doors described in Sentence 9.6.6.1.(1) shall be fastened 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. (See Appendix A.)

(2) Except as permitted in Article 9.6.6.10., hinges for doors described in Sentence 9.6.6.1.(1) shall be fastened to metal doors and metal frames with machine screws not smaller than No. 10 and not less than 10 mm long.

9.6.6.6. Fastening of Strikeplates

(1) Except as permitted in Article 9.6.6.10., strikeplates for doors described in Sentence 9.6.6.1.(1) shall be fastened to wood frames with wood screws that penetrate not less than 30 mm into solid wood. (See A-9.6.6.5.(1) in Appendix A.)

(2) Except as permitted in Article 9.6.6.10., strikeplates for doors described in Sentence 9.6.6.1.(1) shall be fastened to metal frames with machine screws not smaller than No. 10 and not less than 10 mm long.

9.6.6.7. Outward Swinging Doors. Except for storm or screen doors, doors described in Sentence 9.6.6.1.(1) which swing outward shall be provided with hinges or pins so that the doors cannot be removed when they are in the closed position. (See Appendix A.)

9.6.6.8. Door Viewer. Main entrance doors to *dwelling units* shall be provided with a door viewer with a viewing angle of not less than 160°, unless transparent glazing is provided in the door or in a sidelight.

9.6.6.9. Solid Blocking. Solid blocking shall be provided on both sides at the lock height between the jambs for doors described in Sentence 9.6.6.1.(1) and the structural framing so that the jambs will resist spreading by force.

9.6.6.10. Alternate Test Procedure.

Doors, frames and hardware which 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 Articles 9.6.6.2. to 9.6.6.6. (See Appendix A.)

Section 9.7 Windows and Skylights

9.7.1. General

9.7.1.1. Application. Windows shall conform to the requirements of this Section. (See also Sections 9.10 and 9.32 for fire protection and ventilation.)

9.7.1.2. Minimum Window Areas

(1) Except as required in Article 9.7.1.3., the minimum window glass area for rooms in *buildings of residential occupancy* or which are used for sleeping shall conform to Table 9.7.1.A.

(2) The unobstructed glass area of a door or skylight is considered equivalent to that of a window.

9.7.1.3. Bedroom Windows

(1) Except where a bedroom door provides access directly to the exterior, each bedroom shall have not less than one outside window openable from the inside without the use of tools or special knowledge.

(2) Windows referred to in Sentence (1) shall provide an unobstructed opening of not less than 380 mm in height and width and 0.35 m² in area. (See Article 9.7.1.4.)

9.7.1.4. Window Opening into a Window-Well

(1) Where a window required in Article 9.7.1.3. opens into a window-well, a clearance of not less than 550 mm shall be provided in front of the window.

(2) Where the sash of a window referred to in Sentence (1) 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.

Table 9.7.1.A.
Forming Part of Article 9.7.1.2.

Minimum Glass Areas for Rooms of Residential Occupancy		
Location	Unobstructed Glass Area	
	With No Electric Lighting	With Electric Lighting
Laundry, <i>basement</i> recreation room, unfinished <i>basement</i>	4 per cent of area served	Windows not required
Water-closet room	0.37 m ²	Windows not required
Kitchen, kitchen space, kitchen alcove	10 per cent of area served	Windows not required
Living rooms and dining rooms	10 per cent of area served	10 per cent of area served
Bedrooms and other finished rooms not mentioned above	5 per cent of area served ⁽¹⁾	5 per cent of area served ⁽¹⁾
Column 1	2	3

Note to Table 9.7.1.A.:

⁽¹⁾ See Article 9.7.1.3.

9.7.1.5. Double Glazing or Storm Sash. In *buildings* intended for use on a continuing basis during the winter months, windows which separate heated space from unheated space or from the exterior shall be provided with storm sash or double glazing. (See Appendix A.)

9.7.2. Window Standards

9.7.2.1. Window Standard. Windows shall conform at least to the requirements for window ratings A1, B1 and C1 in CAN/CSA-A440-M, "Windows." (See Appendix A.)

9.7.3. Glass

9.7.3.1. Glass Standards

- (1) Glass shall conform to
 - (a) CAN2-12.1, "Glass, Safety, Tempered or Laminated,"
 - (b) CAN2-12.2, "Glass, Sheet, Flat, Clear,"

- (c) CAN2-12.3, "Glass, Polished Plate or Float, Flat, Clear,"
- (d) CAN2-12.4, "Glass, Heat-Absorbing,"
- (e) CAN2-12.8, "Insulating Glass Units,"
- (f) CAN2-12.10, "Glass, Light and Heat Reflecting," or
- (g) CAN2-12.11, "Glass, Wired, Safety."

9.7.3.2. Structural Design of Glass. Glass in windows shall be designed in conformance with CAN/CGSB-12.20-M, "Structural Design of Glass for Buildings." (See Appendix A.)

9.7.4. Caulking and Glazing

9.7.4.1. Sealing Compound. Sealing compound used in the glazing of factory-sealed double-glazed units shall be compatible with the material used to edge seal the units.

9.7.4.2. Caulking Compound. Caulking shall be provided between window frames or trim and the exterior siding or masonry in conformance with Subsection 9.27.4.

9.7.5. Windows in Public Areas

9.7.5.1. Transparent Panels. Except as provided in Article 9.7.5.3., transparent panels that could be mistaken as a *means of egress* shall be protected by barriers or railings.

9.7.5.2. Windows in Exit Stairways. Windows in *exit* stairways that extend to less than 1 070 mm above the landing shall be protected by barriers or railings located approximately 1 070 mm above such landings.

9.7.5.3. Sliding Glass Partitions. Sliding glass *partitions* which separate a *public corridor* from an adjacent *occupancy* and which are open during normal working hours need not conform to Article 9.7.5.1. and Sentence 9.6.5.2.(3), except that such *partitions* shall be suitably marked to indicate their existence and position.

9.7.5.4. Windows in Public Areas. Windows in public areas that extend to less than 1 m from the floor and are located above the second *storey* in *buildings of residential occupancy* shall be protected by barriers or railings 1 m above the floor or the windows shall be non-openable and designed to withstand the lateral design loads for balcony *guards* in Part 4.

9.7.6. Resistance to Forced Entry

9.7.6.1. 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 10.13 of CAN3-A440, "Windows." (See Appendix A.)

9.7.7. Skylights

9.7.7.1. Plastic Skylights. Plastic skylights shall conform to CAN/CGSB 63.14-M, "Plastic Skylights."

9.7.7.2. Glass Skylights. Factory-built glass skylights shall meet the performance requirements of CAN/CGSB 63.14-M, "Plastic Skylights."

Section 9.8 Stairs, Ramps, Handrails and Guards

9.8.1. Scope

9.8.1.1. Application. This Section applies to the design and construction of interior and exterior stairs, steps, ramps, railings and *guards*.

9.8.1.2. Exit Stairs. Where the stair forms part of an *exit*, the appropriate requirements in Sections 9.9 and 9.10 shall also apply.

9.8.1.3. Escalators and Moving Walkways. Escalators and moving walkways shall conform to the appropriate requirements in Part 3.

9.8.2. General

9.8.2.1. Uniform Treads and Risers. Treads and risers shall have uniform rise and run in any one flight.

9.8.2.2. Minimum Number of Risers. Except for interior stairs within a *dwelling unit*, not less than 3 risers shall be provided for interior stairs.

9.8.3. Stair Dimensions

9.8.3.1. Rise and Run of Stairs

(1) Except for stairs to areas used only as *service rooms*, interior stairs within *dwelling units* and exterior stairs serving *dwelling units* shall have a maximum rise of 200 mm, a minimum run of 210 mm and a minimum tread width of 235 mm.

(2) Except for stairs serving not more than one *dwelling unit*, interior stairs not contained within *dwelling units* and exterior stairs for *buildings* shall have a rise of not more than 200 mm and not less than 125 mm.

(3) Stairs referred to in Sentence (2) shall have a run of not less than 230 mm, or not more than 355 mm and a tread width of not less than 250 mm.

9.8.3.2. Nosing or Backslope. Where the run of any stair is less than 250 mm, a nosing of not less than 25 mm shall be provided beyond the face of the riser, or an equivalent back slope on the risers shall be provided.

9.8.3.3. Stair Width

(1) *Exit* stairs and stairs used by the public shall have a width, measured between wall faces or *guards*, of not less than 900 mm.

(2) At least one stairway between each floor level in a *dwelling unit* shall have a width between wall faces of not less than 860 mm.

9.8.3.4. Head Room. The head room measured vertically from a line drawn through the outer edges of the nosings shall be not less than 1.95 m for stairs located in *dwelling units* and 2.05 m for all other stairs.

9.8.4. Landings

9.8.4.1. Dimensions of Landings. Landings shall be at least as wide and as long as the width of stairs in which they occur, except that the length of landing for exterior stairs serving not more than one *dwelling unit* need not exceed 900 mm, and the length of landing for all other stairs in a straight run need not exceed 1 100 mm. (See also Articles 9.9.6.2. and 9.9.6.6. for landings in *exits*.)

9.8.4.2. Required Landings

(1) Where a door swings towards a stair, the full arc of its swing shall be over a landing.

(2) Except as provided in Sentence (3), a landing shall be provided at the top and bottom of each flight of interior stairs and where a doorway occurs in a stairway.

(3) Where a door at the top of a stair in a *dwelling unit* swings away from the stair, no landing is required between the doorway and the stairs.

(4) A landing shall be provided at the top of all exterior stairs, except that a landing may be omitted at a secondary entrance to a *building* containing a single *dwelling unit* provided the stair does not contain more than 3 risers.

9.8.4.3. Height between Landings. The vertical height between any landings shall not exceed 3.7 m.

9.8.4.4. Height over Landings. The clear height over landings shall be not less than 1.95 m in *dwelling units* and 2.05 m for other landings.

9.8.5. Curved Stairs and Winders

9.8.5.1. Curved Stairs in Exits. Curved stairs used in *exits* shall conform to the requirements of Article 3.4.6.8.

9.8.5.2. Curved Stairs not in Exits. Except as permitted in Article 9.8.5.3., a curved stair not required as an *exit* shall have an average run of not less than 200 mm and a minimum run of 150 mm and shall have risers conforming to Article 9.8.3.1.

9.8.5.3. Winders

(1) Stairs within *dwelling units* may contain winders that converge to a centre point provided the winders turn through an angle of not more than 90° and individual treads turn through an angle of 30°.

(2) Only one set of winders described in Sentence (1) shall be permitted between floor levels.

9.8.6. Pedestrian Ramps

9.8.6.1. Ramps in a Barrier-Free Path of Travel. Ramps in a *barrier-free* path of travel shall conform to the requirements in Section 3.7.

9.8.6.2. Maximum Gradient

(1) Except as provided in Article 9.8.6.1., the gradient for pedestrian ramps shall be not more than 1 in 10 for *residential occupancies*, 1 in 6 for *mercantile* or *industrial occupancies* and 1 in 8 for all other *occupancies*.

(2) Except as provided in Article 9.8.6.1., the gradient for every exterior ramp shall be not more than 1 in 10. e

9.8.6.3. Level Areas on Ramps

(1) Except as provided in Article 9.8.6.1., where a doorway or stairway opens onto the side of a ramp, there shall be a level area extending across the full width of the ramp and for a distance of not less than 300 mm on either side of the wall opening.

(2) Except as provided in Article 9.8.6.1., where a doorway or stairway opens onto the end of a ramp, there shall be a level area extending across the full width of the ramp and along it for not less than 900 mm.

9.8.7. Handrails

9.8.7.1. Required Handrails

(1) Except as permitted in Sentences (2) and (3), a handrail shall be provided on

- (a) at least one side of stairs less than 1 100 mm in width,
- (b) two sides of stairs 1 100 mm in width or greater, and
- (c) two sides of a curved stair used as an *exit*.

(2) Handrails are not required for stairs within *dwelling units* having not more than 2 risers, or for exterior stairs having not more than 3 risers and serving not more than one *dwelling unit*.

(3) Only one handrail is required on exterior stairs having more than 3 risers provided such stairs serve not more than one *dwelling unit*.

9.8.7.2. Continuous Handrail. Except for stairs serving only one *dwelling unit*, not less than one handrail shall be continuous throughout the length of the stairway, including landings, except where interrupted by doorways or newels at changes in direction. (See A-3.4.6.4.(5) in Appendix A.)

9.8.7.3. Termination of Handrails. Except for stairs serving only one *dwelling unit*, handrails shall be terminated in a manner that will not obstruct pedestrian travel or create a hazard. (See A-3.4.6.4.(5) in Appendix A.)

9.8.7.4. Handrail Extension. Except for stairways serving only one *dwelling unit*, at least one handrail at the sides of a stairway or ramp shall extend horizontally not less than 300 mm beyond the top and bottom of the stairway or ramp. (See A-3.4.6.4.(5) in Appendix A.)

9.8.7.5. Height of Handrails. Handrails on stairs and ramps shall be not less than 800 mm and not more than 920 mm in height, measured vertically from a line drawn through the outside edges of the stair nosing or from the surface of the ramp, except that handrails not meeting these requirements are

permitted provided they are installed in addition to the required handrails.

9.8.7.6. Handrail Clearance. A clearance of not less than 40 mm shall be provided between each handrail and the wall to which it is fastened.

9.8.7.7. Obstructions. Handrails shall be constructed with no obstruction on or above them to break a handhold except where the handrail is interrupted by newels at changes in direction.

9.8.7.8. Handrail Projection. Handrails and stair stringers shall not project more than 100 mm into the required width of stairway.

9.8.7.9. Handrails for Ramps. Where ramps are used in lieu of stairs, the handrail requirements for stairs in Articles 9.8.7.1. to 9.8.7.8. shall apply where the gradient exceeds 1 in 10.

9.8.7.10. Attachment of Handrails

(1) Handrails shall be attached to wood studs, wood blocking, steel studs or masonry at points spaced not more than 1.2 m apart.

(2) Attachment to wood studs and blocking required in Sentence (1) shall consist of not less than 2 wood screws at each point, penetrating not less than 32 mm into solid wood.

9.8.8. Guards

9.8.8.1. Required Guards

(1) Every exterior landing, porch and every balcony, *mezzanine*, gallery, raised *walkway* and roof to which access is provided for other than maintenance purposes, shall be protected by *guards* on all open sides where the difference in elevation between adjacent levels exceeds 600 mm.

(2) Every exterior stair with more than 6 risers shall be protected with *guards* on all open sides where the difference in elevation between the adjacent ground level and the stair exceeds 600 mm.

(3) When an interior stair has more than 2 risers, the sides of the stair and the landing or floor level around the stair well shall be enclosed by walls or be protected by *guards*, except that a stair to an unfinished *basement* in a *dwelling unit* may have one unprotected side.

(See Appendix A.)

9.8.8.2. Height of Guards

(1) Except as provided in Sentences (2) to (5), all *guards*, including those for balconies, shall be not less than 1 070 mm high.

(2) *Guards* for porches, decks, landings and balconies serving not more than one *dwelling unit* and which are not more than 1.8 m above the finished ground level are permitted to be a minimum of 900 mm high.

(3) Except as provided in Sentence (4), *guards* for stairs shall be not less than 900 mm high measured vertically from a line drawn through the outside edges of the stair nosings, and 1 070 mm in height at landings.

(4) *Guards* for stairs within *dwelling units* and stairs serving not more than one *dwelling unit* shall be not less than 800 mm measured vertically above a line drawn through the outside edges of stair nosings, and not less than 900 mm above landings.

(5) All required *guards* within *dwelling units* other than those described in Sentence (4), shall be not less than 900 mm high.

9.8.8.3. Guards for Floors and Ramps in Garages. Except for floors of garages referred to in Section 9.35, a continuous curb not less than 150 mm in height and a *guard* not less than 1 070 mm above the floor level shall be provided at every opening through a garage floor and around the perimeter of such floor and ramps where the exterior walls are omitted and where the top of the floor is 600 mm or more above an adjacent ground or floor level.

9.8.8.4. Openings in Guards. Openings through a *guard* on a balcony or an *exit* stair, except an *exit* stair serving not more than one *dwelling unit*, shall be of a size as to prevent the passage of a spherical object having a diameter of 100 mm in *residential occupancies* and 200 mm in other *occupancies*, unless it can be shown that the location and size of openings which exceed these limits do not represent a hazard.

9.8.8.5. Design to Prevent Climbing. *Guards* around exterior balconies of *buildings of residential occupancy* shall be designed so that no member, attachment or opening between 100 mm and 900 mm above the balcony floor will facilitate climbing.

9.8.8.6. Guards for Ramps. *Guards* for ramps including vehicular ramps shall conform to the requirements for *guards* for stairs in Articles 9.8.8.2. and 9.8.8.4.

9.8.9. Construction

9.8.9.1. 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 by 150 mm or shall be cantilevered from the main *foundation* wall;
- (b) when cantilevered from the *foundation* wall, constructed and installed in conformance with Subsection 9.8.10.

(2) The depth below ground level for *foundations* for exterior steps shall conform to the requirements in Section 9.12.

9.8.9.2. Exterior Wood Steps. Exterior wood steps shall not be in direct contact with the ground unless suitably treated with a wood preservative.

9.8.9.3. Wooden Stair Stringers

- (1) Wooden stair stringers shall
 - (a) have a minimum effective depth of 90 mm and an over-all 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. for stairs serving not more than one *dwelling unit* and 600 mm o.c. in other stairs.

(2) For stairs serving not more than one *dwelling unit* where risers support the front portion of the tread, the space between stringers shall be not more than 1 200 mm.

9.8.9.4. Thickness of Treads. Lumber or plywood treads for stairs within *dwelling units* shall be not less than 25 mm actual thickness, except that if open risers are used, and the distance between stringers exceeds 750 mm, the treads shall be not less than 38 mm actual thickness.

9.8.9.5.

9.8.9.5. Finish for Treads and Landings

(1) The finish for treads and landings of interior stairs in *dwelling units*, other than stairs to unfinished *basements*, shall consist of hardwood, vertical grain softwood, resilient flooring or other material providing equivalent performance.

(2) Treads and landings of interior and exterior stairs and ramps, other than those within *dwelling units*, shall have a slip-resistant finish or be provided with slip-resistant strips which extend not more than 1 mm above the surface.

9.8.10. Cantilevered Precast Concrete Steps

9.8.10.1. Design. 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. Cantilevered concrete steps 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. 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. Scope

9.9.1.1. Application. 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. *Flame-spread ratings, fire-resistance ratings and fire-protection ratings* shall conform to Section 9.10.

9.9.2. General

9.9.2.1. Egress from Roof Area, Podiums, Terraces, Platforms and Contained Open Spaces

(1) An *access to exit* shall be provided from every roof intended for *occupancy* and from every podium, terrace, platform or contained open space.

(2) Where a roof is intended for an *occupant load* of more than 60 persons, not less than 2 separate *means of egress* shall be provided from the roof to stairs designed in conformance with the requirements for *exit* stairs and located remote from each other.

(3) Where a podium, terrace, platform or contained open space is provided, egress requirements shall conform to the appropriate requirements for rooms or *suites* in Article 9.9.7.3.

9.9.2.2. Types of Exits. *Exits* may consist of doorways, passageways, ramps, stairways and *horizontal exits*.

9.9.2.3. Fire Escapes

(1) Fire escapes may be used as *exits* on existing *buildings* provided they are designed and installed in conformance with Part 3.

(2) Fire escapes shall not be installed on any new *building*.

9.9.2.4. Elevators, Slide Escapes and Windows. Elevators, slide escapes or windows shall not be considered as part of a required *means of egress*.

9.9.2.5. Purpose of Exits. 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*.

9.9.2.6. Ancillary Rooms. Ancillary rooms such as storage rooms, washrooms, toilet rooms, laundry rooms and *service rooms* shall not open directly into an *exit*.

9.9.2.7. Barrier-Free Path of Travel

(1) Except as provided in Sentences (3) and (4), every *building* shall be designed to provide for a

9.9.5.8. Service Rooms. *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*.

9.9.6. Doors in a Means of Egress

9.9.6.1. Application. This Subsection applies to all doors in a *means of egress* except doors within *dwelling units* and exterior doors serving not more than one *dwelling unit* unless otherwise stated herein.

9.9.6.2. Obstructions by Doors

(1) *Exit* doors shall not decrease the required *exit* width by more than 100 mm in *exit* corridors, and not more than 50 mm for other *exit* facilities.

(2) Doors in their swing 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.

9.9.6.3. Headroom Obstructions. No door closer or other device shall be installed in an *exit* in such a manner as to reduce the headroom clearance to less than 1980 mm.

9.9.6.4. Door Sizes

(1) Every *exit* door or door that opens into or is located within a *public corridor* or other facility that provides *access to exit* from a *suite* shall

- (a) be not less than 2030 mm high,
- (b) be not less than 810 mm wide where there is only one door leaf, and
- (c) have no single leaf less than 610 mm wide in any multiple leaf door.

9.9.6.5. Direction of Door Swing

(1) Except as provided in Sentence 3.3.1.11.(1), every door that opens 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, and every door that is located within a corridor that is required to be separated from the remainder of the *floor area* by a *fire separation* shall swing on a vertical axis in the direction of *exit* travel and shall not open onto a step.

(2) Except as permitted in Sentences (3) and (4) and in Sentence 3.4.6.13.(1), every required *exit* door shall open in the direction of *exit* travel and shall swing on its vertical axis.

(3) An *exit* door serving not more than one *dwelling unit* is permitted to swing inward.

(4) *Exit* doors serving a *storage garage* serving not more than one *dwelling unit*, or doors serving other accessory *buildings* where there is no danger to life safety, need not conform to Sentence (2).

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 shall be not less than 300 mm.

(2) Where there is a danger of blockage from ice or snow, an *exit* door may open onto not more than one step provided the riser of such step does not exceed 150 mm.

9.9.6.7. Revolving Doors. Revolving doors used as *exits* shall conform to Article 3.4.6.14.

9.9.6.8. Door Opening Mechanism. *Exit* doors and doors to *suites*, including exterior doors to *dwelling units*, shall be openable from the inside without requiring keys, special devices or specialized knowledge of the door opening mechanism.

9.9.6.9. Automatic Locking Prohibited.

Except for hotels and motels, a door opening onto a *public corridor* which provides *access to exit* from *suites* shall be designed not to lock automatically when such doors are equipped with automatic self-closing devices. (See A-3.3.4.5. in Appendix A.)

9.9.6.10. Effort Required to Open. Every *exit* door 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 at the knob or other latch releasing device. (See Sentence 3.7.3.3.(7) for door opening forces in a *barrier-free* path of travel.)

9.9.7. Access to Exits

9.9.7.1. Means of Egress from Suites.

Except as permitted in Articles 9.9.7.2. and 9.9.9.3., each *suite* in a *floor area* occupied by more than one

9.9.7.1.

suite shall have an exterior *exit* doorway or a doorway to a *public corridor* or to an exterior passageway, and from the point where such doorway enters the *public corridor* or exterior passageway, it shall be possible to go in opposite directions to each of 2 separate *exits*.

9.9.7.2. Dead End Corridors. Except for a dead-end corridor that is entirely within a *suite* and except as permitted in Article 9.9.9.2., a dead-end corridor is permitted provided it is not more than 6 m long.

9.9.7.3. 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.A.

Table 9.9.7.A.
Forming Part of Sentence 9.9.7.3.(1)

Maximum Areas and Travel Distances for Rooms and Suites with a Single Egress Door		
Occupancy of Room, Suite or Floor Area	Maximum Area of Room, Suite or Floor Area, m ²	Maximum Distance to Egress Door, m
Group C (except <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
Column 1	2	3

(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.

9.9.7.4. Independent Access to Exit.

Required *access to exit* from *suites* shall not be through any other *dwelling unit*, *service room* or other *occupancy*.

9.9.7.5. Travel Distance within Rooms and Suites. 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 Clause 3.4.2.5.(1)(d), the travel distance may be determined in accordance with that Clause.

9.9.8.2. Number of Required Exits

(1) Except as provided in Sentence (2) and Subsection 9.9.9., not less than 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 9.9.7.3. and the total *occupant load* served by an *exit* facility does not exceed 60 persons.

9.9.8.3. Contribution of Each Exit. 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. Where more than one *exit* is required from a *floor area*, not less than 2 *exits* shall be independent of each other and be placed remote from each other along the path of travel between them.

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 with the requirements for *exits*, except that rooms other than *service rooms*, storage rooms and rooms of *residential* or *industrial occupancy* may 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 A-3.4.4.2.(2)(e) in Appendix A.)

9.9.8.6. Exits for Mezzanines. A *mezzanine* shall be provided with *exits* on the same basis as required for a *floor area* where a *mezzanine* is considered to be a *storey* in Subsection 9.10.4. or is of a size required to have more than one *exit*.

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 a sufficient number of *exits* or egress doors so that it shall not be necessary to travel up or down more than 1 *storey* 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* not more than 1.5 m above adjacent ground level.

(2) Where there is no *dwelling unit* above or below another *dwelling unit*, 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 is served by an openable window providing an unobstructed opening of not less than 1 m in height and 0.55 m in width, located so that the sill is not more than 1 m above the floor and not more than 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. Except as provided in Article 9.9.7.2., where an egress door from a *dwelling unit* opens onto a *public corridor* or exterior passageway it shall be possible from the location where the egress door opens onto the corridor or exterior passageway to go in opposite directions to 2 separate *exits* unless the *dwelling unit* has a second and separate *means of egress*.

9.9.9.3. Shared Egress Facilities

(1) A *dwelling unit* shall be provided with a second and separate *means of egress* where an egress door from the *dwelling unit* opens onto

- (a) an *exit stairway* serving more than one *suite*,
- (b) a *public corridor* serving more than one *suite* and served by a single *exit stairway*,
- (c) an exterior passageway serving more than one *suite* and served by a single *exit stairway*, or
- (d) a balcony serving more than one *suite* and served by a single *exit stairway*.

9.9.10. Exit Signs

9.9.10.1. Application. This Subsection applies to all *exits* except those serving not more than one *dwelling unit*.

9.9.10.2. Visibility of Exits. *Exits* shall be located so as to be clearly visible or their locations shall be clearly indicated.

9.9.10.3. Required Exit Signs. Except for the main entrance door to a *building*, every *exit door* in a *building* 3 *storeys* in *building height* or in a *building* having an *occupant load* greater than 150 shall have an *exit sign* over or adjacent to it.

9.9.10.4. Exit Direction Signs. *Exit* direction signs shall be placed in corridors and passageways where necessary to indicate the direction of *exit* travel.

9.9.10.5. Visibility of Exit Signs. *Exit* signs shall be installed so as to be visible from the *exit* approach and shall be illuminated continuously while the *building* is occupied.

9.9.10.6. Lettering

(1) *Exit* signs shall have the word EXIT or SORTIE in red letters on a contrasting background or a red background with contrasting letters when the sign is internally lighted, and white letters on a red background or red letters on a white background when the sign is externally lighted.

(2) Lettering referred to in Sentence (1) shall be made with not less than 19 mm wide strokes and be not less than 150 mm high when the sign is externally lighted, and not less than 114 mm high when the sign is internally lighted.

9.9.10.7. Illumination. Where illumination of *exit* signs required in Article 9.9.10.3. is provided by an electrical circuit, that circuit shall serve no equipment other than emergency equipment.

9.9.10.8. Exits Continuing to a Basement. In *buildings* 3 storeys in *building* height any part of an *exit* ramp or stair that continues down to a *basement* past an exterior *exit* door shall be clearly marked to indicate that it does not lead to an *exit* where the portion below ground level may be mistaken as the direction of *exit* travel.

9.9.11. Lighting

9.9.11.1. Application. This Subsection applies to the lighting of all *exits* except those serving not more than one *dwelling* unit.

9.9.11.2. Required Lighting in Egress Facilities. 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.

9.9.11.3. Emergency Lighting

- (1) Emergency lighting shall be provided in
 - (a) *exits*,
 - (b) principal routes providing *access to exit* in an open *floor* area,
 - (c) corridors used by the public,
 - (d) underground *walkways*, and
 - (e) *public* corridors.

(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 when the electric lighting in the affected area is interrupted.

(4) Illumination from lighting required in Sentence (1) shall be not less than 10 lx for a period of at least 30 min.

(5) Where incandescent lighting is provided, lighting equal to 1 W/m² of floor area shall be considered to meet the requirement in Sentence (4).

(6) Where self-contained emergency lighting units are used, they shall conform to CSA C22.2 No. 141, "Unit Equipment for Emergency Lighting."

Section 9.10 Fire Protection

9.10.1. General

9.10.1.1. Support of Noncombustible Construction. An assembly required to be of *noncombustible* construction shall be supported by *noncombustible* construction.

9.10.1.2. Sloped Roofs. For the purposes of this Section, roofs with slopes of 60° or more to the horizontal and which are adjacent to a room or space intended for *occupancy* shall be considered as a wall.

9.10.1.3. Dispensing of Fuel. Except as provided in Article 3.3.5.9., facilities for the dispensing of fuel shall not be installed in any *building*.

9.10.1.4. Commercial Cooking Equipment. In kitchens containing commercial cooking equipment used in processes producing grease-laden

vapours, the equipment shall be designed and installed in conformance with Part 6. (See Appendix A.)

9.10.1.5. Other Items Under Part 3 Jurisdiction. Tents, *air-supported structures*, transformer vaults, *walkways*, elevators and escalators shall conform to Part 3.

9.10.1.6. Openings through Floors. 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).)

9.10.1.7. Assembly Occupancy. Where rooms or spaces are intended for an *assembly occupancy*, such rooms or spaces shall conform to Part 3.

9.10.1.8. Hazardous or Explosive Material. 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 A-3.3.1.2.(1) in Appendix A.)

9.10.1.9. Appliances Installed on a Roof. Where fuel-fired *appliances* are installed on a roof, such *appliances* shall be installed in conformance with Part 6.

9.10.1.10. Sprinkler, Standpipe and Hose Systems. Where sprinkler, standpipe and hose systems are installed, they shall be installed in conformance with Part 3.

9.10.1.11. Chutes and Shafts. Chutes and shafts shall conform to Subsection 3.5.3. except where they are entirely contained within a *dwelling unit*.

9.10.1.12. Large or Multi-Storey Basements. *Basements* containing more than 1 *storey* or exceeding 600 m² in area shall conform to the requirements contained in Part 3.

9.10.2. Occupancy Classification

9.10.2.1. Occupancy Classification. 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.A.

Table 9.10.2.A.
Forming Part of Article 9.10.2.1.

Occupancy Classifications		
Group	Division	Description of Major Occupancies ⁽¹⁾
C	—	Residential occupancy
D	—	Business and personal services occupancies
E	—	Mercantile occupancies
F	2	Medium hazard industrial occupancies
F	3	Low hazard industrial occupancies (Does not include storage garages serving individual dwelling units)
Col. 1	2	3

Note to Table 9.10.2.A.:
⁽¹⁾ See A-3.1.2.A. in Appendix A.

9.10.2.2. Custodial and Convalescent Homes. 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 may be classified as *residential occupancies* (Group C).

9.10.2.3. Major Occupancies above Other Major Occupancies. 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. 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 per cent of the *floor area* on the *storey* on which they are located, they need not be considered as *major occupancies* for the purposes of Articles 9.10.8.1. and 9.10.2.3. provided they are not classified as Group F, Division 2 *occupancies*.

9.10.3. Ratings

9.10.3.1. Fire-Resistance and Fire-Protection Ratings. 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 Chapter 2 of the Supplement to the NBC 1990, with the test methods described in Part 3 or with A-9.10.3.1. in Appendix 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 Chapter 2 of the Supplement to the NBC 1990.

(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) *Firewalls* and 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.

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

e 9.10.4.1. Mezzanines not Considered as Storeys

(1) *Mezzanines* shall not be considered as *storeys* for the purpose of determining *building height* where the aggregate area of *mezzanine* floors does not

exceed 10 per cent of the *floor area* of the *storey* in which they are located.

(2) *Mezzanines* shall not be considered as *storeys* for the purpose of determining *building height* where they occupy an aggregate area of less than 40 per cent of the *floor area* of the *storey* in which they are located provided the space above the *mezzanine* floors and the floor below them have no visual obstructions more than 1 070 mm above such floors.

(See A-3.2.1.1.(3) in Appendix A.)

9.10.4.2. More Than One Level of Mezzanine. Where more than one level of *mezzanine* is provided in a *storey*, each level additional to the first shall be considered as a *storey*.

9.10.4.3. Basement Storage Garages.

Where a *basement* is used primarily as a *storage garage*, the *basement* may 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. Roof-Top Enclosures. Roof-top enclosures provided for elevator machinery, stairways and *service rooms*, used for no purpose other than for service to the *building*, shall not be considered as a *storey* in calculating the *building height*.

9.10.5. Permitted Openings in Wall and Ceiling Membranes

9.10.5.1. Permitted Openings in Wall and Ceiling Membranes

(1) Except as permitted in Sentences (2) and (4), a membrane forming part of an assembly required to have a *fire-resistance rating* shall not be pierced by openings into the assembly unless the assembly has been tested and rated for such openings.

(2) A wall or ceiling membrane forming part of an assembly required to have a *fire-resistance rating* may be pierced by openings for electrical and similar service outlet boxes provided such outlet boxes are tightly fitted.

(3) Where boxes referred to in Sentence (2) are located on both sides of walls required to provide a

(4) Electrical wires or cables, single or grouped, with *combustible* insulation or jacketing that is not totally enclosed in raceways of *noncombustible* material, may partly or wholly penetrate an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required in Sentence (2) provided the overall diameter of the wiring is not more than 25 mm.

(5) *Combustible* totally enclosed raceways which are embedded in a concrete floor slab are permitted in an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required in Sentence (2) where the concrete provides not less than 50 mm of cover between the raceway and the bottom of the slab.

(6) *Combustible* outlet boxes are permitted in an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required in Sentence (2) provided the opening through the membrane into the box does not exceed 160 cm².

(7) *Combustible* water distribution piping that has an outside diameter not more than 30 mm is permitted to partly or wholly penetrate a vertical *fire separation* that is required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required in Sentence (2) provided the piping is sealed in conformance with Article 3.1.9.1.

(8) *Combustible* sprinkler piping is permitted to penetrate a *fire separation* provided the *fire compartments* on each side of the *fire separation* are sprinklered.

9.10.9.7. Combustible Drain, Waste and Vent Piping

(1) Except as permitted in Sentences (2) to (6), *combustible* piping shall not be used in any part of a drain, waste and vent piping system where any part of that system partly or wholly penetrates a *fire separation* required to have a *fire-resistance rating* or penetrates a membrane that forms part of an assembly required to have a *fire-resistance rating*.

(2) *Combustible* drain, waste and vent piping not located in a vertical shaft is permitted to penetrate a *fire separation* required to have a *fire-resistance rating* or a membrane that forms part of an assembly

required to have a *fire-resistance rating* provided the piping is sealed at the penetration by a firestop system that has an F rating not less than the *fire-resistance rating* required for the *fire separation*.

(3) The rating referred to in Sentence (2) shall be based on CAN4-S115, "Standard Method of Fire Tests for Firestop Systems" with a pressure differential of 50 Pa between the exposed and unexposed sides, with the higher pressure on the exposed side.

(4) *Combustible* drain piping is permitted to penetrate a horizontal *fire separation* provided it leads directly from a *noncombustible* water closet through a concrete floor slab.

(5) *Combustible* drain, waste and vent piping is permitted on one side of a vertical *fire separation* provided it is not located in a vertical shaft.

(6) In buildings containing two dwelling units only, *combustible* drain, waste and vent piping is permitted on one side of a horizontal *fire separation*.

9.10.9.8. Collapse of Combustible Construction. *Combustible construction* that abuts on or is supported by a *noncombustible fire separation* shall be constructed so that its collapse under fire conditions will not cause collapse of the *fire separation*.

9.10.9.9. Reduction in Thickness of Fire Separation by Beams and Joists. Beams and joists framed into a masonry or concrete *fire separation* shall not reduce the thickness of the *fire separation* to less than 100 mm of masonry or concrete.

9.10.9.10. Concealed Spaces above Fire Separations

(1) Except as provided in Sentence (2), a *horizontal service space* or other concealed space located above a required vertical *fire separation* shall be divided at the *fire separation* by an equivalent *fire separation* within the space.

(2) Where a *horizontal service space* or other concealed space is located above a required vertical *fire separation* other than a vertical shaft, such space need not be divided as required in Sentence (1) provided the construction between such space and the space below is constructed as a *fire separation* having a *fire-resistance rating* not less than that required for the vertical *fire separation*, except that where the vertical *fire separation* is not required to

have a *fire-resistance rating* greater than 45 min, the *fire-resistance rating* of the ceiling may be reduced to 30 min.

9.10.9.11. Separation of Residential Occupancies

(1) Except as provided in Sentence (2), *residential occupancies* shall be separated from all other *major occupancies* by a *fire separation* having a *fire-resistance rating* of not less than 1 h.

(2) 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, except that where not more than 2 *dwelling units* are located in a building containing a *mercantile occupancy*, such *mercantile occupancy* shall be separated from the *dwelling units* by a *fire separation* having not less than 1 h *fire-resistance rating*.

9.10.9.12. Residential Suites in Industrial Buildings. Not more than one *suite* of *residential occupancy* shall be contained within a building classified as a Group F, Division 2 *major occupancy*.

9.10.9.13. Separation of Suites

(1) Except as required in Article 9.10.9.14. and as permitted by 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.(1)(c) are not required to be separated from each other by *fire separations*.

9.10.9.14. Separation of Residential Suites

(1) Except as provided in Sentences (2) and (3) and Article 9.10.20.2., *suites* in *residential occupancies* shall be separated from adjacent rooms and *suites* by a *fire separation* having a *fire-resistance rating* of not less than 45 min.

(2) Sleeping rooms in boarding and lodging houses where sleeping accommodation is provided for not more than 8 boarders or lodgers need not be separated from the remainder of the *floor area* as

required in Sentence (1) where the sleeping rooms form part of the proprietor's residence and do not contain cooking facilities.

(3) *Dwelling units* that contain 2 or more *storeys* including *basements* shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* of not less than 1 h. (See A-3.3.4.4.(1) in Appendix A.)

