National Building Code of Canada 1995

First Revisions and Errata
(Including Change Pages)

Issued by the Canadian Commission on Building and Fire Codes

July 1998

The attached pages identify revisions and errata to the National Building Code of Canada 1995.

The revisions have been approved by the Canadian Commission on Building and Fire Codes. The revisions contained herein include updates to 30 June 1997.

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

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

For your convenience, change pages have been provided for the majority of errata and revisions. Simply replace the current page in your document with the updated page provided. Additionally, the Errata table included with this package *(Pages e-1 and e-2)* lists minor errata for which change pages have not been provided.

Please note that Tables 2.7.3.2., A-2.7.3.2. and D-1.1.2., for which change pages are provided, contain a Code Reference column that directs the user to the relevant areas of the Code where standards information should be updated. Where those updates are significant, change pages have been provided.

Errata Table

	Page	Location	Corrected text or description of changes
e	3	First column, paragraph 7	Should read: *Fire-protection rating* means the time in minutes or hours that a *closure*...
e	3	First column, paragraph 8	Should read: *Fire-resistance rating* means the time in minutes or hours that a material or assembly...
e	30	3.1.2.4.(1)	Italicize: height
e	30	3.1.2.5.	Heading should read: **3.1.2.5. Convalescent and Children's Custodial Homes**
e	31	3.1.4.2.(1)(c)	Clause should read: c) by any thermal barrier that meets...
e	35	3.1.5.11.	Add vertical change indication line(1) to Sentences (2), (3) and (4)
e	78	3.2.3.2.(3)	Remove vertical change indication line(1) from Sentence
e	78	3.2.3.2.(6)	Add vertical change indication line(1) to Sentence
e	78	3.2.3.7.(3) and (5)	Add vertical change indication lines(1) to Sentences
e	78	3.2.3.7.(5)	Italicize: limiting distance
e	79	3.2.3.12.(1)	Add vertical change indication line(1) to Sentence
e	80	3.2.3.12.(4)	Add vertical change indication line(1) to Sentence
e	80	3.2.3.13.(1)	Italicize: unprotected openings
e	85	3.2.4.19.(4)	Change: dB to dBA
e	118	3.4.6.16.	Add vertical change indication line(1) to Article
e	119	3.4.7.1.(2)(a)	Change: *care and detention occupancies* to: *care or detention occupancies*
e	120	3.4.7.6.(5)	Change: size of an openings to: size of an opening
e	122	3.6.2.1.(4)	Italicize: flash point
e	159	4.3.4.1.	Remove: the letter M at the end of the CSA standard reference

e	176	Section 6.3.	Add period after the 3 in Section title
e	177	Section 7.1.	Add period after the 1 in Section title
e	194	9.7.1.3.(1)	Add vertical change indication line to Sentence
e	195	9.7.1.6.(1)(a)	Add space before "or"
e	223	9.10.18.2.(1)	Add opening parenthesis to: See Appendix A)
e	242	9.20.8.2.(1) & (3)	Italicize: cavity walls
e	375	A-3.8.2.1.	Tenth bullet should read: • onto every balcony provided in conformance with Clause 3.3.1.7.(1)(c), and
e	452	Table A-9.25.1.2.B.	Second bullet in Notes to Table replaced with the following: • The Details of Air Barrier Systems for Houses, Ontario New Home Warranty Program, North York, 1993

Notes to Table:

(1) For further information about change indication lines, please see the National Building Code of Canada 1995, page xiv, "Change Indication."

Engineers (1791 Tullie Circle N.E., Atlanta, Georgia 30329 U.S.A.)

ASME.....American Society of Mechanical Engineers (22 Law Drive, Fairfield, New Jersey 07007 U.S.A.)

r ASTM.....American Society for Testing and Materials (100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428–2959 U.S.A.)

AWPA ..... American Wood-Preservers' Association (P.O. Box 286, Woodstock, Maryland 21163–0286 U.S.A.)

BNQ..... Bureau de Normalisation du Québec (70 Dalhousie, Bureau 220, Québec, Québec G1K 4B2)

CAN.....National Standard of Canada designation (The number or name following the CAN designation represents the agency under whose auspices the standard is issued. CAN1 designates CGA, CAN2 designates CGSB, CAN3 designates CSA, and CAN4 designates ULC.)

CCBFC.....Canadian Commission on Building and Fire Codes (National Research Council of Canada, Ottawa, Ontario K1A 0R6)

r CGA.....now part of CSA. See CSA.

r CGSB.....Canadian General Standards Board (Place du Portage, Phase III, 6B1 11 Laurier Street, Hull, Quebec K1A 1G6)

CHS.....Canadian Hearing Society (271 Spadina Road, Toronto, Ontario M5R 2V3)

CLA.....Canadian Lumbermen's Association (27 Goulburn Avenue, Ottawa, Ontario K1N 8C7)

CMHC..... Canada Mortgage and Housing Corporation (700 Montreal Road, Ottawa, Ontario K1A 0P7)

CSA.....Canadian Standards Association (178 Rexdale Blvd., Etobicoke, Ontario M9W 1R3)

CWC..... Canadian Wood Council (1730 St. Laurent Boulevard, Suite 350, Ottawa, Ontario K1G 5L1)

EPA.....Environmental Protection Agency (Office of Radiation and Air, 401 M Street, Washington M6101, DC 20460 U.S.A.)

FCC.....Forintek Canada Corporation (319 rue Franquet, Ste-Foy (Québec) G1V 4C7)

FMEC.....Factory Mutual Engineering Corporation (1151 Boston-Providence Turnpike, P.O. Box 9102, Norwood, Massachusetts 02062 U.S.A.)

FPS..... Forest Products Society (2801 Marshall Court, Madison, Wisconsin 53705 U.S.A.)

HC.....Health Canada (Communications Directorate, Ottawa, Ontario K1A 0K9)

HI..... Hydronics Institute (35 Russo Place, Berkeley Heights, New Jersey 07922 U.S.A.)

HRAI.....Heating, Refrigerating and Air-Conditioning Institute of Canada (5045 Orbitor Drive, Building 11, Suite 300, Mississauga, Ontario L4W 4Y4)

IRC..... Institute for Research in Construction (National Research Council of Canada, Ottawa, Ontario K1A 0R6)

ISO.....International Standards Organization (Standards Council of Canada, 1200-45 O'Connor Street, Ottawa, Ontario K1P 6N7)

NBC..... National Building Code of Canada 1995 (See CCBFC)

NFC.....National Fire Code of Canada 1995 (See CCBFC)

NFPA.....National Fire Protection Association (Batterymarch Park, Quincy, Massachusetts 02269 U.S.A.)

NLGA.....National Lumber Grades Authority r Suite 103-4400 Dominion Street, Burnaby, British Columbia V5G 4G3

SFPE.....Society of Fire Protection Engineers (One Liberty Square, Boston, Massachusetts 02109-4825 U.S.A.)

SMACNA.....Sheet Metal and Air Conditioning r Contractor's National Association (4201 Lafayette Center Drive, Chantilly, Virginia 20151-1209 U.S.A.)

TC.....Transport Canada (Public Affairs, Tower C, Place de Ville, 330 Sparks Street, 28th Floor, Ottawa, Ontario K1A 0N5

TPIC.....Truss Plate Institute of Canada r (21$_o$ Rodinea Road, Maple, Ontario L6A 1R3 Attn: Ken Coo)

UL.....Underwriters Laboratories Incorporated (333 Pfingsten Road, Northbrook, Illinois 60062 U.S.A.)

ULC.....Underwriters' Laboratories of Canada (7 Crouse Road, Scarborough, Ontario M1R 3A9)

WCLIB.....West Coast Lumber Inspection Bureau (6980 Southwest Varns Street, P.O. Box 23145, Portland, Oregon 97223 U.S.A.)

WWPA.....Western Wood Products Association (1500 Yeon Building, Portland, Oregon 97204 U.S.A.)

1.1.4.2. Symbols and Other Abbreviations

1) The symbols and other abbreviations in this Code shall have the meanings assigned to them in this Article.