9.10.9.15. Separation of Public Corridors

(1) Except as provided in Sentences (2) and (3), *public corridors* shall be separated from the remainder of the *building* by a *fire separation* having not less than a 45 min *fire-resistance rating*.

(2) In other than *residential occupancies*, no *fire-resistance rating* is required for *fire separations* between a *public corridor* and the remainder of the *building* if the *floor area* is *sprinklered* in conformance with Sentence 3.3.1.4.(2).

(3) In other than *residential occupancies*, no *fire separation* is required between a *public corridor* and the remainder of the *building* if the *floor area* is *sprinklered* in conformance with Sentence 3.3.1.4.(2) and the corridor exceeds 5 m in width.

9.10.9.16. Separation of Storage Garages

(1) Except as provided in Sentences (2) and (3), a *storage garage* shall be separated from other *occupancies* by a *fire separation* having not less than a 1.5 h *fire-resistance rating*.

(2) Except as permitted in Sentence (3), *storage garages* containing 5 cars 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 built in, 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* where

- (a) the construction between the garage and the *dwelling unit* provides an effective barrier to gas and exhaust fumes, and
- (b) every door between the garage and the *dwelling unit* conforms to Article 9.10.13.15.

(See Appendix A.)

9.10.9.17. Separation of Repair Garages

(1) Except as provided in Sentence (2), 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).

9.10.9.18. Exhaust Ducts Serving More Than One Fire Compartment.

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, and such individual *fire compartments* shall not have fans that exhaust directly into the duct in the *vertical service space*.

9.10.10. Service Rooms

9.10.10.1. Application. This Subsection applies to *service rooms* in all *buildings* except rooms located within a *dwelling unit*.

9.10.10.2. Service Room Floors. 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. Appliances and Equipment to be Located in a Service Room

(1) Except as provided in Sentence (2) and Article 9.10.10.5., fuel-fired *appliances* other than fireplaces 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 Sentence 6.2.1.4.(1) and Article 9.33.1.2., fuel-fired *space-heating appliances*, *space-cooling appliances* and *service water heaters* need not be separated from the remainder of the *building* as required in Sentence (1), where the equipment serves

- (a) not more than one room or *suite*, or
- (b) a *building* with a *building area* of not more than 400 m² and a *building height* of not more than 2 *storeys*.

9.10.10.5. Incinerators

(1) *Service rooms* containing incinerators shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* of not less than 2 h.

(2) The design, construction, installation and alteration of each indoor incinerator shall conform to NFPA 82, "Incinerators, 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. Rooms for the temporary storage of *combustible refuse* in all *occupancies* or for public storage in *residential occupancies* shall be separated from the remainder of the *building* by a *fire separation* having not less than a 1 h *fire-resistance rating*, except that a 45 min *fire separation* is permitted where the *fire-resistance rating* of the floor assembly is not required to exceed 45 min, or where such rooms are sprinklered.

9.10.11. Firewalls

9.10.11.1. Required Firewalls. Except as provided in Article 9.10.11.2., a *party wall* on a property line shall be constructed as a *firewall*.

9.10.11.2. Firewalls Not Required

(1) In a *building* of *residential occupancy* in which there is no *dwelling unit* above another *dwelling unit*, a *party wall* on a property line between *dwelling*

units need not be constructed as a *firewall* provided it is constructed as a *fire separation* having not less than a 1 h *fire-resistance rating*.

(2) The wall described in Sentence (1) shall provide continuous protection from the top of the footings to the underside of the roof deck.

(3) Any space between the top of the wall described in Sentence (1) and the roof deck shall be tightly sealed by caulking with mineral wool or *noncombustible* material.

e 9.10.11.3. **Construction of Firewalls.** Where *firewalls* are used, the requirements in Subsection 3.1.10. shall apply.

9.10.12. Prevention of Fire Spread at Exterior Walls and between Storeys

9.10.12.1. **Separation of Exterior Openings.** In *buildings of mercantile or medium hazard industrial occupancy*, the exterior openings in one *storey* shall be separated from openings in an adjacent *storey* by not less than 1 m of wall, or a canopy or balcony not less than 1 m in width having a *fire-resistance rating* not less than that required for the floor assembly, except that the rating need not exceed 1 h.

9.10.12.2. Termination of Floors or Mezzanines

(1) Except as provided in Sentence (2) and in Articles 9.10.1.6. 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.

9.10.12.3. **Location of Skylights.** Where a wall in a *building* is exposed to a fire hazard from an adjoining roof of a separate unsprinklered *fire compartment* in the same *building*, the roof shall contain no skylights within a horizontal distance of 5 m of the windows in the exposed wall.

9.10.12.4. 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 opening in one wall to an opening in the other wall shall be not less than 1.2 m, where the openings are in different *fire compartments*.

(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*.

9.10.12.5. Protection of Soffits

(1) Except as provided in Sentence (2), where a common *attic* or *roof space* spans more than 2 *suites of residential occupancy* and projects beyond the exterior wall of the *building*, the portion of any soffit or other surface enclosing the projection which is less than 2.5 m vertically above a window or door and less than 1.2 m from either side of the window or door, shall have no unprotected openings and shall be protected by

- (a) *noncombustible* material having a minimum thickness of 0.38 mm and a melting point not below 650°C,
- (b) not less than 11-mm thick plywood,
- (c) not less than 12.5-mm thick waferboard or strandboard, or
- (d) not less than 11-mm thick lumber.

(2) Where such soffit or other surface is completely separated from the remainder of the *attic* or *roof space* by fire stopping, the requirements in Sentence (1) do not apply. (See Appendix A.)

9.10.13. Doors, Dampers and Other Closures in Fire Separations

9.10.13.1. **Closures.** 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.A. and shall be installed in conformance with Chapters 2 to 14 of NFPA 80, "Fire Doors and Windows" unless otherwise specified herein. (See also Article 9.10.3.1.)

Table 9.10.14.A.
Forming Part of Article 9.10.14.1.

Maximum Percentage of Unprotected Openings in Exterior Walls													
Occupancy Classification of Building	Maximum Area of Exposing Building Face, m ²	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
Column 1	2	3	4	5	6	7	8	9	10	11	12	13	14

equipped to meet the needs of the community, the *limiting distance* determined from Article 9.10.14.1. or required in Articles 9.10.14.12., 9.10.14.14. and 9.10.14.16., shall be doubled.

9.10.14.4. Alternate Method of Determining Limiting Distance. The *limiting distance* shown in Table 9.10.14.A. may be reduced provided it is not less than the square root of the aggregate area of *unprotected openings* in an *exposing building face* in *residential occupancies, business and personal services occupancies and low hazard industrial occupancies*, and is not less than the square root of twice the aggregate area of *unprotected openings* in *mercantile occupancies and medium hazard industrial occupancies*.

9.10.14.5. Openings in Walls Having a Limiting Distance Less Than 1.2 m. 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.A.)

9.10.14.6. Allowance for Sprinklers and Wired Glass or Glass Block. The maximum area of *unprotected openings* may be doubled where the building is *sprinklered*, or where the *unprotected openings* are glazed with wired glass in steel frames or glass blocks as described in Articles 9.10.13.5. and 9.10.13.7. (See A-3.2.3.11. in Appendix A.)

9.10.14.7. Exterior Wall Construction for Irregular-Shaped Buildings. For the purpose of using Table 9.10.14.B to determine the required type of construction, cladding and *fire-resistance rating* for an exterior wall, 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 *exposing building face* of the building is between the vertical plane and the line to which the *limiting distance* is measured and, for these purposes, the permitted area of *unprotected openings* shall be determined from Table 9.10.14.A. or Article 9.10.14.4., using the *limiting distance* measured from this *exposing building face*. (See A-3.2.3.1.(4) in Appendix A.)

9.10.14.8.

9.10.14.8. Percentage of Unprotected Openings for Irregular-Shaped Buildings.

For the purpose of using Table 9.10.14.A. to determine 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 A-3.2.3.1.(4) in Appendix A.)

9.10.14.9. Storeys at Street Level. 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.

9.10.14.10. Open-Air Storage Garages.

When a *storage garage* has all *storeys* constructed as *open-air storeys*, the *exposing building face* of such garage is permitted to have unlimited *unprotected openings* provided the *storage garage* has a *limiting distance* of not less than 3 m.

9.10.14.11. Construction of Exposing Building Face.

Except as permitted in Articles 9.10.14.12. to 9.10.14.16., 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.B. and Subsection 9.10.8.

9.10.14.12. Exposing Building Face of Houses

(1) Except as required in Article 9.10.14.3., in *buildings* containing only *dwelling units* in which there is no *dwelling unit* above another *dwelling unit*, the requirements of Article 9.10.14.11. do not apply provided that the *exposing building face* has a *fire-resistance rating* of not less than 45 min where the *limiting distance* is less than 1.2 m, and when the *limiting distance* is less than 0.6 m, the *exposing building face* is clad with *noncombustible* material.

(2) Window openings in the *exposing building face* referred to in Sentence (1) shall not be permitted

Table 9.10.14.B.
Forming Part of Article 9.10.14.11.

Minimum Construction Requirements for Exposing Building Faces				
Occupancy Classification of Building	Maximum Percentage of Unprotected Openings Permitted, per cent	Minimum Required Fire-Resistance Rating	Type of Construction Required	Type of Cladding Required
<i>Residential, business and personal services, and low hazard industrial</i>	0 – 10	1 h	Noncombustible	Noncombustible
	11 – 25	1 h	Combustible or noncombustible	Noncombustible
	26 – 100	45 min	Combustible or noncombustible	Combustible or noncombustible
<i>Mercantile, and medium hazard industrial</i>	0 – 10	2 h	Noncombustible	Noncombustible
	11 – 25	2 h	Combustible or noncombustible	Noncombustible
	26 – 100	1 h	Combustible or noncombustible	Combustible or noncombustible
Column 1	2	3	4	5

if the *limiting distance* is less than 1.2 m and shall be limited in conformance with the requirements for *unprotected openings* in Article 9.10.14.1. where the *limiting distance* is 1.2 m or greater.

9.10.14.13. Combustible Projections.

Except for *buildings* containing 1 or 2 *dwelling units* only, *combustible* projections on the exterior of a wall that are more than 1 m above ground level, such as balconies, platforms, canopies, eave projections and stairs, and that could expose an adjacent *building* to fire spread, shall not be permitted within 1.2 m of a property line or the centreline of a *public way*, or within 2.4 m of a *combustible* projection on another *building* on the same property.

9.10.14.14. Detached Garage Serving One Dwelling Unit

(1) Except as required in Article 9.10.14.3., the *exposing building face* of a detached garage that serves one *dwelling unit* only shall have a *fire-resistance rating* of not less than 45 min, except that no *fire-resistance rating* is required where the *limiting distance* is 0.6 m or greater.

(2) The *exterior cladding* of detached garages described in Sentence (1) is not required to be *non-combustible* regardless of the *limiting distance*.

(3) The percentage of window openings permitted in the *exposing building face* of detached garages described in Sentence (1) shall conform to the requirements for *unprotected openings* in Article 9.10.14.1.

(4) Where a detached garage serves only one *dwelling unit* and is located on the same property as that *dwelling unit*, then the requirements for *limiting distance* shall not apply between the garage and the *dwelling unit*.

9.10.14.15. Heavy Timber and Steel Columns.

Heavy timber and steel columns need not conform to the requirements of Article 9.10.14.11. provided the *limiting distance* is not less than 3 m.

9.10.14.16. Low Fire Load Occupancies.

Except as required in Article 9.10.14.3., in *buildings* of 1 storey in building height of *noncombustible construction* classified as *low hazard industrial occupancy* which are used only for *low fire load occupancies* such as power generating plants or plants for the manufac-

ture or storage of *noncombustible* materials, *non-loadbearing* wall components need not have a minimum *fire-resistance rating* provided the *limiting distance* is 3 m or more.

9.10.15. Fire Stops

9.10.15.1. Required Fire Stops in Concealed Spaces

(1) Concealed spaces in interior walls, ceilings and crawl spaces shall be separated by fire stops from concealed spaces in exterior walls and *attic* or *roof spaces*.

(2) Fire stops 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.

(3) Fire stops 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.

(4) In unsprinklered *buildings* of *combustible construction*, every concealed space created by a ceiling, roof space or unoccupied attic space shall be separated by fire stops into compartments of not more than 300 m² in area where such space contains exposed construction materials having a surface *flame-spread rating* greater than 25.

(5) No dimension of the concealed space described in Sentence (4) shall exceed 20 m.

(6) 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 stops at intervals of not more than 20 m and at points where such concealed spaces extend across the ends of required vertical *fire separations*.

9.10.15.2. Required Fire Stops in Wall Assemblies

(1) Except as permitted in Sentences (2) and (3), fire stops shall be provided to block off concealed spaces within wall assemblies, including spaces created by furring, at each floor level, and at each

ceiling level where the ceiling contributes to part of the required *fire-resistance rating*, and at other locations within the wall, so that the distance between fire stops does not exceed 20 m horizontally and 3 m vertically.

(2) Fire stops required in Sentence (1) are not required provided the exposed construction materials within the wall space, including insulation, but not including wiring, piping or similar services, have a *flame-spread rating* of not more than 25.

(3) Fire stops required in Sentence (1) are not required provided the wall space is filled with insulation.

9.10.15.3. Fire Stop Materials. Fire stops shall be constructed of not less than 0.38 mm sheet steel, 6 mm asbestos board, 12.7 mm gypsum wall-board, 12.5 mm plywood, waferboard or strand-board, with joints having continuous support, 2 layers of 19 mm lumber with joints staggered, 38 mm lumber or materials conforming to Sentence 3.1.11.7.(1).

9.10.15.4. Penetration of Fire Stops. Where fire stops are pierced by pipes, ducts or other elements, the effectiveness of the fire stops shall be maintained around such elements.

9.10.16. Flame Spread Limits

9.10.16.1. 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* need not conform to Sentences (1) and (2).

9.10.16.2. Ceilings in Exits or Public Corridors. At least 90 per cent of the exposed surface of every ceiling in an *exit* or unsprinklered

ceiling in a *public corridor* shall have a surface *flame-spread rating* of not more than 25. (See Article 9.10.16.6.)

9.10.16.3. Walls in Exits

(1) Except as provided in Sentence (2), at least 90 per cent of the exposed surfaces of every wall in an *exit* shall have a surface *flame-spread rating* of not more than 25. (See Article 9.10.16.6.)

(2) At least 75 per cent 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 9.10.16.6.)

9.10.16.4. Exterior Exit Passageways.

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 per cent of the total wall area and 10 per cent of the total ceiling area is permitted to have a surface *flame-spread rating* of not more than 150.

9.10.16.5. Walls in Public Corridors. At least 90 per cent of the total wall surface in any unsprinklered *public corridor* shall have a surface *flame-spread rating* of not more than 75, or at least 90 per cent of the upper half of such walls shall have a surface *flame-spread rating* of not more than 25. (See Article 9.10.16.6.)

9.10.16.6. Calculation of Wall and Ceiling Areas. *Combustible* doors, skylights, glazing and *combustible* light diffusers and lenses shall not be considered in the calculation of wall and ceiling areas in this Subsection.

9.10.16.7. Corridors Containing an Occupancy. 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*.

9.10.16.8. Light Diffusers and Lenses. Light diffusers and lenses having *flame-spread ratings*

(3) Access panels required in Sentence (1) need not be provided in *buildings* containing only *dwelling units* where there is no *dwelling unit* above another *dwelling unit*.

9.10.19.2. Access to Basements

(1) Except in *basements* serving not more than one *dwelling unit*, each unsprinklered *basement* exceeding 25 m in length or width shall be provided with direct access to the outdoors to not less than 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.

9.10.19.3. Fire Department Access to Buildings

(1) Access for fire department equipment shall be provided to each *building* by means of a *street*, private roadway or yard. (See A-3.2.5.7.(1) in Appendix A.)

(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 fire fighting equipment, width of roadway, radius of curves, overhead clearance, location of fire hydrants, location of fire department connections and vehicular parking.

9.10.19.4. Portable Extinguishers. Portable extinguishers shall be installed in all *buildings*, except within *dwelling units*, in conformance with the appropriate provincial or municipal regulations or, in the absence of such regulations, the National Fire Code of Canada 1990.

9.10.20. Fire Protection for Construction Camps

9.10.20.1. Requirements for Construction Camps. Except as provided in Articles 9.10.20.2. to

9.10.20.9., construction camps shall conform to Subsections 9.10.1. to 9.10.19.

9.10.20.2. Separation of Sleeping Rooms.

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*.

9.10.20.3. Floor Assemblies between the First and Second Storey. 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*.

9.10.20.4. Walkways Connecting Buildings. *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*.

9.10.20.5. Spatial Separations. Construction camp *buildings* shall be separated from each other by a distance of not less than 10 m except as otherwise permitted in Subsection 9.10.14.

9.10.20.6. 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 per cent 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 having a *fire-resistance rating* of not less than 45 min shall have a *flame-spread rating* conforming to the appropriate requirements in Subsection 9.10.16.

9.10.20.7. Smoke Detectors. 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*.

9.10.20.8. Portable Fire Extinguishers. Each construction camp *building* shall be provided

with portable fire extinguishers in conformance with the appropriate provincial or municipal regulations or, in the absence of such regulations, in conformance with the National Fire Code of Canada 1990.

9.10.20.9. 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 the range 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.

Section 9.11 Sound Control

9.11.1. Sound Transmission Class Rating (Airborne Sound)

9.11.1.1. Determination of Sound Transmission Class Ratings. Sound transmission class ratings shall be determined in accordance with ASTM E413, "Classification for Rating Sound Insulation," using results from measurements in accordance with ASTM E90, "Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions" or ASTM E336, "Measurement of Airborne Sound Insulation in Buildings." (See Appendix A.)

9.11.2. Required Sound Control Locations (Airborne Sound)

9.11.2.1. Minimum Sound Transmission Class Ratings

(1) Except as provided in Sentence (2), every

dwelling unit shall be separated from every other space in a *building* in which noise may be generated by a construction providing a sound transmission class rating of at least 50, measured in accordance with Subsection 9.11.1. or listed in A-9.10.3.1. in Appendix A.

(2) Where a *dwelling unit* is adjacent to an elevator shaft or a refuse chute, the separating construction shall have a sound transmission class rating of at least 55, measured in accordance with Subsection 9.11.1. or listed in A-9.10.3.1. in Appendix A.

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 termites are known to occur, 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. *Excavations* shall be kept free of standing water.

9.12.1.3. Protection from Freezing. 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. *Excavations* for *foundations* shall extend to undisturbed *soil*.

9.12.2.2. Minimum Depth of Foundations

(1) Except as provided in Sentences (4) and (5), the minimum depth of *foundations* below finished ground level shall conform to Table 9.12.2.A.

(2) The minimum depth of *foundations* for exterior concrete steps with more than 2 risers shall conform to Sentences (1) to (5).

Table 9.12.2.A.
Forming Part of Sentence 9.12.2.2.(1)

Minimum Depths of Foundation				
Type of Soil	Foundation Containing Heated Basement or Crawl Space		Foundation Containing no Heated Space	
	Good Soil Drainage to not less than the Depth of Frost Penetration	Poor Soil Drainage	Good Soil Drainage to not less than the Depth of Frost Penetration	Poor Soil Drainage
Rock	No limit	No limit	No limit	No limit
Coarse grained soils	No limit	No limit	No limit	Below the depth of frost penetration
Silt	No limit	No limit	Below the depth of frost penetration	Below the depth of frost penetration
Clay or soils not clearly defined ⁽¹⁾	1.2 m	1.2 m	1.2 m but not less than the depth of frost penetration	1.2 m but not less than the depth of frost penetration
Column 1	2	3	4	5

Note to Table 9.12.2.A.:

⁽¹⁾ See Appendix A.

(3) Concrete steps with 1 and 2 risers are permitted to be laid on ground level.

(4) 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.

(5) The *foundation* depths required in Sentence (1) do not apply to *foundations* for *buildings* of other than masonry or masonry veneer construction

- (a) whose superstructure will not be damaged by differential *soil* movement caused by *frost action*, or
- (b) used as accessory *buildings* of not more than 1 *storey* in *building height* and not more than 50 m² in *building area*.

9.12.3. Backfill

9.12.3.1. Placement of Backfill. Backfill shall be placed to avoid damaging the *foundation* wall, the drainage tile, externally applied thermal insulation and waterproofing of the wall.

9.12.3.2. Grading of Backfill. Backfill shall be graded to prevent drainage towards the *foundation* after settling.

9.12.3.3. Deleterious Debris and Boulders. Backfill within 600 mm of the *foundation* shall be free of deleterious debris and boulders larger than 250 mm diam.

9.12.4. Trenches beneath Footings

9.12.4.1. The *soil* in trenches beneath footings for sewers and water mains 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 Waterproofing and Dampproofing

(See Appendix A.)

9.13.1. General

9.13.1.1. Required Waterproofing

(1) Where hydrostatic pressure occurs, floors on ground and exterior surfaces of walls below ground level shall be waterproofed.

(2) Roofs of underground structures shall be waterproofed to prevent the entry of water into the structure.

9.13.1.2. Required Dampproofing

(1) Where hydrostatic pressure does not occur and 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 in garages and unenclosed portions of *buildings*, concrete slabs-on-ground shall be dampproofed. (See A-9.13 in Appendix A.)

9.13.1.3. Standards for Application

(1) The method of application of all bituminous waterproofing and dampproofing materials shall conform to

- (a) CAN/CGSB-37.3-M, "Application of Emulsified Asphalts for Dampproofing or Waterproofing,"
- (b) CGSB 37-GP-12Ma, "Application of Unfilled Cutback Asphalt for Dampproofing," or
- (c) CAN/CGSB-37.22-M, "Application of Unfilled Cutback Tar Foundation Coating for Dampproofing."

9.13.2. Material

9.13.2.1. Material Standards

(1) Materials used for dampproofing or waterproofing shall conform to

- (a) CAN/CGSB-37.2-M, "Emulsified Asphalt, Mineral Colloid Type, Unfilled, for

Dampproofing and Waterproofing and for Roof Coatings,"

- (b) CGSB 37-GP-6Ma, "Asphalt, Cutback, Unfilled, for Dampproofing,"
- (c) CAN/CGSB-37.16-M, "Filled Cutback Asphalt for Dampproofing and Waterproofing,"
- (d) CGSB 37-GP-18Ma, "Tar, Cutback, Unfilled, for Dampproofing,"
- (e) CSA A123.4, "Bitumen for Use in Construction of Built-Up Roof Coverings and Dampproofing and Waterproofing Systems," or
- (f) CAN/CGSB-51.34-M, "Vapour Barrier, Polyethylene Sheet, for Use in Building Construction."

9.13.3. Waterproofing of Walls

9.13.3.1. Preparation of Surface

(1) Unit masonry walls 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.

(2) Concrete walls to be waterproofed shall have all holes and recesses resulting from removal of form ties sealed with mortar or waterproofing material.

9.13.3.2. Application of Waterproofing Membranes. Concrete or unit masonry walls to be waterproofed shall be covered with not less than 2 layers of bitumen-saturated membrane, with each layer being cemented in place with bitumen and coated over-all with a heavy coating of bitumen.

9.13.4. Waterproofing of Floors

9.13.4.1. *Basement* floors 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 mopped to the wall membrane to form a complete seal.

9.13.5. Dampproofing of Walls

9.13.5.1. Preparation of Surface

(1) 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, and shall be covered over the footing when the first course of block is laid.

(2) Concrete walls to be dampproofed shall have holes and recesses resulting from the removal of form ties sealed with cement mortar or dampproofing material.

9.13.5.2. Application of Dampproofing

Material. Bituminous or other dampproofing material shall be applied over the parging or concrete below ground level.

9.13.5.3. Interior Dampproofing of Walls

(1) Where a separate interior cladding is applied to a concrete or unit masonry wall which is in contact with the *soil*, or where wood members are applied to such walls for the installation of insulation or finish, the interior surface of the *foundation* wall below ground level shall be dampproofed.

(2) The dampproofing required in Sentence (1) shall extend from the *basement* floor and shall terminate at ground level and no membrane shall be applied above ground level between the insulation and the *foundation* wall.

9.13.5.4. Barrier to Soil Gas and Water Vapour.

Masonry walls which are to be dampproofed and which are not dampproofed on their interior surface as required in Sentence 9.13.5.3.(1) shall include a course of masonry units without voids or be sealed with flashing material extending across the full width of the masonry at or below the level of the adjoining floor slab or, in the absence of a floor slab, the level of the ground cover required in Article 9.18.6.1. (See A-9.13 in Appendix A.)

9.13.6. Dampproofing and Sealing of Slabs

9.13.6.1. Location of Dampproofing.

When slabs are dampproofed, the dampproofing shall be installed below the slab, except that where a separate floor is provided over the slab, the dampproofing may be applied to the top of the slab.

9.13.6.2. Dampproofing below the Slab

(1) When installed below the slab, dampproofing shall consist of polyethylene not less than 0.15 mm thick.

(2) Joints in dampproofing described in Sentence (1) shall be lapped not less than 300 mm.

9.13.6.3. Dampproofing above the Slab.

When installed above the slab, dampproofing shall consist of not less than 2 mopped-on coats of bitumen, 0.05 mm polyethylene or other material providing equivalent performance.

9.13.6.4. Perimeter Seal. The slab shall be sealed around its perimeter to the inner surfaces of adjacent walls using flexible sealant. (See A-9.13 in Appendix A.)

9.13.6.5. Seal of Penetrations. All penetrations of the slab by pipes or other objects shall be sealed against water vapour and *soil* gas leakage. (See A-9.13 in Appendix A.)

9.13.6.6. Seal of Drain Penetrations. All penetrations of the surface of the concrete slab which are required to drain water from the slab surface shall be sealed in a manner which prevents the upward flow of water vapour and *soil* gas without preventing the downward flow of liquid water. (See A-9.13 in Appendix A.)

Section 9.14 Drainage

9.14.1. Scope

9.14.1.1. Application. This Section applies to subsurface drainage and to surface drainage.

9.14.1.2. Crawl Spaces. Drainage for crawl spaces shall conform to Section 9.18.

9.14.1.3. Floor Slabs. Drainage requirements beneath floor slabs shall conform to Section 9.16.

9.14.2. General

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

9.14.2.1.

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, it shall extend to the footing level to facilitate drainage of ground water to the *foundation* drainage system. (See Appendix A.)

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, "Clay Drain Tile,"
- (b) ASTM C412-M, "Concrete Drain Tile,"
- (c) ASTM C444-M, "Perforated Concrete Pipe Metric,"
- (d) ASTM C700, "Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated,"
- (e) CAN/CGSB-34.22-M, "Pipe, Asbestos Cement, Drain,"
- (f) CGSB 41-GP-29Ma, "Tubing, Plastic, Corrugated, Drainage,"
- (g) CAN/CSA B182.1, "Plastic Drain and Sewer Pipe and Pipe Fittings," or
- (h) CAN3-G401, "Corrugated Steel Pipe Products."

9.14.3.2. Minimum Size. 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 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 per cent of material that will pass a 4 mm sieve.

9.14.4. Granular Drainage Layer

9.14.4.1. Type of Granular Material.

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 not more than 10 per cent of material that will pass a 4 mm sieve.

9.14.4.2. Installation. 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 *building* and extend not less than 300 mm beyond the outside edge of the footings.

9.14.4.3. Grading. 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. 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. *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 not less than 750 mm deep, 0.25 m² in area and be provided with a cover.

(2) 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.

9.18.5. Drainage

9.18.5.1. Drainage

(1) Unless *groundwater levels* and site conditions are such that water will not accumulate in the crawl space, the crawl space floor and access trenches shall be sloped to drain to a sewer, ditch or dry well.

(2) Drains shall conform to Section 9.14.

9.18.6. Ground Cover

9.18.6.1. Materials and Installation

(1) Except as required in Sentence (3), a ground cover consisting of not less than 50 mm of asphalt, 10 MPa Portland cement concrete, Type S roll roofing or 0.10 mm polyethylene shall be provided in every crawl space.

(2) Joints in sheet-type ground cover required in Sentence (1) shall be lapped not less than 100 mm and weighted down.

(3) Where a crawl space serves a *dwelling unit* and is not vented to the outside air, 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 provided in every crawl space.

(4) Joints in the ground cover required in Sentence (3) shall be lapped not less than 300 mm and weighted down.
(See A-9.13 in Appendix A.)

9.18.7. Fire Protection

9.18.7.1. Crawl Spaces as Warm Air Plenums

(1) Crawl spaces used as warm-air *plenums* in *buildings of residential occupancy* shall be restricted to 1-storey portions of *dwelling units*.

(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 covered with *noncombustible* material or have *noncombustible* receptacles beneath the register openings.

Section 9.19 Roof Spaces

9.19.1. Ventilation

9.19.1.1. Required Ventilation

(1) Except as provided in Article 9.19.1.2., every roof space or attic above an insulated ceiling shall be ventilated with openings to the exterior to provide unobstructed vent area of not less than 1/300 of the insulated ceiling area.

(2) Vents required in Sentence (1) may be roof type, eave type, gable-end type or any combination thereof, and shall be uniformly distributed on opposite sides of the *building*.

(3) Vents required in Sentence (1) shall be designed to prevent the entry of rain, snow and insects.

(4) The unobstructed vent area required in Sentence (1) shall be determined in conformance with CAN3-A93, "Natural Airflow Ventilators for Buildings."

9.19.1.2. Low Slope Roofs

(1) Where insulation is placed below the roof sheathing in roofs having a slope of 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.

(2) Vents described in Sentence (1) shall be uniformly distributed to ventilate each roof space.

9.19.1.3. Cross Purlins

(1) Except as provided in Sentence (2), cross purlins not less than 38 mm by 38 mm shall be applied to the top of the roof joists where the roof does not incorporate an attic space, and the top of the insulation shall be not less than 25 mm below the top of the roof joists.

(2) Cross purlins required by Sentence (1) may be omitted where the roof slope is 1 in 6 or greater provided the roof framing members run in the same direction as the roof slope and a clearance of not less than 75 mm is maintained between the underside of the roof sheathing and the top of the insulation throughout the length of the roof joist.

(3) Vents in roofs described in Sentence (2) shall be distributed so that approximately 50 per cent of the required vent area is located near the lower part of the roof and approximately 50 per cent of the required vent area is near the ridge.

9.19.1.4. Obstruction by Insulation. Ceiling insulation shall be installed in a manner which will not restrict a free flow of air through roof vents or through any portion of the roof space or attic.

9.19.1.5. 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 the requirements in Articles 9.19.1.1. to 9.19.1.4., except that not less than 50 per cent of the required vent opening shall be provided near the junction of the upper and lower portions.

9.19.2. Access

9.19.2.1. Access

(1) Every attic space more than 600 mm in height at the highest point shall be provided with an access stair or shall have a hatchway of not less than 550 mm by 900 mm, except that where such hatchway serves not more than one *dwelling unit*, the hatchway may be reduced to 500 mm by 700 mm.

(2) Hatchways to attic spaces shall be fitted with doors or covers.

Section 9.20 Above-Grade Masonry

9.20.1. Scope

9.20.1.1. Application

(1) This Section applies to unreinforced masonry and masonry veneer in which the wall height above the *foundation* wall does not exceed 11 m, and in which the roof or floor system above the *first storey* is not of concrete construction.

(2) For *buildings* other than described in Sentence (1), or where the masonry is designed on

the basis of design loads and allowable stresses, Subsection 4.3.2. shall apply.

9.20.1.2. Earthquake Reinforcement

(1) In velocity- or acceleration-related seismic zones of 4 or greater, *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 in Subsection 9.20.15.

(2) In velocity- or acceleration-related seismic zones of 2 and 3, *loadbearing* elements of masonry *buildings* 3 *storeys* in *building height* shall be reinforced with not less than the minimum amount of reinforcement required in Subsection 9.20.15. (See Appendix A.)

9.20.2. Masonry Units

9.20.2.1. Masonry Unit Standards

- (1) Masonry units shall comply with
 - (a) CAN/CSA-A82.1, "Burned Clay Brick (Solid Masonry Units Made from Clay or Shale),"
 - (b) CSA A82.3, "Calcium Silicate (Sand-Lime) Building Brick,"
 - (c) CSA A82.4, "Structural Clay Load-Bearing Wall Tile,"
 - (d) CSA A82.5, "Structural Clay Non-Load-Bearing Tile,"
 - (e) CAN3-A165.1, "Concrete Masonry Units,"
 - (f) CAN3-A165.2, "Concrete Brick Masonry Units,"
 - (g) CAN3-A165.3, "Prefaced Concrete Masonry Units,"
 - (h) CAN3-A165.4, "Autoclaved Cellular Units,"
 - (i) ASTM C126, "Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units," or
 - (j) ASTM C212, "Structural Clay Facing Tile."

9.20.2.2. Used Brick. 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. Glass blocks shall not be used as *loadbearing* units or in the construction of fireplaces or *chimneys*.

9.20.2.4. Foamed Concrete. Masonry made with foamed concrete shall not be used in contact with the *soil* or exposed to the weather.

9.20.2.5. Stone. Stone shall be sound and durable.

9.20.2.6. Concrete Units Exposed to the Weather

(1) *Loadbearing* concrete units or non-*loadbearing* concrete units exposed to the weather shall have weight and water absorption characteristics conforming to the Classes A, B or C, described in CAN3-A165.1, "Concrete Masonry Units."

(2) Where cellular concrete blocks are used in situations described in Sentence (1), allowance shall be made in the design for the shrinkage characteristics of the units to be used.

9.20.2.7. Compressive Strength. The compressive strength of masonry units shall conform to Table 9.20.2.A.

Table 9.20.2.A.
Forming Part of Article 9.20.2.7.

Compressive Strength of Masonry		
Type of Unit	Minimum Compressive Strength over Net Area, MPa	
	Exposed to Weather	Not Exposed to Weather
Solid or hollow concrete block	15	10
Solid <i>loadbearing</i> cellular units	Not permitted	5
Solid non- <i>loadbearing</i> cellular units	Not permitted	2
Column 1	2	3

9.20.3. Mortar

9.20.3.1. Mortar Materials

(1) Cementitious materials and aggregates for mortar shall comply with

- (a) CAN3-A5, "Portland Cements,"
- (b) CAN3-A8, "Masonry Cement,"

(c) CSA A82.22, "Gypsum Plasters,"

(d) CSA A82.56, "Aggregate for Masonry Mortar,"

(e) ASTM C5, "Quicklime for Structural Purposes," or

(f) ASTM C207, "Hydrated Lime for Masonry Purposes."

(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 Mixes

(1) Except as provided in Sentences (3) and (4), mortar mixes shall conform to Table 9.20.3.A.

(2) Mortar containing portland cement shall not be used later than 2.5 h after mixing.

(3) Mortar for sand-lime brick and concrete brick may consist of 1 part of masonry cement to not less than 3 or not more than 3.5 parts of aggregate by volume in addition to those mixes permitted in Table 9.20.3.A.

(4) Mortar for glass block shall consist of 1 part portland cement, 1 part hydrated lime to not more than 4 parts aggregate by volume.

9.20.4. Mortar Joints

9.20.4.1. Thickness

(1) Maximum average joint thickness shall be 12 mm.

(2) Maximum thickness of an individual joint shall be 20 mm.

9.20.4.2. Solid Masonry Units. Solid masonry units shall be laid with full head and bed joints.

9.20.4.3. Hollow Masonry Units. Hollow masonry units shall be laid with mortar applied to head and bed joints of both inner and outer face shells.

Table 9.20.3.A.
Forming Part of Article 9.20.3.2.

Mortar Mix Proportions (by volume)				
Permissible Use of Mortar	Portland Cement	Masonry Cement	Lime	Aggregate
All locations but not for use with sand-lime or concrete brick	$\frac{1}{2}$ to 1 1	1 —	— $\frac{1}{4}$ to $\frac{1}{2}$	Not less than $2\frac{1}{4}$ and not more than 3 times the sum of the volumes of the cement and the lime
All locations except <i>foundation</i> walls and piers, but not for use with sand-lime or concrete brick	— 1	1 —	— $\frac{1}{2}$ to $1\frac{1}{4}$	
All locations except <i>loadbearing</i> walls of hollow units, parapet walls and <i>chimneys</i>	1	—	$1\frac{1}{4}$ to $2\frac{1}{2}$	
All non- <i>loadbearing</i> interior walls and all <i>loadbearing</i> walls of solid units, except <i>foundation</i> walls, parapet walls and <i>chimneys</i>	1 —	— —	$2\frac{1}{4}$ to 4 1	
Column 1	2	3	4	5

Table 9.20.5.A.
Forming Part of Sentence 9.20.5.2.(2)

Maximum Allowable Spans for Steel Lintels Supporting Masonry Veneer, m					
Minimum Angle Size, mm			75 mm Brick	90 mm Brick	100 mm Stone
Vertical Leg	Horizontal Leg	Thickness			
90	75	6	2.55	—	—
90	90	6	2.59	2.47	2.30
100	90	6	2.79	2.66	2.48
125	90	8	3.47	3.31	3.08
125	90	10	3.64	3.48	3.24
Column 1	2	3	4	5	6

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 9.15.1.3.(3).

(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, reinforced concrete or masonry lintels or arches designed to support the imposed load.

(2) Steel angle lintels supporting masonry veneer above openings shall conform to Table 9.20.5.A.

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-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 walls 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 nor 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 Article 9.20.10.1.

(2) Interior non-*loadbearing* walls shall be not less than 65 mm thick. (See Article 9.20.10.1.)

9.20.6.4. Masonry Veneer Walls

(1) Masonry veneer resting on a bearing support shall be of solid units not less than 75 mm thick for wall heights up to 11 m.

(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 individually supported by the back-up material shall conform to the appropriate requirements contained in Subsection 4.3.2.

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 from the top of the parapet to not less than 300 mm below the adjacent roof level.

9.20.6.6. Facings. Limestone slab facings and precast concrete panel facings shall conform to the appropriate requirements of Subsection 4.3.2.

9.20.7. Chases and Recesses

9.20.7.1. Maximum Dimensions. 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 horizontal projection 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 and 750 mm in height, and the horizontal projection of the recess does not exceed 500 mm.