1 in 2 ..... slope of 1 vertical to 2 horizontal
cm ..... centimetre(s)
° ..... degree(s)
°C ..... degree(s) Celsius
dB(A) ..... A-weighted sound level
diam ..... diameter
g ..... gram(s)
ga ..... gauge
h ..... hour(s)
Hz ..... hertz
Inc. ..... Incorporated
J ..... joule(s)
kg ..... kilogram(s)
kN ..... kilonewton(s)
kPa ..... kilopascal(s)
kW ..... kilowatt(s)
L ..... litre(s)
lx ..... lux
m ..... metre(s)
max. ..... maximum
min. ..... minimum
min ..... minute(s)
MJ ..... megajoule(s)
mm ..... millimetre(s)
MPa ..... megapascal(s)
N ..... newton
N/A ..... not applicable
ng ..... nanogram(s)
No. ..... number(s)
nom. ..... nominal
o.c. ..... on centre
OSB ..... oriented strandboard
s ..... second(s)
temp. ..... temperature
T&G ..... tongue and groove
W ..... watt(s)
wt ..... weight
% ..... per cent

2.7.2. Conflicting Requirements

2.7.2.1. Priority of the National Building Code

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. Documents Referenced

1) Unless otherwise specified herein, the documents referenced in this Code shall include all amendments, revisions and supplements effective to 30 June 1997. r

2.7.3.2. Applicable Editions

1) Where documents are referenced in this Code, they shall be the editions designated in Table 2.7.3.2.

Table 2.7.3.2.
Documents Referenced in the National Building Code of Canada 1995
Forming Part of Article 2.7.3.2.

	Issuing Agency	Document Number	Title of Document	Code Reference
r	ANSI	A208.1-1993	Particleboard, Mat-Formed Wood	9.23.14.2.(3) 9.29.9.1.(1) 9.30.2.2.(1)
	ANSI	B18.6.1-1981	Slotted and Recessed Wood Screws (Inch Series)	9.23.3.1.(2)
	ANSI/ ASHRAE	62-1989	Ventilation for Acceptable Indoor Air Quality	6.2.2.1.(2)
r	ASTM	A 123/A 123M-97a	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products	Table 9.20.16.1.
r	ASTM	A 153-95	Zinc Coating (Hot-Dip) on Iron and Steel Hardware	Table 9.20.16.1.
r	ASTM	A 252-96	Welded and Seamless Steel Pipe Piles	4.2.3.8.(1)
r	ASTM	A 283/A 283M-97	Low and Intermediate Tensile Strength Carbon Steel Plates	4.2.3.8.(1)
r	ASTM	A 570/A 570M-96	Steel, Sheet and Strip, Carbon, Hot Rolled, Structural Quality	4.2.3.8.(1)
r	ASTM	A 611-97	Structural Steel, Sheet, Carbon, Cold-Rolled	4.2.3.8.(1)
r	ASTM	A 653/A 653M-97	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process	9.3.3.2.(1)
r	ASTM	A 924/A 924M-97	Steel Sheet, Metallic-Coated by the Hot-Dip Process	9.3.3.2.(1)
r	ASTM	C 4-97	Clay Drain Tile	9.14.3.1.(1)
	ASTM	C 5-79 (1992)	Quicklime for Structural Purposes	9.20.3.1.(1)
	ASTM	C 27-93	Classification of Fireclay and High-Alumina Refractory Brick	9.21.3.4.(1)
r	ASTM	C 36-97	Gypsum Wallboard	3.1.5.11.(4) 9.29.5.2.(1)
r	ASTM	C 37-95	Gypsum Lath	9.29.5.2.(1)
e	ASTM	C 79-94	Gypsum Sheathing Board	Table 9.23.16.2.A.
r	ASTM	C 126-96	Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units	9.20.2.1.(1)

Table 2.7.3.2. (Continued)

	Issuing Agency	Document Number	Title of Document	Code Reference
	ASTM	C 207-91 (1992)	Hydrated Lime for Masonry Purposes	9.20.3.1.(1)
r	ASTM	C 212-96	Structural Clay Facing Tile	5.6.1.2.(3) 9.20.2.1.(1)
r	ASTM	C 260-95	Air-Entraining Admixtures for Concrete	9.3.1.8.(1)
r	ASTM	C 411-97	Hot-Surface Performance of High-Temperature Thermal Insulation	3.6.5.4.(4) 3.6.5.5.(1) 9.33.6.4.(4) 9.33.8.2.(2)
	ASTM	C 412M-94	Concrete Drain Tile (Metric)	9.14.3.1.(1)
r	ASTM	C 442-95	Gypsum Backing Board and Coreboard	3.1.5.11.(4) 9.29.5.2.(1)
r	ASTM	C 444M-95	Perforated Concrete Pipe (Metric)	9.14.3.1.(1)
r	ASTM	C 494-92	Chemical Admixtures for Concrete	9.3.1.8.(1)
r	ASTM	C 588-95a	Gypsum Base for Veneer Plaster	3.1.5.11.(4) 9.29.5.2.(1)
r	ASTM	C 630/C 630M-96a	Water Resistant Gypsum Backing Board	3.1.5.11.(4) 9.29.5.2.(1)
r	ASTM	C 700-97	Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated	9.14.3.1.(1)
r	ASTM	C 931/C 931M-95a	Exterior Gypsum Soffit Board	3.1.5.11.(4) 9.29.5.2.(1)
r	ASTM	C 960-97	Predecorated Gypsum Board	3.1.5.11.(4) 9.29.5.2.(1)
r	ASTM	C 1002-96a	Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases	9.24.1.4.(1) 9.29.5.7.(1)
r	ASTM	D 323-94	Vapor Pressure of Petroleum Products (Reid Method)	1.1.3.2.(1)
r	ASTM	D 2178-97a	Asphalt Glass Felt Used in Roofing and Waterproofing	5.6.1.2.(1)
	ASTM	D 2898-94	Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing	3.1.5.5.(4) 3.1.5.5.(5)
r	ASTM	E 90-97	Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements	3.3.4.6.(1) 9.11.1.1.(1)
r	ASTM	E 96-95	Water Vapor Transmission of Materials	5.5.1.2.(4) 9.30.1.2.(1)
r	ASTM	E 336-97	Measurement of Airborne Sound Insulation in Buildings	3.3.4.6.(1) 9.11.1.1.(1)
	ASTM	E 413-87 (1994)	Classification for Rating Sound Insulation	3.3.4.6.(1) 9.11.1.1.(1)
r	ASTM	F 476-84 (1996)	Security of Swinging Door Assemblies	9.6.8.10.(1)
r	AWPA	M4-96	Care of Preservative-Treated Wood Products	4.2.3.2.(2)
r	BNQ	NQ 3624-115-1995	Thermo-Plastic Pipe – Flexible Corrugated Tubing and Fittings for Soil Drainage	9.14.3.1.(1)

Table 2.7.3.2. (Continued)

	Issuing Agency	Document Number	Title of Document	Code Reference
	CCBFC	NRCC 38727	National Fire Code of Canada 1995	3.2.5.17.(1) 3.3.1.2.(1) 3.3.5.2.(1) 6.2.2.5.(1) 8.2.2.2.(1) 8.2.2.4.(1) 8.2.2.6.(1) 8.2.2.15.(1) 8.2.3.2.(1) 8.2.3.4.(1) 8.2.3.6.(1) 8.2.3.10.(1) 8.2.3.12.(1) 9.10.19.4.(1) 9.10.20.8.(1)
	CCBFC	NRCC 38728	National Plumbing Code of Canada 1995	5.6.2.2.(2) 7.1.2.1.(1) 9.31.6.3.(1)
	CCBFC	NRCC 38732	National Farm Building Code of Canada 1995	2.1.5.1.(1)
r	CGA	CAN/CGA-B149.1-M95	Natural Gas Installation Code	6.2.1.5.(1) 8.2.2.11.(1) 9.10.21.1.(1) 9.31.6.3.(2) 9.33.5.2.(1)
r	CGA	CAN/CGA-B149.2-M95	Propane Installation Code	6.2.1.5.(1) 8.2.2.11.(1) 9.31.6.3.(2) 9.33.5.2.(1)
	CGA	CAN/CGA-6.19-M93	Residential Carbon Monoxide Detectors	9.32.3.8.(6) 9.32.3.8.(8)
	CGSB	CAN/CGSB-1.501-M89	Method for Permeance of Coated Wallboard	5.5.1.2.(3) 9.25.4.2.(5)
	CGSB	CAN/CGSB-7.1-M86	Cold Formed Steel Framing Components	9.24.1.2.(1)
	CGSB	CAN/CGSB-7.2-94	Adjustable Steel Columns	9.17.3.4.(1)
	CGSB	CAN/CGSB-10.3-92	Air Setting Refractory Mortar	9.21.3.4.(1) 9.21.3.9.(1) 9.22.2.2.(2)
	CGSB	CAN/CGSB-11.3-M87	Hardboard	5.6.1.2.(3) 9.27.10.1.(2) 9.29.7.1.(1) 9.30.2.2.(1)
	CGSB	CAN/CGSB-11.5-M87	Hardboard, Precoated, Factory Finished, for Exterior Cladding	5.6.1.2.(3) 9.27.10.1.(1)
e	CGSB	CAN/CGSB-12.1-M90	Tempered or Laminated Safety Glass	3.3.1.18.(2) 3.4.6.14.(1) 3.4.6.14.(3) 9.6.6.2.(2) 9.7.3.1.(1) 9.8.8.6.(1)

Table 2.7.3.2. (Continued)

Issuing Agency	Document Number	Title of Document	Code Reference
CGSB	CAN/CGSB-12.2-M91	Flat, Clear Sheet Glass	9.6.6.2.(2) 9.7.3.1.(1)
CGSB	CAN/CGSB-12.3-M91	Flat, Clear Float Glass	9.7.3.1.(1)
CGSB	CAN/CGSB-12.4-M91	Heat Absorbing Glass	9.7.3.1.(1)
CGSB	CAN/CGSB-12.8-M90	Insulating Glass Units	5.3.1.2.(2) 9.7.3.1.(1)
CGSB	CAN/CGSB-12.10-M76	Glass, Light and Heat Reflecting	9.7.3.1.(1)
CGSB	CAN/CGSB-12.11-M90	Wired Safety Glass	3.3.1.18.(2) 3.4.6.14.(1) 3.4.6.14.(3) 9.6.6.2.(2) 9.7.3.1.(1) 9.8.8.6.(1)
CGSB	CAN/CGSB-12.20-M89	Structural Design of Glass for Buildings	4.3.6.1.(1) 9.7.3.2.(1)
r CGSB	19-GP-5M-1984	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)
CGSB	CAN/CGSB-19.22-M89	Mildew-Resistant Sealing Compound for Tubs and Tiles	9.29.10.5.(1)
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	5.6.1.2.(3) 9.27.8.1.(1)
CGSB	CAN/CGSB-34.5-M89	Sheets, Asbestos-Cement, Corrugated	5.6.1.2.(3) 9.27.8.1.(1)
CGSB	CAN/CGSB-34.14-M89	Sheets, Asbestos-Cement, Decorative	5.6.1.2.(3) 9.27.8.1.(1)
CGSB	CAN/CGSB-34.16-M89	Sheets, Asbestos-Cement, Flat, Fully Compressed	5.6.1.2.(3) 9.27.8.1.(1)
CGSB	CAN/CGSB-34.17-M89	Sheets, Asbestos-Cement, Flat, Semicompressed	5.6.1.2.(3) 9.27.8.1.(1)
CGSB	CAN/CGSB-34.21-M89	Panels, Sandwich, Asbestos-Cement with Insulating Cores	5.6.1.2.(3) 9.27.8.1.(1)
r CGSB	CAN/CGSB-34.22-94	Asbestos-Cement Drain Pipe	9.14.3.1.(1)
CGSB	CAN/CGSB-37.1-M89	Chemical Emulsified Type, Emulsified Asphalt for Dampproofing	9.13.2.1.(1)
CGSB	CAN/CGSB-37.2-M88	Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings	5.8.2.2.(6) 9.13.2.1.(1)

Table 2.7.3.2. (Continued)

	Issuing Agency	Document Number	Title of Document	Code Reference
e	CGSB	CAN/CGSB-37.3-M89	Application of Emulsified Asphalts for Dampproofing or Waterproofing	5.8.2.3.(1) 9.13.1.4.(1)
	CGSB	CAN/CGSB-37.4-M89	Fibrated, Cutback Asphalt, Lap Cement for Asphalt Roofing	5.6.1.2.(1) 9.26.2.1.(1)
	CGSB	CAN/CGSB-37.5-M89	Cutback Asphalt Plastic Cement	5.6.1.2.(1) 9.26.2.1.(1)
e	CGSB	37-GP-6Ma-1983	Asphalt, Cutback, Unfilled, for Dampproofing	5.8.2.2.(7) 5.8.2.2.(8) 9.13.2.1.(1)
	CGSB	CAN/CGSB-37.8-M88	Asphalt, Cutback, Filled, for Roof Coating	5.6.1.2.(1) 9.26.2.1.(1)
	CGSB	37-GP-9Ma-1983	Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing	5.6.1.2.(1) 5.8.2.2.(6) 9.26.2.1.(1)
e	CGSB	37-GP-12Ma-1984	Application of Unfilled Cutback Asphalt for Dampproofing	5.8.2.3.(2) 9.13.1.4.(1)
	CGSB	CAN/CGSB-37.16-M89	Filled Cutback Asphalt for Dampproofing and Waterproofing	5.8.2.2.(6) 9.13.2.1.(1)
e	CGSB	37-GP-18Ma-1985	Tar, Cutback, Unfilled, for Dampproofing	5.8.2.2.(7) 5.8.2.2.(8) 9.13.2.1.(1)
	CGSB	37-GP-21M-1985	Tar, Cutback, Fibrated, for Roof Coating	5.6.1.2.(1) 9.26.2.1.(1)
e	CGSB	CAN/CGSB-37.22-M89	Application of Unfilled Cutback Tar Foundation Coating for Dampproofing	5.8.2.3.(2) 9.13.1.4.(1)
e	CGSB	37-GP-36M 1976	Application of Filled Cutback Asphalts for Dampproofing and Waterproofing	5.8.2.3.(1)
e	CGSB	37-GP-37M 1977	Application of Hot Asphalt for Dampproofing or Waterproofing	5.8.2.3.(1)
	CGSB	CAN/CGSB-37.50-M89	Hot Applied Rubberized Asphalt for Roofing and Waterproofing	5.6.1.2.(1) 5.8.2.2.(6) 9.26.2.1.(1)
e	CGSB	CAN/CGSB-37.51-M90	Application of Hot-Applied Rubberized Asphalt for Roofing and Waterproofing	5.6.1.3.(1) 5.8.2.3.(1) 9.26.15.1.(1)
	CGSB	37-GP-52M-1984	Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric	5.6.1.2.(1) 5.8.2.2.(6) 9.26.2.1.(1)
r	CGSB	CAN/CGSB-37.54-95	Polyvinyl Chloride Roofing and Waterproofing Membrane	5.6.1.2.(1) 5.8.2.2.(6) 9.26.2.1.(1)
	CGSB	37-GP-55M-1979	Application of Sheet Applied Flexible Polyvinyl Chloride Roofing Membrane	5.6.1.3.(1) 9.26.16.1.(1)

Table 2.7.3.2. (Continued)