9.20.7.3. Separation of Chases or Recesses.

Chases and recesses shall be not less than 4 times the wall thickness apart and not less than 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.

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.

9.20.7.5. Chases or Recesses Cut into Walls.

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), *load-bearing* 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 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 not less than 57 mm of solid masonry, bridging the full thickness of the wall, or 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. Distance to Edge of Supporting Members. The distance from the face of a wall to the edge of a supporting member attached to the structure, such as a shelf angle or the flange of a beam, shall not exceed 30 mm, except as otherwise permitted in Subsection 4.3.2.

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 Ties. 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 with Masonry Units

(1) Where wythes are bonded together with masonry units, the bonding units shall comprise not less than 4 per cent 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. Bonding with Metal Ties

(1) Where 2 or more wythes are bonded together with metal ties of the individual rod type, the ties shall conform to the requirements in Sentences (2) to (7).

(2) Other metal bonding 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 be corrosion-resistant and shall have

- (a) a minimum cross-sectional area of not less than 17.8 mm², and
- (b) 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 are bonded 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) Where the inner and outer wythes of cavity walls are connected with individual wire ties, the ties shall be

- (a) spaced not more than 600 mm apart horizontally within 100 mm of the bottom of each floor or roof assembly where the cavity extends below the assemblies,
- (b) spaced not more than 900 mm apart within 300 mm of any openings, and
- (c) spaced not more than 900 mm apart horizontally and 400 mm apart vertically at other locations.

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 back-up or to wood framing members with not less than 0.76-mm thick, 22-mm wide corrosion-resistant straps spaced in accordance with Table 9.20.9.A. and shaped to provide a key with the mortar.

(2) Masonry veneer individually supported by masonry or wood-frame back-up shall be secured to the back-up 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 spaced at vertical intervals of not more than 600 mm for units 190 mm or less in height and in every horizontal joint for units higher than 190 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 supported at right angles to the wall by floor or roof construction or by intersecting masonry walls or buttresses.

(2) The maximum spacing of supports required in Sentence (1) shall be

- (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 two-thirds of the sum of the thicknesses of the wythes.

(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.

Table 9.20.9.A.
Forming Part of Sentence 9.20.9.5.(1)

Veneer Tie Spacing	
Maximum Vertical Spacing, mm	Maximum Horizontal Spacing, mm
400	800
500	600
600	400
Column 1	2

9.20.11. Anchorage of Roofs, Floors and Intersecting Walls

9.20.11.1. Anchorage of Floor or Roof Assemblies

(1) Where required to provide 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 of 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 tie.

(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. Anchorage of Intersecting Walls

(1) Where required to provide lateral support, intersecting walls shall be bonded or tied together.

(2) Fifty per cent of the adjacent masonry units in the intersecting wall referred to in Sentence (1) shall be embedded in the laterally supported wall, or corrosion-resistant metal ties equivalent to not less than 4.76 mm by 40 mm steel strapping shall be provided.

(3) Ties required in Sentence (1) shall be spaced not more than 800 mm o.c. vertically and shaped at both ends to provide sufficient mechanical key to develop the strength of the ties.

9.20.11.3. Wood Frame Walls Intersecting Masonry Walls

(1) Wood-frame walls shall be tied to intersecting masonry walls with not less than 4.76 mm diam corrosion-resistant steel rods spaced not more than 900 mm o.c. vertically.

(2) Ties required in Sentence (1) shall be anchored to the wood framing at one end and shaped to provide a mechanical key at the other end to develop the strength of the tie.

9.20.11.4. Wood Frame Roof Systems

(1) Except as permitted in Sentence (2), roof systems of wood-frame construction shall be tied to exterior walls by not less than 12.7 mm diam anchor bolts, spaced not more than 2.4 m apart, embedded not less than 90 mm into the masonry and 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. Cornices, Sills and Trim. Cornices, sills or other trim of masonry material which project beyond the wall face shall have not less than 65 per cent 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. Anchor Bolts. Where anchor bolts are to be placed in the top of a pier, the pier shall be capped with concrete or reinforced masonry not less than 300 mm thick.

9.20.12. Corbelling

9.20.12.1. Corbelling

(1) All corbelling shall consist of solid 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. e

(2) The unit masonry *foundation* wall referred to in Sentence (1) is permitted to be corbelled to meet flush with the inner face of a cavity wall provided the individual corbel does not exceed half the height or one third the width of the corbelled unit and the total corbel does not exceed one-third of the *foundation* wall thickness. e

9.22.5.2. Support of Hearth

(1) Except as permitted in Sentence (2), the hearth shall be supported on not less than a 140 mm thick trimmer arch of solid masonry units or not less than a 100 mm thick reinforced concrete trimmer.

(2) A hearth extension for a fireplace with an opening raised not less than 200 mm from a *combustible* floor is permitted to be placed on that floor provided the requirements of Clauses 5.3.6.5. to 5.3.6.7. of CAN/CSA-A405, "Design and Construction of Masonry Chimneys and Fireplaces" are followed.

9.22.6. Damper

9.22.6.1. 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. 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. 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. Factory-built fireplaces and their installation shall conform to CAN/ULC S610, "Standard for Factory-Built Fireplaces."

9.22.9. Clearance of Combustible Material

9.22.9.1. Clearance to the Fireplace Opening. *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.

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 Openings

(1) The clearance of *combustible* material above heat-circulating duct openings from those openings 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

9.22.10.1. The installation of fireplace inserts shall conform to CAN3-B365, "Installation Code for Solid-Fuel Burning Appliances and Equipment."

Section 9.23 Wood-Frame Construction**9.23.1. Scope****9.23.1.1. Application**

(1) This Section applies to conventional wood-frame construction in which the framing members are spaced not more than 600 mm o.c.

(2) The requirements in this Section with regard to floor framing, subflooring and their fasten-

9.23.1.1.

ings apply to floors for which the design *live load* does not exceed 2.4 kPa.

(3) The requirements in this Section with regard to wall framing and its fastenings apply to walls which support floors for which the design *live load* does not exceed 2.4 kPa on any floor.

(4) Where the conditions in Sentences (2) or (3) are exceeded, the design of the framing and fastening shall conform to Subsection 4.3.1.

9.23.1.2. Post, Beam and Plank Construction. Post, beam and plank construction and plank frame wall construction shall conform to Article 9.4.1.2.

9.23.2. General

9.23.2.1. Strength and Rigidity. 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 air barriers.

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 which are supported on concrete in contact with the ground or fill shall be separated from the concrete by not less than 0.05 mm polyethylene film or Type S roll roofing.

(2) Dampproofing material referred to in Sentence (1) is not required where the wood member is at least 150 mm above the ground.

9.23.2.4. Lumber. Lumber shall conform to the appropriate requirements in Subsection 9.3.2.

9.23.3. Nails and Staples

9.23.3.1. Standard for Nails. Nails specified in this Section shall be common steel wire nails or common spiral nails, conforming to CSA B111, "Wire Nails, Spikes and Staples" unless otherwise indicated.

9.23.3.2. Length of Nails. All nails shall be long enough so that not less than half their length penetrates into the second member.

9.23.3.3. Prevention of Splitting. 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.

9.23.3.4. Nailing of Framing

(1) Except as provided in Sentence (2), nailing of framing shall conform to Table 9.23.3.A.

(2) Where the bottom wall plate or sole plate of an exterior wall is not nailed to joists or blocking in conformance with Table 9.23.3.A., the exterior wall may be fastened to the floor framing by

- (a) having plywood, waferboard or strand-board 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 50 mm wide galvanized-metal strips of not less than 0.41 mm in thickness, spaced not more than 1.2 m apart, and fastened at each end with not less than two 63 mm nails.

9.23.3.5. Fasteners for Sheathing or Subflooring

(1) Fastening of sheathing and subflooring shall conform to Table 9.23.3.B.

(2) 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.

(3) Roofing nails for the attachment of fibre-board or gypsum sheathing shall not be less than 3.2 mm in diameter with a minimum head diameter of 11.1 mm.

9.23.4.2. Steel Beams

(1) The spans for steel beams with laterally supported top flanges that support floors in 1- and 2-storey houses shall conform to Table 9.23.4.A. (See Appendix A.)

(2) Beams described in Sentence (1) shall at least meet the requirements for Grade 300 W steel in CAN/CSA-G40.21, "Structural Quality Steels."

9.23.4.3. Glued-Laminated Beams

(1) The spans for glued-laminated beams that support floors in 1- and 2-storey houses shall conform to Table 9.23.4.B.

(2) Beams described in Sentence (1) shall conform to 20 f-E stress grade in CSA O122, "Glued-Laminated Timber" and to Article 4.3.1.2.

Table 9.23.4.A.⁽¹⁾
Forming Part of Sentence 9.23.4.2.(1)

Maximum Spans for Steel Beams Supporting Floors in Dwelling Units, m							
<i>One Storey Supported</i>							
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
W150 × 22	5.5	5.2	4.9	4.8	4.5	4.3	4.1
W200 × 21	6.5	6.2	5.7	5.3	5.0	4.7	4.5
W200 × 27	7.3	6.9	6.6	6.3	6.1	5.8	5.5
W200 × 31	7.8	7.4	7.1	6.8	6.6	6.4	6.1
W250 × 24	8.1	7.5	6.9	6.4	6.0	5.7	5.4
W250 × 33	9.2	8.7	8.3	8.0	7.6	7.2	6.9
W250 × 39	10.0	9.4	9.0	8.6	8.3	8.0	7.6
W310 × 31	10.4	9.6	8.8	8.2	7.7	7.3	7.0
W310 × 39	11.3	10.7	10.2	9.8	9.2	8.7	8.3
<i>Two Storeys Supported</i>							
W150 × 22	4.7	4.2	3.9	3.6	3.4	3.2	3.0
W200 × 21	5.2	4.7	4.3	4.0	3.7	3.5	3.4
W200 × 27	6.3	5.7	5.2	4.8	4.5	4.3	4.1
W200 × 31	6.9	6.2	5.7	5.3	5.0	4.7	4.5
W250 × 24	6.2	5.6	5.1	4.8	4.5	4.2	4.0
W250 × 33	7.9	7.1	6.5	6.0	5.7	5.4	5.1
W250 × 39	8.7	7.8	7.2	6.7	6.3	5.9	5.6
W310 × 31	8.0	7.2	6.6	6.1	5.8	5.4	5.2
W310 × 39	9.5	8.6	7.9	7.3	6.9	6.5	6.2
Column 1	2	3	4	5	6	7	8

Note to Table 9.23.4.A.:

⁽¹⁾ See Appendix A.

9.23.4.4.

9.23.4.4. Concentrated Loads or Higher Live Loads. Where a floor is required to be designed to support a concentrated load as specified in Table 4.1.6.B., or to support a uniform *live load* in excess of those shown in the span tables, such spans shall be determined in conformance with Subsection 4.3.1.

9.23.4.5. Concrete Topping. Where a floor is required to support a concrete topping, the spans shown in Tables A-1 and A-2 or the spacing of the members shall be reduced to allow for the loads due to the topping. (See Appendix A.)

Table 9.23.4.B.
Forming Part of Sentence 9.23.4.3.(1)

Maximum Spans (m) for Glued-Laminated Floor Beams Supporting Floors in Dwellings ^(2, 3, 4)									
Number of Storeys Supported	Beam Width, mm	Supported Length, ⁽¹⁾ m	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
1	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
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
2	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
Col. 1	2	3	4	5	6	7	8	9	10

Note to Table 9.23.4.B.:

- ⁽¹⁾ Supported length means half the sum of the joist spans on both sides of the beam.
- ⁽²⁾ Spans are valid for any species covered by CSA O122-M, "Structural Glued-Laminated Timber."
- ⁽³⁾ Spans are clear spans between supports.
- ⁽⁴⁾ Provide minimum 89 mm of bearing.

9.23.4.6. Heavy Roofing Materials. Where a roof is required to support an additional uniform *dead load* from roofing materials other than as specified in Section 9.27, such as concrete or clay roofing tiles, spans for framing members in Tables A-4 to A-7, A-10 and A-11 or the spacing of the members shall be reduced to allow for the loads due to the roofing. (See A-9.23.4.1.(1) and A-9.23.4.5. in Appendix A.)

9.23.5. Notching and Drilling

9.23.5.1. Holes Drilled in Framing Members. 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. Floor, roof and ceiling framing members may 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. 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. 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. 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) *Building* frames shall be anchored to the *foundation* unless a structural analysis of wind and earth pressures shows anchorage is not required.

(2) Except as provided in Article 9.23.6.3., anchorage shall be provided by embedding the ends of the first floor joists in concrete, or 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) Anchor bolts referred to in Sentence (2) shall be fastened to the sill plate with nuts and washers and shall be embedded not less than 100 mm in the *foundation* and so designed that they may be tightened without withdrawing them from the *foundation*.

9.23.6.2. Anchorage of Columns and Posts. Exterior columns and posts shall be anchored to resist uplift and lateral movement.

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* may be anchored by means of corrosion-resistant steel rods or cables of not less than 12.7 mm diam, attached to the *building* frame near each corner of the *building* in a manner that will develop the full strength of the rod or cable.

(2) Each rod or cable described in Sentence (1) shall be anchored to the ground by means of ground anchors having a withdrawal resistance of not less than 500 N for each metre of length of the *building*. (See A-9.15.1.1.(1) in Appendix A.)

9.23.7. Sill Plates

9.23.7.1. Size of Sill Plates. 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 of Sill Plates. Sill plates shall be levelled by setting them on a full bed of mortar, except that where the top of the *foundation* is level, they may be laid directly on the *foundation* provided the junction between the *foundation* and the sill plate is caulked or the sill plate is placed on a layer of mineral wool not less than 25 mm thick before being compressed. (See also 9.23.2.3.)

9.23.8. Beams to Support Floors

9.23.8.1. Bearing for Beams. Beams shall have even and level bearing and shall have not less than 89 mm length of bearing at end supports.

9.23.8.2. Priming of Steel Beams. Steel beams shall be shop primed.

9.23.8.3. Built-up Wood Beams

(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.

(See Appendix A.)

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.A.

(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.

Except as provided in Sentence 9.23.9.4.(2), 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.

Table 9.23.12.A.
Forming Part of Sentences 9.23.12.3.(1) and (4)

Wood Lintel Spans			
Location of Lintels	Supported Loads including <i>Dead Loads</i> and Ceiling	Depth of Lintels, mm	Maximum Allowable Spans, m
Interior walls	Limited attic storage	89	1.22
		140	1.83
		184	2.44
		235	3.05
		286	3.81
	Full attic storage or roof load or limited attic storage plus one floor	89	0.61
		140	0.91
		184	1.22
		235	1.52
		286	1.83
	Full attic storage plus one floor or roof load plus one floor or limited attic storage plus 2 or 3 floors	89	—
		140	0.76
		184	0.91
		235	1.22
		286	1.52
	Full attic storage plus 2 or 3 floors or roof load plus 2 or 3 floors	89	—
		140	0.61
		184	0.91
		235	1.07
		286	1.22
Exterior walls	Roof with or without attic storage	89	1.12
		140	1.68
		184	2.24
		235	2.79
		286	3.35
	Roof with or without attic storage plus one floor	89	0.56
		140	1.40
		184	1.96
		235	2.24
		286	2.51
	Roof with or without attic storage plus 2 or 3 floors	89	0.56
		140	1.12
		184	1.68
		235	1.96
		286	2.24
Column 1	2	3	4

Table 9.23.12.B.
Forming Part of Sentence 9.23.12.3.(5)

Built-Up Wood Lintels Supporting Roof and Ceiling Loads over Large Openings ^(4, 5)														
Supported Length, m ⁽¹⁾	No. 1 and No.2 Lintel Span, m ^(2, 3)							Select Structural Lintel Span, m ^(2, 3)						
Live Load – 1.0 kPa	2.4	3.0	3.6	4.2	4.8	5.4	6.0	2.4	3.0	3.6	4.2	4.8	5.4	6.0
2.4	A	A	A	B	D	F	F	A	A	A	B	C	D	F
3.0	A	A	B	D	F	G*	G*	A	A	A	B	D	E	G*
3.6	A	B	C	D	F	G*	G*	A	A	A	C	D	F	G*
4.2	A	B	D	F	G*	G*	G*	A	A	B	C	E	F	G*
4.8	A	C	D	F	G*	G*	I*	A	A	B	D	F	G*	I*
Live Load – 1.5 kPa	2.4	3.0	3.6	4.2	4.8	5.4	6.0	2.4	3.0	3.6	4.2	4.8	5.4	6.0
2.4	A	A	B	D	F	G*	I*	A	A	A	C	D	F	I*
3.0	A	B	D	F	G*	I*	J*	A	A	B	C	E	I*	J*
3.6	A	C	D	F	G*	I*	K*	A	A	B	D	F	I*	K*
4.2	B	D	F	G*	G*	I*	M*	A	A	C	D	F	I*	M*
4.8	B	D	F	G*	I*	K*	M*	A	B	D	F	I*	K*	M*
Live Load – 2.0 kPa	2.4	3.0	3.6	4.2	4.8	5.4	6.0	2.4	3.0	3.6	4.2	4.8	5.4	6.0
2.4	A	A	C	D	F	I*	K*	A	A	B	C	E	I*	K*
3.0	A	B	D	F	G*	I*	M*	A	A	C	D	F	I*	M*
3.6	B	D	F	G*	I*	K*	M*	A	B	D	F	I*	K*	M*
4.2	B	D	G*	G*	I*	K*	P*	A	B	D	F	I*	K*	P*
4.8	C	F	G*	G*	I*	M*	P*	A	D	F	G*	I*	M*	P*
Live Load – 2.5 kPa	2.4	3.0	3.6	4.2	4.8	5.4	6.0	2.4	3.0	3.6	4.2	4.8	5.4	6.0
2.4	A	C	E	G*	G*	I*	M*	A	A	C	D	F	I*	M*
3.0	B	D	F	G*	I*	K*	M*	A	B	D	F	I*	K*	M*
3.6	B	E	G*	G*	I*	M*	P*	A	B	D	F	I*	M*	P*
4.2	D	F	G*	G*	I*	M*	R*	B	D	F	G*	I*	M*	R*
4.8	D	G*	G*	I*	K*	P*	R*	B	D	F	I*	K*	P*	R*
Column 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Addendum to Table 9.23.12.B.:

- (1) Supported length means half the span of trusses, roof joists or rafters supported by the lintel plus the length of the overhang beyond the lintel.
(2) Table valid for all major species groups (D Fir-L, Hem-Fir, S-P-F).
(3) Span are clear spans between supports. For total spans, add two bearing lengths.
(4) Provide minimum 89 mm of bearing.
(5) Any size in the Table may be substituted by any size of higher rank (A lowest, R highest).

Legend – Lintel Sizes

A = 3 – 38 × 184	G* = 80 × 380	N* = 80 × 532
B = 4 – 38 × 184	H* = 130 × 304	O* = 130 × 418
C = 3 – 38 × 235	I* = 80 × 418	P* = 80 × 570
D = 4 – 38 × 235	J* = 130 × 342	Q* = 130 × 456
E = 3 – 38 × 286	K* = 80 × 456	R* = 80 × 608
F = 4 – 38 × 286	L* = 130 × 380	
	M* = 80 × 494	*Glued-laminated 20 f-E grade

9.23.13.6. Hip and Valley Rafters. 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.

9.23.13.7. Intermediate Support for Rafters and Joists

(1) Ceiling joists and collar ties of not less than 38 mm by 89 mm lumber may 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 *load-bearing* 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.

9.23.13.8. Ridge Support

(1) Except as provided in Sentence (3), the ridge of the roof shall be supported by a *loadbearing* wall extending from the ridge to suitable bearing or by a ridge beam of not less than 38 mm by 140 mm material.

(2) Ridge beams referred to in Sentence (1) shall be 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.

(3) When the roof slope is 1 in 3 or more, ridge support may be omitted provided the lower ends of the rafters are adequately tied to prevent outward movement.

(4) Ties required in Sentence (3) are permitted to consist of tie rods or ceiling joists forming a continuous tie for opposing rafters and nailed in accordance with Table 9.23.13.A.

(5) Ceiling joists referred to in Sentence (4) shall be fastened together with at least one more nail per joist splice than required for the rafter to joist connection shown in Table 9.23.13.A.

(6) Members referred to in Sentence (5) may be fastened together either directly or through a gusset plate.

9.23.13.9. Restraint of Joist Bottoms.

Roof joists supporting a finished ceiling, other than plywood, waferboard or strandboard, shall be restrained from twisting along the bottom edges by means of furring, blocking, cross bridging or strapping conforming to Article 9.23.9.4.

9.23.13.10. 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 the span tables for roof joists.

9.23.13.11. Wood Roof Trusses

(1) Except for roof trusses constructed of Poplar, Eastern White Pine, Western White Pine, Red Pine, Western Red Cedar and Eastern White Cedar, the member sizes for Howe or Fink type wood roof trusses spaced not more than 600 mm o.c. which are to be supported at or near their ends may be determined in conformance with Tables A-10 and A-11 provided such trusses conform to the requirements of Sentences (3) to (7). (See Appendix A.)

(2) The joint connections used in trusses described in Sentence (1) shall be designed in conformance with the requirements in Subsection 4.3.1.

(3) Where a roof truss described in Sentence (1) supports a ceiling, and the unsupported length of the bottom chord between the truss panel points exceeds 3.05 m, the bottom chord shall be not less than 38 mm by 114 mm in size.

Table 9.23.13.A.
Forming Part of Sentences 9.23.13.8.(4) and (5)

Rafter-to-Joist Nailing (Minimum Number of Nails not less than 76 mm Long) (Unsupported Ridge)													
Roof Slope	Spacing, mm	Rafter Tied to Every Joist						Rafter Tied to Joist every 1.2 m					
		Building Width up to 8 m			Building Width up to 9.8 m			Building Width up to 8 m			Building Width up to 9.8 m		
		Roof Snow Load, kPa											
		1.0 or less	1.5	2.0 or more	1.0 or less	1.5	2.0 or more	1.0 or less	1.5	2.0 or more	1.0 or less	1.5	2.0 or more
1 in 3	400	4	5	6	5	7	8	11	—	—	—	—	—
	600	6	8	9	8	—	—	11	—	—	—	—	—
1 in 2.4	400	4	4	5	5	6	7	7	10	—	9	—	—
	600	5	7	8	7	9	11	7	10	—	—	—	—
1 in 2	400	4	4	4	4	4	5	6	8	9	8	—	—
	600	4	5	6	5	7	8	6	8	9	8	—	—
1 in 1.71	400	4	4	4	4	4	4	5	7	8	7	9	11
	600	4	4	5	5	6	7	5	7	8	7	9	11
1 in 1.33	400	4	4	4	4	4	4	4	5	6	5	6	7
	600	4	4	4	4	4	5	4	5	6	5	6	7
1 in 1	400	4	4	4	4	4	4	4	4	4	4	4	5
	600	4	4	4	4	4	4	4	4	4	4	4	5
Column 1	2	3	4	5	6	7	8	9	10	11	12	13	14

(4) Where the unsupported length of the bottom chord described in Sentence (3) exceeds 3.66 m between the panel points, the bottom chord shall be not less than 38 mm by 140 mm in size.

(5) Where the length of compression web members in roof trusses described in Sentence (1) exceeds 1.83 m, such web members shall be provided with continuous bracing to prevent buckling.

(6) Bracing required in Sentence (5) shall consist of not less than 19 mm by 89 mm lumber nailed at right angles to the web members near their centres with at least two 63 mm nails for each member.

(7) Web members referred to in Sentence (5) shall be not less than 38 mm by 89 mm lumber of at least No. 2 grade.

(8) Roof trusses that are not designed in conformance with Sentence (1) shall

- (a) be capable of supporting a total ceiling load (*dead load plus live load*) of 0.5 kPa plus two and two-thirds times the design roof load for 24 h, and
- (b) not exceed the deflections shown in Table 9.23.13.B. when loaded with the ceiling load plus one and one-third times the design roof snow load for 1 h.

(9) Testing for lumber roof trusses referred to in Sentence (8) shall be in conformance with CSA S307, "Load Test Procedure for Wood Roof Trusses for Houses and Small Buildings," except that the unsymmetrical loading requirement in Clause 7.7 of that standard shall not apply.

Table 9.23.13.B.
Forming Part of Sentence 9.23.13.11.(8)

Maximum Roof Truss Deflections		
Truss Span	Type of Ceiling	Maximum Deflection
4.3 m or less	Plaster or gypsum board	$1/360$ of the span
	Other than plaster or gypsum board	$1/180$ of the span
Over 4.3 m	Plaster or gypsum board	$1/360$ of the span
	Other than plaster or gypsum board	$1/240$ of the span
Column 1	2	3

9.23.14. Subflooring

9.23.14.1. Subflooring Required. Subflooring shall be provided beneath finish flooring where the finish flooring does not have adequate strength to support the design loads (see Subsection 9.30.3.).

9.23.14.2. Material Standards

- (1) 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) CAN3-O437.0-M85, "Waferboard and Strandboard," or
 - (e) CAN/CSA O325.0, "Construction Sheathing."

(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 N-1 or N-2 in CAN3-O188.1, "Interior Mat-Formed Wood 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 bath-

rooms, kitchens, laundry rooms or other areas subject to periodic wetting. (See Appendix A.)

9.23.14.3. Edge Support. 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.

9.23.14.4. 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) Waferboard and strandboard subflooring conforming to O-1 and O-2 grades in CAN3-O437.0 shall be installed with the direction of face orientation at right angles to the joists and with joints parallel to floor joists staggered. (See Appendix A.)

9.23.14.5. Subfloor Thickness or Rating

(1) Except as provided in Sentences (2) and (3), subfloors shall conform to either Table 9.23.14.A. or Table 9.23.14.B.

(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 waferboard or strandboard conforming to O-2 grade, or

Table 9.23.14.A.
Forming Part of Sentences 9.23.14.5.(1) and 9.23.15.6.(1)

Thickness of Subflooring, mm				
Maximum Spacing of Supports, mm	Plywood and O-2 Grade Waferboard and Strandboard	Waferboard and Strandboard, R-1 and O-1 Grades	Particle-board	Lumber
400	15.5	15.9	15.9	17.0
500	15.5	15.9	19.0	19.0
600	18.5	19.0	25.4	19.0
Column 1	2	3	4	5

9.23.14.5.

Table 9.23.14.B

Forming Part of Sentences 9.23.14.5.(1) and 9.23.15.6.(1)

Rating for Subfloor When Applying CSA O325.0		
Maximum Spacing of Supports, mm	Panel Mark	
	Subfloor	Used with Panel-Type Underlay
400	1F16	2F16
500	1F20	2F20
600	1F24	2F24
Column 1	2	3

- (c) 12.7-mm thick waferboard or strandboard conforming to grades R-1 or O-1.

(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 may consist of not less than

- (a) 12.5-mm thick plywood,
- (b) 12.5-mm thick waferboard or strandboard conforming to O-2 grade, or
- (c) 12.7-mm thick waferboard or strandboard conforming to grades R-1 or O-1.

(See Article 9.30.6.2.)

9.23.14.6. Annular Grooved Nails. When resilient flooring is applied directly to a waferboard and strandboard, particleboard or plywood subfloor, the subfloor shall be fastened to the supports with annular grooved nails.

9.23.14.7. 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.

9.23.15. Roof Sheathing

9.23.15.1. 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) CAN3-O437.0-M85, "Waferboard and Strandboard," or

(e) CAN/CSA O325.0, "Construction Sheathing."

9.23.15.2. Direction of Installation

(1) Plywood roof sheathing shall be installed with the surface grain at right angles to the roof framing.

(2) Waferboard and strandboard roof sheathing conforming to O-1 and O-2 grades in CAN3-O437.0 shall be installed with the direction of face orientation at right angles to the roof framing members. (See A-9.23.14.4.(2) in Appendix A.)

9.23.15.3. Gap between Sheets. Waferboard and strandboard and plywood roof sheathing shall be installed with not less than a 2 mm gap between sheets.

9.23.15.4. Lumber Roof Sheathing. 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.

9.23.15.5. Edge Support. 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.

9.23.15.6. 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 9.23.14.A. or Table 9.23.14.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 9.23.15.A. or Table 9.23.15.B.

(3) Asphalt-coated or asphalt-impregnated fibreboard not less than 11.1 mm thick conforming to CAN3-A247-M, "Insulating Fibreboard" may be used as a roof sheathing over supports spaced not more than 400 mm o.c. provided the roofing consists of a continuous sheet of galvanized steel of not less than 0.33 mm in thickness or a continuous sheet of aluminum of not less than 0.61 mm in thickness.

Table 9.24.2.B.
Forming Part of Article 9.24.2.5.

Steel Studs for Non-Loadbearing Exterior Walls				
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
Column 1	2	3	4	5

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.

(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.

(See Appendix A.)

9.24.3.3. Orientation of Studs. 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. 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 suitably fastened together 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, welding or other suitable methods 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., such 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 Thermal Insulation and Control of Condensation

(See Appendix A.)

9.25.1. Scope

9.25.1.1. Application

(1) This Section applies to thermal insulation and measures to control condensation for *buildings of residential occupancy* intended for use on a continuing basis during the winter months.

(2) Insulation of heating and ventilating ducts shall conform to Sections 9.32 and 9.33.

9.25.2. General

9.25.2.1. Required Insulation. 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.

9.25.2.2. Barrier to Air Leakage. Thermally insulated wall, ceiling and floor assemblies shall be constructed so as to provide a continuous barrier to leakage of air from the interior of the building into wall spaces, floor spaces or *attic or roof spaces*.

9.25.2.3. Barrier to Vapour Diffusion. Except as provided in Article 9.25.6.3., thermally insulated wall, ceiling and floor assemblies shall be constructed so as to provide a barrier to diffusion of water vapour from the interior into wall spaces, floor spaces or *attic or roof spaces*.

9.25.3. Materials

9.25.3.1. Insulation Material Standards

(1) Except as required in Sentence (2), thermal insulation shall conform to the requirements of

- (a) CSA A101, "Thermal Insulation, Mineral Fibre, for Buildings,"

- (b) CAN/CSA-A247-M, "Insulating Fibre-board,"
- (c) CAN/CGSB 51.20-M, "Thermal Insulation, Polystyrene, Boards and Pipe Covering,"
- (d) CGSB 51-GP-21M, "Thermal Insulation, Urethane and Isocyanurate, Unfaced,"
- (e) CAN/CGSB-51.25-M, "Thermal Insulation, Phenolic, Faced,"
- (f) CAN/CGSB-51.26-M, "Thermal Insulation, Urethane and Isocyanurate, Board, Faced,"
- (g) CGSB 51-GP-27M, "Thermal Insulation, Polystyrene, Loose Fill," or
- (h) CAN/CGSB-51.60M, "Cellulose Fibre Loose Fill Thermal Insulation."

(2) The *flame-spread ratings* requirements contained in the standards listed in Sentence (1) shall not apply. (See Appendix A.)

9.25.3.2. Insulation in Contact with the Ground. 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.

9.25.3.3. Type 1 Polystyrene Insulation. Type 1 expanded polystyrene insulation as described in CAN/CGSB 51.20M "Thermal Insulation, Expanded Polystyrene" shall not be used in contact with the ground or as roof insulation applied above the roofing membrane.

9.25.3.4. Air Barrier Materials

(1) Air barrier protection shall possess the characteristics necessary to provide an effective barrier to air exfiltration under differential air pressure due to stack effect, mechanical systems or wind.

(2) Polyethylene sheet used to provide the air barrier protection required in 9.25.2.2., shall conform to CAN/CGSB-51.34-M, "Vapour Barrier, Polyethylene Sheet for Use in Building Construction."

9.25.3.5. Vapour Barrier Materials

(1) Membrane-type vapour barriers shall conform to the requirements of

- (a) CAN/CGSB-51.34-M, "Vapour Barrier,

Polyethylene Sheet for Use in Building Construction," or

- (b) CAN/CGSB-51.33-M, "Vapor Barrier, Sheet Excluding Polyethylene, for Use in Building Construction."

(2) Vapour barriers conforming to Clause (1)(b) shall be Type 1 when used where a high resistance to vapour movement is required, such as in wall constructions that incorporate *exterior cladding* or sheathing having a low water vapour permeance.

9.25.4. Installation of Thermal Insulation

9.25.4.1. General

(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.

9.25.4.2. Batt-Type Insulation. Batt-type insulation manufactured with no membrane on either face shall be installed so that at least one face is in full and continuous contact with cladding, sheathing or other air-impermeable membrane.

9.25.4.3. Loose-Fill Insulation

(1) Except as provided in Sentences (2) and (3), loose-fill insulation shall be used on horizontal surfaces only.

(2) Water repellent loose-fill insulation may be used between the outer and inner wythes of masonry cavity walls. (See Appendix A.)

(3) Loose-fill insulation may be used in wood frame walls of existing *buildings*. (See Appendix A.)

(4) Where soffit venting is used, measures shall be taken to prevent loose-fill insulation from causing blockage of soffit vents.

9.25.4.4. Insulation in Crawl Spaces. Insulation on the interior of *foundation* walls enclosing a crawl space shall be applied so that there is not less than 50 mm clearance above the crawl space floor, if the insulation is of a type that may be damaged by water.

9.25.4.5. Insulation around Slabs-on-Grade.

Insulation around concrete slabs-on-grade 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.

9.25.4.6. Insulation Exposed to Weather.

Where insulation is exposed to the weather and subject to mechanical damage, it shall be protected with not less than 6 mm asbestos-cement board, 6 mm preservative-treated plywood or 12 mm cement parging on wire lath applied to the exposed face and edge.

9.25.4.7. Mechanical Damage. Insulation located in areas where it may be subject to mechanical damage shall be protected by a covering such as gypsum board, plywood, particleboard, waferboard, strandboard or hardboard.

9.25.4.8. Factory-Built Buildings. Insulation in factory-built *buildings* shall be installed so that it will not become dislodged during transportation.

9.25.5. Installation of Air Barrier Systems

9.25.5.1. Joints in Air Barrier Protection

(1) Where the air barrier protection consists of an air-impermeable panel-type material, all joints shall be sealed to prevent air leakage.

(2) Where the air barrier protection is formed 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.

9.25.5.2. Air Barrier Protection with Low Permeability. Where the air barrier protection consists of a material with a water vapour permeance less than the maximum permitted for Type 2 vapour barriers in Clause 9.25.3.5.(1)(b), it shall be installed in a location where the temperature will not be below the dew point of the interior air when the exterior temperature is 10°C above the 2.5 per cent January design temperature. (See Appendix A.)

9.25.5.3. Interior/Exterior Intersections.

Where an interior wall meets an exterior wall, ceiling, floor or roof required to be provided with air barrier protection, the protection shall extend across the intersection.

9.25.5.4. Penetrations of Air Barrier Protection.

Penetrations of the air barrier protection, 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 protection over the entire surface.

9.25.5.5. Access Hatches. Access hatches through surfaces requiring air barrier protection shall be weatherstripped around their perimeters to prevent air leakage.

9.25.5.6. Joints in Ductwork. Ductwork passing through unheated spaces shall have all joints taped or be otherwise sealed to ensure that the ducts are airtight throughout their length.

9.25.5.7. Clearances around Chimneys and Vents. Clearances between *chimneys* or *gas vents* and the surrounding construction which 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.

9.25.5.8. Hollow Masonry Walls

(1) Masonry walls of hollow units which penetrate the ceiling shall be sealed at or near the ceiling adjacent to the roof space to prevent air within the voids from entering the *attic* or *roof space* by

- (a) capping with masonry units without voids, or
- (b) installation of flashing material extending across the full width of the masonry.

9.25.6. Installation of Vapour Barriers

9.25.6.1. General. Vapour barrier protection shall be installed to protect the entire surfaces of thermally insulated wall, ceiling and floor assemblies.

9.25.6.2. Location of Vapour Barriers.

Vapour barrier protection shall be installed on the warm side of insulation. (See Appendix A.)

9.25.6.3. Low Permeance Insulation

(1) Additional vapour barrier protection is not required with insulation when

- (a) the insulation is of a type which, when installed, has a vapour permeance less than that required for vapour barriers in Article 9.25.3.5., or
- (b) the insulation is foamed plastic insulation with a permeance rating of not more than $230 \text{ ng/Pa} \cdot \text{s} \cdot \text{m}^2$ and is installed in continuous contact with masonry or concrete walls.

(See Appendix A.)

Section 9.26 Roofing**9.26.1. General**

9.26.1.1. Purpose of Roofing. Roofs shall be protected with roofing, including flashing, installed to shed rain effectively and prevent water due to ice damming from entering the roof.

9.26.1.2. Alternate Installation Methods. Methods described in CAN3-A123.51, "Asphalt Shingle Application on Roof Slopes 1:3 and Steeper," or CAN3-A123.52, "Asphalt Shingle Application on Roof Slopes 1:6 to less than 1:3" are permitted to be used for asphalt shingle applications not described in this Section.

9.26.2. Roofing Materials**9.26.2.1. Material Standards**

- (1) Roofing materials shall conform to
 - (a) CAN/CGSB 37.4-M, "Fibrated, Cutback, Lap Cement for Asphalt Roofing," **e**
 - (b) CAN/CGSB 37.5-M, "Cutback Asphalt Plastic Cement," **e**
 - (c) CAN/CGSB 37.8-M, "Asphalt, Cutback, Filled, for Roof Coating,"
 - (d) CGSB 37-GP-9Ma, "Primer, Asphalt for Asphalt Roofing, Dampproofing and Waterproofing,"
 - (e) CGSB 37-GP-21M, "Tar, Cutback, Fibrated, for Roof Coating,"
 - (f) CAN/CGSB-37.50M, "Hot Applied Rub-

Rubberized Asphalt for Roofing and Waterproofing,"

- (g) CGSB 37-GP-52M, "Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric,"
- (h) CGSB 37-GP-54M, "Roofing and Waterproofing Membrane, Sheet Applied, Flexible, Polyvinyl Chloride,"
- (i) CGSB 37-GP-56M, "Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing,"
- (j) CGSB 41-GP-6M, "Sheets, Thermosetting Polyester Plastics, Glass Fiber Reinforced,"
- (k) CAN2-51.32, "Sheathing, Membrane, Breather Type,"
- (l) CSA A123.1, "Asphalt Shingles Surfaced with Mineral Granules,"
- (m) CSA A123.2, "Asphalt Coated Roofing Sheets,"
- (n) CSA A123.3, "Asphalt or Tar Saturated Roofing Felt,"
- (o) CSA A123.4, "Bitumen for Use in Construction of Built-Up Roof Coverings and Dampproofing and Waterproofing Systems,"
- (p) CSA A123.17, "Asphalt-Saturated Felted Glass-Fibre Mat for Use in Construction of Built-Up Roofs," or
- (q) CSA-O118.1, "Western Red Cedar Shingles, and Shakes."