	Issuing Agency	Document Number	Title of Document	Code Reference
r	CGSB	37-GP-56M-1985	Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing	5.6.1.2.(1) 5.8.2.2.(6) 9.26.2.1.(1)
	CGSB	37-GP-64M-1977	Mat Reinforcing, Fibrous Glass, for Membrane Waterproofing Systems and Built-Up Roofing	5.6.1.2.(1)
	CGSB	41-GP-6M-1983	Sheets, Thermosetting Polyester Plastics, Glass Fiber Reinforced	5.6.1.2.(1) 9.26.2.1.(1)
r	CGSB	CAN/CBSB-41.24-95	Rigid Vinyl Siding, Soffits and Fascia	5.6.1.2.(3) 9.27.13.1.(1)
	CGSB	51-GP-21M-1978	Thermal Insulation, Urethane and Isocyanurate, Unfaced	5.3.1.2.(2) Table 9.23.16.2.A. 9.25.2.2.(1)
	CGSB	CAN/CGSB-51.23-92	Spray-Applied Rigid Polyurethane Cellular Plastic Thermal Insulation	5.3.1.2.(2) 9.25.2.2.(1)
	CGSB	CAN/CGSB-51.25-M87	Thermal Insulation, Phenolic, Faced	5.3.1.2.(2) Table 9.23.16.2.A. 9.25.2.2.(1)
	CGSB	CAN/CGSB-51.26-M86	Thermal Insulation, Urethane and Isocyanurate, Boards, Faced	5.3.1.2.(2) Table 9.23.16.2.A. 9.25.2.2.(1)
	CGSB	51-GP-27M-1979	Thermal Insulation, Polystyrene, Loose Fill	5.3.1.2.(2) 9.25.2.2.(1)
e	CGSB	CAN/CGSB-51.32-M77	Sheathing, Membrane, Breather Type	5.6.1.2.(1) 5.6.1.2.(3) 9.20.13.9.(1) 9.23.17.1.(1) 9.26.2.1.(1)
	CGSB	CAN/CGSB-51.33-M89	Vapour Barrier, Sheet, Excluding Polyethylene, for Use in Building Construction	5.5.1.2.(2) 9.25.4.2.(4)
r	CGSB	CAN/CGSB-51.34-M86 (Amended 1988)	Vapour Barrier, Polyethylene Sheet for Use in Building Construction	5.5.1.2.(2) 9.13.2.1.(1) 9.13.2.1.(2) 9.18.6.2.(1) 9.25.3.2.(2) 9.25.4.2.(3)
	CGSB	CAN/CGSB-51.39-92	Sprayed Application of Rigid Polyurethane Cellular Plastic Thermal Insulation for Building Construction	5.3.1.3.(3) 9.25.2.5.(1)
	CGSB	CAN/CGSB-51.60-M90	Cellulose Fibre Loose Fill Thermal Insulation	5.3.1.2.(2) 9.25.2.2.(1)
	CGSB	CAN/CGSB-63.14-M89	Plastic Skylights	5.4.1.2.(3) 5.4.1.2.(4) 5.6.1.2.(1) 5.6.1.2.(2) 9.7.7.1.(1) 9.7.7.2.(1)

Table 2.7.3.2. (Continued)

	Issuing Agency	Document Number	Title of Document	Code Reference
	CGSB	CAN/CGSB-82.1-M89	Sliding Doors	5.3.1.2.(2) 5.4.1.2.(3) 5.4.1.2.(5) 5.6.1.2.(3) 5.6.1.2.(4) 9.6.5.2.(1)
	CGSB	CAN/CGSB-82.5-M88	Insulated Steel Doors	5.3.1.2.(2) 5.4.1.2.(3) 5.6.1.2.(3) 9.6.5.3.(1)
	CGSB	CAN/CGSB-82.6-M86	Doors, Mirrored Glass, Sliding or Folding, Wardrobe	9.6.6.3.(1)
	CGSB	CAN/CGSB-93.1-M85	Sheet, Aluminum Alloy, Prefinished, Residential	5.6.1.2.(3) 9.27.12.1.(4)
e	CGSB	CAN/CGSB-93.2-M91	Prefinished Aluminum Siding, Soffits and Fascia, for Residential Use	5.6.1.2.(3) 9.27.12.1.(3)
e	CGSB	CAN/CGSB-93.3-M91	Prefinished Galvanized and Aluminum-Zinc Alloy Steel Sheet for Residential Use	5.6.1.2.(3) 9.27.12.1.(2)
e	CGSB	CAN/CGSB-93.4-92	Galvanized and Aluminum-Zinc Alloy Coated Steel Siding, Soffits and Fascia, Prefinished, Residential	5.6.1.2.(3) 9.27.12.1.(1)
	CSA	CAN/CSA-A5-93	Portland Cement	9.3.1.2.(1) 9.20.3.1.(1) 9.28.2.1.(1)
	CSA	CAN/CSA-A8-93	Masonry Cement	9.20.3.1.(1)
	CSA	A23.1-94	Concrete Materials and Methods of Concrete Construction	4.2.3.6.(1) 4.2.3.9.(1) 9.3.1.3.(1) 9.3.1.4.(1)
	CSA	A23.3-94	Design of Concrete Structures	Table 4.1.9.1.B. 4.3.3.1.(1)
	CSA	CAN/CSA-A82.1-M87	Burned Clay Brick (Solid Masonry Units Made from Clay or Shale)	9.20.2.1.(1)
	CSA	A82.3-M1978	Calcium Silicate (Sand-Lime) Building Brick	9.20.2.1.(1)
	CSA	A82.4-M1978	Structural Clay Load-Bearing Wall Tile	9.20.2.1.(1)
	CSA	A82.5-M1978	Structural Clay Non-Load-Bearing Tile	9.20.2.1.(1)
	CSA	CAN3-A82.8-M78	Hollow Clay Brick	9.20.2.1.(1)
e	CSA	CAN/CSA-A82.27-M91	Gypsum Board	3.1.5.11.(4) Table 9.23.16.2.A. 9.29.5.2.(1)
	CSA	A82.30-M1980	Interior Furring, Lathing and Gypsum Plastering	9.29.4.1.(1)
	CSA	A82.31-M1980	Gypsum Board Application	9.10.12.5.(1) 9.29.5.1.(2)
	CSA	A82.56-M1976	Aggregate for Masonry Mortar	9.20.3.1.(1)

Table 2.7.3.2. (Continued)

Issuing Agency	Document Number	Title of Document	Code Reference
CSA	CAN3-A93-M82	Natural Airflow Ventilators for Buildings	9.19.1.2.(6)
CSA	A123.1-M1979	Asphalt Shingles Surfaced with Mineral Granules	5.6.1.2.(1) 9.26.2.1.(1)
CSA	A123.2-M1979	Asphalt Coated Roofing Sheets	5.6.1.2.(1) 9.26.2.1.(1)
CSA	A123.3-M1979	Asphalt or Tar Saturated Roofing Felt	5.6.1.2.(1) 9.26.2.1.(1)
CSA	A123.4-M1979	Bitumen for Use in Construction of Built-Up Roof Coverings and Dampproofing and Waterproofing Systems	5.6.1.2.(1) 5.8.2.2.(6) 9.13.2.1.(1) 9.26.2.1.(1)
CSA	CAN/CSA-A123.5-M90	Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules	5.6.1.2.(1) 9.26.2.1.(1)
CSA	A123.17-1963	Asphalt-Saturated Felted Glass-Fibre Mat for Use in Construction of Built-Up Roofs	5.6.1.2.(1) 9.26.2.1.(1)
CSA	CAN3-A123.51-M85	Asphalt Shingle Application on Roof Slopes 1:3 and Steeper	5.6.1.3.(1) 9.26.1.2.(1)
CSA	CAN3-A123.52-M85	Asphalt Shingle Application on Roof Slopes 1:6 to Less Than 1:3	5.6.1.3.(1) 9.26.1.2.(1)
CSA	A165.1-94	Concrete Masonry Units	9.15.2.2.(1) 9.17.5.1.(1) 9.20.2.1.(1) 9.20.2.6.(1)
CSA	A165.2-94	Concrete Brick Masonry Units	9.20.2.1.(1)
CSA	A165.3-94	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-A220.0-M91	Performance of Concrete Roof Tiles	5.6.1.2.(1) 9.26.2.1.(1)
CSA	CAN/CSA-A220.1-M91	Installation of Concrete Roof Tiles	9.26.17.1.(1)
CSA	CAN/CSA-A247-M86	Insulating Fibreboard	5.3.1.2.(2) 9.23.15.6.(3) Table 9.23.16.2.A. 9.25.2.2.(1) 9.29.8.1.(1)
CSA	CAN/CSA-A324-M88	Clay Flue Liners	9.21.3.3.(1)
CSA	A371-94	Masonry Construction for Buildings	5.6.1.2.(3) 5.6.1.3.(3) 9.20.15.2.(1)

Table 2.7.3.2. (Continued)

	Issuing Agency	Document Number	Title of Document	Code Reference
	CSA	CAN/CSA-A405-M87	Design and Construction of Masonry Chimneys and Fireplaces	9.21.3.5.(1) 9.22.1.4.(1) 9.22.5.2.(2)
	CSA	CAN3-A438-M84	Concrete Construction for Housing and Small Buildings	9.3.1.1.(1) 9.3.1.7.(1)
	CSA	CAN/CSA-A440-M90	Windows	5.4.1.2.(3) 5.4.1.2.(5) 5.4.1.2.(6) 5.6.1.2.(3) 5.6.1.2.(4) 5.6.1.2.(5) 9.7.2.1.(1) 9.7.6.1.(1)
r	CSA	CAN/CSA-B44-94 (Supplement 1-B44S1-97)	Safety Code for Elevators	3.2.6.7.(2) 3.5.2.1.(1) 3.5.2.1.(2) 3.5.2.1.(3) 3.5.4.2.(1) 3.8.3.5.(1) Table 4.1.10.5.
r	CSA	B51-97	Boiler, Pressure Vessel, and Pressure Piping Code	6.2.1.5.(1) 9.31.6.3.(2) 9.33.5.2.(1)
r	CSA	B52-95	Mechanical Refrigeration Code	6.2.1.5.(1) 9.33.5.2.(1)
	CSA	CAN/CSA-B72-M87	Installation Code for Lightning Protection Systems	6.3.1.4.(1)
	CSA	B111-1974	Wire Nails, Spikes and Staples	9.23.3.1.(1) 9.26.2.2.(1) 9.29.5.6.(1)
	CSA	CAN/CSA-B139-M91	Installation Code for Oil Burning Equipment	6.2.1.5.(1) 8.2.2.11.(1) 9.31.6.3.(2) 9.33.5.2.(1)
r	CSA	B182.1-96	Plastic Drain and Sewer Pipe and Pipe Fittings	9.14.3.1.(1)
	CSA	B355-94	Lifts for Persons with Physical Disabilities	3.8.3.5.(2)
	CSA	CAN/CSA-B365-M91	Installation Code for Solid-Fuel-Burning Appliances and Equipment	6.2.1.5.(1) 9.21.1.3.(2) 9.22.10.2.(1) 9.31.6.3.(2) 9.33.5.2.(1) 9.33.5.3.(1)

Table 2.7.3.2. (Continued)

	Issuing Agency	Document Number	Title of Document	Code Reference
	CSA	C22.1-94	Canadian Electrical Code, Part 1	3.6.1.2.(1) 3.6.2.1.(6) 3.6.2.8.(1) 6.2.1.5.(1) 8.2.2.9.(2) 9.31.6.3.(2) 9.33.5.2.(1) 9.34.1.1.(1)
r	CSA	C22.2 No. 0.3-96	Test Methods for Electrical Wires and Cables	3.1.4.3.(1) 3.1.5.17.(1) 3.6.4.3.(1)
	CSA	C22.2 No.113-M1984	Fans and Ventilators	9.32.3.9.(6)
	CSA	C22.2 No.141-M1985	Unit Equipment for Emergency Lighting	3.2.7.4.(2) 9.9.11.3.(6)
	CSA	C22.2 No. 211.0-M1984	General Requirements and Methods of Testing for Nonmetallic Conduit	3.1.5.19.(1)
	CSA	CAN/CSA-C260-M90	Rating the Performance of Residential Mechanical Ventilating Equipment	9.32.3.9.(1)
	CSA	CAN/CSA-C282-M89	Emergency Electrical Power Supply for Buildings	3.2.7.5.(1)
	CSA	CAN/CSA-C439-88	Standard Methods of Test for Rating the Performance of Heat Recovery Ventilators	9.32.3.9.(3)
	CSA	CAN/CSA-C445-M92	Design and Installation of Earth Energy Heat Pump Systems for Residential and Other Small Buildings	9.33.5.2.(1)
	CSA	CAN/CSA-F280-M90	Determining the Required Capacity of Residential Space Heating and Cooling Appliances	6.2.1.3.(1) 9.33.5.1.(1)
	CSA	CAN/CSA-F326-M91	Residential Mechanical Ventilation Systems	9.32.3.1.(1)
	CSA	CAN/CSA-G40.21-M92	Structural Quality Steels	4.2.3.8.(1) 9.23.4.3.(2)
	CSA	G401-93	Corrugated Steel Pipe Products	9.14.3.1.(1)
r	CSA	O80 Series-97	Wood Preservation	3.1.4.4.(1) 4.2.3.2.(1) 4.2.3.2.(2)
r	CSA	O80.1-97	Preservative Treatment of All Timber Products by Pressure Processes	9.3.2.9.(3)
r	CSA	O80.2-97	Preservative Treatment of Lumber, Timber, Bridge Ties, and Mine Ties by Pressure Processes	4.2.3.2.(1) 9.3.2.9.(3)
r	CSA	O80.3-97	Preservative Treatment of Piles by Pressure Processes	4.2.3.2.(1)
r	CSA	O80.9-97	Preservative Treatment of Plywood by Pressure Processes	9.3.2.9.(3)
r	CSA	O80.15-97	Preservative Treatment of Wood for Building Foundation Systems, Basements, and Crawl Spaces by Pressure Processes	4.2.3.2.(1) 9.3.2.9.(3)

Table 2.7.3.2. (Continued)

	Issuing Agency	Document Number	Title of Document	Code Reference
	CSA	O86.1-94	Engineering Design in Wood (Limit States Design)	Table 4.1.9.1.B. 4.3.1.1.(1)
	CSA	O115-M1982	Hardwood and Decorative Plywood	5.6.1.2.(3) 9.27.9.1.(1) 9.30.2.2.(1)
r	CSA	O118.1-97	Western Cedars, Shakes and Shingles	5.6.1.2.(1) 5.6.1.2.(3) 9.26.2.1.(1) 9.27.7.1.(1)
	CSA	O118.2-M1981	Eastern White Cedar Shingles	5.6.1.2.(1) 5.6.1.2.(3) 9.26.2.1.(1) 9.27.7.1.(1)
e	CSA	O121-M1978	Douglas Fir Plywood	5.6.1.2.(3) 9.23.14.2.(1) 9.23.15.1.(1) Table 9.23.16.2.A. 9.27.9.1.(1) 9.30.2.2.(1) Table A-14 Table A-16 Table A-18
	CSA	CAN/CSA-O122-M89	Structural Glued-Laminated Timber	Table A-11 Table A-20
	CSA	CAN/CSA-O132.2 Series-90	Wood Flush Doors	9.6.5.1.(1)
	CSA	CAN/CSA-O141-91	Softwood Lumber	3.1.4.6.(2) 9.3.2.6.(1)
e	CSA	O151- M1978	Canadian Softwood Plywood	5.6.1.2.(3) 9.23.14.2.(1) 9.23.15.1.(1) Table 9.23.16.2.A. 9.27.9.1.(1) 9.30.2.2.(1) Table A-14 Table A-16 Table A-18
	CSA	O153-M1980	Poplar Plywood	5.6.1.2.(3) 9.23.14.2.(1) 9.23.15.1.(1) Table 9.23.16.2.A. 9.27.9.1.(1) 9.30.2.2.(1)
e	CSA	CAN/CSA-O177-M89	Qualification Code for Manufacturers of Structural Glued-Laminated Timber	4.3.1.2.(1) Table A-11 Table A-20