9.26.2.2. Nails

(1) Nails used for roofing shall be corrosion-resistant roofing or shingle nails conforming to 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 Appendix A.)

9.26.2.3. 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 if the number of staples specified in Article 9.26.7.4. is increased by one-third.

(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 A-9.26.2.2.(4) in Appendix A.)

9.26.3. Roof Slope

9.26.3.1. Slope

(1) Except as provided in Sentences (2) and (3), the roof slopes on which roof coverings may be applied shall conform to Table 9.26.3.A.

(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) Sheet metal roof cladding systems specifically designed for low-slope applications are permitted to be installed with lower slopes than required in Sentence (1).

9.26.4. Flashing at Intersections

9.26.4.1. Materials. Sheet metal flashing shall consist of not less than 1.73 mm thick sheet lead, 0.33 mm thick galvanized steel, 0.46 mm thick copper, 0.46 mm thick zinc or 0.48 mm thick aluminum.

9.26.4.2. Valley Flashing

(1) Where sloping surfaces of shingled roofs intersect to form a valley, the valley shall be flashed.

(2) Closed valleys shall not be used with rigid shingles on slopes of less than 1 in 1.2.

(3) Open valleys shall be flashed with not less than one layer of sheet metal not less than 600 mm wide, or 2 layers of roll roofing.

Table 9.26.3.A.
Forming Part of Sentence 9.26.3.1.(1)

Roofing Types and Slope Limits of Roofs		
Type of Roofing	Minimum Slope	Maximum Slope
Built-up Roofing		
Asphalt base (gravelled)	1 in 50 ⁽¹⁾	1 in 4
Asphalt base (without gravel)	1 in 25	1 in 2
Coal-tar base (gravelled)	1 in 50 ⁽¹⁾	1 in 25
Cold process	1 in 25	1 in 1.33
Asphalt Shingles		
Normal application	1 in 3	no limit
Low slope application	1 in 6	no limit
Roll Roofing		
Smooth and mineral surfaced	1 in 4	no limit
480 mm wide selvage asphalt roofing	1 in 6	no limit
Cold application felt	1 in 50	1 in 1.33
Wood Shingles	1 in 4	no limit
Handsplit Shakes	1 in 3	no limit
Asbestos-Cement Corrugated Sheets	1 in 4	no limit
Corrugated Metal Roofing	1 in 4	no limit
Sheet Metal Shingles	1 in 4	no limit
Slate Shingles	1 in 2	no limit
Clay Tile	1 in 2	no limit
Glass Fibre Reinforced Polyester Roofing Panels	1 in 4	no limit
Column 1	2	3

Note to Table 9.26.3.A.:

⁽¹⁾ See Sentences 9.26.3.1.(2) and (3).

(4) The bottom layer of roofing required in Sentence (3) shall consist of not less than 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.

(5) The top layer of roofing required in Sentence (3) shall consist of not less than 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.

9.26.4.3. 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.

(2) Caulking 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) Caulking 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 9.7.4.2., 9.20.13.12. and 9.28.1.5.)

9.27.4.2. Materials

(1) Caulking shall be of a non-hardening type suitable for exterior use, selected for its ability to resist the effects of weathering and shall be compatible with and adhere to the substrate to which it is applied.

- (2)** Caulking shall conform to
 - (a) CGSB 19-GP-5M, "Sealing Compound, One Component, Acrylic Base, Solvent Curing,"
 - (b) CAN/CGSB-19.13, "Sealing Compound, One Component, Elastomeric, Chemical Curing,"
 - (c) CGSB 19-GP-14M, "Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing," or
 - (d) CAN/CGSB-19.24, "Multi-Component, Chemical Curing Sealing Compound."

9.27.5. Attachment of Siding

9.27.5.1. Attachment

(1) Except as permitted in Sentences (2) to (7), siding shall be nailed to the framing members, furring members or to blocking between the framing members.

(2) Vertical lumber and stucco lath or reinforcing may be attached to sheathing only where the sheathing consists of not less than 14.3 mm lumber, 12.5 mm plywood or 12.5 mm waferboard and strandboard.

(3) Vertically applied metal siding and wood shingles and shakes may be attached to the sheathing only where the sheathing consists of not less than 14.3 mm lumber, 7.5 mm plywood or 7.5 mm waferboard and strandboard.

(4) Asbestos-cement shingles may be attached to the sheathing only when the sheathing consists of not less than 14.3 mm lumber, 9.5 mm plywood or 9.5 mm waferboard and strandboard.

(5) Where wood shingles or shakes are applied to sheathing which is not suitable for attaching the shingles or shakes, the shingles or shakes may 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.

(6) Where asbestos-cement shingles are applied to sheathing that is not suitable for attaching the shingles, the shingles may be fastened to a wood lath not less than 89 mm by 9.5 mm thick securely nailed to the framing.

(7) Lath referred to in Sentence (6) shall be applied so that it overlaps the preceding shingle course by not less than 20 mm.

9.27.5.2. Blocking. Blocking for the attachment of siding shall be not less than 38 mm by 38 mm lumber securely nailed to the framing and spaced not more than 600 mm o.c.

9.27.5.3. Furring

(1) Except as permitted in Sentences 9.27.5.1.(5) and (6), furring for the attachment of siding 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 19 mm by 64 mm lumber on supports spaced not more than 400 mm o.c., and 19 mm by 89 mm on supports spaced not more than 600 mm o.c.

(3) Furring referred to in Sentence (1) shall be securely fastened to the framing and shall be spaced not more than 600 mm o.c.

9.27.5.4. Size and Spacing of Fasteners. Nail or staple size and spacing for the attachment of siding and trim shall conform to Table 9.27.5.A.

9.27.5.5. Fastener Materials. Nails or staples for the attachment of sidings and wood trim shall be corrosion-resistant and shall be compatible with the siding material.

9.27.5.6.

Table 9.27.5.A.
Forming Part of Article 9.27.5.4.

Attachment of Siding			
Type of Siding	Minimum Nail or Staple Length, mm	Minimum Number of Nails or Staples	Maximum Nail or Staple Spacing
Wood trim	51	—	600 mm (o.c.)
Lumber siding or horizontal siding made from sheet material	51	—	600 mm (o.c.)
Metal siding	38	—	600 mm (o.c.) (nailed to framing) 400 mm (o.c.) (nailed to sheathing only)
Handsplit wood shakes up to 200 mm in width	51	2	—
Handsplit wood shakes over 200 mm in width	51	3	—
Wood shingles and machine grooved shakes up to 200 mm in width	32	2	—
Wood shingles and machine grooved shakes over 200 mm in width	32	3	—
Asbestos-cement shingles	32	2	—
Panel or sheet type siding up to 7 mm thick	38	—	150 mm (o.c.) along edges
Panel or sheet type siding more than 7 mm thick	51	—	300 mm (o.c.) along intermediate supports
Column 1	2	3	4

9.27.5.6. Expansion and Contraction. Fasteners for metal or vinyl siding shall be positioned to permit expansion and contraction of the siding.

9.27.5.7. Penetration of Fasteners

(1) Fasteners for shakes and shingles shall penetrate through the nail-holding base or not less than 19 mm into the framing.

(2) Fasteners for siding other than that described in Sentence (1) shall penetrate through the nail-holding base or not less than 25 mm into the framing.

9.27.6. Lumber Siding

9.27.6.1. Materials. 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 not less than 5 mm thick at the top and 12 mm thick at the butt for

(3) The uppermost wall nails shall be not more than 200 mm below the ceiling.

(4) Nails shall be located not less than 10 mm from the side or edge of the board.

(5) Nails shall be driven so that the heads are below the plane of the board surface but do not puncture the paper.

9.29.5.9. Spacing of Screws. Where gypsum board is applied with drywall screws, the screws shall be spaced not more than 300 mm o.c. along supports, except that on vertical surfaces the screws may be spaced 400 mm o.c. where the supports are not more than 400 mm o.c.

9.29.5.10. Low Temperature Conditions. In cold weather, heat shall be provided to maintain a temperature of 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) The minimum thickness of plywood interior finish shall conform to Table 9.29.6.A., except that no minimum thickness is required when the plywood is applied over solid backing.

(2) Thicknesses listed in Table 9.29.6.A. shall permit a manufacturing tolerance of ± 0.4 mm.

Table 9.29.6.A.

Forming Part of Articles 9.29.6.1. and 9.29.6.2.

Minimum Thickness of Plywood Interior Finish		
Maximum Spacing of Supports, mm (o.c.)	On Supports with no Horizontal Blocking, mm	On Supports with Blocking at Vertical Intervals not Exceeding 1.2 m, mm
400	4.7	4.0
600	8.0	4.7
Column 1	2	3

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.A. 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. 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.

9.29.6.4. Edge Support. All plywood edges shall be supported by furring, blocking or framing.

9.29.7. Hardboard Finish

9.29.7.1. Material Standard. Hardboard shall conform to CGSB 11-GP-3M, "Hardboard."

9.29.7.2. Thickness. Hardboard shall be not less than 3 mm thick where applied over continuous back-up, 6 mm thick when applied over supports spaced not more than 400 mm o.c. and 9 mm thick when applied over supports spaced not more than 600 mm o.c.

9.29.7.3. Nails. 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. All hardboard edges shall be supported by furring, blocking or framing where the back-up is not continuous.

9.29.8. Insulating Fibreboard Finish

9.29.8.1. Material Standard. Insulating fibreboard shall conform to CAN3-A247-M, "Insulating Fibreboard."

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. All fibreboard edges shall be supported by blocking, furring or framing.

9.29.9. Particleboard, Waferboard or Strandboard Finish

9.29.9.1. Material Standard

(1) Particleboard finish shall conform to CAN3-O188.1, "Interior Mat-Formed Wood Particleboard."

(2) Waferboard and strandboard finish shall conform to CAN3-O437.0 "Waferboard and Strandboard."

9.29.9.2. Minimum Thickness

(1) The minimum thickness of O-2 grade waferboard and strandboard used as an interior finish shall conform to that shown for plywood in Table 9.29.6.A., except that no minimum thickness is required when applied over solid backing.

(2) Thicknesses listed in Table 9.29.6.A. shall permit a manufacturing tolerance of ± 0.4 mm.

(3) Waferboard and strandboard conforming to grades R-1 and O-1, 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.

9.29.9.3. Nails. Nails for fastening particleboard, waferboard or strandboard 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.

9.29.9.4. Edge Support. All particleboard, waferboard or strandboard 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 1 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. 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. 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. The joints between wall tiles and a bathtub shall be suitably caulked with material conforming to CAN/CGSB-19.22M, "Mildew Resistant Sealing Compound for Tubs and Tile."

vinyl-asbestos, unbacked vinyl or vinyl with an inorganic type backing.

(2) Flooring described in Sentence (1) shall be attached to the base with a suitable waterproof and alkali-resistant adhesive.

9.30.6. Ceramic Tile

9.30.6.1. Ceramic tile shall be set in a mortar bed or applied to a sound smooth base with a suitable adhesive.

9.30.6.2. Panel-type subfloor to which ceramic tile is to be applied with adhesive shall have its edges supported according to Article 9.23.14.3.

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) Plumbing facilities other than those required in *dwelling units* shall conform to Subsection 3.6.4. (See also Section 3.7 regarding *barrier-free* plumbing facilities.)

9.31.2. General

9.31.2.1. General. 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. 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. When provided, grab bars shall be capable of resisting a load of not less than 1.3 kN applied vertically or horizontally.

9.31.3. Water Supply and Distribution

9.31.3.1. Required Water Supply. 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 and hose bib.

9.31.4. Required Facilities

9.31.4.1. Required Fixtures. A kitchen sink, lavatory, bathtub and water closet shall be provided for every *dwelling unit* where a piped water supply is available.

9.31.4.2. Laundry Facilities. Laundry facilities or a space for laundry facilities shall be provided in every *dwelling unit*, or grouped elsewhere in the *building* in a location conveniently accessible to occupants of every *dwelling unit*.

9.31.4.3. Hot Water Supply. Where a piped water supply is available a hot water supply shall be provided in every *dwelling unit*.

9.31.4.4. 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. 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 Temperature. Where a hot water supply is required by Article 9.31.4.3., equipment shall be installed which is capable of heating to at least 45°C but not above 60°C an adequate supply of service hot water for every *dwelling unit*.

9.31.6.2. Supply Source. Service hot water may be distributed from a centrally located heater to supply the entire *building* or may be supplied by an individual *service water heater* for each *dwelling unit*.

9.31.6.3. Equipment and Installation Requirements. Every *service water heater* and its installation shall conform to Part 6.

9.31.6.4. Corrosion-Resistant Coating. 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.

9.31.6.5. Fuel-Burning Heaters. Fuel-burning *service water heaters* shall be connected to a *chimney flue* conforming to Section 9.21.

9.31.6.6. Heating Coils. Heating coils of *service water heaters* shall not be installed in a *flue* or in the combustion chamber of a *boiler* or *furnace* heating a *building*.

Section 9.32 Ventilation

9.32.1. General

9.32.1.1. Application

(1) This Section applies to the ventilation of rooms and spaces in *residential occupancies* by natural ventilation and to self-contained mechanical ventilation systems serving only one *dwelling unit*.

(2) Mechanical ventilation systems, other than self-contained systems serving single *dwelling units*, shall conform to Part 6.

(3) Ventilation of rooms and spaces in other than *residential occupancies* shall conform to Part 6.

(4) A *storage garage* for more than 5 cars shall be ventilated in accordance with Part 6.

9.32.1.2. General. Rooms or spaces in *dwelling units* shall be ventilated during the non-heating season by natural means in accordance with Subsection 9.32.2. or by a mechanical ventilation system conforming to Subsection 9.32.3.

9.32.2. Natural Ventilation

9.32.2.1. Natural Ventilation Area

(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.A.

(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.

9.32.2.2. Protection from Weather and Insects

(1) Openings for natural ventilation other than windows shall be constructed to provide protection from the weather and insects.

(2) Screening shall be of rust-proof material.

9.32.3. Mechanical Ventilation (See Appendix A.)

9.32.3.1. Required Mechanical Ventilation for Dwelling Units

(1) Every *dwelling unit* shall be provided with a mechanical ventilation system having a capacity to exhaust inside air or to introduce outside air at the rate of not less than 0.3 air changes per hour averaged over any 24-hour period.

(2) The rate of air change required in Sentence (1) shall be based on the total interior volume of all *storeys* including the *basement*, but excluding any attached or built-in garage or unheated crawl space.

9.32.3.2. Mechanical Ventilation of Rooms and Spaces. Where a habitable room or space in a *dwelling unit* is not provided with natural ventilation described in Article 9.32.1.2., mechanical ventilation shall be provided to exhaust inside air or

to introduce outside air to that room or space at the rate of one-half air change per hour if the room or space is mechanically cooled in summer, and one air change per hour if it is not.

9.32.3.3. Design and Installation Requirements

(1) Except as provided in Sentence (2), mechanical ventilation shall conform to the requirements in Part 6.

(2) Mechanical ventilation required in Articles 9.32.3.1. and 9.32.3.2., and consisting of one or more exhaust fans without an air circulating ductwork system, need not conform with Part 6, provided

- (a) each exhaust fan conforms to CSA C22.2 No. 113, "Fans and Ventilators,"
- (b) except as permitted in Sentences (4) and

(5), air intake openings for make-up air are installed and are of a size to prevent excessive depressurization in the *dwelling unit* when all exhaust fans of the system are operating, and

- (c) the exhaust fans are controlled either manually by a switch or automatically by a humidistat.

(3) The mechanical ventilation capacity of the system described in Sentence (2) shall be assumed to be the sum of the capacities of the individual fans, as rated at a differential static pressure of at least 25 Pa.

(4) The air intake openings described in Clause (2)(b) are not required if spillage-susceptible fuel-fired heating *appliances* which are required to be vented are not installed in the *dwelling unit*.

Table 9.32.2.A.
Forming Part of Sentence 9.32.2.1.(1)

Natural Ventilation Area		
	Location	Minimum Unobstructed Area
Within dwelling unit	Bathrooms or water-closet rooms	0.09 m ²
	Unfinished <i>basement</i> space	0.2 per cent 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 dwelling unit	Bathrooms or water-closet rooms	0.09 m ² per water closet
	Sleeping areas	0.14 m ² per occupant
	Laundry rooms, kitchens, recreation rooms	4 per cent of the <i>floor area</i>
	Corridors, storage rooms and other similar public rooms or spaces	2 per cent of the <i>floor area</i>
	Unfinished <i>basement</i> space not used on a shared basis	0.2 per cent of the <i>floor area</i>
Column 1	2	3

(5) The air intake openings described in Clause (2)(b) are not required if it can be shown by test that air leakage is sufficient to prevent excessive depressurization in the *dwelling unit* when all exhaust fans of the system are operating.

(6) Special purpose air exhausting equipment such as central vacuum cleaning systems, downdraft cook tops and clothes dryers shall not be included in the calculation of the capacity of the system described in Sentence (2).

9.32.3.4. Combustion and Dilution Air.

Systems designed to provide combustion and/or dilution air for fuel-burning *appliances* shall not be used to supply make-up air for ventilation systems unless their capacity is sufficient to serve both functions simultaneously without creating excessive depressurization in the *dwelling unit*.

9.32.3.5. Exhaust Ducts

(1) *Exhaust ducts* shall discharge directly to the outdoors.

(2) Where the *exhaust duct* passes through or is adjacent to unheated space, the duct shall be insulated to prevent moisture condensation in the duct.

9.32.3.6. Accessibility

(1) Ventilation equipment shall be accessible for inspection, maintenance, repair and cleaning.

(2) Kitchen *exhaust ducts* shall be designed and installed so that the entire duct can be cleaned where the duct is not equipped with a filter at the intake end.

9.32.3.7. Protection from Weather and Insects

(1) Outdoor air intake and exhaust outlets shall be shielded from weather and insects.

(2) Screening shall be of rust-proof material.

9.32.3.8. Requirements for Ducts. Ventilating ducts shall conform to the requirements of Part 6 for *supply ducts*, except *exhaust ducts* that serve only a bathroom or water-closet room may be of *combustible* material provided the duct is reasonably air tight and constructed of a material impervious to water.

Section 9.33 Heating and Air-Conditioning

9.33.1. General

9.33.1.1. Design and Installation Requirements

(1) The design and installation of central heating systems, including requirements for combustion air, shall conform to the requirements in Part 6 and to this Section. (See Appendix A.) (See also Subsection 9.10.10.)

(2) The design and installation of air-conditioning systems shall conform to the requirements in Part 6.

9.33.1.2. Solid-Fuel Burning Appliances.

The installation of solid-fuel burning *stoves*, *ranges* and *space heaters*, including the requirements for combustion air, shall conform to CAN/CSA-B365, "Installation Code for Solid-Fuel Burning Appliances and Equipment."

9.33.1.3. Design Temperatures

(1) Residential *buildings* intended for use in the winter months on a continuing basis shall be equipped with heating facilities capable of maintaining an indoor air temperature of 22°C at the outside winter design temperature except as provided in Sentences (4) and (5).

(2) All *buildings* other than those described in Sentence (1) shall be equipped with heating facilities of sufficient capacity to maintain the desired indoor air temperature, commensurate with the use of the *building*, at the outside winter design temperature.

(3) Winter design temperatures shall be determined in conformance with Subsection 2.2.1.

(4) Heating facilities shall be provided which shall be capable of maintaining a temperature not below 18°C in an unfinished *basement* in *buildings* of *residential occupancy*.

(5) Where crawl spaces are required to be heated, the heating facilities shall be capable of maintaining a temperature not below 15°C.

9.33.2. Fire Protection for Gas and Electric Ranges

9.33.2.1. Vertical Clearance

(1) Except as provided in Sentence (2), a vertical clearance of not less than 750 mm shall be provided above the elements or burners of electric- and gas-fired domestic *ranges*.

(2) Where cabinets located above the elements or burners referred to in Sentence (1) are *noncombustible* or are protected with asbestos millboard not less than 6 mm thick, covered with sheet metal not less than 0.33 mm thick, or by a metal hood with a 125 mm projection beyond the upper cabinets, the vertical clearance may be reduced to 600 mm.

9.33.2.2. Clearance to Wall Framing. *Combustible* wall framing members within 450 mm of the area where the *range* is to be located shall be protected above the level of the heating elements by material providing fire resistance not less than that of a 9.5 mm thickness of gypsum board.

Section 9.34 Electrical Facilities

9.34.1. General

9.34.1.1. Standard for Electrical Installations. 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 or municipal legislation or, in the absence of such legislation, shall conform to CSA C22.1, "Canadian Electrical Code, Part I."

9.34.1.2. Required Facilities. 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. 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. 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. Electrical wiring and cables installed in *buildings* permitted to be of *combustible construction* shall conform to Sentence 3.1.4.3.(1).

9.34.2. Lighting Outlets

9.34.2.1. Lighting of Entrances. 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 not less than one lighting outlet with fixture for stairways with 4 or more risers in *dwelling units*.

(3) The stairway lighting for *basements* that do not contain finished space or lead to an outside entrance or built-in garage and which serve not more than one *dwelling unit* may 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*.

9.34.2.4.

(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. 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) Outlets required in Sentence (1) shall be controlled by a wall switch near the doorway where the fixture is ceiling mounted above an area normally occupied by a parked car; otherwise a switched lampholder may be used.

(3) 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.A. (See 9.9.11.2. for lighting in *means of egress*.)

Table 9.34.2.A.

Forming Part of Sentences 9.34.2.7.(2) and (3)

Minimum Lighting for Public Areas		
Room or Space	lx	W/m ² of Floor Area (Incandescent Lighting)
Storage rooms	50	5
Service rooms and laundry areas	200	20
Garages	50	5
Public water-closet rooms	100	10
Service hallways and stairways	50	5
Recreation rooms	100	10
Column 1	2	3

(3) When other types of lighting are used, illumination equivalent to that shown in Table 9.34.2.A. shall be provided.

9.34.3. Emergency Lighting

9.34.3.1. Emergency lighting shall conform to Subsection 9.9.11.

Section 9.35 Garages and Carports

9.35.1. Scope

9.35.1.1. Application. This Section applies to garages and carports serving not more than one *dwelling unit*.

9.35.1.2. Construction Requirements. 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. Where a roofed enclosure used for the storage or parking of a car or cars has more than 60 per cent of the total perimeter enclosed by walls, doors or windows, the enclosure shall be considered a garage.

9.35.2.2. Garage Floor. Where an attached or built-in garage is provided, the garage floor shall be sloped to the outdoors.

9.35.3. Foundations

9.35.3.1. Foundation Required. 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.

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

- e dwelling unit by a breezeway shall be approximately the same depth as the main *building foundation*.
- (2) Where slab-on-grade construction is used, a construction joint shall be provided between the main *building* slab and the garage or breezeway or carport slab.
- e (3) Except as provided in Section 9.12, *foundations* for attached unheated garages or carports shall be below frost level.

9.35.3.3. Small Garages. Detached garages of less than 50 m² floor area and not more than 1 storey in height may be supported on wood mud sills provided the garage is not of masonry or masonry veneer construction.

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. Interior finish need not be applied to garage and carport walls.

9.35.4.2. Columns. Columns for garages and carports shall conform to Section 9.17, except that 89 mm by 89 mm wood columns may be used.

- e **9.35.4.3. Anchorage.** 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.

Table A-1
Forming Part of Sentence 9.23.4.1.(1)

Floor Joists – Living Quarters											
Commercial Designation	Grade	Member Size, mm	Strapping Only			Bridging Only			Strapping and Bridging		
			Joist Spacing			Joist Spacing			Joist Spacing		
			300 mm	400 mm	600 mm	300 mm	400 mm	600 mm	300 mm	400 mm	600 mm
			m	m	m	m	m	m	m	m	m
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	1.68	1.55	1.96	1.78	1.55	1.96	1.78	1.55
Hemlock – 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	1.55	1.96	1.78	1.55	1.96	1.78	1.55

Table A-7 (Continued)

Roof Rafters – (Design Roof Snow Loads 2.0 and 2.5 kPa)								
Commercial Designation	Grade	Member Size, mm	2.0 kPa			2.5 kPa		
			Rafter Spacing			Rafter Spacing		
			300 mm	400 mm	600 mm	300 mm	400 mm	600 mm
			m	m	m	m	m	m
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	2.37	2.15	1.88
		38 × 140	4.02	3.65	3.19	3.73	3.39	2.96
		38 × 184	5.28	4.80	4.19	4.90	4.45	3.89
		38 × 235	6.74	6.13	5.35	6.26	5.69	4.97
		38 × 286	8.21	7.46	6.52	7.62	6.92	5.90
	No. 1 and No. 2	38 × 89	2.47	2.24	1.96	2.29	2.08	1.82
		38 × 140	3.89	3.53	3.08	3.61	3.28	2.86
		38 × 184	5.11	4.64	3.89	4.74	4.31	3.52
		38 × 235	6.52	5.82	4.75	6.06	5.27	4.30
		38 × 286	7.80	6.76	5.52	7.06	6.11	4.99
	No. 3	38 × 89	2.43	2.11	1.72	2.21	1.91	1.56
		38 × 140	3.48	3.01	2.46	3.15	2.73	2.23
		38 × 184	4.23	3.67	2.99	3.83	3.32	2.71
		38 × 235	5.18	4.48	3.66	4.68	4.06	3.31
		38 × 286	6.01	5.20	4.25	5.43	4.71	3.84
	Construction	38 × 89	2.43	2.20	1.93	2.25	2.05	1.79
	Standard	38 × 89	2.33	2.12	1.85	2.17	1.97	1.72
Northern Species (includes any Canadian softwood covered by the NLGA Standard Grading Rules)	Select Structural	38 × 89	2.28	2.07	1.81	2.12	1.93	1.68
		38 × 140	3.59	3.26	2.85	3.33	3.03	2.65
		38 × 184	4.72	4.29	3.68	4.38	3.98	3.33
		38 × 235	6.03	5.48	4.51	5.60	4.99	4.08
		38 × 286	7.34	6.40	5.23	6.69	5.79	4.73
	No. 1 and No. 2	38 × 89	2.23	2.03	1.77	2.07	1.88	1.62
		38 × 140	3.51	3.14	2.56	3.26	2.84	2.32
		38 × 184	4.41	3.82	3.12	3.99	3.46	2.82
		38 × 235	5.40	4.67	3.82	4.88	4.23	3.45
		38 × 286	6.26	5.42	4.43	5.66	4.90	4.00
	No. 3	38 × 89	1.95	1.69	1.38	1.77	1.53	1.25
		38 × 140	2.79	2.42	1.97	2.52	2.19	1.78
		38 × 184	3.40	2.94	2.40	3.07	2.66	2.17
		38 × 235	4.15	3.60	2.94	3.76	3.25	2.66
		38 × 286	4.82	4.17	3.41	4.36	3.77	3.08
	Construction	38 × 89	2.18	1.98	1.73	2.02	1.84	1.60
	Standard	38 × 89	2.12	1.87	1.53	1.95	1.69	1.38

Table A-8
Forming Part of Sentence 9.23.4.1.(1)

Maximum Spans (m) for Built-up Floor Beams Supporting not more than One Floor in Houses⁽¹⁾								
Commercial Designation	Grade	Supported Length, m	Size of Built-Up Beam, mm					
			3 – 38 x 184	4 – 38 x 184	3 – 38 x 235	4 – 38 x 235	3 – 38 x 286	4 – 38 x 286
Douglas Fir – Larch (includes Douglas Fir and Western Larch)	Select Structural	2.4	3.84	4.43	4.70	5.42	5.45	6.29
		3.0	3.43	3.97	4.20	4.85	4.87	5.63
		3.6	3.14	3.62	3.83	4.43	4.45	5.14
		4.2	2.90	3.35	3.55	4.10	3.95	4.76
		4.8	2.67	3.14	3.13	3.83	3.46	4.45
	No. 1 and No. 2	2.4	2.99	3.45	3.66	4.22	4.24	4.90
		3.0	2.67	3.09	3.27	3.78	3.79	4.38
		3.6	2.44	2.82	2.98	3.45	3.46	4.00
		4.2	2.26	2.61	2.76	3.19	3.21	3.70
		4.8	2.11	2.44	2.59	2.98	3.00	3.46
Hemlock – Fir (includes Western Hemlock and Amabilis Fir)	Select Structural	2.4	3.78	4.37	4.62	5.34	5.37	6.20
		3.0	3.38	3.91	4.09	4.78	4.53	5.54
		3.6	2.91	3.57	3.41	4.36	3.78	5.03
		4.2	2.50	3.30	2.92	3.90	3.24	4.31
		4.8	2.19	2.91	2.56	3.41	2.83	3.78
	No. 1 and No. 2	2.4	3.14	3.62	3.83	4.43	4.45	5.14
		3.0	2.80	3.24	3.43	3.96	3.98	4.60
		3.6	2.56	2.96	3.13	3.61	3.63	4.19
		4.2	2.37	2.74	2.90	3.35	3.24	3.88
		4.8	2.19	2.56	2.56	3.13	2.83	3.63
Spruce – Pine – Fir (includes Spruce (all species except Coast Sitka Spruce), Jack Pine, Lodgepole Pine, Balsam Fir and Alpine Fir)	Select Structural	2.4	3.84	4.43	4.70	5.42	5.45	6.29
		3.0	3.43	3.97	4.20	4.85	4.87	5.63
		3.6	3.14	3.62	3.79	4.43	4.19	5.14
		4.2	2.78	3.35	3.25	4.10	3.60	4.76
		4.8	2.43	3.14	2.84	3.79	3.15	4.19
	No. 1 and No. 2	2.4	3.25	3.75	3.97	4.59	4.61	5.32
		3.0	2.90	3.35	3.55	4.10	4.12	4.76
		3.6	2.65	3.06	3.24	3.74	3.76	4.34
		4.2	2.45	2.83	3.00	3.47	3.48	4.02
		4.8	2.30	2.65	2.81	3.24	3.15	3.76
Northern Species (includes any Canadian softwood covered by the NLGA Standard Grading Rules)	Select Structural	2.4	3.08	3.55	3.76	4.35	4.37	5.04
		3.0	2.75	3.18	3.37	3.89	3.91	4.51
		3.6	2.51	2.90	3.07	3.55	3.57	4.12
		4.2	2.33	2.69	2.85	3.29	3.24	3.81
		4.8	2.18	2.51	2.56	3.07	2.83	3.57
	No. 1 and No. 2	2.4	2.61	3.01	3.19	3.68	3.70	4.27
		3.0	2.33	2.69	2.85	3.29	3.31	3.82
		3.6	2.13	2.46	2.60	3.00	3.02	3.49
		4.2	1.97	2.27	2.41	2.78	2.80	3.23
		4.8	1.84	2.13	2.25	2.60	2.61	3.02

Note to Table A-8

⁽¹⁾ See A-9.23.4.1.(1) in Appendix A

Table A-9
Forming Part of Sentence 9.23.4.1.(1)

Maximum Spans (m) for Built-up Floor Beams Supporting not more than Two Floors in Houses⁽¹⁾								
Commercial Designation	Grade	Supported Length, m	Size of Built-Up Beam, mm					
			3 – 38 x 184	4 – 38 x 184	3 – 38 x 235	4 – 38 x 235	3 – 38 x 286	4 – 38 x 286
Douglas Fir – Larch (includes Douglas Fir and Western Larch)	Select Structural	2.4	2.91	3.36	3.56	4.11	3.98	4.77
		3.0	2.46	3.01	2.88	3.68	3.19	4.25
		3.6	2.05	2.73	2.40	3.20	2.66	3.54
		4.2	1.76	2.84	2.06	2.74	2.28	3.04
		4.8	1.54	2.05	1.80	2.40	1.99	2.66
	No. 1 and No. 2	2.4	2.27	2.62	2.77	3.20	3.22	3.72
		3.0	2.03	2.34	2.48	2.86	2.88	3.32
		3.6	1.85	2.14	2.26	2.62	2.63	3.03
		4.2	1.71	1.98	2.06	2.42	2.28	2.81
		4.8	1.54	1.85	1.80	2.26	1.99	2.63
Hemlock – Fir (includes Western Hemlock and Amabilis Fir)	Select Structural	2.4	2.52	3.31	2.95	3.93	3.26	4.35
		3.0	2.01	2.68	2.36	3.14	2.61	3.48
		3.6	1.68	2.24	1.96	2.62	2.17	2.90
		4.2	1.44	1.92	1.68	2.25	1.86	2.48
		4.8	1.26	1.68	1.47	1.96	1.63	2.17
	No. 1 and No. 2	2.4	2.38	2.75	2.91	3.36	3.26	3.90
		3.0	2.01	2.46	2.36	3.00	2.61	3.48
		3.6	1.68	2.24	1.96	2.62	2.17	2.90
		4.2	1.44	1.92	1.68	2.25	1.86	2.48
		4.8	1.26	1.68	1.47	1.96	1.63	2.17
Spruce – Pine – Fir (includes Spruce (all species except Coast Sitka Spruce), Jack Pine, Lodgepole Pine, Balsam Fir and Alpine Fir)	Select Structural	2.4	2.80	3.36	3.27	4.11	3.62	4.77
		3.0	2.24	2.98	2.62	3.49	2.90	3.86
		3.6	1.86	2.49	2.18	2.91	2.42	3.22
		4.2	1.60	2.13	1.87	2.49	2.07	2.76
		4.8	1.40	1.86	1.64	2.18	1.81	2.42
	No. 1 and No. 2	2.4	2.46	2.85	3.01	3.48	3.50	4.04
		3.0	2.20	2.55	2.62	3.11	2.90	3.61
		3.6	1.86	2.32	2.18	2.84	2.42	3.22
		4.2	1.60	2.13	1.87	2.49	2.07	2.76
		4.8	1.40	1.86	1.64	2.18	1.81	2.42
Northern Species (includes any Canadian softwood covered by the NLGA Standard Grading Rules)	Select Structural	2.4	2.34	2.70	2.86	3.30	3.26	3.83
		3.0	2.01	2.41	2.36	2.95	2.61	3.42
		3.6	1.68	2.20	1.96	2.62	2.17	2.90
		4.2	1.44	1.92	1.68	2.25	1.86	2.48
		4.8	1.26	1.68	1.47	1.96	1.63	2.17
	No. 1 and No. 2	2.4	1.98	2.28	2.42	2.79	2.81	3.24
		3.0	1.77	2.04	2.16	2.50	2.51	2.90
		3.6	1.61	1.86	1.96	2.28	2.17	2.65
		4.2	1.44	1.73	1.68	2.11	1.86	2.45
		4.8	1.26	1.61	1.47	1.96	1.63	2.17

Note to Table A-9

⁽¹⁾ See A-9.23.4.1.(1) in Appendix A

Table A-10
Forming Part of Article 9.23.13.11.

Maximum Clear Spans (m) between End Supports for Fink Trusses										
Top Member Size, mm	Bottom Member Size, mm	Roof Slope	No. 1 Grade Lumber				No. 2 Grade Lumber			
			Design Roof Snow Load, kPa				Design Roof Snow Load, kPa			
			1.0	1.5	2.0	2.5	1.0	1.5	2.0	2.5
38 × 89	38 × 89	1 in 4.8	6.75	4.87	–	–	5.84	4.01	–	–
		1 in 4	9.57	8.12	6.01	4.54	8.02	7.13	5.18	3.78
		1 in 3	9.60	8.83	7.62	6.75	8.91	7.69	6.60	5.84
		1 in 2.4	9.80	9.04	7.79	6.93	9.11	7.87	6.78	6.01
	38 × 114	1 in 4.8	7.74	5.74	3.78	–	6.75	4.85	–	–
		1 in 4	9.27	8.53	7.06	5.48	8.58	7.36	6.14	4.67
		1 in 3	9.60	8.83	7.62	6.75	8.91	7.69	6.60	5.84
		1 in 2.4	9.80	9.04	7.79	6.93	9.11	7.87	6.78	6.01
	38 × 140	1 in 4.8	8.50	6.35	4.39	–	7.44	5.46	3.47	–
		1 in 4	9.27	8.53	7.28	5.89	8.58	7.36	6.29	5.08
		1 in 3	9.60	8.83	7.62	6.75	8.91	7.69	6.60	5.84
		1 in 2.4	9.80	9.04	7.79	6.93	9.11	7.87	6.78	6.01
38 × 114	38 × 89	1 in 4.8	7.97	5.91	3.96	–	6.95	5.02	–	–
		1 in 4	9.57	8.66	7.18	5.56	8.02	7.16	6.24	4.77
		1 in 3	10.54	9.75	8.81	7.97	8.96	8.20	7.31	6.57
		1 in 2.4	11.20	9.90	9.65	8.89	9.57	8.91	8.10	7.41
	38 × 114	1 in 4.8	9.27	6.98	4.95	3.30	8.12	6.04	4.08	–
		1 in 4	11.91	10.23	8.48	6.68	10.31	9.24	7.44	5.79
		1 in 3	12.19	10.64	9.14	8.66	10.74	9.24	8.48	7.49
		1 in 2.4	12.19	10.89	9.39	8.91	10.99	9.49	8.71	7.74
	38 × 140	1 in 4.8	10.23	7.79	5.63	4.08	9.01	6.78	4.77	–
		1 in 4	11.91	10.23	9.11	7.23	10.31	9.47	8.05	6.29
		1 in 3	12.19	10.64	9.14	8.66	10.74	9.47	8.48	7.49
		1 in 2.4	12.19	10.89	9.39	8.91	10.99	9.49	8.71	7.74
38 × 140	38 × 89	1 in 4.8	8.89	6.73	4.72	–	7.39	5.81	3.86	–
		1 in 4	9.57	8.66	7.62	6.35	8.02	7.16	6.24	5.48
		1 in 3	10.54	9.75	8.81	7.97	8.96	8.20	7.31	6.57
		1 in 2.4	11.20	10.49	9.65	8.89	9.57	8.91	8.10	7.41
	38 × 114	1 in 4.8	10.46	7.97	5.79	4.24	9.22	6.95	4.92	3.27
		1 in 4	12.19	11.12	9.62	7.64	10.33	9.24	8.02	6.68
		1 in 3	12.19	12.19	11.17	9.90	11.50	10.54	9.42	8.45
		1 in 2.4	12.19	12.19	11.48	10.18	12.19	11.45	9.98	9.44
	38 × 140	1 in 4.8	11.68	8.96	6.60	5.00	10.33	7.84	5.68	4.14
		1 in 4	12.19	12.19	10.43	8.33	12.19	10.82	9.22	7.31
		1 in 3	12.19	12.19	11.17	9.90	12.19	11.30	9.67	9.16
		1 in 2.4	12.19	12.19	11.48	10.18	12.19	11.60	9.98	9.44

Appendix A

Explanatory Material for the National Building Code 1990

A-1.1.2.1. Application to Existing Buildings.

This Code is most often applied to existing buildings when an owner voluntarily wishes to rehabilitate a building, change its use or build an addition; or when an enforcement authority decrees that the building be altered for reasons of public safety. Whatever the reason, its application to existing 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 alternate design proposals for new construction. First the objective of the Code requirements must be established. To assist the Code user in this regard, Appendix notes are included to clarify the intent of certain requirements. In addition, commentaries on the more complicated Code issues are available. Once the objective is defined, one must then determine to what extent the existing building must be altered to meet the objective.

In developing Code 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 Code 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 Appendix to this document is included for explanatory purposes only and does not form part of the requirements. The bold-face reference numbers that introduce each item apply to the requirements in the Code.

The successful application of Code 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 Code objectives. The degree to which any particular requirement can be relaxed without affecting the intended level of safety of the Code requires considerable judgment on the part of both the designer and the authority having jurisdiction.

Further information on the application of Code requirements to existing buildings may be found in Canadian Building Digest No. 230, "Applying Building Codes to Existing Buildings," available from the Institute for Research in Construction, National Research Council of Canada, Ottawa, K1A 0R6.

A-1.1.3.2. 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 and balconies.

A-1.1.3.2. Farm Building. Farm buildings as defined in Article 1.1.3.2. include but are not limited to produce storage and packing facilities, livestock and poultry housing, milking centres, manure storage facilities, grain bins, silos, feed preparation centres, farm workshops, greenhouses, farm retail centres, and horse riding, exercise and training facilities. Farm buildings may be classed as low or high human occupancy depending on the occupant load.

Examples of farm buildings likely to be classed as low human occupancy as defined in Article 1.2.1.2. of the Canadian Farm Building Code are livestock and poultry housing, manure and machinery storage facilities and horse exercise and training facilities where no bleachers or viewing area are provided.

A-1.1.3.2.

Examples of buildings that would be classed as other than low human occupancy include farm retail centres for feeds, horticultural and livestock produce, auction barns and show areas where bleachers or other public facilities are provided. Farm work centres where the number of workers frequently exceeds the limit for low human occupancy will also be in this category.

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

A-1.1.3.2. Fire Separation. A fire separation may or may not have a fire-resistance rating.

A-1.1.3.2. 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.

A-1.1.3.2. 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.

A-1.1.3.2. 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 are 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 Code. 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. 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.

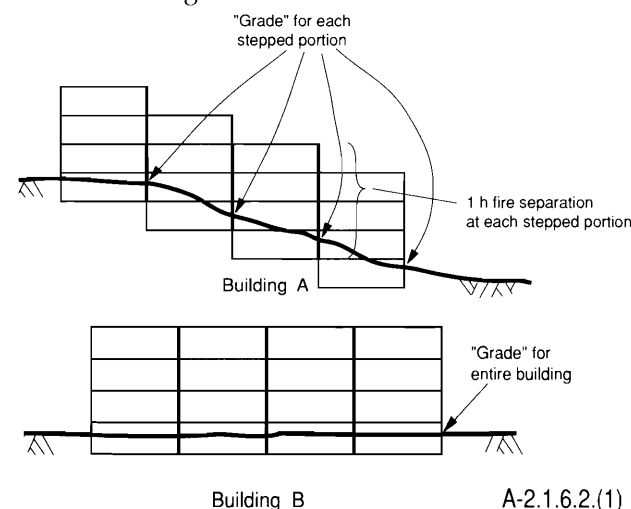
For certain requirements in the Code the expression "room or suite" is used (e.g. travel distance). This means that the requirement applies within the rooms of suites as well as to the suite itself and to rooms that may be located outside the suite. In other places the expression "suite, and rooms not 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, that are not considered as tenant occupied space.

A-2.1.6.1. Buildings Divided by Firewalls. ^e

This concept relates to the provisions directly regulated by this Code and does not apply to electrical service entrance requirements which are regulated by other documents.

A-2.1.6.2.(1) 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 3 storeys in building height even though there may be only 2 or 3 storeys at any one location. The diagrams below illustrate this application compared to a similar building on a flat site.



A-2.1.6.2.(1)

noncombustible materials even though there are no combustible components in the core. Gypsum board has satisfactory properties for resisting the spread of fire and Clause 3.1.5.2.(1)(b) has been included to specifically permit the use of paper faced gypsum board in a building of noncombustible construction.

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. Where 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) Combustible Cladding. These requirements allow for exterior wall assemblies incorporating combustible cladding elements on buildings of noncombustible construction. Since the tested assemblies must be representative of actual construction, the performance of the entire assembly is assessed with regard to its ability to resist flame propagation up the outside of a building. The thermal barrier protection limits the impact of an interior fire on the wall assembly.

These requirements, in combination, thus allow for wall assemblies containing both combustible cladding elements and non-loadbearing combustible framing members. These wall assemblies can be used as infill or panel type walls between structural elements, or attached directly to a loadbearing noncombustible structural system. They do not, however, waive other requirements specifically intended for the protection of combustible insulation in buildings of noncombustible construction.

These requirements are predicated upon the assumption that the manufacturing process and field installation procedure are both carried out under an independent quality assurance program designed to confirm that the product and its application are consistent with the system as tested.

A-3.1.5.5.(5) Flame Spread Distance. The maximum flame spread distance refers to the dis-

tance between the top of the opening and the highest observable instance of flaming along the wall assembly and thus allows intermittent flaming to a height of 5 m above the opening.

A-3.1.5.5.(6) Heat Flux Measurement. All heat flux measurement should be done using water-cooled transducers installed flush with the outer face of the wall assembly. Not less than three readings should be recorded every minute and a running average calculated for each minute of fire exposure. The heat flux to the assembly in Sentence 3.1.5.5.(6) refers to 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.

Since the exact location of flaming on the exterior surface of a wall assembly can be influenced by the presence of furring strips, cavities, etc. in the assembly which could channel the flame away from a heat flux transducer, sufficient transducers should be located at any given height to intercept any flaming that could occur along the assembly. This should be achieved if not less than three transducers are installed as follows: one within 0.2 m horizontally of the centreline through the opening, and not less than one on each side and within 0.5 ± 0.1 m horizontally of the first one. The exact position of the transducers will depend on the location of cavities, joints, studs or furring strips in the assembly.

A-3.1.5.11.(2)(e) Foamed Plastic Insulation Protection. The standard fire exposure temperature in CAN/ULC-S101-M, "Standard Methods of Fire Endurance Tests of Building Construction and Materials" is the same as in CAN4-S124-M, "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-M will not exceed an average temperature rise of 140°C on the unexposed face of the thermal barrier after a period of 10 min satisfies this requirement.

A-3.1.5.17.(1) Wire and Cable Flammability. In regulating the flammability characteristics of electrical wires and cables installed in a building, it is intended that the requirements of this

Sentence and of other similar Sentences in the Code apply to wires and cables that are essentially a part of the distribution system for power or communications. These distribution systems will normally include branch circuits that terminate at an outlet box in the space to be served and at that location cable terminators or plugs for individual items of equipment will be plugged in.

A-3.1.6. Tents and Air-Supported Structures. The requirements in this Subsection are intended to be limited to certain types of structures. For instance, the word “tent” as used in the Code is intended to refer to a temporary shelter which is used at open air events such as fairs and exhibitions. 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.

Similarly, the term “air-supported structure” as used in the Code is intended to refer to an envelope which is held up by air pressure alone and which is erected on the ground or above a basement. Such a structure will usually require a ballast or positive ground anchorage system around the entire perimeter to secure it to the ground or basement. To reinforce this intent, the Code prohibits the location of such air-supported structures above the first storey of any building.

The requirements of Subsection 3.1.6. are not intended to apply to air-supported roof assemblies on buildings, such as domed stadia, or to other types of air-supported structures, such as those over swimming pools situated on the roofs of buildings which would not be anchored at or near ground level. Such assemblies or structures are normally designed and evaluated on the basis of equivalents as permitted in Section 2.5.

A-3.1.8.1.(1)(a) Fire Separation Continuity. The continuity of a fire separation where it abuts against another fire separation, a floor, a ceiling or an exterior wall assembly is maintained by filling all openings at the juncture of the assemblies with a material that will ensure the integrity of the fire separation at that location.

A-3.1.8.1.(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. 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-3.1.8.9.(6) Fire 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-3.1.8.14.(2)(d)(ii) Wired Glass Assembly Support. It is intended that the mullions will not distort or be displaced to the extent that there would be a failure of the wired glass closure during the period for which a closure in the fire separation would be expected to function. Hollow structural steel tubing not less than 100 mm square filled with a portland cement based grout will satisfy the intent of this Subclause.

A-3.1.8.17. Fire-Protection Rating for Door. The provisions in this Article and Articles 3.1.8.15. and 3.1.8.16. do not waive the requirements 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 in Article 3.1.8.16., it is the governing criterion. Conversely, if the area limits in Article 3.1.8.16. are less than the area required to achieve a fire-protection rating, then the area limits in this Article govern.

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 requirement.

A-3.2.1.1.(3) Building Height. Where mezzanines are located at the same level but in different portions of a building, it is the intent of this Sentence that the aggregate area of all such mezzanines be used in relation to the area of the storey in which they are located. For example, mezzanines in suites of residential occupancy are visually obstructed by

ered to be an acceptable means of complying with the requirements of this Subsection. It is not, however, intended that these measures should be regarded as excluding any other equally effective measure that may be developed.

A-3.2.6.2.(2) to (4) Smoke Control Measures B, D, F, H, or I. The requirements of Sentences 3.2.6.2.(2), (3) and (4) may be met by the use of Measures B, D, F, H or I described in Chapter 3 of the Supplement to the NBC 1990.

A-3.2.6.3.(1) Smoke Control Measures K or L. The requirements in Sentence 3.2.6.3.(1) may be met by the use of Measures K or L, described in Chapter 3 of the Supplement to the NBC 1990.

A-3.2.6.4.(1) Sprinklered Building. The requirements in Sentence 3.2.6.4.(1) may be met by the use of Measure A, described in Chapter 3 of the Supplement to the NBC 1990.

A-3.2.6.5.(1) Exit Stair Safety Area. The requirements of Sentence 3.2.6.5.(1) may be met by the use of Measures C, E, G or J, described in Chapter 3 of the Supplement to the NBC 1990.

A-3.2.6.6.(1) Residential Balcony. The requirements of Sentence 3.2.6.6.(1) may be met by the use of Measure M, described in Chapter 3 of the Supplement to the NBC 1990.

A-3.2.6.7. Connected Buildings. The requirements of Article 3.2.6.7. may be met by the use of Measure N, described in Chapter 3 of the Supplement to the NBC 1990.

A-3.2.6.8.(6)(a) Elevator Recall. Automatic emergency recall actuation that is dependent on the operation of 2 smoke detectors in the elevator lobby meets the intent of this requirement. Such an arrangement may reduce the frequency of nuisance recalls.

A-3.2.6.9.(6)(b) Electrical Cable Protection. Electrical cables that provide continuous operation for 1 h when subjected to the CAN/ULC-S101-M fire test do not need additional protection against exposure to fire.

A-3.2.7.6. Hospital Emergency Power. CAN/CSA Z32.4-M, "Essential Electrical Systems for Hospitals" contains requirements other than those

that relate specifically to the installation of emergency equipment. Compliance with these other requirements is not intended by the reference in this Article.

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 the 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 National Fire Code of Canada 1990. If the operation of emergency generators or batteries is anticipated for other than fire emergency conditions, such as power failures, fuel supplies or battery capacity must be increased to compensate for such use.

A-3.2.8.2.(3) Special Protection of Opening.

In manufacturing operations involving the use of conveyor systems to transport material through fire separations it may not be possible to use standard closure devices. NFPA 80, "Fire Doors and Windows," includes appendix information concerning protection of openings through vertical fire separations. NFPA 13, "Installation of Sprinkler Systems," includes methods of protecting openings through floor assemblies, however it is assumed by that standard that the remainder of the building would be sprinklered. Combinations of methods may be required to ensure that the level of safety inherent in the requirements of the Code is maintained.

A-3.2.8.2.(6)(b) Stairway Opening. The phrase "used only for stairways, escalators or moving walkways" is intended to restrict a floor opening to the size that is necessary to accommodate the stairway, escalator or moving walkway.

A-3.2.8.8.(1) Smoke Exhaust System. This mechanical exhaust system is intended as an aid to fire fighters in removing smoke and is 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-3.3 Safety Within Floor Area. Section 3.3 regulates safety within floor areas including rooms or other spaces within a building with the exception of

service rooms and service spaces that are regulated in Section 3.5. The regulations are grouped according to the occupancy of the floor area, room or space. The occupancy of these floor areas and other spaces is not necessarily the major occupancy for which the building is classified. For example, a building may be classified by major occupancy as an office building and, as such, the provisions for structural fire protection and fire protection equipment for office buildings prescribed in Section 3.2 apply. Within that building a room or floor area may be used for mercantile, institutional, business, residential, industrial or other occupancy.

Life safety for the occupants of any floor area is dependent 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, and these requirements apply regardless of the major occupancy of the building that contains them. 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 or other major occupancy.

A-3.3.1.2.(1) Hazardous Substance.

Examples of hazardous substances include radioactive materials, corrosive liquids, poisonous gases, reactive substances and explosive or highly flammable materials.

A-3.3.1.4.(1) Occupancy in Corridor. Since this Code regulates new construction, alterations and changes of occupancies, kiosks in public corridors, including malls, are required to be constructed on the same basis as the remainder of the building. This means that the construction of such structures must take into consideration all the requirements which 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 which were not contemplated in the original design of a mall or public corridor, and which represent only a temporary change in occupancy, are regulated in the National Fire Code of Canada 1990. These regulations include maintaining egress paths clear of

obstructions, controlling combustible contents and providing measures to ensure quick response for fire fighting.

A-3.3.1.7. 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 such a plan are contained in the National Fire Code of Canada 1990.

The protected elevator in Clause 3.3.1.7.(1)(a) is intended to be used by fire fighters 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 fire fighters.

Where an estimate is to be made of the number of persons with disabilities in a floor area which can be accommodated in each zone in Clause 3.3.1.7.(1)(b), this estimate may be based on Table 3.7.2.A., which is used to determine the minimum number of spaces to be provided for wheelchair occupants in fixed seating areas. Where more precise information is available, it should be used for sizing the zones.

A-3.3.1.9.(4) Obstruction in Corridor. The sweep of a cane used by blind or visually impaired persons normally detects obstructions that are within 680 mm of the floor. Any obstruction above this height would not normally be detected and can, therefore, create a hazard if it projects more than 100 mm into the path of travel.

A-3.3.3.1. Safety in Institutional Occupancy. Fire safety for patients in bedroom areas in hospitals and nursing homes 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 such a plan are contained in the National Fire Code of Canada 1990.

There are many factors which may affect the abilities of staff to carry out life safety functions, such as the mobility of patients who cannot fend for themselves and the built-in protection for patients who cannot be moved except under exceptional circumstances.

can be found in the Commentary on Effects of Earthquakes in Chapter 4 of the Supplement to the NBC 1990.

A-4.1.9.D. Horizontal Force Factor, S_p .

Lower values of S_p may be used for towers, chimneys, smokestacks and penthouses when connected to or forming part of a building if the lower values can be proven by analysis. Information on the seismic design of towers, chimneys, smokestacks and penthouses can be found in the Commentary on Effects of Earthquakes in Chapter 4 of the Supplement to the NBC 1990.

A-4.1.9.E. Seismic Coefficient, C_p . Lower values of C_p may be used for machinery, fixtures and equipment, pipes and tanks, when connected to or forming part of a building if the lower values can be proven by analysis. Information on the seismic design of machinery, fixtures and equipment, pipes and tanks can be found in the Commentary on Effects of Earthquakes in Chapter 4 of the Supplement to the NBC 1990.

A-4.1.9.1.(22) Modal Coupling. Severe modal coupling may occur in symmetrical or nearly symmetrical structures when the fundamental lateral and torsional periods are almost equal. Information on this phenomenon is given in the Commentary on Effects of Earthquakes in Chapter 4 of the Supplement to the NBC 1990.

A-4.1.9.1.(25) Setbacks. A definition of setback together with a recommended design procedure for buildings having setbacks is contained in the Commentary on Effects of Earthquakes in Chapter 4 of the Supplement to the NBC 1990.

A-4.1.9.4.(3) 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-4.1.9.4.(5) Seismic 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 on Effects of Earthquakes in Chapter 4 of the Supplement to the NBC 1990.

A-4.1.10.3. Loads on Firewalls. Information on loads on firewalls can be found in the Commentary on Structural Integrity of Firewalls in Chapter 4 of the Supplement to the NBC 1990.

A-4.1.10.5.(1) Dynamic Analyses of Floor Vibrations. Information on a dynamic analysis of floor vibrations from rhythmic activities can be found in the Commentary on Serviceability Criteria for Deflections and Vibrations in Chapter 4 of the Supplement to the NBC 1990.

A-4.2.2.1. 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. Under some situations, such as highly technical designs, it may be necessary for the "other suitably qualified person" to be someone responsible to the designer. In these cases the authority having jurisdiction 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 gives 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-4.2.4.6.(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 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. Excavations. Information on excavations can be found in the Commentary on Foundations in Chapter 4 of the Supplement to the NBC 1990.

A-4.2.6.1.

A-4.2.6.1. Shallow Foundations. Information on shallow foundations can be found in the Commentary on Foundations in Chapter 4 of the Supplement to the NBC 1990.

A-4.2.7.1. Deep Foundation Units. A deep foundation unit can be pre-manufactured or cast-in-place; it can be driven, jacked, jetted, screwed, bored or excavated; it can be of wood, concrete or steel or a combination thereof.

A-4.2.7.2.(1) Deep Foundations. Information on deep foundations can be found in the Commentary on Foundations in Chapter 4 of the Supplement to the NBC 1990.

A-4.2.7.2.(2) Load Testing of Piles. ASTM D1143, "Standard Method of Testing Piles Under Static Axial Compressive Load" defines routine load test procedures which have been used extensively.

A-4.3.3.1. Precast Concrete. CAN3-A23.3, "Design of Concrete Structures for Buildings" requires that precast concrete members be constructed in plants conforming to CSA A251, "Qualification Code for the Manufacturers of Architectural and Structural Precast Concrete."

A-4.3.4.1. Welded Construction. Qualification for fabricators and erectors of welded construction is found in Clause 24.3 of CAN/CSA-S16.1, "Limit States Design of Steel Structures."

A-4.3.6.1. Glass Design. Information on glass design can be found in the Commentary on Glass Design in Chapter 4 of the Supplement to the NBC 1990.

A-5.5.2.1. Dampproofing and Waterproofing. For simple structures, requirements in Part 9 may be referred to as a guide in dampproofing and waterproofing below ground level. More complex structures may require additional provisions not contained in Part 9.

A-5.5.3.1. Crawl Spaces. For simple structures, requirements in Part 9 may be referred to as a guide for providing ground cover for crawl spaces. More complex structures may require additional provisions not contained in Part 9.

A-5.6.1.1. Materials. Part 3 contains additional requirements to regulate fire properties. Part 4 contains requirements to regulate the structural design.

A-5.7.1.1. Installation. For simple structures, requirements in Part 9 may be referred to as a guide for the installation of exterior claddings, vapour barriers, thermal insulations, sheathing papers, flashings and fastening devices. More complex structures may require additional provisions not contained in Part 9.

A-5.7.1.2. Glass Design. Information on the design of glass can be found in the Commentary on Glass Design in Chapter 4 of the Supplement to the NBC 1990.

A-5.7.1.3.(3) Deformations in Building Components. Information on the effects of deformations in building components can be found in the Commentary on Effects of Deformations in Building Components in Chapter 4 of the Supplement to the NBC 1990.

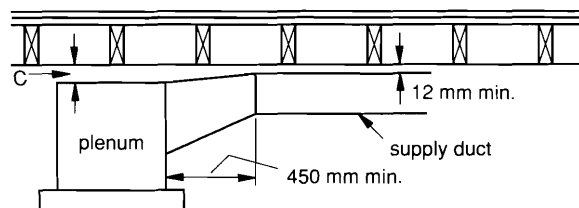
A-6.2.2.5. NFPA Publications Pertaining to the Heating, Ventilating and Air-Conditioning of Spaces Containing Hazardous Gases, Dusts or Liquids.

NFPA 30, Flammable and Combustible Liquids Code,
NFPA 32, Drycleaning Plants,
NFPA 33, Spray Application Using
Flammable and Combustible Materials,
NFPA 34, Dipping and Coating Processes
Using Flammable or Combustible Liquids,
NFPA 35, Manufacture of Organic Coatings,
NFPA 36, Solvent Extraction Plants,
NFPA 40, Storage and Handling of Cellulose Nitrate
Motion Picture Film,
NFPA 50A, Gaseous Hydrogen Systems at Consumer
Sites,
NFPA 50B, Liquefied Hydrogen Systems at Consumer
Sites,
NFPA 51, Design and Installation of Oxygen-Fuel
Gas Systems for Welding and Cutting,
NFPA 51A, Acetylene Cylinder Charging Plants,
NFPA 61A, Fire and Dust Explosions in Facilities
Manufacturing and Handling Starch,
NFPA 61B, Prevention of Fires and Explosions in
Grain Elevators and Facilities Handling Bulk
Raw Agricultural Commodities,
NFPA 61C, Prevention of Fire and Dust Explosions in
Feed Mills,
NFPA 65, Processing and Finishing of Aluminum,
NFPA 68, Venting of Deflagrations,

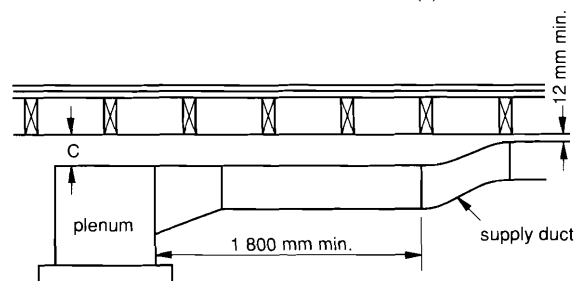
NFPA 69, Explosion Prevention Systems,
 NFPA 81, Fur Storage, Fumigation and Cleaning,
 NFPA 85F, The Installation and Operation of Pulverized Fuel Systems,
 NFPA 86, Ovens and Furnaces, Design, Location and Equipment,
 NFPA 88A, Parking Structures,
 NFPA 88B, Repair Garages,
 NFPA 91, Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying,
 NFPA 96, Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment,
 NFPA 204M, Guide for Smoke and Heat Venting,
 NFPA 303, Marinas and Boatyards,
 NFPA 307, Marine Terminals, Piers and Wharfs,
 NFPA 321, Basic Classification of Flammable and Combustible Liquids,
 NFPA 325M, Fire Hazard Properties of Flammable Liquids, Gases and Volatile Solids,
 NFPA 395, Storage of Flammable and Combustible Liquids on Farms and Isolated Construction Projects,
 NFPA 409, Aircraft Hangars,
 NFPA 416, Construction and Protection of Airport Terminal Buildings,
 NFPA 480, Magnesium, Storage, Handling,
 NFPA 481, Production, Processing, Handling and Storage of Titanium,
 NFPA 482, Production, Processing, Handling and Storage of Zirconium,
 NFPA 490, Storage of Ammonium Nitrate,
 NFPA 650, Pneumatic Conveying Systems,
 NFPA 651, Manufacture of Aluminum or Magnesium Powder,
 NFPA 654, Prevention of Fire and Dust Explosions in the Chemical, Dye, Pharmaceutical, and Plastics Industries,
 NFPA 655, Prevention of Sulfur Fires and Explosions, and
 NFPA 664, Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities.

A-6.2.3.12. Make-Up Air for Exhaust Systems. When make-up air is introduced into a building in cold weather, it should be preheated when the comfort of people in the air path is a consideration.

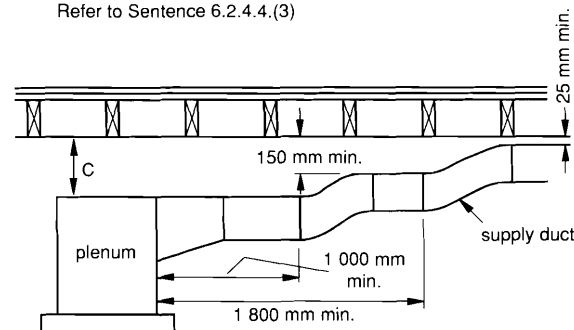
A-6.2.4.4. Clearances for Warm-Air Supply Ducts.



(a) Applicable to forced-air furnaces where permissible clearance C above plenum is 75 mm or less. Refer to Sentence 6.2.4.4. (2)



(b) Applicable to forced-air furnaces where permissible clearance C above plenum is more than 75 mm but not more than 150 mm. Refer to Sentence 6.2.4.4.(3)



(c) Applicable to forced-air furnaces where permissible clearance C above plenum is more than 150 mm. Refer to Sentence 6.2.4.4.(4)

A-6.2.4.4.

A-6.2.4.5.(2) Warm Air Supply Outlets. If the heating system is designed to also distribute ventilation air, high inside wall or ceiling outlets with diffusers, and designed for such applications, may be used.

A-6.2.9.2.(6) Temperature of Exposed Piping. Normally piping carrying steam or high-temperature hot water at pressures above atmospheric (corresponding temperature 100°C or above) will be insulated to reduce heat losses as an economy measure. Above a temperature of approximately 70°C, however, a bare pipe can cause a burn to human flesh coming in contact with the pipe. 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-8.1.2.1. 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 (i.e. police department).

A-8.2.2.1.(1) Demolition during Renovation. When renovation is taking place, only the portion of the building undergoing demolition is covered by this Subsection. The requirements for the portion undergoing construction are covered by Subsection 8.2.3.

A-8.2.2.1.(2) Demolition. In certain buildings which do not pose an exposure hazard to other buildings, or in which there is little fire hazard to staff, such as in small buildings, the degree of application of this Subsection may be minimal. The degree of application should be determined in advance in conjunction with the authority having jurisdiction.

A-8.2.2.3.(2) Access for Fire Fighting. Fire fighting in storeys above the first requires prompt vertical movement by fire department personnel. Provision should be made for the use of elevators, hoists or lifts to assist such personnel in reaching upper storeys of the building.

A-8.2.2.5. Standpipe System. During freezing conditions, the standpipe may be drained to prevent damage to the equipment. It is not anticipated that hose will be available in the building being demolished, but that it will be brought to the relevant floor by the responding fire department.

A-8.2.2.11.(3) Purging of Tank. Guidance on methods of rendering inert tanks, piping and machinery reservoirs is available in NFPA 327, "Standard Procedures for Cleaning or Safeguarding Small Tanks and Containers."

A-8.2.3.1. Construction Sites. Construction sites can range from a large multi-storey building to small single-storey residences and may include additions or renovations to an existing building. The degree to which this Subsection should apply to each site should be determined in advance, as part of the fire safety plan for the construction site, taking into consideration such issues as the size of the project and condition of the site.

A-9.3.2.1. Grade Marking of Lumber. Lumber is generally grouped for marketing into the species combinations contained in the following table. 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, Hem-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 the following table. Accreditation by the CLS Accreditation Board applies to the inspection, grading and grade marking of lumber, including mill supervisory service, in accordance with CSA Standard 0141, "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.

Canadian lumber is graded to the NLGA Standard Grading Rules for Canadian Lumber, published by the National Lumber Grades Authority. The NLGA 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 per cent. "MC 15" indicates a moisture content not exceeding 15 per cent. "S-GRN" in the grade mark signifies that the lumber was surfaced at a moisture content higher than 19 per cent 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.

A-9.3.2.A. Lumber Grading. To identify board grades the paragraph number of the NLGA rules under which the lumber is graded must be shown in the grade mark. Paragraph 113 is equivalent to WWPA rules and paragraph 114 is equivalent to WCLIB rules. When graded in accordance with WWPA or WCLIB rules, the grade mark will not contain a paragraph number.



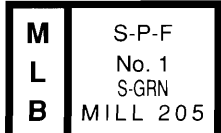
A-9.3.2.8. Non-Standard Lumber. The NLGA "Standard Grading Rules for Canadian Lumber" permit lumber to be dressed to sizes below the standard sizes (38 x 89, 38 x 140, 38 x 184, etc.) provided the grade stamp shows the reduced size. This Article permits the use of the span tables for such lumber provided the size indicated on the stamp is not less than 95 per cent of the corresponding standard size. Allowable spans in the tables must be reduced a full 5 per cent even if the undersize is less than the 5 per cent permitted.


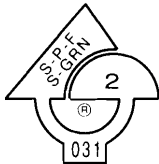




Species Designations and Abbreviations

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 NLGA Standard Grading Rules

A-9.3.2.1.

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
<p>A.F.P.A.[®] 00 S - P - F S-DRY STAND</p>	<p>Alberta Forest Products Assoc. 204 - 11710 Kingsway Avenue Edmonton, Alberta T5G 0X5</p>
<p>C L A[®] S-P-F 100 No. 2 S - GRN.</p>	<p>Canadian Lumbermen's Association 27 Goulburn Avenue Ottawa, Ontario K1N 8C7</p>
<p> 1 S-GRN 1 1 D FIR-N</p>	<p>Cariboo Lumber Mfrs. Association 301, 197 Second Avenue N. Williams Lake, British Columbia V2G 1Z5</p>
<p> W. CEDAR S-GRN.-(N) 100 No 3</p>	<p>Council of Forest Industries of British Columbia 1200 - 555 Burrard Street Vancouver, British Columbia V7X 1S7 Council of Forest Industries of British Columbia Northern Interior Lumber Sector 400 - 1488 Fourth Avenue Prince George, British Columbia V2L 4Y2</p>
<p>C F P A[®] 00 S-P-F S-DRY CONST</p>	<p>Central Forest Products Association P.O. Box 1169 Hudson Bay, Saskatchewan S0E 0Y0</p>
<p></p>	<p>Maritime Lumber Bureau P.O. Box 459 Amherst, Nova Scotia B4H 4A1</p>

Facsimiles of Grade Mark	Association or Agency
<p>NFLD. LUMBER</p> 	<p>Newfoundland Lumber Producers Association P.O. Box 8 Glovertown, Newfoundland A0G 2L0</p>
<p>O.L.M.A.® 01-1 CONST. S-DRY SPRUCE - PINE - FIR</p>	<p>Ontario Lumber Manufacturers Association 55 University Avenue, Ste. 325 Toronto, Ontario M5J 2H7</p>
	<p>L'association des manufacturiers des bois de sciage du Québec Quebec Lumber Manufacturers Association 5055, boul. Hamel ouest, bureau 200 Québec, Québec G2E 2G6</p>
<p>NLGA RULE No 1 S-GRN 00 HEM-FIR-N</p> 	<p>Pacific Lumber Inspection Bureau 1110 - 355 Burrard Street Vancouver, British Columbia V6C 2G8</p>
<p>ILMA® S-DRY 1 00 S-P-F</p> 	<p>Interior Lumber Inspection Bureau 203 - 2350 Hunter Road Kelowna, British Columbia V1X 6C1</p>
<p>No 1 S-DRY D FIR (N) NLGA RULE</p> 	<p>MacDonald Inspection c/o Warnock Hersey Professional Services Ltd. 211 School House Street Coquitlam, British Columbia V3K 4X9</p>
<p>10 CONST S-P-F S-GRN</p> 	<p>Northwest Territories Forest Industries Association 6301 Silverthorne Road P.O. Box 346 Sardis, British Columbia V2R 2N1</p>

A-9.4.4.A.

A-9.4.4.A. Classification of Soils. Sand or gravel may be classified by means of a picket test in which a 38 mm by 38 mm picket bevelled 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-9.6.5.A. Glass in Doors. Maximum areas in Table 9.6.5.A. for other than fully tempered glazing are cut off at 1.50 m², as this would be the practical limit after which safety glass would be required by Sentence 9.6.5.2.(3).

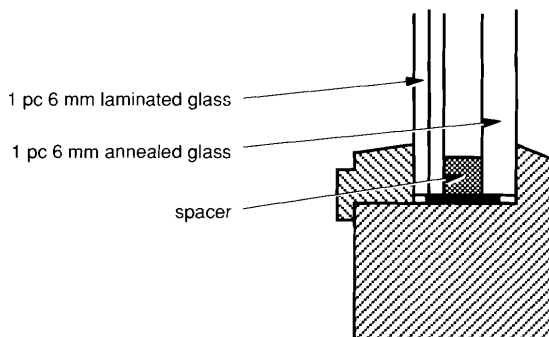
A-9.6.5.3. Mirrored Glass Doors. Standard CAN/CGSB-82.6 covers mirrored glass doors for use on reach-in closets. It specifies that such doors are not intended to be used for walk-in closets.

A-9.6.6.1. 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.

Laminated glass is more expensive than annealed glass and must be used in greater thicknesses. The sketch 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 9.6.6.1., in windows located within 900 mm of locks in such doors, and in basement windows.

Underwriters' Laboratories of Canada have produced a document ULC Subject C972-1974, “Guide for the Investigation of 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.



Combined laminated/annealed glazing

A-9.6.6.1.

A-9.6.6.5.(1) 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-9.6.6.7. Hinged Doors. Methods of satisfying this Article 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-9.6.6.10. Resistance of Doors to Forced Entry. This Article designates ASTM Standard F476, “Standard Test Methods for Security of Swinging Doors” as an alternate 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 has only specified 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-9.7.1.5. Double Glazing. In a cold climate such as Canada's, windows which separate heated space from unheated space or the exterior must be at least double glazed to prevent the accumulation of significant amounts of condensation on the inside surface of the glazing. Although glazing materials are generally unharmed by such condensation, the water can run down and damage the materials in the window frame and in the wall below the window. Water accumulating in these materials can also lead to the growth of moulds.

Because of the potential for damage to the structure, this measure is required in any heated building, whether or not there is normally human occupancy.

A-9.7.2.1. Windows. The CSA Standard CAN/CSA-A440, "Windows," includes a window classification system that rates the assembly according to air leakage, water leakage and wind load resistance. The ratings, shown below, are marked on the window

and indicate the level of performance that can be expected. Units can then be selected which are most appropriate for design conditions.

Air Leakage

- A1 – intended for use primarily in low-rise residential (i.e. buildings of 3 storeys or less and having an area not exceeding 600 m²), industrial, and light commercial use.
- A2 – intended for use primarily in medium- to high-rise residential, institutional, and commercial use.
- A3 – intended for use in high-performance institutional and commercial applications.

Water Leakage

- B1 – moderate climatic conditions
- B2 – severe climatic conditions
- B3 – extreme climatic conditions

Wind Resistance

- C1 – lowest wind load resistance
- C2 – medium wind load resistance
- C3 – highest wind load resistance

Article 9.7.2.1. has specified the lowest grades, since the NBC is a collection of minimum requirements only. Designers or builders should consider windows with higher ratings depending on the height of buildings, climatic conditions and occupancy classification.

A-9.7.3.2. Maximum Glass Area. Subject to the restrictions noted, tables A-9.7.3.2.A. and A-9.7.3.2.B. may be used to select glass thickness for windows. These tables are based on Standard CAN/CGSB-12.20-M. In many cases, glass design based on these tables will be conservative due to conservative assumptions on which the tables are based. More exact design using the Standard directly could result in reduced glass thickness.

A-9.7.6.1. Resistance of Windows To Forced Entry. Although this Article 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.

A-9.7.6.1.

This Article 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.

Table A-9.7.3.2.A.

Maximum Glass Area for Windows, m² In Areas for Which the “One in Ten” Wind Pressure (Q₁₀)* Listed in the Supplement to the NBC is less than 0.40 kPa								
Type of Glass	Glass Thickness, mm							
	2.5	3	4	5	6	8	10	12
Annealed	0.66	1.02	1.58	2.17	2.95	4.67	6.40	8.95
Factory-sealed IG Units	1.16	1.82	2.79	3.82	5.24	7.23	8.98	12.40
Heat strengthened or tempered	1.39	1.86	2.51	3.07	3.83	5.22	6.48	8.95
Wired	0.31	0.49	0.76	1.04	1.44	2.26	3.13	5.00

* The maximum hourly wind pressure with one chance in ten of being exceeded in any one year.

Table A-9.7.3.2.B.

Maximum Glass Area for Windows, m² In Areas for Which the “One in Ten” Wind Pressure (Q₁₀)* Listed in the Supplement to the NBC is less than 0.60 kPa								
Type of Glass	Glass Thickness, mm							
	2.5	3	4	5	6	8	10	12
Annealed	0.42	0.66	1.02	1.40	1.93	3.05	4.20	6.65
Factory-sealed IG Units	0.75	1.17	1.80	2.47	3.39	5.29	7.29	10.12
Heat strengthened	0.89	1.39	2.05	2.50	3.12	4.25	5.29	7.29
Tempered	1.13	1.52	2.05	2.50	3.12	4.25	5.29	7.29
Wired	0.20	0.32	0.50	0.68	0.95	1.50	2.06	3.32

* The maximum hourly wind pressure with one chance in ten of being exceeded in any one year.

Restrictions on use of Tables A-9.7.3.2.A. and A-9.7.3.2.B.