Table 2.7.3.2. (Continued)

	Issuing Agency	Document Number	Title of Document	Code Reference
e	CSA	CAN/CSA-O325.0-92	Construction Sheathing	5.6.1.2.(3) 9.23.14.2.(1) Table 9.23.14.5.B. 9.23.15.1.(1) Table 9.23.15.6.B. Table 9.23.16.2.B. Table A-14 Table A-16 Table A-18
e	CSA	O437.0-93	OSB and Waferboard	5.6.1.2.(3) 9.23.14.2.(1) 9.23.14.4.(2) 9.23.15.1.(1) 9.23.15.2.(2) Table 9.23.16.2.A. 9.27.11.1.(1) 9.29.9.1.(2) 9.30.2.2.(1) Table A-14 Table A-16 Table A-18
	CSA	CAN/CSA-S16.1-94	Limit States Design of Steel Structures	Table 4.1.9.1.B. 4.3.4.1.(1)
	CSA	S136-94	Cold Formed Steel Structural Members	4.3.4.2.(1)
	CSA	CAN3-S157-M83	Strength Design in Aluminum	4.3.5.1.(1)
	CSA	S269.1-1975	Falsework for Construction Purposes	4.1.1.3.(3)
	CSA	CAN/CSA-S269.2-M87	Access Scaffolding for Construction Purposes	4.1.1.3.(3)
	CSA	CAN/CSA-S269.3-M92	Concrete Formwork	4.1.1.3.(3)
e	CSA	CAN3-S304-M84	Masonry Design for Buildings	4.3.2.1.(1) 9.21.4.5.(1)
e	CSA	S304.1-94	Masonry Design for Buildings (Limit States Design)	Table 4.1.9.1.B. 4.1.9.3.(5) 4.3.2.1.(1)
	CSA	S307-M1980	Load Test Procedure for Wood Roof Trusses for Houses and Small Buildings	9.23.13.11.(5)
	CSA	S350-M1980	Code of Practice for Safety in Demolition of Structures	8.1.1.3.(1)
	CSA	CAN3-S367-M81	Air-Supported Structures	4.4.1.1.(1)
	CSA	CAN/CSA-S406-92	Construction of Preserved Wood Foundations	9.15.1.3.(3) 9.16.5.1.(1)
	CSA	S413-94	Parking Structures	4.4.2.1.(1)
	CSA	CAN/CSA-Z32.4-M86	Essential Electrical Systems for Hospitals	3.2.7.6.(1)
	CSA	CAN/CSA-Z240.2.1-92	Structural Requirements for Mobile Homes	9.12.2.2.(6) 9.15.1.4.(1)

Table 2.7.3.2. (Continued)

	Issuing Agency	Document Number	Title of Document	Code Reference
	CSA	Z240.10.1-94	Site Preparation, Foundation, and Anchorage of Mobile Homes	9.15.1.4.(1) 9.23.6.3.(1)
	CSA	CAN/CSA-Z305.1-92	Nonflammable Medical Gas Piping Systems	3.7.5.1.(1)
	CSA	CAN/CSA-Z317.2-M91	Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities	6.2.1.1.(1)
	EPA	EPA 402-R-92-003	Protocols for Radon and Radon Decay Product Measurements in Homes	9.13.8.2.(7)
e	HC	H49-58	Exposure Guidelines for Residential Indoor Air Quality (1989)	9.13.8.2.(10)
	ISO	8201: 1987	Acoustics – Audible emergency evacuation signal	3.2.4.19.(2)
r	NFPA	13-1996	Installation of Sprinkler Systems	3.2.4.8.(2) 3.2.4.16.(1) 3.2.5.13.(1) 3.3.2.12.(3)
r	NFPA	13D-1996	Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes	3.2.5.13.(3)
r	NFPA	13R-1996	Installation of Sprinkler Systems in Residential Occupancies up to and including Four Stories in Height	3.2.5.13.(2)
r	NFPA	14-1996	Installation of Standpipe and Hose Systems	3.2.5.9.(1) 3.2.5.10.(1)
r	NFPA	20-1996	Installation of Centrifugal Fire Pumps	3.2.5.19.(1)
	NFPA	71-1989	Installation, Maintenance and Use of Signaling Systems for Central Station Service	3.2.4.7.(4)
	NFPA	72-1990	Installation, Maintenance and Use of Protective Signaling Systems	3.2.4.7.(4)
r	NFPA	80-1995	Fire Doors and Fire Windows	3.1.8.5.(2) 3.1.8.10.(2) 3.1.8.12.(2) 3.1.8.12.(3) 3.1.8.14.(1) 9.10.13.1.(1) 9.10.13.2.(3)
	NFPA	82-1994	Incinerators, Waste and Linen Handling Systems and Equipment	6.2.6.1.(1) 9.10.10.5.(2)
	NFPA	96-1994	Ventilation Control and Fire Protection of Commercial Cooking Equipment	6.2.2.6.(1)
r	NFPA	211-1996	Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances	6.3.1.2.(2) 6.3.1.3.(1)
r	NFPA	214-1996	Water-Cooling Towers	6.2.3.15.(4)
	NLGA		Standard Grading Rules for Canadian Lumber (1994)	9.3.2.1.(1)
r	SMACNA		HVAC Duct Construction Standards – Metal and Flexible (1985) 2nd Edition - 1995	6.2.4.2.(1) 9.33.6.5.(2)
	TPIC		Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses (1988)	9.23.13.11.(6)

Table 2.7.3.2. (Continued)

Issuing Agency	Document Number	Title of Document	Code Reference
ULC	CAN/ULC-S101-M89	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.(7) 3.2.6.5.(6)
ULC	CAN/ULC-S102-M88	Test for Surface Burning Characteristics of Building Materials and Assemblies	3.1.12.1.(1)
ULC	CAN/ULC-S102.2-M88	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	ULC S102.3-M1982	Fire Test of Light Diffusers and Lenses	3.1.13.4.(1)
ULC	CAN4-S104-M80	Fire Tests of Door Assemblies	3.1.8.4.(1) 3.2.6.5.(3) 9.10.13.2.(1)
ULC	CAN4-S105-M85	Fire Door Frames Meeting the Performance Required by CAN4-S104	9.10.13.6.(1)
ULC	CAN4-S106-M80	Fire Tests of Window and Glass Block Assemblies	3.1.8.4.(1)
ULC	CAN/ULC-S107-M87	Fire Tests of Roof Coverings	3.1.15.1.(1)
ULC	CAN/ULC-S109-M87	Flame Tests of Flame-Resistant Fabrics and Films	3.1.6.5.(1) 3.2.3.20.(1) 3.6.5.2.(2) 3.6.5.3.(1) 9.33.6.3.(1)
ULC	CAN/ULC-S110-M86	Fire Tests for Air Ducts	3.6.5.1.(2) 3.6.5.1.(5) 9.33.6.2.(2) 9.33.6.2.(4)
r ULC	ULC-S111-95	Fire Tests for Air Filter Units	6.2.3.14.(1) 9.33.6.15.(1)
ULC	CAN/ULC-S112-M90	Fire Test of Fire Damper Assemblies	3.1.8.4.(1) 9.33.6.2.(4)
ULC	CAN4-S113-79	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	Test for Determination of Non-Combustibility in Building Materials	1.1.3.2.(1)
r ULC	ULC-S115-95	Fire Tests for Fire Stop Systems	3.1.5.15.(3) 3.1.9.1.(1) 3.1.9.1.(2) 3.1.9.4.(4) 9.10.9.7.(3)
ULC	CAN4-S124-M85	Test for the Evaluation of Protective Coverings for Foamed Plastic	3.1.5.11.(2)

Table 2.7.3.2. (Continued)