1. The tables apply to buildings which have essentially uniform distribution of openings, i.e. no large opening, such as a loading door.
2. The tables do not apply to buildings in exposed locations such as hilltops or the shores of large bodies of water.
3. The tables apply to buildings 12 m or less from grade to the uppermost roof.

A-9.8.8.1. Loads on Guards. Guards should be constructed so as to be strong enough to provide protection from falling under normal use. Such guards may be accepted on the basis of experience or by structural design. Loading criteria for the structural design of guards can be found in Article 4.1.10.1.

A-9.10.1.4. Commercial Cooking Equipment. Part 6 refers to NFPA 96, "Standard for the Installation of Equipment for the Removal of Smoke and Grease-laden Vapours from Commercial Cooking Equipment," which in turn references "Commercial Cooking Equipment." However, the deciding factor as to whether or not NFPA 96 applies is the potential for production of grease-laden vapours and smoke, rather than the type of equipment used. While NFPA 96 does not apply to domestic equipment for normal residential family use, it should

apply to domestic equipment used in commercial, industrial, institutional and similar cooking applications where the potential for the production of smoke and grease-laden vapours exceeds that for normal residential family use.

A-9.10.3.1. Fire and Sound Resistance of Building Assemblies. The following tables may be used to select building assemblies for compliance with Article 9.10.3.1. and Subsection 9.11.2. However, these tables are provided only for the convenience of Code users. Assemblies not listed in these tables are equally acceptable provided their fire and sound resistance can be demonstrated to meet the above-noted requirements on the basis of tests described in 9.10.3.1. and 9.11.1. or by using the data in Chapter 2 of the Supplement to the NBC 1990.

Table A-9.10.3.A.

Fire and Sound Resistance of Walls					
Type of Wall	No.	Description	Finish on Each Side ⁽¹⁾	Fire-Resistance Rating	Typical Sound Transmission Class ⁽²⁾
Hollow concrete block (normal weight aggregate)	1	140-mm block	None ⁽³⁾	1 h	48
	2	Same as 1	B	2 h	51
	3	Same as 1, with both surfaces fastened directly, or both on metal resilient channels, or both on metal resilient channels with absorptive material ⁽⁴⁾	A	2 h	47
	4	Same as 1, with metal resilient channels and absorptive material on one side ⁽⁴⁾	A	1.75 h	51
	5	Same as 1, with 38-mm x 38-mm wood strapping and absorptive material on both sides ⁽⁴⁾	A	2 h	57
	6	190-mm block	None ⁽³⁾	1.5 h	50
	7	190-mm block	B	2 h	50

Table A-9.10.3.A. (Cont'd)

Fire and Sound Resistance of Walls					
Type of Wall	No.	Description	Finish on Each Side ⁽¹⁾	Fire-Resistance Rating	Typical Sound Transmission Class ⁽²⁾
	8	Same as 6, with both surfaces fastened directly, or both on metal resilient channels, or both on metal resilient channels with absorptive material ⁽⁴⁾	A	2.5 h	49
	9	Same as 6, with metal resilient channels and absorptive material on one side ⁽⁴⁾	A	2.5 h	53
	10	Same as 6, with 38-mm x 38-mm wood strapping on at least one side	A ⁽⁶⁾	2.5 h	53
	11	Same as 6, with 38-mm x 38-mm wood strapping and absorptive material on both sides ⁽⁴⁾	A ⁽⁶⁾	2.5 h	59
	12	Same as 6, with 50-mm metal Z-bars (or 38-mm x 38-mm wood strapping plus metal resilient channels) and absorptive material on both sides ⁽⁴⁾	A	2.5 h	64
	13	Same as 6, with studs (65-mm steel or 38-mm x 64-mm wood) and absorptive material on both sides ⁽⁴⁾	A ⁽⁶⁾	2.5 h	70
	14	Same as 6, with metal resilient channels and absorptive material on one side	D (finish one side only)	2.5 h	55
Concrete	15	150 mm	None ⁽³⁾	3 h	55
	16	200 mm	None ⁽³⁾	4 h	58

e

Table A-9.10.3.B.

Fire and Sound Resistance of Floors, Ceilings and Roofs					
Type of Assembly	No.	Description	Finish on Ceiling ⁽¹⁾	Fire Resistance Rating	Typical Sound Transmission Class ⁽²⁾
Concrete slabs	1	90-mm reinforced concrete with 20-mm minimum cover over reinforcing steel	None ⁽³⁾	1 h	48
	2	130-mm reinforced concrete with 25-mm minimum cover over reinforcing steel	None ⁽³⁾	2 h	52
Open web steel joists	3	Open web steel joists at 400 mm o.c. with minimum 50-mm thick concrete deck, ceiling secured to furring channels spaced not more than 600 mm o.c. wired to underside of joists ⁽⁴⁾	C	45 min	53
Wood floor joists spaced not more than 400 mm o.c.	4	Subfloor of 19-mm T&G lumber or 15.5-mm plywood, waferboard or strandboard, ceiling finish attached to metal resilient channels spaced at 200 mm o.c., absorptive material in cavity ⁽⁴⁾	C	45 min	48
or	5	Same as 4, with additional layer of 11 mm sanded plywood, waferboard or strandboard on floor	C	45 min	50
Wood floor trusses ⁽⁵⁾ spaced not more than 600 mm o.c.	6	19-mm gypsum-concrete topping (at least 34 kg/m ²) on subfloor of 19-mm T&G lumber or 15.5-mm plywood waferboard or strandboard	D	45 min	52
	7	Same as 6	E	1 h	52
	8	Same as 6, with absorptive material in cavity ⁽⁴⁾ , ceiling finish attached to metal resilient channels spaced at 200 mm o.c.	C	45 min	55

Table A-9.10.3.B. (Cont'd)

Fire and Sound Resistance of Floors, Ceilings and Roofs					
Type of Assembly	No.	Description	Finish on Ceiling ⁽¹⁾	Fire Resistance Rating	Typical Sound Transmission Class ⁽²⁾
	9	38-mm lightweight concrete topping (at least 70 kg/m ²) on subfloor of 19-mm T&G lumber or 15.5-mm plywood, waferboard or strandboard	D	45 min	54
	10	Same as 9	E	1 h	56
	11	Same as 9, except ceiling finish attached to metal resilient channels	C	45 min	57
	12	Same as 9, with absorptive material in cavity ⁽⁴⁾ , ceiling finish attached to metal resilient channels spaced at 200 mm o.c.	C	45 min	60
Rating provided by membrane only	13	Supporting members spaced not more than 600 mm o.c.	C	30min	N/A
	14	Same as 13	E	1 h	N/A
Wood roof trusses spaced not more than 600 mm o.c.	15	38-mm x 89-mm framing members with metal connector plates not less than 1 mm thick with teeth not less than 8 mm in length	C	45 min	N/A

Addendum to Table A-9.10.3.B.:

- ⁽¹⁾ Finishes designated by letter as follows:
C = 15.9-mm special fire-resistant Type X gypsum board conforming to CSA A82.27, "Gypsum Board Products" with joints taped and filled,
D = two layers of 12.7-mm gypsum board with joints taped and filled, and
E = two layers of 15.9-mm special fire-resistant Type X gypsum board with joints taped and filled.
- ⁽²⁾ Sound ratings listed are based on the most reliable laboratory test data available. Results of specific tests may differ slightly because of measurement precision and minor construction details. Constructions with sound transmission class ratings of 50 or more require acoustical sealant applied around electrical and other openings, and at the junction of intersecting walls and floors, except intersection of walls constructed of concrete or solid brick.
- ⁽³⁾ Sound ratings assume no cracks or voids.
- ⁽⁴⁾ Sound absorptive material includes fibre processed from rock, slag or glass and must fill at least three-quarters of the cavity space to provide the listed STC.
- ⁽⁵⁾ Floor trusses have 38-mm x 89-mm wood framing members with metal connector plates not less than 1 mm thick with teeth not less than 8 mm in length.

A-9.10.9.6.(1) Penetration of Fire-Rated Assemblies By Service Equipment.

This Article, together with Article 3.1.9.1., is intended to ensure that the integrity of fire-rated assemblies is maintained where they are penetrated by various types of service equipment.

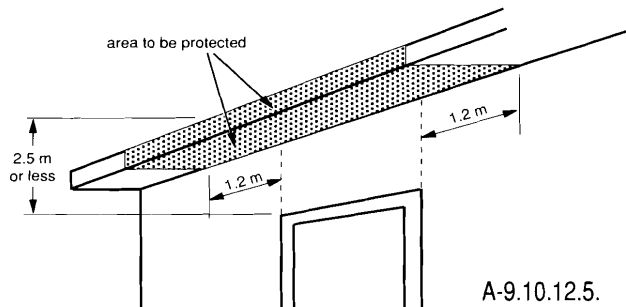
For buildings regulated by the requirements in Part 3, fire stop materials used to seal openings around building services, such as pipes, ducts and electrical outlet boxes, must meet a minimum level of performance demonstrated by standard test criteria.

This is different from the approach in Part 9. Because of the type of construction normally used for buildings regulated by the requirements in Part 9, it is assumed that this requirement is satisfied by the use of generic fire stop materials such as mineral wool, gypsum plaster or Portland cement mortar.

A-9.10.9.16.(3) Separation Between Dwelling Units and Garages.

The gas-tight barrier between a dwelling unit and an attached garage is intended to provide reasonable protection from carbon monoxide and gasoline fumes entering the dwelling unit. Construction assemblies incorporating a vapour barrier will perform adequately with respect to gas tightness provided reasonable care is exercised where the wall or ceiling is pierced by service assemblies. Where a garage is open to the adjacent attic space above the dwelling unit it serves, a gas-tight barrier in the dwelling unit ceiling 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 wallboard on the side of the wall exposed to the garage.

A-9.10.12.5. Protection of Overhang of Common Roof Space.



A-9.10.12.5.

A-9.10.13.2.(1) Wood Doors in Fire Separations. CAN4-S113 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) 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-9.11.1.1. Sound Transmission Class

Ratings. The specified STC rating of 50 is considered the minimum acceptable value, but many builders prefer to design for STC 55 or more in high quality accommodation.

Another reason to choose assemblies rated higher than STC 50 is that the STC ratings of assemblies are based on laboratory tests, but the sound transmission of any assembly as constructed in the field may be significantly less than its rating. This can be due to sound leaks, departures from design, poor workmanship or indirect (flanking) transmission paths overlooked in design. To provide a margin of safety to compensate for these builders often select wall and floor systems that have been rated at least 5 points higher than the design STC rating in laboratory tests

Sound leaks can occur where one wall meets another, the floor, or the ceiling. Leaks may also occur where the wall finish is cut for the installation of equipment or services. 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 drywall sheets 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. Sound-absorbing material inside a well-designed wall decreases sound transmission. It has another advantage; it also helps to reduce the effects of leaks due, perhaps, to poor workmanship.

Indirect or flanking transmission arises where the parts of a building are rigidly connected together and where cavities in hollow walls or floors, or continuous lightweight layers connect apartments. Sound travels in cavities, as vibration along surfaces and through walls, ceilings and floors to adjacent rooms.

A-9.11.1.1.

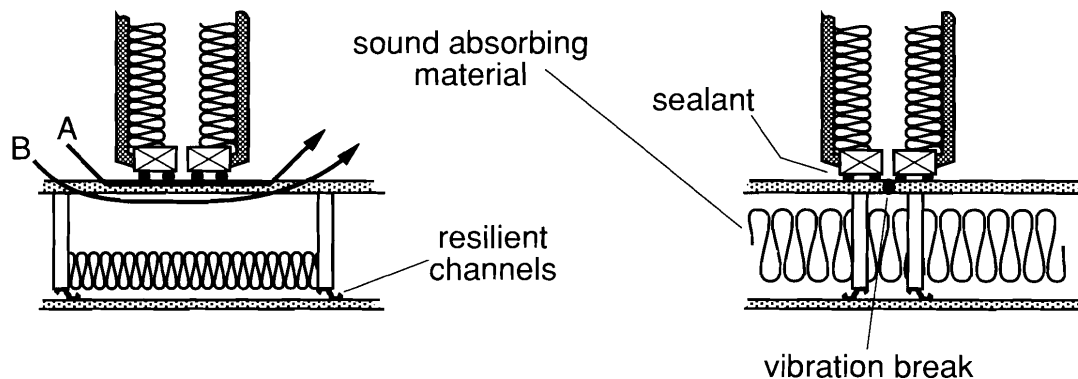
Many paths other than the direct one through the party wall or floor may be involved. To achieve good sound insulation, transmission along flanking paths must be minimized by introducing breaks and resilient connections in the construction. Some examples of bad and good details are shown in the illustration.

Changes to constructions should not be made without consultation with someone competent in the field of acoustical design. Adding extra layers of drywall to walls in an attempt to reduce sound transmission, can actually increase it if done incorrectly. For example, attaching drywall on resilient channels directly to an existing wall or ceiling usually increases low frequency sound transmission. Adding an additional layer of drywall inside a double layer wall will also seriously increase sound transmission. Adding blocking inside walls to reduce the risk of firespread should be done so it does not increase vibration transmission from one part of a wall or floor to the other.

To verify that acoustical privacy is being achieved, a field test can be done at an early stage in the con-

struction; ASTM E336 will give a complete measurement. A simpler and less expensive method is ASTM E597, "Standard Practice for Determining a Single Number Rating of Airborne Sound Insulation in Multi Unit Building Specifications." The rating provided by 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 control of impact noise transmission. Footstep and other impacts can cause severe annoyance in multi-family 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 cause 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



**Cross section through
wall floor junctions**

Wall and floor get good STC ratings in laboratory tests and the sealing procedures are good. The system performance is low, however, because of flanking paths A and B.

This detail is better. There is no hollow cavity and the break in the floor prevents transmission along the floor. The same techniques should be applied to walls.

A-9.11.1.1.

noise transmission. Good footstep noise rejection requires fairly heavy floor slabs or floating floors. Impact noise requirements are being considered for inclusion in future versions of the NBC.

Most frequently used methods of test for impact noise are ASTM E492, "Method of Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using The Tapping Machine", or ASTM E1007, "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-9.12.2.A. 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-9.13 Exclusion of Soil Gas (see also A-9.16.2.1.) 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 which it picks 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.

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 the decay products of radon in sufficient quantity can lead to 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

- (1) low in cost,
- (2) difficult to retrofit, and
- (3) desirable for other benefits they provide.

There are two principal methods of excluding soil gas:

- (1) Sealing the interface between the soil and the occupied space, so far as is reasonably practicable.

Sections 9.13 and 9.18 include requirements for dampproofing of slabs and ground covers in crawl spaces, which are intended to help in isolating the occupied space from the soil.

Providing control joints to reduce cracking of foundation walls and airtight covers for sump pits are other measures which can help achieve this objective.

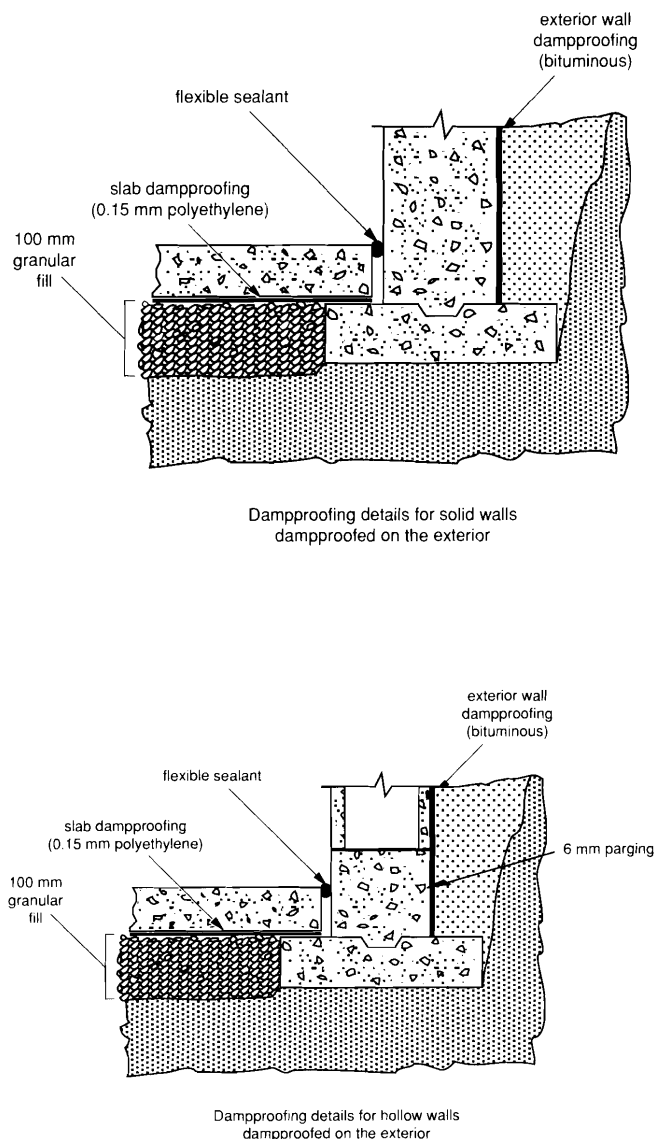
- (2) Ensuring that the pressure difference across the soil/space interface is positive (i.e., towards the outside) so that inward soil gas flow through any remaining leaks will be prevented.

Section 9.16 includes requirements related to this objective.

The measures covered in Section 9.13 are illustrated on the following drawings. The measures covered in Section 9.18 are similar. The measures covered in Section 9.16 are discussed in a separate Appendix note.

The requirement in 9.13.6.5. regarding sealing of penetrations of the slab also applies to hollow metal and masonry columns. Not only the perimeters but also the centres of such columns must be sealed or blocked.

The requirement in Article 9.13.6.6. regarding drainage openings in slabs can be satisfied with any of a number of proprietary devices which prevent soil gas entry through floor drains. Some types of floor



A-9.13.

drains incorporate a trap which 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 soil gas.

A-9.14.2.1.(2) Insulation Applied to the Exterior of Foundation Walls. In addition to the prevention of heat loss, some types of mineral fibre insulation, such as rigid glass fibre, are installed on the exterior of basement walls for the purpose of moisture control. This is sometimes used instead of crushed rock as a drainage layer between the basement wall and the surrounding soil in order to facilitate the drainage of soil moisture. Water drained by this drainage layer must be carried away from the foundation by the footing drains or the granular drainage layer in order to prevent it from developing hydro-static pressure against the wall. Provision must be made to permit the drainage of this water either by extending the insulation or crushed rock to the drain or by the installation of granular material connecting the two. The installation of such drainage layer does not eliminate the need for normal waterproofing or dampproofing of walls as specified in Section 9.13.

A-9.15.1.1.(1) Installation of Mobile Homes. CSA has prepared a standard entitled CAN3-Z240.10.1, "Recommended Practice for the Site Preparation, Foundation and Anchorage of Mobile Homes." This document is intended to provide guidance to inspectors, installers and owners of mobile homes and includes information on site preparation, foundations, anchorage and skirting.

A-9.15.1.3.(4) Preserved Wood Foundations – Design Assumptions. Tabular data and figures in CAN3-S406, "Construction of Preserved Wood Foundations" are based upon the general principles provided in CAN3-O86, "Engineering Design in Wood (Working Stress Design)" with the following assumptions:

- (1) soil bearing capacity: 75 kPa or more,
- (2) clear spans for floors: 5 000 mm or less,
- (3) floor loadings: 1.9 kPa for first floor and suspended floor, and 1.4 kPa for second storey floor,
- (4) foundation wall heights: 2 400 mm for slab floor foundation, 3 000 mm for suspended wood floor foundation,

- (5) top of granular layer to top of suspended wood floor: 600 mm,
- (6) lateral load from soil pressure: equivalent to fluid pressure of 4.7 kPa per metre of depth,
- (7) ground snow load: 3 kPa,
- (8) basic snow load coefficient: 0.6,
- (9) roof loads are carried to the exterior wall,
- (10) 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-9.16.2.1. Control of Infiltration of Soil Gas. (See also A-9.13.)

As noted in A-9.13, one method of excluding soil gas from below-grade living space is to ensure that the pressure difference across the soil/space interface is positive (i.e., towards the outside) so that inward soil gas flow through any leaks will be prevented. This requires consideration of the air pressure on the inside of the envelope and the pressure within the soil. Each is affected by quite different factors.

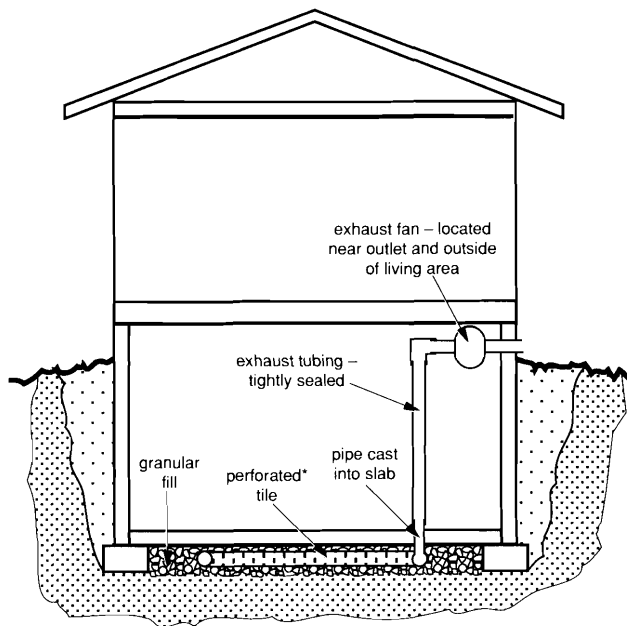
There is a safe range for the interior pressure in a house. The upper limit is primarily due to the need to minimize outward leakage of the warm, moist interior air through leaks in the building envelope. The lower limit depends on the type of combustion heating equipment present in the house. It also follows from the need to avoid drawing in soil gas, as discussed in Appendix Notes A-9.13 and A-9.33.

Controlling the entry of soil gas by house or basement pressurization is therefore problematic, since it could lead to exfiltration-caused condensation problems in the building envelope. This leaves the option of reducing the pressure outside the envelope as the most practical method of achieving the desired outward pressure difference. The remainder of this note describes how this may be accomplished.

At least in areas which are prone to higher than normal radon levels, or other ground pollutants, the practice described below should be followed:

- (1) Any slab-on-ground should have not less than 100 mm of coarse granular fill beneath the slab (as required in Article 9.16.2.1.) if no perforated tile is laid within the fill. If tile is used, not less than 50 mm of fill is required and no point in the filled area should be more than 3 m from the tile. The tile should not be connected to any drainage tile.
- (2) A short length of pipe, of not less than 100 mm diameter, should be cast vertically into the slab. If no tile is used, this pipe should be located near the centre of the slab and the fill around the pipe location should not be less than 150 mm deep for a radius of 300 mm. If tile is used, the bottom end of the pipe should connect to the tile at its lowest point. The top end of the pipe should have a removeable cap.
- (3) When the house is completed, a test should be carried out to determine the radon concentration. (Local health authorities can provide guidance as to whether the test results indicate the need for remedial measures.)
- (4) If radon concentrations are above guideline levels, the sub-slab space should be ventilated. This requires that the pipe connection to the sub-slab space be uncapped and connected to a ventilation system exhausting to the outside. Exhaust pipes passing through unheated spaces should be insulated. The fan should be located where noise will not be a nuisance and outside the occupied space. It is also best to locate the fan as close to the final outlet end of the ventilation system as possible so that the pressurized portion of the system downstream of the fan will not be located in or adjacent to the living space. If the pressurized portion of the system were to pass through the living space, then any leak in the system would have the potential to spill high radon concentration soil gas into the living space, thus exacerbating the situation the system was intended to correct. The fan should be of a type suitable for the application and capable of continuous operation. This sub-slab ventilation system is illustrated on the following page.
- (5) The house should be re-tested for radon after completion of the ventilation system.

A-9.16.2.1.



One type of sub-slab ventilation system

*suggested for radon-prone areas

A-9.16.2.1.

A-9.20.1.2. Seismic Zones. Information on seismic zones for various localities can be found in Chapter 1 of the Supplement to the National Building Code 1990.

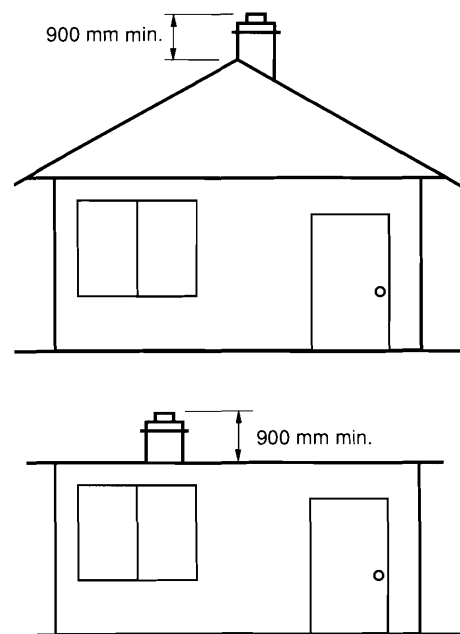
A-9.20.13.10.(3) Dampproofing of Masonry Walls. The reason for installing sheathing paper behind masonry walls is to prevent rainwater from reaching the interior finish if it should leak past the masonry. The sheathing paper intercepts the rainwater and leads it to the bottom of the wall where the flashing 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 sheathing paper. 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 sheathing paper. 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.

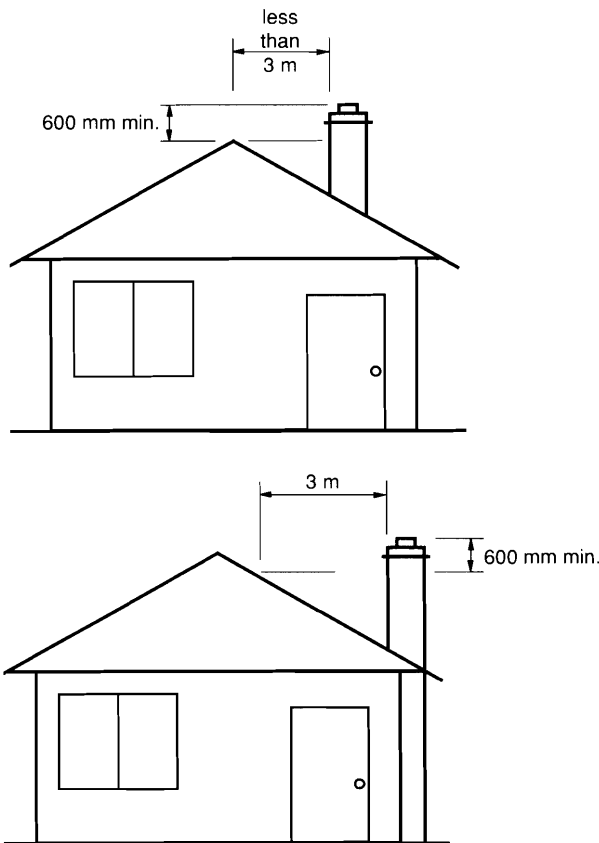
Where sheathing paper is not used, therefore, the adhesive or mortar should be applied to form a continuous bond between the masonry and the insulation. If this is not practicable because of an irregular masonry surface, then sheathing paper is necessary. (See Article 9.25.5.2. for vapour barriers with foamed plastic insulation.)

A-9.21.1.2. Factory-Built Chimneys. Under the provisions of Section 2.5, certain solid-fuel burning appliances may be connected to factory-built chimneys other than those specified in Article 9.21.1.2. if tests show that the use of such a chimney will provide an equivalent level of safety.

A-9.21.3.6. Metal Chimney Liners. Under the provisions of Section 2.5, 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. Location of Chimney Top.





A-9.21.4.4.

A-9.21.4.5. Lateral Support for Chimneys.

The following information is from CAN/CSA-A405.

- (1) Engineering calculations show that free-standing chimneys constructed with Type N mortar and with least dimension not less than 400 mm can extend to a height of 3.6 m.
- (2) The number of flues contained within the same stack does not affect the height given in (1).
- (3) The height shall be taken from the last point of lateral support for the chimney. For example,
 - (a) on frame construction of interior chimneys, the height measurement is taken from the bottom of the lowest flue liner;
 - (b) in solid or brick veneer construction, the height measurement is taken from the

point where the chimney stack leaves the masonry which forms part of the exterior wall.

- (4) Where a chimney is fastened to the house framing with metal anchors, in accordance with CSA Standard CAN3-A370 "Connectors for Masonry," it shall be considered to have adequate lateral support. The portion of the chimney stack above the roof shall be considered as free standing.

A-9.22.1.4. Combustion Air for Fireplaces.

The intent of this Article is to allow the fireplace to be operated without affecting, or being affected by, other appliances or exhaust equipment. For this to occur, the fireplace must be provided with a supply of combustion air dedicated to the fireplace only; an opening to the exterior should be provided at or near the fireplace opening. The opening of a window is not considered to be sufficient, as discomfort from drafts is likely to inhibit its use. Factory built fireplaces should have combustion air provided in accordance with manufacturers' installation instructions. In the case of site-built masonry fireplaces, this Article will be satisfied if the following procedures are followed:

- (1) The combustion air in Article 9.22.1.4. is supplied by a duct having a minimum diameter of 100 mm or equivalent area.
- (2) The air supply duct is noncombustible, corrosion-resistant and, where exposed to room air, insulated for its entire length with insulation having a thermal resistance value of RSI 1.41.
- (3) The air supply outlet is located as close to the fireplace opening as possible.
- (4) When the air supply outlet is placed inside the fire chamber, it is located at the front centre of the chamber hearth and is equipped with a non-combustible hood which when open will direct air away from the fire, and designed to prevent embers from entering the supply duct.
- (5) The supply duct contains a damper that fits tightly when in the closed position and is located close to the outlet end.
- (6) The damper is operable from the room containing the fireplace and the control mechanism clearly indicates the actual position of the damper.

- (7) Any portion of the air supply duct within 1 m of its outlet in the fire chamber has a minimum 50 mm clearance from combustibles.
- (8) The exterior air supply duct is protected against the entry of rain and direct wind and the inlet opening has an insect screen of corrosion-resistant material.
- (9) The exterior air supply duct inlet is located to avoid being blocked by either snow or fallen leaves.

A-9.23.4.1.(1) Span Tables for Wood Joists and Rafters. 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 design roof snow load than shown in the tables, the maximum member spacing may be calculated as the product of the member spacing and snow load shown in the span tables divided by the design snow load for the locality being considered. The following are examples of how this principle can be applied:

- (1) For a 3.0 kPa design snow load, use spans for 1.5 kPa and 600 mm o.c. spacing but space members 300 mm o.c., or use spans for 2.0 kPa and 600 mm o.c. spacing but space members 400 mm o.c.
- (2) For a 3.5 kPa design snow load, use spans for 2.5 kPa and 600 mm o.c. spacing but space members 400 mm o.c.
- (3) For a 4.0 kPa design snow load, use spans for 2.0 kPa and 600 mm o.c. spacing but space members 300 mm o.c.

The allowable spans in the span tables are measured from the face or edge of support to the 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 Tables A-8 and A-9 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.

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 CAN3-O86, “Engineering Design in Wood (Working Stress Design).”

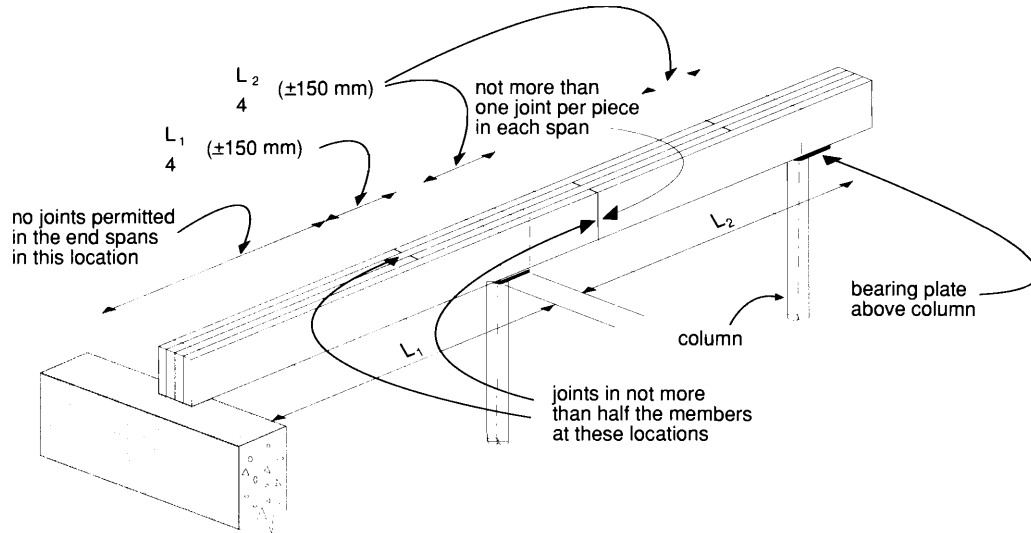
A-9.23.4.1.(2) Numerical Method to Establish Vibration-Controlled Spans for Wood Frame Floors. In addition to the normal strength and deflection analyses, the calculations on which the floor joist span tables are based include a method of ensuring that the spans are not so long that floor vibrations could lead to occupants’ perceiving the floors as too “bouncy” or “springy.” Limiting deflection under the normal uniformly distributed loads to 1/360 of the span does not provide this assurance.

Normally, vibration analysis requires detailed dynamic modelling. However, the calculations for the span tables use the following simplified static analysis method of estimating vibration-acceptable spans:

- The span which will result in a 2-mm deflection of a single joist supporting a 1 kN concentrated midpoint load is calculated.

- This span is multiplied by a factor, K, to determine the “vibration-controlled” span for the entire floor system. If this span is less than the strength- or deflection-controlled span under uniformly distributed load, the vibration-controlled span becomes the maximum allowable span.

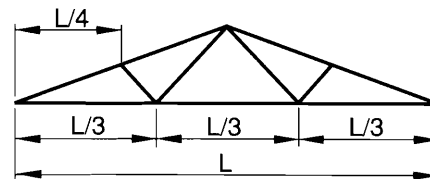
A-9.23.8.3. Joint Location in Built-up Beams



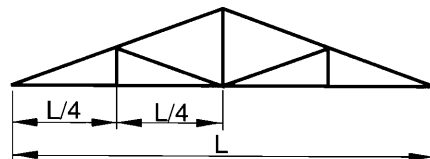
A-9.23.8.3.

Where wood roof trusses are intended for use in a locality having a design roof snow load higher than shown in the tables, the maximum truss spacing may be adjusted to allow for the higher loading in the same manner as described for roof rafters and roof joists.

Where wood roof trusses are to be used in an area where the design roof snow load falls between the values shown in the tables, the spans may be interpolated between the spans shown in the tables. The truss spans in these tables are valid only where the design live load on the bottom member does not exceed 0.5 kPa of ceiling area. This applies to trusses in buildings whose attic spaces have limited access through an access hatch and not to attics that are accessible by stairways. The spans do not apply to trusses which may be subject to concentrated loads, such as those required to support hoisting equipment. In addition, the top members of the trusses must be constructed to prevent lateral buckling by the provision of roof sheathing or by other suitable bracing.



Fink truss



Howe truss

A-9.23.13.11.(1)

- A-9.23.14.2.(4) Water Absorption Test.** A method for determining water absorption is described in ASTM D1037, "Standard Methods of Evaluating the 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 x 300 mm sample when treated on all sides and edges does not increase in weight by more than 6 per cent when tested in the horizontal position.

A-9.23.14.4.(2) Oriented Waferboard and Strandboard. The CSA Standard requires that Type O (aligned) panels be marked to show the grade and the direction of face alignment.

A-9.23.17.3.(9) Omission of Sheathing Paper Under Metal Siding. The purpose of sheathing paper is to prevent drafts and the entry of wind-driven rain into the wall cavity. Certain types of metal siding consisting of large sheets or panels will perform this function, eliminating the need for sheathing paper. This requirement applies to siding such as that commonly used on mobile homes but does not apply to metal siding installed in strips which is intended to simulate the appearance of lapped wood siding. Such material does not act as a substitute for sheathing paper since it incorporates provision for venting the wall cavity and has many joints.

A-9.23.18. Bracing. Traditionally, diagonal bracing has been provided at the corners of wood framed walls to provide resistance against wind racking forces. Laboratory tests have indicated, however, that the bracing that had been traditionally used contributed relatively little to the overall strength of the wall. Most of the racking resistance was in effect provided by the interior finish. Because of this, the requirements for bracing were deleted in the late 1950's. (See "Shear Resistance of Wood Frame Walls," by A.T. Hansen, Building Practice Note 61, Institute for Research in Construction, National Research Council, Ottawa.)

Where the interior is not finished, however, bracing is necessary if the siding itself or the sheathing does not provide the required racking strength. If panel

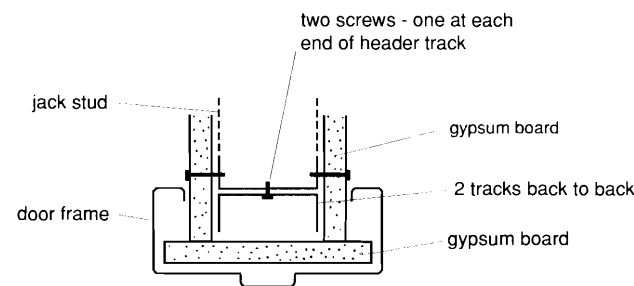
type siding is used, or if the sheathing consists of plywood, waferboard, strandboard, gypsum board, diagonal lumber, or fibreboard sheathing, additional bracing is not considered necessary because of the wind bracing provided by these materials.

Where bracing is provided, it must be installed at roughly a 45° angle on each wall and in each storey, extending the full height of the storey. This type of bracing provides considerably greater resistance to wind forces than the traditional bracing that was found to be relatively ineffective.

The permission to omit bracing assumes typical house designs. Some houses may have reduced resistance to racking forces as a result of their configuration. These include tall narrow houses in exposed locations with large door or window openings located in the short sides. In such cases racking resistance can be improved by ensuring that paneled sections are placed adjacent to the openings.

The Code does not address the issue of bracing of the structure during construction. It is often necessary to provide temporary bracing until the interior finish or sheathing is installed, however, this is not a Code requirement.

A-9.24.3.2. Framing Above Doors in Steel Stud Fire Separations



Header detail

A-9.24.3.2.

A-9.25 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. However, the integrity of the air barrier protection can be compromised at the joints and here special care must be taken in the design and construction of an effective air barrier system.

Although this Section refers separately to vapour barrier protection and air barrier protection, these functions in a wall or ceiling assembly of conventional wood frame construction are often combined as a single membrane which 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/floor intersections and gaps created by shrinkage of framing members.

In some constructions the air barrier protection is provided by 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 protection. In such cases, special care in sealing joints in a separate vapour barrier is not critical. These techniques often use no separate vapour barrier but rely on appropriate paint coatings to give the interior finish sufficient resistance to water vapour diffusion that it can provide the required vapour barrier protection.

The wording in this Section 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 is available in "Moisture Problems in Houses," by A.T. Hansen, Canadian Building Digest 231, available from the Institute for Research in Construction, National Research Council of Canada, Ottawa K1A 0R6.

A-9.25.3.1.(2) Flame-Spread Ratings of Insulating Materials. Part 9 has no requirements for flame-spread ratings of insulation materials since these are seldom exposed in parts of buildings where fires are likely to start. Certain of the insulating material standards referenced in 9.25.3.1.(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-9.25.4.3.(2) 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, "Specification for Vermiculite Loose Fill Insulation."

A-9.25.4.3.(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-9.25.5.2. Location of Low Permeance Air Barriers.

Generally the location in a building assembly of the air barrier is not critical; it 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. However, if the material chosen to act as the air barrier 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. Any moisture from the indoor air which diffuses through the inner layers of the assembly or is carried by air leakage through those layers is likely to be trapped at such an air barrier. This will not cause a problem if the air/vapour barrier is located where the temperature is above the dew point of the indoor air; the trapped water vapour will remain as vapour and no harm will be done. But if the air/vapour barrier is located where the temperature is below the dew point of the indoor air, the trapped water vapour will condense as liquid water or ice. If this temperature remains below the dew point for any length of time, significant moisture could accumulate.

Moisture which remains into warmer weather can allow the growth of decay organisms. Therefore 9.25.5.2. specifies that the temperature at such an air/vapour barrier be checked when the outdoor temperature is at a fairly low value. The January 2.5 per cent value is a temperature below which the temperature in an average January can be expected to go only 2.5 per cent of the hours in the month. Using this value would certainly be safe; however, modelling studies have indicated that moisture accumulation is unlikely to be significant if the location of the air/vapour barrier is based on exterior temperatures up to 10°C above this temperature. The method of carrying out this check is illustrated in the following example (see illustration next page):

Consider this wall on a house located in an area where the January 2.5 per cent temperature, as listed in the Supplement to the National Building Code, is -30°C. The designated air barrier is a material with low water vapour permeance (extruded polystyrene); therefore, the wall should be checked for compliance with 9.25.5.2., (i.e., the wall should be checked to ensure that the temperature at the location of the air/vapour barrier is above the dew point of the interior air when the outdoor temperature is -20°C).

Thus, in this example, the temperature at the location of the air/vapour barrier is below the dew point of the interior air and the design is not acceptable for use in this area. However, similar calculations would show that, if the extruded polystyrene were 100 mm thick, its surface temperature would be 4.7°C and the design would be acceptable in this area. Similarly, if the extruded polystyrene were 50 mm thick, the wall could be used in an area where the January 2.5 per cent temperature is -20°C.

A-9.25.6.2. 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-9.25.6.3. Low Permeance Insulation.

Where foamed plastic provides the resistance to water vapour specified in this Article, then no additional vapour barrier is necessary to reduce the rate of water vapour diffusion. Most serious problems resulting from moisture condensation, however, are the result of the leakage of moist air from inside the building into concealed wall spaces during colder weather. (See Appendix Note A-9.25.) In most cases, vapour diffusion accounts for only a small fraction of the total moisture.

If the insulation is installed by spot applied adhesives, large areas of the wall can share common interconnected air spaces between the insulation and the masonry. These can allow openings in the interior finish (due to holes, cracks, electrical boxes and other discontinuities) to communicate with openings in the exterior masonry surface (e.g. from cracks, joints and weep holes). Any air pressure differential between the inside and outside due to wind effects, mechanical equipment or buoyancy of

Intake ducts should be insulated and wrapped with an air/vapour barrier (on the side of the insulation away from the duct) to prevent the formation of condensation on the cold surface of the duct.

(4) Choice of Fans

The flow capacity of some types of fans decreases quite dramatically when the fan is required to work against a significant pressure difference. Therefore in selecting fans for a ventilation system, the fan capacity when rated at a 25 Pa pressure difference must be compared with the required system capacity.

Another important characteristic that should be borne in mind when selecting fans is the noise rating. If the ventilation system is too noisy, the occupants may just turn it off. Although much can be accomplished in reducing noise by locating the fans away from occupied areas and by mounting them in a manner that isolates them from the structure, the first step is to choose quiet fans. The noise disturbance created by a fan is usually expressed as its "sone" rating. Fans used in ventilation systems should have sone ratings of less than 2.0.

(5) Fully Ducted Balanced Systems

Fully ducted "balanced" ventilation systems with both intake and exhaust fans have the advantage of providing better control of the ventilation rate and more effective distribution of the fresh air within the dwelling. Such systems can be relatively expensive; however this need not be the case in houses with forced warm air heating systems since the heating ducts can also be used for ventilation.

In fact, it is very difficult to achieve a perfect balance between the intake and exhaust flows in "balanced" systems. It is therefore best to err on the side of slightly higher exhaust flow in order to avoid pressurizing the house, which can lead to interstitial moisture problems in the roof and wall structures.

These systems may also incorporate heat recovery equipment to reduce the energy loss due to ventilation.

Section 6.2 deals with design and installation of ventilation systems and includes references to relevant standards and manuals that are considered representative of good practice.

(6) Summer Ventilation

When windows are not openable, the mechanical ventilation system must provide fresh air on a year-round basis. While 0.3 ach is adequate for health purposes, it may not be adequate in summer to keep the indoor temperatures from climbing to uncomfortable levels as a result of solar heating. Unless the dwelling unit is air-conditioned, therefore, the mechanical ventilation rate to individual rooms must be increased to 1 ach if the windows are not designed to provide summer ventilation. Even this rate is marginal in warm weather. Fortunately most houses incorporate openable windows.

(7) Fan Sizes

The specified ventilation rates are additional to the natural infiltration that also occurs. The rates are based on the total volume enclosed within the building envelope.

A 2-storey house with openable windows has 100 m² of floor area on each of the first and second storeys and in the basement. Exhaust fans are to be provided in each of 2 bathrooms and if necessary in the kitchen. The ceiling height is 2.4 m.

Find the fan capacity required for winter ventilation.

Volume of house

$$(100 + 100 + 100) \times 2.4 = 720 \text{ m}^3.$$

Required rate of ventilation

$$720 \times 0.3 = 216 \text{ m}^3/\text{h}.$$

Required total fan capacity

$$(216 \text{ m}^3/\text{h} \times 1\,000 \text{ L/m}^3)/3\,600 \text{ s/h} \\ = 60 \text{ L/s}.$$

In this case, a 30 L/s (60 cfm) exhaust fan in each bathroom will provide adequate capacity, or a 60 L/s (120 cfm) kitchen exhaust fan can be used.

If the dwelling incorporates naturally-aspirating fuel-fired heating equipment, intake openings with a total area of at least 0.033 m² should be installed.

(8) Reference Sources

Information on acceptable levels of air quality in dwelling units and methods of design to control air

quality can be found in the documents listed below. Designs which comply with these methods can be expected to meet or exceed the requirements in 9.32.3.

Health and Welfare Canada, "Exposure Guidelines for Residential Indoor Air Quality,"

ASHRAE 62-81, "Ventilation for Acceptable Indoor Air Quality,"

Canadian Home Builders Association, "R-2000, Design and Installation Guidelines for Ventilation Systems,"

CSA preliminary standard F326.1- "Requirements for Residential Ventilation,"

Institute for Research in Construction, Canadian Building Digest 245, "Mechanical Ventilation and Air Pressure in Houses."

A-9.33.1.1. 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 outside 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 Sentence 6.2.1.4.(1). In the case of solid fuel-burning stoves, ranges and space heaters, CAN/CSA B365-M87 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 is available in Canadian Building Digest 222, "Airtight Houses and Carbon Monoxide Poisoning," from the Institute for Research in Construction, National Research Council of Canada, Ottawa K1A 0R6.

Index⁽¹⁾

A

Abbreviations

- proper names, 1.1.4.1.
- symbols and other abbreviations, 1.1.4.2.

Access for fire fighting, 2.1.6.2.(1)., 3.2.2.6., 3.2.2.11.(3), 3.2.5.1. – 3.2.5.7., 8.2.2.3., 8.2.3.3., 9.10.19.

Accessibility for the disabled (see also Barrier-free design) 3.7, 9.9.2.7.

Accessibility signs, 3.7.3.1.

Access openings through barricades, 8.2.1.3.(3)

Access

- attic spaces, 3.5.4.4., 9.19.2.1.
 - crawl spaces, 3.5.4.6., 9.18.2.1.
 - fire dampers, 3.1.8.9.(6)
 - heating, ventilating and air-conditioning equipment, 6.2.1.9., 9.18.4.2., 9.32.3.6.
 - horizontal service spaces, 3.5.4.5., 9.18.2., 9.19.2.1.
 - roof areas, 3.2.5.4.
- Access to exits, 3.3.1.3., 3.3.1.8., 3.3.1.18., 3.3.2.5., 3.3.2.6., 3.4.6.15.(4), 9.9.2.1., 9.9.3., 9.9.6., 9.9.7., 9.10.20.6.
- capacity, 3.3.1.16., 9.9.3.
 - headroom clearance, 3.3.1.8., 9.9.3.4.
 - illumination, 3.2.7.1.(1), 9.9.11.2.
 - residential occupancies, 3.3.4.4., 9.9.7., 9.9.9.
 - from roofs, 3.3.1.3.(1), 9.9.2.1.
 - width, 3.3.1.9., 9.9.3.

Adfreezing, design considerations for, 4.2.4.6.(1)

Administration of the Code, 1.1.1.

Aggregate

- built-up roofs, 9.26.11.4.
- ceramic tile, 9.29.10.2.
- concrete, 9.3.1.4., 9.3.1.8.(2)
- mortar, 9.20.3.1.
- stucco, 9.28.2.2.

Air

- barriers, 5.3.1., 9.23.2.2., 9.25.3.4., 9.25.5.
- contaminants, 3.2.6.2., 6.2.2.4.
- duct systems (see Ducts)
- filters, 6.2.3.14.(1)
- intakes, 6.2.3.12.(3), 6.2.3.12.(4), 9.32.3.3.
- leakage, control, 5.3
- openings, 6.2.3.13.
- outlets, 6.2.3.13., 6.2.4.5., 9.32.3.3.
- washers, 6.2.3.15.

Airborne sound rating, 3.3.4.6., 9.11

Air-conditioning systems, Part 6, 9.33.1.1.

Air-supported structures, 3.1.6., 4.4.1.1., 9.10.1.5.

Aisles, 3.3.2.3.(2), 3.3.2.4.

Alarm systems, fire (see Fire alarm and detection systems)

Alterations, 1.1.2.1., 8.1.2.1.

Alternative materials, 2.5

Aluminum,

- design basis for, 4.3.5.1.
- flashing, 9.20.13.1., 9.20.13.2., 9.26.4.1., 9.27.3.1., 9.28.1.5.
- nails and staples, 9.26.2.2.
- roofing, 9.26.13.1.
- siding, 9.27.12.1.(3), (4)

⁽¹⁾ Items contained in the Index are referenced to the numbering system used in this Code instead of to page numbers. For more information on the numbering system, refer to "A Guide to the Use of the Code" at the front of the document.

Anchorage
 against overturning, 4.1.3.4.
 architectural components, 4.1.9.1.(5), (16)
 concrete stairs, 9.8.10.2.
 to foundations, 9.23.6., 9.36.4.3.
 masonry, 9.20.11.
 mechanical/electrical components, 4.1.9.1.(15), (17)
 roofs, floors and intersecting walls, 9.20.11.

Annunciators, fire alarm, 3.2.4.8.

Appliances, installation (see also Equipment and Service Rooms)

heating, 6.2.1., 6.2.5., 9.33.1.
 in means of egress, 3.3.1.2.(3), 3.4.4.4.(4), 9.9.5.7.
 roof top, 3.5.2.2.(1), 6.2.3.16.(2), 6.2.5.2., 9.10.1.9.
 solid-fuel burning (stoves, ranges and space heaters) 3.5.2.1.(2), 6.2.1.4., 6.2.1.5., 9.33.1.
 ventilating, 6.2.1., 6.2.2., 9.32

Application of the National Building Code, 1.1.2.1., 2.1

Arabic numerals, 3.4.6.17.(1), 3.5.5.2.

Areas of rooms, 3.6.1.2., 9.5

Arena type buildings, 3.1.2.3., 3.2.1.1.(2), 3.2.2.14.

Asbestos cement

pipe, 9.14.3.
 siding, 9.23.17.3.(7), 9.27.5., 9.27.8.

Asbestos in air systems, 6.2.1.11.

Ash storage bins, 6.2.11.2.

Asphalt shingles (see Shingles)

Assembly occupancies (see Group A occupancies)

Assistive listening devices, 3.7.3.7.

Atriums (see Openings through floor assemblies)

Attics (see also Horizontal service space), 3.1.11.1., 3.1.11.5.(1), 3.5.1.1., 3.5.4.1., 4.1.6.3., 9.10.12.5., 9.10.15.1., 9.10.16.10., 9.19

B

Backfilling, 4.2.2.3.(2), 4.2.5.8., 9.8.10.3., 9.12.3.

Balconies (see also Mezzanines)

as horizontal exits, 3.4.6.9.(2), 3.4.6.9.(6)
 exterior, 3.2.2.7., 3.2.6.6.(1), 9.4.2.2., 9.9.9.1.

e floor loads, 4.1.6.3., 4.1.6.4., 9.4.2.3.

guards around, 9.8.8.

occupant load of, 3.1.16.1.(3)

Barrier-free design, 3.3.1.7., 3.7, 9.9.2.7.

application, 3.7.1.1., 9.9.2.7.

areas requiring, 3.7.2.1.

balconies, 3.3.1.7.

building controls, 3.7.1.3.(3)

design, 3.7

doors, 3.7.3.3.(1) – (4)

entrances, 3.7.1.2.

elevators, 3.3.1.7., 3.7.2.1.(1)(g), 3.7.2.2., 3.7.3.5.

exterior walks, 3.7.3.2.

floor surfaces, 3.7.1.3.(2)

lavatories, 3.7.3.10.

parking areas, 3.7.2.2.

path of travel, 3.7, 9.9.2.7.

ramps, 3.7.3.4., 9.8.6.1.

shower stalls for disabled persons, 3.7.3.12.

signs, 3.7.3.1.

soap and towel dispensers, 3.7.3.10.

special washrooms, 3.7.3.11.

vestibules, 3.7.3.3.(11)

washrooms, 3.7.2.3., 3.7.3.1.(2), 3.7.3.8. – 3.7.3.11.

water closets, 3.7.3.9.

water closet stalls, 3.7.3.8.

wheelchair space, 3.7.2.1.(2)

width, 3.7.1.3.(1)

Basements, 2.1.6.2.(2), 3.2.1.2., 3.2.1.4., 3.2.1.5., 3.2.2.5.(1), 3.2.2.11., 3.2.5.2., 3.2.5.3., 3.3.5.3., 3.4.5.2., 9.10.1.12., 9.10.9.4., 9.10.19.2.

crawl spaces considered as, 3.2.2.5., 9.10.8.8.

heating facilities, 9.33.1.3.

lighting, 9.34.2.4.

supply outlets, 6.2.4.5.(3)

used primarily as a storage garage, 2.1.6.2.(2), 3.1.10.3.(1), 3.2.1.2., 9.10.4.3.

Beams, 9.4.1.2.

basement and crawl space, 9.23.8.

glued-laminated, 9.23.4.3.

preservative treatment, 9.23.2.2.

ridge, 9.23.13.8.

spans, 9.23.4.

steel, 9.23.4.2.

supported on masonry or concrete, 9.10.9.9., 9.15.5., 9.20.8.3., 9.20.8.4., 9.23.8.1.

wood, built-up, 9.23.8.

Bedrooms, 9.5.6.

windows, 9.7.1.3.

Bins
 refuse, 3.5.3.3.(10)
 storage, 6.2.11.
 Bleacher seats, 3.3.2.8., 3.3.2.10., 4.1.6.11., 4.1.10.6.
 Boiler rooms, 3.5.2.4., 9.10.10.
 Bracing for wood framing, 9.23.18.
 Bridging for floor joists, 9.23.9.4.
 Building classification, 3.1.2., 9.10.2.
 Building height, 2.1.6.2.(1), 3.2.1.1., 9.10.4.
 Building services
 shut-off during demolition, 8.2.2.9.
 in fire separations and fire rated assemblies, 3.1.9.,
 9.10.9.6., 9.10.9.7.
 Building size and construction relative to occupancy,
 3.2.2., 9.10.8.
 Building size determination, 2.1.6., 3.2.2., 9.10.4.
 Business and personal services occupancies (see
 Group D occupancies)

C

Cables
 in noncombustible construction, 3.1.5.16.
 in plenums, 3.5.4.3.
 Calculations and analysis (see also Plans,
 specifications and calculations) 2.3.4.5.
 Carpets, 3.1.13.1.(1)
 Carports, 9.35
 Caulking, 9.7.4., 9.10.11.2., 9.20.13.12., 9.23.7.2.,
 9.23.17.8., 9.27.4., 9.27.9. – 9.27.11., 9.28.1.5.,
 9.29.10.5.
 Cavity walls (see also Masonry) 9.20.6.2., 9.20.8.2.,
 9.20.9.4., 9.20.10.1., 9.20.12.2., 9.20.13.6.,
 9.20.13.11.
 Ceiling membranes
 contribution to fire-resistance rating, 3.1.7.3.,
 3.1.7.4.(1), 3.5.4.3.(2), 9.10.3.4.
 openings, 3.1.9.1.(1), 3.1.9.4.(3) and (4), 3.1.9.5.,
 9.10.5., 9.10.9.6.(6), 9.10.9.7.
 below sprinkler systems, 3.2.5.13.(4)
 supports, 3.5.4.3.(1)(b), 9.10.3.4.
 Ceiling spaces used as plenums, 3.1.9.6., 3.5.4.3.,
 6.2.3.2., 6.2.4.8.(14)
 Cellars (see Basements)
 Central alarm and control facility, 3.2.6.12.,
 3.2.6.14.(2)
 Ceramic tile, 9.23.14.5.(3), 9.29.10., 9.30.2., 9.30.6.

Children's custodial homes, 3.1.2.5., 9.10.2.2.
 fire alarm system for, 3.2.4.3.

Chimneys, 6.3, 9.21
 access ladders, 6.3.1.5.
 cleanouts, 9.21.4.7.
 clearances, 9.21.5, 9.25.5.7.
 concrete, 6.3.1.2., 9.21.1.1., 9.21.4.
 construction, 9.21.4.
 design of, 6.3.1.1., 9.20.2.3., 9.21.1.1.
 factory built, 9.21.1.2.
 fireplace, 9.21.2.4.
 flues, 9.21.2.
 incinerator, 6.2.6.1.(2), 9.10.10.5., 9.21.2.1.
 lightning protection, 6.3.1.4.
 linings, 9.21.3., 9.21.4.9.
 masonry, 6.3.1.2., 9.21.1.1., 9.21.4.
 metal, 6.3.1.3.
 penetrating fire separations, 3.1.9.1.(1)
 rectangular, 9.21.1.
 saddles, 9.26.4.7.

Chutes, linen and refuse, 3.5.3.3., 9.10.1.11.

Cladding (see also Siding), 3.1.5.5., Part 5, 9.27

Clearances

boots and register boxes, 6.2.3.8.
 chimneys, 9.25.5.7.
 crawl spaces, 9.18.4.
 door and window frames, 9.27.10.5., 9.27.11.4.
 ducts, 6.2.3.8., 6.2.4.4.
 electric and gas-fired ranges, 9.33.2.
 fireplaces, 9.22.9.
 furnaces, 6.2.1.4.
 furnace plenums, 6.2.3.8., 6.2.4.4.
 heating and air-conditioning equipment, 6.2.1.4.
 hot water pipes, 6.2.9.3.
 internal combustion engines, 8.2.2.10., 8.2.3.9.
 solid-fuel fired appliances, 9.33.1.2.
 supply ducts, 6.2.4.4.
 unit heaters, 6.2.7.1.

Climatic data, 2.2

Closures

for chutes, 3.5.3.3.(2), (4)
 in exterior wall openings, 3.2.3.5.
 fire dampers used as, 3.1.8.7.(2), 9.10.13.13.
 fire-protection rating, 3.1.8.4., 9.10.13.1.
 in fire separations, 3.1.8., 3.2.8.2.(2), 3.3.3.6.(9),
 3.3.3.7.(5), 9.10.9.3., 9.10.13.

- hold-open devices, 3.1.8.12.(1), (2), 9.10.13.11.
- installation, 3.1.8.5.(2), 9.10.13.1.
- wired glass and glass block as, 3.1.8.14., 3.2.3.5., 9.10.13.5., 9.10.13.7.
- Cold weather requirements, 6.2.1.9.(3), 9.3.1.11., 9.12.1.3., 9.20.14., 9.28.6.1., 9.29.5.10.
- Collar ties, 9.23.13.7.
- Columns, 9.17, 9.35.4.
- Combustible
 - cladding, 3.1.5.5.
 - projections, 3.1.10.7.(2), 3.2.3.6., 3.2.3.16., 9.10.12.5., 9.10.14.13.
 - sprinkler piping, 3.1.5.15.(2), 3.1.9.4.(1), 3.2.5.14., 9.10.9.6.
- Combustible construction, 3.1.4.
 - foamed plastics, 3.1.4.2., 9.10.16.10.
 - support, 9.10.9.8.
- Combustible materials in noncombustible construction, 3.1.5., 3.1.8.2., 9.10.6.
- Commercial cooking equipment, 3.3.1.2.(2), 6.2.2.6., 9.10.1.4.
- Concealed spaces
 - fire separation, 3.1.8.3., 3.5.4.2., 9.10.9.10.
 - fire stopping, 3.1.11., 9.10.15.
 - horizontal, 3.1.8.3., 3.1.11.4.(1), 9.10.9.10.
 - insulation, 3.1.11.2.(2)
 - unsprinklered, 3.1.11.5.
- Concrete, 9.3.1.
 - aggregate, 9.3.1.4.
 - cantilevered steps, 9.8.9.1., 9.8.10.
 - columns, 9.17.6.
 - design, 4.2.3.5., 4.2.3.6., 4.3.3.1., 9.3.1., 9.4.1.1.
 - foundations, 4.2.3.5., 4.2.3.6., 9.15
 - joints, 9.15.4.6.
 - plain, reinforced and prestressed, 4.3.3., 9.3.1.
 - slabs, 6.2.4.6., 9.16
 - topping, 9.16.4.2., 9.23.4.5.
- Condensation control, 5.2.1., 5.3.1., 9.25
- Contraction (see Expansion and contraction)
- Conflict of provisions, 2.7.2.1.
- Connected buildings, 3.2.6.7.
- Connectors, duct (see also Ducts, connectors)
 - isolation, 6.2.3.4.
- Construction camps, 9.10.20.
- Construction sites
 - fire safety, 8.2.3.
 - protection, 8.2.1.5.
- safety measures, Part 8
- Construction types, 3.1.4., 3.1.5., 9.10.6.
- Contained use area, 3.2.4.1.(1), 3.3.1.12., 3.3.3.9., 3.4.6.15.(3)
- Contaminants, air, 6.2.2.4.
- Control joints, 9.15.4.6.
- Convalescent homes, 3.1.2.5., 9.10.2.2.
 - fire alarm systems for, 3.2.4.3.
- Convectors, 6.2.8.
- Cooling equipment, 6.2.10.1.
- Corbelling, 9.15.4.5., 9.20.12.
- Corridors
 - as access to exits, 3.3.1.12.(1), 3.3.2.5., 3.4.2.5., 9.9.7.
 - dead end, 3.3.1.9.(7), 3.3.3.3., 3.3.4.4.(6), 9.9.7.2.
 - dimensions, 3.3.1.9., 9.9.3.3., 9.9.5.2.
 - doors opening onto, 3.3.1.10., 3.3.1.12., 9.9.6.2.
 - emergency lighting, 3.2.7.3., 9.9.11.3.
 - fire separation, 3.3.1.4.(1), 9.10.9.21., 9.10.9.22.
 - flame-spread ratings, 3.1.13.6., 9.10.16.
 - floor loads, 4.1.6.3., 4.1.6.4.
 - illumination, 3.2.7.1., 3.2.7.3., 9.9.11.2.,
 - obstructions, 3.3.1.9.(3), 9.9.5.2., 9.9.5.3.
 - paired doors, 3.3.3.3.(3)
 - serving patients' sleeping rooms, 3.3.3.6.(3)
 - transparent doorways and panels, 3.3.1.18., 9.6.5., 9.7.5.
 - used by the public in institutional occupancies, 3.3.3.3., 3.3.3.6.(3), (4)
 - width, 3.3.1.9., 9.9.3., 9.9.5.2.
 - windows, 3.3.1.18.(5), 9.7.5.
- Corrosion resistance, 9.20.18.
- Covered walkways (see Walkways)
- Covered ways, 8.2.1.1., 8.2.1.2.
- Cranes, loads due to, 4.1.10.4.(3) – (5)
- Crawl spaces, 3.5.4.6., 9.18
 - access, 3.5.4.6., 9.18.2.
 - control of groundwater, 5.5.3., 9.18.5.
 - fire stopping, 3.1.11.6.
 - floors over, 9.10.8.1., 9.10.9.4.(4)
 - ground cover, 9.18.6.
 - heating requirements, 9.33.1.3.(5)
 - insulation, 9.18.1.3.
 - regulated as basement, 3.2.2.5., 9.10.8.8.
 - used as warm-air plenums, 9.18.3.5.
 - used for any occupancy, 9.10.8.8.
- Cutting and welding operations, 3.3.5.4.

e

interconnected floor spaces, 3.1.3.6.(3), 9.10.9.5.
 libraries, 3.3.2.11.
 major occupancies, 3.1.3.6., 9.10.9.11., 9.10.9.16., 9.10.9.17.
 meeting at exterior walls, 3.2.3.14., 9.10.12.4.
 multiple occupancies, 3.1.3., 9.10.9.
 occupied areas during demolition, 8.2.2.13.
 openings, 3.1.8.1.(2), 3.1.8.6.(1), (2), 3.2.8.2.(2), (3), 9.10.13.
 operating, recovery and delivery rooms, 3.3.3.8.
 public corridors, 3.3.1.4.(1), 9.10.9.15.
 rating, 3.1.7.4.(2), 9.10.3.
 residential occupancies, 3.1.3.6.(2), 3.3.4.2., 9.10.9.11., 9.10.9.14.
 roof top enclosures, 3.2.2.10.
 service equipment penetrating, 3.1.9.1. – 3.1.9.4., 9.10.9.6.
 service rooms, 3.5.2., 9.10.8.4., 9.10.10.
 stages for theatrical performances, 3.3.2.13.
 storage rooms, 3.3.4.3., 9.10.10.6.
 suites, 3.3.1.1., 3.3.4.2., 9.10.9.13., 9.10.9.14.
 various occupancies, 3.2.2., 3.3, 9.10.9., 9.10.10.
 vehicular passageways, 3.2.3.19.
 vertical, 2.1.6.2.
 vertical service spaces, 3.5.3., 9.10.1.11.
 walkways, 3.2.3.20., 3.2.3.21.
 between zones in hospitals or nursing homes, 3.3.3.6.(8)
 Fire stop materials, 3.1.5.2.(1), 3.1.9.1., 3.1.11.7., 9.10.15.3.
 Fire stop flap, 3.5.4.3.(2), 9.10.13.14.
 Fire stopping, 3.1.5.2.(1), 3.1.11., 3.2.3.16.(3), 9.10.9.6., 9.10.15.
 concealed spaces, 3.1.11., 9.10.15.
 mansard style roofs, 3.1.11.5.(2), 9.10.15.1.(16)
 pipes and ducts, 3.1.9.1.(1), 3.1.9.4., 6.2.9.5., 9.10.9.6., 9.10.15.4.
 Firewalls, 3.1.10., 9.10.11.
 combustible projections near, 3.1.10.7.(2)
 construction, 3.1.10., 9.10.11.
 continuity, 3.1.10.3.(1)
 fire-resistance rating, 3.1.7.4.(2), 3.1.10.2., 9.10.3.3.(3), 9.10.11.3.
 meeting of exterior walls, 3.1.10.6.
 openings, 3.1.10.5.

parapets, 3.1.10.4.
 party walls as, 3.2.3.4., 9.10.11.1.
 separating buildings, 2.1.6.1., 3.1.10.4.(2)
 service equipment penetrating, 3.1.10.1.(4)
 structural stability, 3.1.10.1.(1), (2),
 supports, 3.1.10.1.(3)
 Fixtures, plumbing, 9.31.4.
 Flammable and combustible liquids
 storage, 8.2.3.10.
 Flame-spread rating
 assembly occupancies, 3.1.13.2.
 bathrooms within suites of residential occupancy, 3.1.13.3.(1), 9.10.16.11.
 business and personal services occupancies, 3.1.13.2., 9.10.16.
 combustible insulation, 3.1.5.11., 9.10.16.10., 9.10.16.12.
 combustible raceways, 3.1.5.15.(1)
 combustible skylight assemblies, 3.1.5.4.(1), 9.10.16.9.
 combustible vertical glazing, 3.1.5.4.(2), 9.10.16.1., 9.10.16.6.
 determination, 3.1.12., 9.10.3.2.
 doors, 3.1.13.2.(2), (3), 9.10.16.1.
 ducts, linings and coverings, 6.2.3.6., 9.10.16.12.
 elevator cars, 3.1.13.7.
 exits, 3.1.13.2.(1), 3.1.13.7., 3.1.13.8., 9.10.11.3., 9.10.16.
 exterior exit passageways, 3.1.13.10., 9.10.16.4.
 fire-retardant treated wood, 3.1.4.4.(1)
 foamed plastic insulation, 3.1.5.11., 9.10.16.10.
 glazing and skylights, 3.1.13.2., 9.10.16.
 high buildings, 3.1.13.7.
 industrial occupancies, 3.1.13.2., 9.10.16.
 institutional occupancies, 3.1.13.2.
 insulation in concealed spaces, 3.1.11.2.(2), 9.10.16.
 interior finishes, 3.1.13., 9.10.16.
 light diffusers and lenses, 3.1.13.4.(1), 9.10.16.6., 9.10.16.8.
 lobbies, 3.1.13.2., 9.10.16.3.(2)
 mercantile occupancies, 3.1.13.2., 9.10.16.
 noncombustible construction, 3.1.5.
 public corridors, 3.1.13.6., 9.10.16.
 residential occupancies, 3.1.13.2., 3.1.13.3., 9.10.16.

e

- service rooms, 3.1.13.7., 9.10.16.
- tests, 3.1.12., 9.10.3.2.
- underground walkways, 3.1.13.9.
- vehicular passageways, 3.1.13.2.
- vestibules, 3.1.13.7.
- Flashing, 5.4.4., 5.5.1., 5.6.1., 5.7.1.1.
 - chimney, 9.21.4.6.(4), 9.21.4.10.
 - roof, 9.26.4., 9.26.11.10.(3)
 - wall, 9.13.5.4., 9.20.13., 9.25.5.8.(1), 9.27.3., 9.28.1.5.
- Floor areas
 - dimensions, 9.5
 - general requirements, 3.3.1.
 - institutional occupancies, 3.3.3.
 - occupant load, 3.1.16.
 - requirements for suites, 3.3.1.1.
 - special requirements (see specific occupancy under Group entry)
- Flooring, 9.30
 - ceramic tile, 9.30.6.
 - parquet, 9.30.4.
 - resilient, 9.30.5.
 - underlay, 9.30.2.
 - wood strip, 9.30.3.
- Floor joists, 9.23.9.
- Floors
 - acting as diaphragms, 4.1.9.1.(18)
 - anchorage of intersecting, 9.20.11.1.
 - combustible elements permitted, 3.1.5.8.
 - heavy timber construction, 3.1.4.6.
 - loads due to use, 4.1.6.
 - ratings, 9.10.3.1.
 - sub floors, 9.23.14.
 - supports, 3.1.4.6., 3.2.1.4.(2), 9.30.1.3.
 - vibrations, 4.1.1.6.(1)
- Flue pipes, 9.21.1.3.
- Flues, chimney, 9.21.2.
- Foamed plastic
 - insulation, 6.2.3.6.(4), (5)
 - protection, 3.1.4.2.(1), 3.1.5.11., 3.2.3.7.(3), 9.10.16.10.
- Footings (see also Shallow foundations) 4.2, 9.15
 - area for column spaces, 9.15.3.3.
 - chimney, 9.15.3.1., 9.21.4.3.
 - fireplace, 9.15.3.1., 9.22.1.3.
 - non-loadbearing masonry wall, 9.15.3.5.
 - projection, 9.15.3.6., 9.15.3.7.
 - size, 9.15.3.3.
 - strip sizes, for exterior walls, 9.15.3.3.
 - tile drains, 9.14.2.1., 9.14.3.3.
 - trenches, 9.12.4.1.
 - width, 9.15.3.3., 9.15.3.7.
- Foundations, 4.2, 9.15
 - backfilling, 4.2.5.8.
 - deep (see Deep foundations)
 - depth, 4.2.4.6., 9.12.2.
 - design, 4.1.9.4., 4.2.4., 9.4.4., 9.15.1.1.(2)
 - drawings, 2.3.4.6., 4.7, 4.2.2.2.
 - dynamic loading, 4.2.4.9.
 - eccentric loading, 4.2.4.8.
 - equivalent approaches to design, 2.5.2.
 - excavations, 4.2.5., 9.12
 - on filled ground, 4.2.4.15.(1)
 - footing sizes, 9.15.3.
 - on frozen ground, 9.12.1.3.
 - frost action, 4.2.4.6., 9.12.2.2.
 - garages and carports, 9.35.3.
 - granular drainage layer, 9.14.4.
 - hydrostatic uplift, 4.2.4.10., 9.16.3.2.
 - loads, 4.2.4.4.
 - masonry, 4.2.3.3., 4.2.3.4.
 - materials, 4.2.3., 9.15.1.3., 9.15.2.
 - movement, 4.2.4.5., 9.12.2.2.(5)
 - on organic soils, 9.12.1.1.
 - on permafrost, 4.2.4.12., 9.15.1.2.
 - pier type, 9.15.2.4.
 - piles (see Deep foundations)
 - raft (see Shallow foundations)
 - review, 4.2.2.3.
 - on rock, 9.15.3.1., 9.15.3.2.
 - shallow (see Shallow foundations)
 - on sloping ground, 4.2.4.7.
 - special, 4.2.8.
 - steel, 4.2.3.7. – 4.2.3.10.
 - structural design, 4.2.4.16.
 - subsurface investigation, 4.2.2.1., 4.2.4.2.
 - on swelling and shrinking soils, 4.2.4.13., 9.4.4.4., 9.35.3.2.
 - walls, 9.4.4.6., 9.15.4.
 - wood, 4.2.3.1., 4.2.3.2., 9.15.1.3.
 - wood-frame construction, 9.15.1.3.

Framing

- conventional wood-frame construction, 9.23
- plank frame wall construction, 9.4.1.2.
- post, beam and plank construction, 9.4.1.2.
- sheet steel stud, 9.24

Freezing, protection from, 3.2.5.18., 6.2.1.9.(3), 9.3.1.11., 9.8.10.3., 9.10.20.9., 9.12.1.3., 9.20.16.1., 9.28.6.1., 9.29.5.10.

Frost penetration, depth, 2.2.1.2.

Fuel

- bins for solid fuel, 6.2.11.1.
- dispensing, 3.3.5.9., 9.10.1.3.
- supplies for heating equipment, 8.2.2.11.

Furnace

- capacity, 6.2.1.2., 9.33.1.3.
- clearances, 6.2.3.8., 6.2.4.4.
- installation, 6.2.1.4.(1)

Furnace rooms (see Service rooms)

Furring

- interior finish, 9.29.3.
- noncombustible construction, 3.1.5.6.
- siding, 9.27.5.3.
- stucco lath, 9.28.4.4.

G

Galvanized sheet metal, 9.3.3.2.

Garages

- detached, 9.10.14.14., 9.35.3.3.
- for dwelling units, 9.10.9.16., 9.35
- floor loads, 4.1.6.3.
- lighting, 9.34.2.6.
- repair, 3.3.3.2., 3.3.5.6., 9.10.9.17.
- storage, 3.2.1.2., 3.2.8.2.(2), 3.3.5.5., 6.2.2.3., 9.10.4.3., 9.10.9.17., 9.10.14.10., 9.32.1.1.(4)
- ventilation, 3.3.5.5.(4), 6.2.2.2., 9.32.1.1.(4)
- walls and columns, 9.35.4.

Garbage rooms (see Service rooms)

Gas-burning appliances (see Appliances)

Gas vents, 6.3.1.1., 9.21.1.3.

Glass

- area, 3.1.8.16., 9.6.5.1., 9.7.1.2., 9.7.3.2.
- design, 3.3.1.18.(5), 4.3.6.1., 5.7.1.2., 9.7.3.2., 9.7.5.4.
- doors, 3.3.1.18.(1) – (4), 3.4.1.8., 9.6.5.2. – 9.6.5.6.
- in fire separations, 3.1.8.14., 3.2.3.13.(1), (2), 9.10.13.5., 9.10.13.8.

panels, 3.3.1.18.(1) – (4)

safety, 3.3.1.18., 3.4.1.8., 3.6.4.5., 9.6.5.2., 9.6.5.5.

standards, 9.7.3.1.

thickness, 9.6.5.1., 9.7.3.2.

wired or glass block, 3.1.8.14., 3.1.8.16., 3.2.3.5., 3.2.3.11.(2), 3.2.3.13.(1), 3.3.1.18.(1), 9.9.4.3. – 9.9.4.6., 9.10.13.5., 9.10.13.7., 9.10.14.5., 9.10.14.6.