	Issuing Agency	Document Number	Title of Document	Code Reference
	ULC	CAN/ULC-S126-M86	Test for Fire Spread under Roof-Deck Assemblies	3.1.14.1.(1) 3.1.14.2.(1)
	ULC	CAN/ULC-S134-92	Fire Test of Exterior Wall Assemblies	3.1.5.5.(1)
	ULC	S505-1974	Fusible Links for Fire Protection Service	3.1.8.9.(1)
	ULC	CAN/ULC-S524-M91	Installation of Fire Alarm Systems	3.2.4.5.(1)
	ULC	CAN/ULC-S531-M87	Smoke Alarms	3.2.4.21.(1) 9.10.18.1.(1)
r	ULC	CAN/ULC-S537-97	Verification of Fire Alarm Systems	3.2.4.5.(2)
	ULC	CAN/ULC-S553-M86	Installation of Smoke Alarms	3.2.4.21.(7)
	ULC	CAN/ULC-S610-M87	Factory-Built Fireplaces	9.22.8.1.(1)
	ULC	ULC-S628-93	Fireplace Inserts	9.22.10.1.(1)
	ULC	CAN/ULC-S629-M87	650°C Factory-Built Chimneys	9.21.1.2.(1)
	ULC	CAN/ULC-S639-M87	Steel Liner Assemblies for Solid-Fuel Burning Masonry Fireplaces	9.22.2.3.(1)
r	ULC	CAN/ULC-S701-97	Thermal Insulation, Polystyrene, Boards and Pipe Covering	5.3.1.2.(2) Table 9.23.16.2.A. 9.25.2.2.(1) 9.25.2.2.(4)
r	ULC	CAN/ULC-S702-97	Thermal Insulation, Mineral Fibre, for Buildings	5.3.1.2.(2) Table 9.23.16.2.A. 9.25.2.2.(1)
	ULC	ULC/ORD-C199P-M1988	Combustible Piping for Sprinkler Systems	3.2.5.14.(2)

a) more than 1.8 m high between the lowest part of the floor assembly and the ground or other surface below,
b) used for any *occupancy*,
c) used for the passage of *flue pipes*, or
d) used as a *plenum* in *combustible construction*.

2) A floor assembly immediately above a crawl space is not required to be constructed as a *fire separation* and is not required to have a *fire-resistance rating* provided the crawl space is not required to be considered as a *basement* by Sentence (1).

3.2.2.10. Streets

1) Every *building* shall face a *street* located in conformance with the requirements of Articles 3.2.5.4. and 3.2.5.5. for access routes. *e*

2) For the purposes of Subsections 3.2.2. and 3.2.5. an access route conforming to Subsection 3.2.5. is permitted to be considered as a *street*.

3) A *building* is considered to face 2 *streets* provided not less than 50% of the *building* perimeter is located within 15 m of the *street* or *streets*.

4) A *building* is considered to face 3 *streets* provided not less than 75% of the *building* perimeter is located within 15 m of the *street* or *streets*.

5) Enclosed spaces, tunnels, bridges and similar structures, even though used for vehicular or pedestrian traffic, are not considered as *streets* for the purpose of this Part.

3.2.2.11. Exterior Balconies

1) An exterior balcony shall be constructed in accordance with the type of construction required by Articles 3.2.2.20. to 3.2.2.83., as applicable to the *occupancy* classification of the *building*.

3.2.2.12. Exterior Passageways

1) An elevated exterior passageway used as part of a *means of egress* shall conform to the requirements of Articles 3.2.2.20. to 3.2.2.83. for *mezzanines*.

3.2.2.13. Occupancy on Roof

1) A portion of a roof that supports an *occupancy* shall be constructed in conformance with the *fire separation* requirements of Articles 3.2.2.20. to 3.2.2.83. for floor assemblies, and not the *fire-resistance rating* for roof assemblies.

3.2.2.14. Roof-Top Enclosures

1) A roof-top enclosure for elevator machinery or for a *service room* shall be constructed in accordance with the type of construction required by Articles 3.2.2.20. to 3.2.2.83.

2) A roof-top enclosure for elevator machinery or for a *service room*, not more than one *storey* high, is not required to have a *fire-resistance rating*.

3) A roof-top enclosure for a stairway shall be constructed in accordance with the type of construction required by Articles 3.2.2.20. to 3.2.2.83.

4) A roof-top enclosure for a stairway need not have a *fire-resistance rating* nor be constructed as a *fire separation*.

3.2.2.15. Storeys below Ground

1) If a *building* is erected entirely below the adjoining finished ground level and does not extend more than one *storey* below that ground level, the minimum precautions against fire spread and collapse shall be the same as are required for *basements* under a *building* of 1 *storey* in *building height* having the same *occupancy* and *building area*.

2) If any portion of a *building* is erected entirely below the adjoining finished ground level and extends more than one *storey* below that ground level, the following minimum precautions against fire spread and collapse shall be taken:

a) except as permitted by Sentence (3), the *basements* shall be *sprinklered* throughout,
b) a floor assembly below the ground level shall be constructed as a *fire separation* with a *fire-resistance rating* not less than
   i) 3 h if the *basements* are used as Group E or Group F, Division 1 or 2 *occupancies*, or
   ii) 2 h if the *basements* are not used as Group E or Group F, Division 1 or 2 *occupancies*, and
c) all *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the construction that they support.

3) If the *first storey* of a *building* is not required to be *sprinklered*, sprinklers are not required in the *storey* immediately below the *first storey* provided the *storey* below

a) contains only *residential occupancies*, and
b) has at least one unobstructed access opening conforming to Sentence 3.2.5.1.(2) installed on that *storey* for each 15 m of wall length in at least one wall required by this Subsection to face a *street*.

3.2.2.16. Heavy Timber Roof Permitted

1) Unless otherwise permitted by Articles 3.2.2.20. to 3.2.2.83., a roof assembly in a *building* up to 2 *storeys* in *building height* is permitted to be of *heavy timber construction* regardless of *building area* or type of construction required, provided the *building* is *sprinklered* throughout.

2) If Sentence (1) permits a roof assembly to be of *heavy timber construction*, structural members in the *storey* immediately below the roof assembly are permitted to be of *heavy timber construction*.

3.2.2.17. Arena Type Building Roof Assembly

1) The requirements for a roof assembly to have a *fire-resistance rating* are permitted to be waived for a gymnasium, a swimming pool, an arena, or a rink if no part of the roof assembly is less than 6 m above the main floor or balcony and the roof carries no loads other than normal roof loads, including permanent access walks, and ventilating, sound and lighting equipment, except that the restriction concerning minimum distance shall not apply to

a) an inclined and stepped floor ascending from the main floor which is used for seating purposes only, or
b) a balcony used for seating purposes only.

3.2.2.18. Automatic Sprinkler System Required

1) Except as permitted by Sentence (2), an automatic sprinkler system conforming to the requirements of Articles 3.2.4.7., 3.2.4.8., 3.2.4.9., and 3.2.5.13. shall be installed throughout a *building* regulated by one or more of Articles 3.2.2.20., 3.2.2.21., 3.2.2.22., 3.2.2.23., 3.2.2.24., 3.2.2.26., 3.2.2.27., 3.2.2.29., 3.2.2.31., 3.2.2.33., 3.2.2.36., 3.2.2.37., 3.2.2.38., 3.2.2.39., 3.2.2.40., 3.2.2.41., 3.2.2.42., 3.2.2.43., 3.2.2.45., 3.2.2.48., 3.2.2.49., 3.2.2.51., 3.2.2.52., 3.2.2.54., 3.2.2.56., 3.2.2.57., 3.2.2.58., 3.2.2.60., 3.2.2.62., 3.2.2.63., 3.2.2.64., 3.2.2.65., 3.2.2.67., 3.2.2.68., 3.2.2.70., 3.2.2.72., 3.2.2.73., 3.2.2.75., 3.2.2.77., 3.2.2.79. and 3.2.2.81.

2) If a *storey* in a *building* or a *floor area* is required to have an automatic sprinkler system installed throughout in accordance with one or more of Articles 3.2.2.20. to 3.2.2.83. or Section 3.3., the automatic sprinkler system shall also be installed throughout all lower *storeys* in the *building* notwithstanding permission in Articles 3.2.2.20. to 3.2.2.83. to construct one or more of those *storeys* without installing automatic sprinkler protection. (See Appendix A.)