Glazing, combustible, vertical, 3.1.5.4.(2)

Glazing compound, 9.7.4.1.

Glued-laminated timber, 3.1.4.6.

beams, 9.23.4.3.

lintels, 9.23.12.3.(5)

Grab bars, 3.6.4.8., 3.7.3.8.(1), 3.7.3.11.(1), 3.7.3.12.(1), 9.31.2.3.

Grading of site, 9.14.6.

Groundwater, control, 5.5

Group A occupancies (assembly)

building construction, 3.2.2.16. – 3.2.2.28.

classification, 3.1.2.1.

fire alarms, 3.2.4.1.

fire detectors, 3.2.4.10.

fire safety within floor areas, 3.3.1., 3.3.2.

flame-spread rating, 3.1.13.2.

high buildings, 3.2.6.

occupant load, 3.1.16.

standpipes and hose systems, 3.2.5.9.

water closets required, 3.6.4.2.

Group B occupancies (institutional)

building construction, 3.2.2.29. – 3.2.2.33.

classification, 3.1.2.1.

fire alarms, 3.2.4.1.

fire detectors, 3.2.4.10.

fire safety within floor area, 3.3.1., 3.3.3.

flame-spread rating, 3.1.13.2.

high buildings, 3.2.6.

occupant load, 3.1.16.

standpipe and hose systems, 3.2.5.9.

water closets required, 3.6.4.2.

Group C occupancies (residential)

air circulation, 6.2.3.10.(6), (7), 6.2.3.11.(2)

building construction, 3.2.2.34. – 3.2.2.38., 9.10.8.

classification, 3.1.2.1., 9.10.2.

fire alarms, 3.2.4.1., 9.10.17.

fire detectors, 3.2.4.10.

fire separations, 3.3.4.2., 9.10.9.11., 9.10.9.14.

fire safety within floor areas, 3.3.1., 3.3.4.

flame-spread rating, 3.1.13.2., 3.1.13.3., 9.10.16.
 high buildings, 3.2.6.
 occupant load, 3.1.16.
 smoke alarms, 3.2.4.21., 9.10.18.
 standpipe and hose systems, 3.2.5.9., 9.10.1.10.
 water closets required, 3.6.4.2., 9.31.4.1.
 Group D occupancies (business and personal services)
 building construction, 3.2.2.39. – 3.2.2.42., 9.10.8.
 classification, 3.1.2.1., 9.10.2.
 fire alarms, 3.2.4.1., 9.10.17.
 fire detectors, 3.2.4.10.
 fire safety within floor areas, 3.3.1.
 flame-spread rating, 3.1.13., 9.10.16.
 high buildings, 3.2.6.
 occupant load, 3.1.16.
 standpipe and hose systems, 3.2.5.9., 9.10.1.10.
 water closets required, 3.6.4.2.
 Group E occupancies (mercantile)
 building construction, 3.2.2.43. – 3.2.2.46., 9.10.8.
 classification, 3.1.2.1., 9.10.2.
 fire alarms, 3.2.4.1., 9.10.17.
 fire detectors, 3.2.4.10.
 fire safety within floor areas, 3.3.1.
 flame-spread rating, 3.1.13., 9.10.16.
 high buildings, 3.2.6.
 occupant load, 3.1.16.
 standpipe and hose systems, 3.2.5.9., 9.10.1.10.
 water closets required, 3.6.4.2.
 Group F occupancies (industrial)
 building construction, 3.2.2.47. – 3.2.2.62., 9.10.8.
 classification, 3.1.2.1., 9.10.2.
 fire alarms, 3.2.4.1., 9.10.17.
 fire detectors, 3.2.4.10.
 fire safety within floor areas, 3.3.1., 3.3.5.
 flame-spread rating, 3.1.13., 9.10.16.
 high buildings, 3.2.6.
 occupant load, 3.1.16.
 standpipe and hose systems, 3.2.5.9., 9.10.1.10.
 water closets required, 3.6.4.2.
 Guards, 3.3.1.17., 3.3.4.7., 3.3.4.8., 3.4.6.5., 9.8.8., 9.9.1.1.
 balconies in residential occupancies, 3.3.4.7., 9.8.8.
 decks, 9.8.8.2.(2)
 height, 3.3.1.17.(1), 3.3.2.8., 3.3.5.5.(6), 3.4.6.5.(2) – (4), 9.8.8.2.

loads, 4.1.10.1.
 mechanical equipment, 6.2.1.9.(2)
 openings through, 3.3.1.17.(3), 3.4.6.5.(5), 9.8.8.4., 9.8.8.5.
 porches, 9.8.8.2.(2)
 ramps, 3.7.3.4., 9.8.8.6.
 where required, 3.3.1.17., 3.4.6.5.(1), 3.4.7.6.(1), 9.8.8.1.
 windows in public areas, 3.3.1.18.(5), 9.7.5.
 Gypsum board
 as a thermal barrier, 3.1.4.2.(1), 3.1.5.11.
 interior finish, 9.29
 wall sheathing, 9.23.16.2., 9.23.16.3.
 Gypsum lath, 9.29.5.

H

Hallways, within dwelling units, 9.5.8.1.
 Handicapped persons, provisions for (see Barrier-free design)
 Handrails, 3.3.4.8., 3.4.6.4., 3.4.7.6.(3), 3.7.3.4., 9.8.7.
 Hardboard
 exterior siding, 9.27.10.
 interior finish, 9.29.7.
 underlay, 9.30.2.2.
 Hardware for doors, 3.1.8.5.(3), 3.1.8.11., 3.1.8.12., 3.3.1.18.(1), 3.3.2.6., 3.3.3.6.(5), 3.4.6.15., 3.7.3.3.(6), 3.7.3.8.(1), 3.7.3.11., 9.6.6., 9.9.6.3., 9.9.6.8. – 9.9.6.10., 9.10.13.9. – 9.10.13.11.
 Hazardous substances, 3.2.4.10.(2), 3.2.6.11.(1), 3.3.1.2.(1), 3.3.1.19., 3.3.5.3., 3.5.2.1.(4), 6.2.2.4., 9.10.1.8.
 Hearth, fireplace, 9.22.5.
 Heat detectors, 3.2.4.11.(1), 3.2.4.16.(1), 9.10.17.3.
 Heaters
 service water (see Service water heaters)
 unit, 6.2.7.1.
 Heating appliances (see Appliances)
 Heating coils, 9.31.6.6.
 Heating, ventilating and air-conditioning systems,
 Part 6, 9.32 and 9.33
 design, 6.2.1.1., 9.32.3.3., 9.33.1.1.
 plans, 2.3.5.
 Heating, ventilating and air-conditioning equipment,
 installation codes, 6.2.1.4.(1)
 mounting, 9.33.1.1., 9.33.1.2.
 Heat recovery ventilators, 6.2.1.7.

Heavy timber construction, 3.1.4.5., 3.1.4.6.,
3.1.13.8.(1), 3.2.2., 3.2.3.8.(3), 9.10.6.2., 9.10.14.15.

Height

access to exit, 3.3.1.8., 9.9.3.4.
exit, 3.4.3.7., 9.8.3.4., 9.8.4.4., 9.9.3.4., 9.9.6.4.
room, 3.6.1.1., 9.5.2.1.

Helicopter landing areas, 4.1.6.12.

High buildings, additional requirements, 3.2.6.

High hazard industrial occupancies (see Group F occupancies)

Hold-open devices, 3.1.8.12., 9.10.13.11.

Horizontal exits (see Exits)

Horizontal service space

above fire separations, 3.1.8.3., 3.5.4., 9.10.9.10.
access, 3.5.4.5.
sprinklered, 3.2.5.15.

Hose

cabinets, fire, 3.2.5.11.
connections, 3.2.5.10.(5), 3.2.5.11.(4)
fire (see Standpipe and hose systems)
stations, fire, 3.2.5.11.

Hot water supply, 9.31.4.3.

Hydrostatic uplift pressures, 4.2.4.10., 9.16.3.2.

I

Impeded egress zone, 3.2.2.15., 3.2.4.1.(1), 3.2.4.8.(1),
3.3.1.12., 3.4.6.13.(2), 3.4.6.15.(3)

Incinerator, 6.2.6., 9.10.10.5.

rooms, 3.5.2.6., 3.5.2.8., 9.10.10.5.

Industrial occupancies (see Group F occupancies)

Insulation, 9.25

concealed spaces, 3.1.11.2.(2)
duct, 3.1.5.14.(2), 6.2.3.6.
foamed plastic, 3.1.5.11., 3.2.3.7.(3), 6.2.3.6.(4), (5),
9.10.16.10.
installation, 9.25.4.
noncombustible construction, 3.1.5.11., 3.1.5.14.(2)
materials, 9.25.3.1.
pipe, 3.1.5.14.(2), 6.2.9.2., 6.2.9.6.
protection of, 3.1.4.2., 3.1.5.11., 9.10.16.10., 9.25.4.6.,
9.25.4.7.
vapour barriers, 9.25.2.3., 9.25.6.
wall sheathing, 9.23.16.
wiring, 3.1.5.17.

Institutional occupancies (see Group B occupancies)

Interconnected floor spaces (see also Openings
through floor assemblies)

exemption, 3.1.3.6.(3), 9.10.9.5.

Interior finish (see also Flame-spread ratings) 3.1.13.,
9.10.16., 9.29 and 9.30

treads, landings and ramps in public buildings,
3.4.6.1., 9.8.9.5.

J

Janitors' rooms, 3.3.1.20.

Joints and connections for ducts, 6.2.3.2., 6.2.3.5.,
6.2.4.3.

Joists, 9.3.2.1.

floor, 9.20.8.3., 9.23.9.

roof and ceiling, 9.23.13.

Junction boxes, electrical, 3.1.5.2.(1)

K

Kitchens

area, in dwelling units, 9.5.5.1.
containing commercial cooking equipment,
3.3.1.2.(2), 6.2.2.6., 9.10.1.4., 9.10.13.13.(5)
exhaust ducts, 9.32.3.6.(2), 9.32.3.8.
floor loads, 4.1.6.3.
supply ducts, 9.33.3.8.

L

Landings (see Stairs)

Lath, stucco, 9.27.5.1.(2), 9.28.4.

Libraries, 3.3.2.11., 4.1.6.3.

Light diffusers and lenses, 3.1.13.4.(1), 9.10.16.6.,
9.10.16.8.

Lighting, 3.2.7., 9.9.11., 9.34.2., 9.34.3.

elements, transparent or translucent, 3.1.13.1.,
9.10.16.6., 9.10.16.8.

emergency, 3.2.7.3., 9.9.11., 9.34.3.

exit, 3.2.7.1.(1), 9.9.11.

fixtures, recessed, 3.2.7.2., 9.34.1.4.

garages and carports, 9.34.2.6.

levels, 3.2.7.1., 9.9.11.2., 9.34.2.

natural, 9.7.1.2.

outlets, 3.2.7.1.(3), 9.34.2.

public corridors, 3.2.7.1.(1), 9.9.11.2.
Limiting distance, 3.1.7.2., 3.2.3., 9.10.14.
Limit states design, 4.1.4.
 definition of terms, 4.1.4.1.
 effect of factored loads, 4.1.4.2.(3)
 importance factors, 4.1.4.2.(7)
 load combination factors, 4.1.4.2.(5)
 load factors, 4.1.4.2.(4)
 serviceability check, 4.1.4.3.
 strength and stability check, 4.1.4.2.
Linen chutes (see Chutes, linen and refuse)
Liners
 chimney, 9.21.3., 9.21.4.9.
 fireplace, 9.22.2., 9.22.3.
Lining for air ducts and plenums, 3.1.5.14.(2),
 3.2.4.5.(5), 6.2.3.6.
Lintels
e fireplace, 9.22.4.1.
 masonry wall, 9.20.5.2.
e steel, 3.2.2.3.(1), 9.10.7.1., 9.20.5.2., 9.22.4.1.
 wood, 9.23.12.
Live loads (see Loads, structural)
Living rooms, 9.5.3.1.
Loads, 4.1, 9.4
 combination, 4.1.3.1.
 concentrated, 4.1.6.10.
 during construction, 4.1.1.3.(2), (4)
 covered ways, 8.2.1.2.
 crane, 4.1.10.4.(3) – (5)
 dead, 4.1.5., 9.4.3.1.(2)
 deflections under, 4.1.1.5., 9.4.3.
 design requirement, 4.1.1.3.(1).
 dining areas, 4.1.6.6.
 earthquake, 4.1.9.
 eccentric, on foundations, 4.2.4.8.
 on exterior areas, 4.1.6.5.
 on firewalls, 4.1.10.3.
 grab bars, 3.6.4.8., 9.31.3.2.
 on guards, 4.1.10.1.
 ice, 4.1.7.1.(7)
 impact, 4.1.10.4.
 on interior walls and partitions, 4.1.8.4.
 rain, 4.1.7.3.
 on residential balconies, 9.4.2.2.
 due to partitions, 4.1.5.1.
 due to resonance, 4.1.10.5.(1)

snow, 4.1.7.1., 4.1.7.2., 9.4.2.
specified, 4.1.2.
structural, 4.1, 9.4
 due to sway forces, 4.1.10.5.(2)
 due to use and occupancy, 3.1.16., 4.1.6.
 variation with tributary area, 4.1.6.9.
vibration, 4.1.1.6., 4.1.10.4.(1), 4.1.10.5.(1)
on walls, 4.1.10.2.
wind, 4.1.8.

Low hazard industrial occupancies (see Group F occupancies)

Lumber (see also Wood)

dimensions, 3.1.4.6., 9.3.2.6., 9.3.2.8.
grades, 9.3.2.
moisture content, 9.3.2.5.

M

Machinery rooms

building height exception, 3.2.1.1.(1), 9.10.4.5.
fire separations, 3.5.2.1.(3), 3.5.2.3., 9.10.10.3.

Masonry

as a thermal barrier, 3.1.5.11.
chimney (see Chimneys)
columns, 9.17.5.
design and construction, 4.3.2.1.
foundations, 4.2.3.3., 4.2.3.4., 9.15.4.
walls, 9.20

Materials, 2.4, 2.5.1., 2.6.4., 3.1.4.1.(1), 3.1.5., 3.1.11.7.,

3.1.13., 4.2.3., 4.3, 5.6, 6.2.3.2., 6.2.9., 6.3, 9.3
combustible, in noncombustible construction,
3.1.5., 3.1.8.2., 9.10.6.

equivalent, 2.5.1.

fire stop, 3.1.9.1.(1), 3.1.11.7., 9.10.15.3.

storage, 2.4.1.2.

testing, 2.5.1., 2.5.3.

Means of egress, 3.3, 3.4, 9.9

Mechanical systems and equipment, 6.2.1.3.

Mechanical ventilation systems, 3.3.1.19.(1), 6.2.2.,
9.32

in storage garages, 6.2.2.2.

Medical gas piping systems, 3.6.5.1.

Medium hazard industrial occupancies (see Group F occupancies)

Membrane fire protection, openings, 3.1.9.5., 9.10.5.

Mercantile occupancies (see Group E occupancies)

Metal, sheet, thickness, 9.3.3.
 Metal roof deck assembly, 3.1.14.2.
 Mezzanines, 3.2.8.1., 3.4.2.2.(2), 9.5.2.2., 9.8.8.1.(1),
 9.10.4.1., 9.10.8.5., 9.10.12.2.
 in calculating building height, 3.2.1.1.(3) – (6),
 9.10.4.1., 9.10.4.2.
 exits, 3.4.2.2.(1), 9.9.8.6.
 fire-resistance ratings, 3.2.8.1.(1), 9.10.8.5., 9.10.9.4.
 floor loads, 4.1.6.1., 4.1.6.4.
 occupant load, 3.1.16.1.(3), 9.9.3.2.
 Minimum lighting levels, 3.2.7.1., 9.9.11., 9.34.2.
 Mobile home parks
 sanitary facilities, 3.6.4.4.
 Moderate hazard industrial occupancies (see Group F
 occupancies)
 Moving walks, 3.2.8.2.(5), (8), 9.8.1.3.
 Multiple occupancy requirements, 3.1.3.1., 9.10.2.,
 9.10.9.11., 9.10.9.16.

N

Nailing
 bracing, 9.23.18.2.(2)
 built-up beams, 9.23.8.3.(7)
 columns, 9.17.4.2.(2)
 fibreboard finish, 9.29.8.3.
 gypsum board, 9.29.5.
 hardboard finish, 9.29.7.3.
 joists, 9.23.9.2.(2)
 lintels, 9.23.12.
 plywood finish, 9.29.6.3.
 rafters and joists, 9.23.13.
 roofing, 9.26.2.2.
 sheathing, 9.23.3.5.
 siding, 9.27.5., 9.27.7., 9.27.8.
 stucco, 9.28.3.2.
 subflooring, 9.23.3.5., 9.23.14.6.
 underlay, 9.30.2.3.
 waferboard and strandboard finish, 9.29.9.3.
 wood-frame construction, 9.23.3., 9.23.13.
 wood strip flooring, 9.30.3.3.
 Noncombustible construction, 3.1.5., 9.10.6.1.
 support, 3.1.7.6.(3), 3.1.8.2., 9.10.1.1.

O

Occupancies (see also entries under Group occupan-
 cies)
 classification, 3.1.2.1., 9.10.2.
 multiple, 3.1.3., 9.10.2., 9.10.9.11., 9.10.9.16.,
 9.10.9.17.
 Occupancy combinations, prohibition, 3.1.3.7.,
 9.10.9.12.
 Occupant load
 determination, 3.1.16.
 Oil-burning appliances (see Appliances)
 Openings
 access through barricades, 8.2.1.3.(3)
 access to heating, ventilating and air-conditioning
 systems, 6.2.1.12.
 between an institutional occupancy and a garage,
 3.3.3.2.
 closures (see Closures)
 in concealed spaces, 3.1.11.7.(5)
 duct, 3.1.9.5., 3.5.4.5., 9.10.5.1.(4)
 escalator and moving walkway, 3.2.8.2.(5), (6)
 in exterior walls, 3.2.3.1., 3.2.3.13.(1), (2), 9.9.4.4. –
 9.9.4.6., 9.10.12.1., 9.10.12.4., 9.10.14.
 fire damper, 9.24.3.7.
 in fire separations, 3.1.3.6.(3), 3.1.8.1.(2), 3.1.8.6.,
 3.1.8.15., 3.2.8.2.(2), (3), 3.3.3.2., 3.2.3.13.(3),
 3.4.4.4.(1), 9.10.5., 9.10.13.
 in guards, 3.3.1.17.(3), 9.8.8.4.
 in membrane ceilings, 3.1.9.5., 9.10.5.
 natural ventilation, 9.32.2.1.
 support of masonry above, 9.20.5.2., 9.22.4.
 through floor assemblies (Interconnected floor
 spaces) 3.2.8., 9.10.1.6.
 unprotected (see Unprotected openings)
 in walls above adjacent roofs, 3.2.3.15., 9.10.12.4.
 Orphanages, types of fire alarms, 3.2.4.3.
 Outdoor equipment installations, 6.2.1.9.(3),
 6.2.3.16.(2)
 Outdoor places of assembly (see Group A occupan-
 cies)
 Outlets, air (see Air outlets)

P

Panel-type underlay, 9.30.2.

Parapets

design, 5.4.4., 9.20.6.5.

firewall, 3.1.10.4.(1), (2)

Parging (see also Stucco)

above-grade masonry, 9.20.13.10.(3)

for dampproofing, 9.13.5.1.

foundation walls, 9.15.6.

for waterproofing, 9.13.3.1.

Parking areas

access to, 3.7.2.2.

Parking decks on roofs, 4.1.6.13.

Parking garages (see Garages)

Parking structures

design basis for, 4.4.2.1.

Particleboard

interior finish, 9.29.9.

subflooring, 9.23.14.

underlay, 9.30.2.

Partitions

combustible construction, 3.1.5.12.

loads, 4.1.5.1.(1) – (4)

Party walls, 3.2.3.4., 9.10.11.

Passageways, 3.3.1.13., 9.9.2.2.

exterior, 3.1.13.10., 3.2.2.8., 3.3.1.14., 3.4.4.3.(1),

9.9.4.2., 9.10.8.7., 9.10.16.4.

vehicular, 3.2.3.19.

Penthouses, 3.2.1.1.(1), 3.2.2.9., 9.10.8.6.

Permafrost, 4.2.4.12., 9.15.1.2.

Physical security (see Resistance to forced entry)

Pilasters, 9.15.5.3., 9.20.8.4.

Piles, 4.2.3.8., 4.2.7.

Pipes (see also Ducts)

clearances, 6.2.9.3.

combustible, 3.1.5.15.(1), 3.1.9.4., 9.10.9.6., 9.10.9.7.

drainage, 9.14.2., 9.14.3.

for heating and cooling systems, 6.2.9.

insulation of, 6.2.9.2.

metal, 9.14.3., 9.31.2.2.

penetrating fire separations, 3.1.9.1.(1), 3.1.9.2.,

3.1.9.4., 3.1.10.1.(4), 9.10.9.6., 9.10.9.7.

sleeves, 6.2.9.5.

in storage bins, 6.2.11.1.(1), (2)

used in DWV piping systems, 3.1.9.4., 9.10.9.7.

Piping systems, non-flammable medical gas, 3.6.5.1.

Plank construction, 9.4.1.2.

Plans, specifications and calculations, 2.3

for fire protection components, 2.3.3.

for foundations, 2.3.4.6., 2.3.4.7.

for heating, ventilating and air-conditioning systems, 2.3.5.2., 6.1.4.1.

site, 2.3.2.

structural, 2.3.4., 4.1.1.8.

Plasterboard (see Gypsum board)

Plastering, 9.29.4.

Plastic

light diffusers and lenses, 3.1.13.4., 9.10.16.6.

9.10.16.8.

pipe (see Pipes, combustible)

Plastics, foamed (see Foamed Plastics)

Plates

sill, 9.23.7.

wall, 9.23.11.

Plenums

ceiling spaces used as, 3.1.9.6., 3.5.4.3., 6.2.3.2.(1), 6.2.4.8.(14)

return air, 3.5.4.3.(2), 6.2.4.8.(8), 6.2.4.8.(14)

e

Plumbing, Part 7

facilities required, 3.6.4., 7.1.3., 9.31

fixtures, combustible, 3.1.5.18.

Plywood

finish, 9.29.6.

fire-retardant treated, 3.1.14.

phenolic-bonded, for firestopping, 3.1.11.7.(4), 9.10.15.3.

roof sheathing, 9.3.2.4., 9.23.15.

siding, 9.27.9.

subflooring, 9.23.14.

underlay, 9.30.2.2.

wall sheathing, 9.23.16.

Police stations, 3.1.2.4.

Polyester roofing, 9.27.14.

Portable extinguishers, 3.2.5.17., 8.2.2.4., 8.2.3.4., 9.10.19.4.

Post, beam and plank construction, 9.4.1.2.

Post-disaster buildings, 4.1.8.1.(4), 4.1.9.1.(10)

Potable water system, 9.31.3.

Power supply, emergency, 3.2.7.4. – 3.2.7.6., 3.2.7.8., 3.2.7.9.

Power operated doors, 3.7.3.3.(5)

Pressure vessels, 6.2.1.4.(1)

- Sound resistance ratings of walls, floors and ceilings, 9.11.2.1.
- Space frame, earthquake design, 4.1.9.1.(9)
- Space heaters, 6.2.1.5., 9.33.1.2.
- Spans, wood, rafters, joists and beams, 9.23.4.
- Spatial separations between buildings, 3.2.3., 9.10.14.
- Special structures, 3.2.2.2.
- Specifications (see Standards, material)
- Sprinkler systems, 2.3.3.2., 3.1.4.6.(4), 3.1.5.11.(3), (4), 3.1.8.12.(2), 3.1.11.6., 3.1.13.6., 3.1.13.7.(2), 3.1.14.2.(2), 3.2.1.5.(1), 3.2.2., 3.2.3.11.(1), 3.2.3.15., 3.2.3.21.(1), 3.2.4.8.(5), 3.2.4.16., 3.2.5.3., 3.2.5.9.(1), 3.2.5.13., 3.2.5.14., 3.2.6.4.(1), 3.2.6.11., 3.2.8.2.(5), 3.2.8.6., 3.3.1.4.(1), 3.3.1.7.(1), 3.3.2.2.(2), 3.3.2.5.(1), 3.3.2.11.(1), 3.3.2.13.(1), 3.3.3.7.(1), 3.3.4.2.(2), 3.3.4.3., 3.5.2.9.(2), 3.5.3.3.(6), 9.9.8.1.(2), 9.9.8.2., 9.9.8.5.(2), 9.10.1.10., 9.10.8.2., 9.10.9.6.(8), 9.10.9.13.(2), 9.10.9.15., 9.10.10.6., 9.10.12.3., 9.10.13.8.(2), 9.10.14.6., 9.10.17.3.(3)
- Stability, structural, 4.1.1.7.
- Stages, theatrical, 3.3.2.13.
- Stairs (see also Escalators), 3.3.1.13., 3.3.4.8., 3.4.6., 9.8 cantilevered concrete, 9.8.9.1., 9.8.10. construction, wood, 9.8.9. curved, 3.3.1.15., 3.4.6.8., 9.8.5. dimensions, 3.4.3., 9.8.3. exit, 3.4.3.6.(3), 3.4.6., 9.8 fire stops required, 3.1.11.4.(1), 9.10.15.1.(3) handrails and guards, 3.3.4.8., 3.4.6.4., 3.4.6.5., 3.4.7.6.(2), 9.8.7., 9.8.8. landings, 3.4.3.6.(3), 3.4.6.1.(2), 3.4.6.3.(2), 9.8.4. rise and run, 3.4.6.7., 9.8.3.1. slip-resistant finish, 3.4.6.1.(1), 9.8.9.5. treads, 3.4.6.1., 3.4.6.7., 9.8.2.1., 9.8.3.1., 9.8.9.4., 9.8.9.5. winders, 9.8.5.3.
- Stairways, 3.3.1.13., 9.9.1.1. headroom clearance, 3.4.3.7., 9.8.3.4. lighting, 9.34.2.3. rooftop enclosures, 3.2.2.10. unenclosed between storeys, 3.2.8.2.(6) weather protection, 3.3.5.5.(2) width, 3.4.3.1. – 3.4.3.5., 9.8.3.3.
- Standards material, 2.4, 2.5
- Standpipe and hose systems, 3.2.5.9., 9.10.1.10. construction sites, 8.2.3.5., 9.10.20.9. demolition sites, 8.2.2.5. installation, 3.2.5.10., 8.2.3.5. where required, 3.2.5.9.(1)
- Steel beams, 9.23.4.2. columns, 9.10.14.15., 9.17.3. design and construction, 4.3.4. fire protection, 3.2.2.3.(1), 9.10.7. in foundations, 4.2.3.7. – 4.2.3.10. siding, 9.27.12.1. studs, 9.24
- Storage bins (see also Bins, refuse) 6.2.11.
- Storage garages, 3.2.1.2., 3.3.5.5., 6.2.2.3., 9.5.2.3., 9.6.6.1.(1), 9.9.3.4.(2), 9.9.6.5.(4) 9.10.4.3., 9.10.9.16., 9.10.14.10., 9.10.17.8.
- Storage lockers, 3.1.5.13.
- Storage of materials, 2.4.1.2., 3.3.1.2.(1), 9.10.1.8.
- Storage rooms fire detectors, 3.2.4.10.(2), 9.10.17.5. fire separation, 3.3.4.3., 3.5.2.7., 9.10.10.6. wood storage lockers permitted, 3.1.5.13.
- Storey, open-air, 3.2.1.5.(2), 9.10.14.10, 9.10.17.8.
- Storeys below ground level, 3.2.2.11. (see also Garages)
- Stoves, 6.2.1.5., 9.33.1.2.
- Strandboard, 3.1.11.7.(4), 3.2.3.16.(1) for fire stopping, 3.1.11.7.(4), 3.2.3.16.(1), 9.10.15.3. interior finish, 9.29.9. roof sheathing, 9.3.2.4., 9.23.15. siding, 9.27.11. subflooring, 9.3.2.4., 9.23.14. tolerances, 9.3.2.7. underlay, 9.30.2. wall sheathing, 9.3.2.4., 9.23.16.
- Streets, use of, 8.2.5.
- Stress reversal, 4.1.3.3.
- Structural fire protection, 3.2.2., 9.10.8.
- Structural loads and procedures, 4.1, 9.4
- Structural design, Part 4, 9.4 limit states design, 4.1.4. working stress design, 4.1.3.
- Structures, special, 3.2.2.2.
- Stucco, 9.28
- Studs, wall, 9.23.10., 9.24
- Subflooring, 9.23.14.

Suites, separation, 3.3.1., 9.10.9.13.
Sumps, 6.2.3.15.(2), 9.14.5.2.
Supply outlets, air, 6.2.4.5.

T

Tables for fire and sound resistance, 9.10.3.1., 9.11.2.1.
Tape for joints in air duct systems, 6.2.3.5.
Telephone shelves or counters, 3.7.3.14.
Temperature
 indoor design, 9.33.1.3.
 outdoor design, 6.2.1.2., 6.2.1.8., 9.33.1.3.
 supply air, 6.2.4.5.(7)
Tents, 3.1.6., 9.10.1.5.
Termites, protection against, 4.3.1.3., 9.3.2.9.,
 9.12.1.1.(2), 9.15.5.1.(2), 9.18.4.1.
Tests
 control of smoke movement in high buildings,
 3.2.6.15.
 elevator control, 3.5.5.1.(2)
 fire-protection rating, 3.1.8.4., 9.10.3.1.
 fire-resistance rating, 3.1.7.1., 9.10.3.1.
 flame-spread rating, 3.1.12., 3.1.13.4.(1), 6.2.3.5.,
 6.2.3.6., 9.10.3.2.
 load, 2.5.2.1., 4.2.4.1., 9.23.13.11.(8), 9.23.13.11.(9)
 roof covering, 3.1.15.1.
 smoke developed classification, 3.1.12.
 sound transmission, 9.11.1.1.
 verification of fire alarm systems, 3.2.4.5.(2)
Thermal barrier for foamed plastics, 3.1.5.11.
Thermal insulation (see Insulation)
Tile
 drainage, 9.14.2. and 9.14.3.
 floor, 9.30.5.1., 9.30.6.
 wall, 9.29.10.
Timber (see Wood)
Traffic control, 8.2.6.
Transformer vaults, 9.10.1.5.
Travel distance, 3.3.1.6., 3.3.3.6.(11), 3.3.3.7.(6),
 3.4.2.1.(2), 3.4.2.4., 9.9.7.5., 9.9.8.1., 9.9.8.2.
Treads (see Stairs)
Trusses, 9.4.2.1.(3), 9.23.13.8.
Tubing for pneumatic controls, 3.1.5.2.(1)
Turnstiles, 3.3.1.21., 9.9.5.4.

U

Underground walkways, 3.2.3.21., 3.2.7.3.(1)
Underlay
 beneath flooring, 9.30.2.
 beneath shakes, 9.26.10.2.
 beneath shingles, 9.26.6.
Unit masonry (see Masonry)
Unprotected openings, 3.2.3., 9.10.14.
 in floors, 3.2.8., 9.10.1.6.
Unsprinklered areas, 3.1.11.5., 3.3.1.7.
Unusual structures, 3.2.2.2.

V

Vacuum cleaning systems, 3.2.4.14., 9.10.17.7.
Valves, supervision of water control in standpipe and
 hose systems, 3.2.5.12.
Vapour barriers, 5.2.1., 9.25.2.3., 9.25.6.
Vapour diffusion control, 5.2, 9.25.2.3., 9.25.6.
Vault, 3.5.2.9.
Vehicular passageway, 3.2.3.19.
 flame-spread rating, 3.1.13.2.
Vehicular traffic, 8.2.6.
Ventilation, 3.3.1.19., 3.5.2.9.(5), 3.6.3., 6.2.1.1., 6.2.2.,
 9.18.3. 9.19.1., 9.32
 crawl space, 9.18.3.
 dwelling unit, 9.32
 mechanical, 9.32.1., 9.32.3.
 natural, 9.32.1., 9.32.2.
 roof space, 9.19.1.
 storage garage, 6.2.2.3., 9.32.1.1.(4)
Venting
 chimney, 6.3, 9.21
 chutes, 3.5.3.3.(3)
 explosion, 3.3.1.19.(2)
 for fire fighting in atriums, 3.2.8.8.
 for fire fighting in high buildings, 3.2.6.10.,
 3.2.6.15.
 heating appliances, 6.2.1.4.(1)., 6.3.1.1., 9.21
 soffits, 9.25.4.3.(4)
Vertical service space, 3.5.3., 9.10.1.11.
 flame-spread rating, 3.1.13.2.

e

Vestibules, 3.1.8.17.(1), 3.1.13.7., 3.2.8.4., 3.3.5.5.(1),
3.3.5.8., 3.4.6.9.(2), 3.7.3.3.(11)
Vibrations, 4.1.1.6., 9.23.4.1.(2)
Voice communication systems, 3.2.4.22., 3.2.6.13.,
3.2.7.8.(5)

W

Waferboard

fire stopping, 3.1.11.7.(4), 3.2.3.16.(1), 9.10.15.3.
interior finish, 9.29.9.
roof sheathing, 9.3.2.4., 9.23.15.
siding, 9.27.11.
subflooring, 9.3.2.4., 9.23.14.
tolerances, 9.3.2.7.
underlay, 9.30.2.
wall sheathing, 9.3.2.4., 9.23.16.

Walkways

exterior, in a barrier-free path of travel, 3.7.3.2.
moving, 3.2.8.2.(5), 9.8.1.3.
separation of buildings connected by, 3.2.3.20.
underground, 3.2.3.21., 3.2.7.3.(1)

Walls

bracing, 9.23.18.
combustible elements permitted, 3.1.5.
exposed to adjoining roof, 3.2.3.15., 9.10.12.3.
exterior, exposed to another wall, 3.2.3.14.,
9.10.12.4.
external, meeting at a firewall, 3.1.10.6.
fire-resistance rating, exterior, 3.1.7.2., 3.1.7.4.(3),
3.2.3.7., 3.2.3.10., 9.10.3., 9.10.14.7., 9.10.14.11. –
9.10.14.14.
fire-resistance rating, interior, 3.1.7.1., 3.1.7.4.(2),
9.10.3.
firewalls, 4.1.10.3., 9.10.11.3.
foundation, 4.2, 9.15.4.
framing, 9.23.10. – 9.23.12., 9.24.2., 9.24.3.4.
garage, 9.35.4.
intersecting, anchorage, 9.20.11.
loadbearing, 3.2.1.4.(2), 9.20.6.3., 9.23.10.1.,
9.24.1.1.(2)
loads, 4.1.10.2.
masonry, 9.20
party, 3.2.3.4., 9.10.11.1.
plank frame, 9.4.1.2.

post and beam, 9.4.1.2.
sheathing, 9.23.16.

Washroom facilities for disabled persons, 3.7.3.8. –
3.7.3.11.

Waste material, 8.2.7.

Watch service, 8.2.2.14.

Waterclosets, 3.6.4.2., 3.7.3.8., 3.7.3.9., 9.31.4.1.

Watercloset rooms, 3.7.3.8., 9.5.7.

Water heaters, service (see Service water heaters)

Waterproofing and dampproofing, 5.5.2.1., 9.13,
9.20.13.

Water supply, 9.31.3.

firefighting, 3.2.5.8.

standpipes, 3.2.5.10.(3)

Water systems, 9.31.3.

potable, 9.31.3.1.

Weep holes, 9.20.13.9.

Wells, water, 9.14.5., 9.14.6.2.

Wheelchair space, 3.7.2.1.(2)

Wind, water and vapour protection, Part 5

Wind loads, 4.1.8.

dynamic effects, 4.1.8.2.

full and partial, 4.1.8.3.

pressure differences due to, 4.1.8.4.

specified, 4.1.8.1.

Winders, 9.8.5.3.

Windows (see also Unprotected openings) 3.1.5.4.(2),

3.3.1.18., 3.4.6.5.(6), 3.6.2., 9.7, 9.10.14.12.(2)

access to exits, 3.3.1.18., 9.7.5.

in exits, 3.1.8.16., 3.4.6.5.(6), 9.7.5., 9.9.4.5.

factory-sealed double-glazed, 9.7.3.1., 9.7.4.1.

in public spaces, 3.3.1.18.(5), 9.7.5.

minimum glass area, 9.7.1.2.

minimum glass thickness, 9.7.3.2.

standard, 9.7.2.1.

Wired glass (see Glass)

Wires and cables

electrical, 3.1.4.3.(1), 3.1.9.3., 3.2.6.9., 3.5.1.2.,
3.5.4.3.(1), 9.34

in noncombustible construction, 3.1.5.17.

Wood

cant strips, 3.1.5.3.(3)

columns, 3.1.4.6.(7), (8), 9.10.14.15., 9.17.4., 9.35.4.2. **e**

design and construction, 3.1.4.1.(1), 3.1.4.6., 4.3.1.,
9.4, 9.10.6.2., 9.23

dimensions, 3.1.4.6., 9.3.2.6. – 9.3.2.8.

fire-retardant treated, 3.1.4.4.(1), 3.1.14.

flooring, 9.30.3., 9.30.4.
floor supports, 3.1.4.6.(5), 9.23.8., 9.30.1.3.
foundations, 4.2.3.1., 4.2.3.2., 9.15.1.3.
preservative treatment, 4.2.3.2., 9.3.2.9.
products, 9.3.2.
roofs, 3.1.4.6.(4), (6), 3.1.14.1., 9.20.11.4.
shingles and shakes, 9.26.9., 9.26.10., 9.27.7.
siding, 9.27.6.
Working stress design, 4.1.3.
load combinations, 4.1.3.1. and 4.1.3.2.
overturning and sliding, 4.1.3.4.
stress reversal of, 4.1.3.3.
Workmanship, 2.6.4.

Y

Yard, as access for fire fighters, 3.2.5.7.(1), 9.10.19.3.