3.2.2.19. Buildings Containing Impeded Egress Zones

1) A *building* containing an *impeded egress zone* and conforming to the appropriate requirements of Articles 3.2.2.20. to 3.2.2.83. is not required to conform to the requirements of Articles 3.2.2.36. and 3.2.2.37. for a Group B, Division 1 *major occupancy* provided

a) the *building* is *sprinklered* throughout,
b) it is not more than 1 *storey* in *building height*,
c) it does not include
   i) a *contained use area*,
   ii) sleeping accommodation,
   iii) a *high hazard industrial occupancy*, or
   iv) a *mercantile occupancy*,
d) the *building area* is not more than 6 400 m^2 if the *building* includes a *medium hazard industrial occupancy*,
e) the *impeded egress zone* does not extend beyond the boundaries of the *fire compartment* in which it is located, and
f) the *occupant load* of the *impeded egress zone* is not more than 100.

3.2.2.20. Group A, Division 1, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.21. and 3.2.2.22., a *building* classified as Group A, Division 1 shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,
b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,
c) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and
d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.21. Group A, Division 1, One Storey, Limited Area, Sprinklered

1) A *building* classified as Group A, Division 1 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 1 *storey* in *building height*,
c) it has less than 40% of the area of the *building* as 2 *storeys* for the purpose of
   i) development of productions, including preparation of scenery and costumes and rehearsal of performers,
   ii) organization of performers, scenery and sound equipment,
   iii) preparation by performers for a performance,
   iv) managerial functions, or
   v) toilets, rest rooms and similar public facilities,

have a *fire-resistance rating* not less than 45 min, and

b) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.66. Group F, Division 1, One Storey

1) A *building* classified as Group F, Division 1 is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination provided

a) it is not more than 1 *storey* in *building height*, and

b) it has a *building area* not more than 800 m^2.

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

1) Except as permitted by Articles 3.2.2.68. to 3.2.2.72., a *building* classified as Group F, Division 2 shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,

b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,

c) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.68. Group F, Division 2, up to 4 Storeys, Increased Area, Sprinklered

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

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 4 *storeys* in *building height*, and

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

i) 18 000 m^2 if 1 *storey* in *building height*,

ii) 9 000 m^2 if 2 *storeys* in *building height*,

iii) 6 000 m^2 if 3 *storeys* in *building height*, or

iv) 4 500 m^2 if 4 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.69. Group F, Division 2, up to 3 Storeys

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

a) it is not more than 3 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.69.

Table 3.2.2.69.
Maximum Building Area, Group F, Division 2, up to 3 Storeys
Forming Part of Sentence 3.2.2.69.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	1 500	1 500	1 500
2	1 500	1 500	1 500
3	1 070	1 340	1 500

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,

b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, except that in a *building* not more than 1 *storey* in *building height*, the *fire-resistance rating* is permitted to be waived provided that the roof assembly is constructed as a *fire-retardant treated wood* roof system conforming to Article 3.1.14.1.,

d) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall
   i) have a *fire-resistance rating* not less than 45 min, or
   ii) be of *noncombustible construction*, and
e) *loadbearing* walls, columns and arches supporting a *fire separation* shall have a *fire-resistance rating* not less than that required for the *fire separation*.

3.2.2.70. Group F, Division 2, up to 4 Storeys, Sprinklered

1) A *building* classified as Group F, Division 2 is permitted to conform to Sentence (2) provided
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 4 *storeys* in *building height*, and
c) it has a *building area* not more than
   i) 9 600 m^2 if 1 *storey* in *building height*,
   ii) 4 800 m^2 if 2 *storeys* in *building height*,
   iii) 3 200 m^2 if 3 *storeys* in *building height*, or
   iv) 2 400 m^2 if 4 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,
b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,
c) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall
   i) have a *fire-resistance rating* not less than 45 min, or
   ii) be of *noncombustible construction*, and
d) *loadbearing* walls, columns and arches supporting a *fire separation* shall have a *fire-resistance rating* not less than that required for the *fire separation*.

3.2.2.71. Group F, Division 2, up to 2 Storeys

1) A *building* classified as Group F, Division 2 is permitted to conform to Sentence (2) provided
a) it is not more than 2 *storeys* in *building height*, and
b) it has a *building area* not more than the value in Table 3.2.2.71.

Table 3.2.2.71.
Maximum Building Area, Group F, Division 2, up to 2 Storeys *e*
Forming Part of Sentence 3.2.2.71.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	1 000	1 250	1 500
2	600	750	900

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min, and
b) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall
   i) have a *fire-resistance rating* not less than 45 min, or
   ii) be of *noncombustible construction*.

3.2.2.72. Group F, Division 2, up to 2 Storeys, Sprinklered

1) A *building* classified as Group F, Division 2 is permitted to conform to Sentence (2) provided
a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 2 *storeys* in *building height*, and
c) it has a *building area* not more than
   i) 4 500 m^2 if 1 *storey* in *building height*, or
   ii) 1 800 m^2 if 2 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and
a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min, and
b) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall
   i) have a *fire-resistance rating* not less than 45 min, or
   ii) be of *noncombustible construction*.

3.2.2.79. Group F, Division 3, up to 2 Storeys, Sprinklered

1) A *building* classified as Group F, Division 3 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 2 *storeys* in *building height*, and
c) it has a *building area* not more than
   i) 7 200 m^2 if 1 *storey* in *building height*, or
   ii) 2 400 m^2 if 2 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min, and
b) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall
   i) have a *fire-resistance rating* not less than 45 min, or
   ii) be of *noncombustible construction*.

3.2.2.80. Group F, Division 3, One Storey

1) A *building* classified as Group F, Division 3 is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination provided

a) it is not more than 1 *storey* in *building height*, and
b) it has a *building area* not more than
   i) 5 600 m^2 if facing one *street*,
   ii) 7 000 m^2 if facing 2 *streets*, or
   iii) 8 400 m^2 if facing 3 *streets*.

3.2.2.81. Group F, Division 3, One Storey, Sprinklered

1) A *building* classified as Group F, Division 3 is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,
b) it is not more than 1 *storey* in *building height*, and
c) it has a *building area* not more than 16 800 m^2.

3.2.2.82. Group F, Division 3, One Storey, Any Area, Low Fire Load Occupancy

1) A *building* classified as Group F, Division 3 is permitted to conform to Sentence (2) provided it is

a) not more than 1 *storey* in *building height*,
b) used solely for low *fire load occupancies* such as
   i) power generating plants, or
   ii) plants for the manufacture or storage of *noncombustible* materials, and
c) not limited in *building area*.

2) The *building* referred to in Sentence (1) shall be of *noncombustible construction*.

3.2.2.83. Group F, Division 3, Storage Garages up to 22 m High

1) A *building* used as a *storage garage* with all *storeys* constructed as *open-air storeys* and having no other *occupancy* above it is permitted to have its floor, wall, ceiling and roof assemblies constructed without a *fire-resistance rating* provided it is

a) of *noncombustible construction*,
b) not more than 22 m high, measured between *grade* and the ceiling level of the top *storey*,
c) not more than 10 000 m^2 in *building area*, and
d) designed so that every portion of each *floor area* is within 60 m of an exterior wall opening.

3.2.3. Spatial Separation and Exposure Protection

3.2.3.1. Limiting Distance and Area of Unprotected Openings

1) Except as permitted by Articles 3.2.3.9. to 3.2.3.11., the area of *unprotected openings* in an *exposing building face* for the applicable *limiting distance* shall be not more than the value determined in accordance with

a) Table 3.2.3.1.A. or Table 3.2.3.1.B. for an *exposing building face* conforming to Article 3.2.3.2. of a *building* or *fire compartment* which is not *sprinklered*, or
b) Table 3.2.3.1.C. or Table 3.2.3.1.D. for an *exposing building face* conforming to Article 3.2.3.2. of a *sprinklered fire compartment* that is part of a *building* which is *sprinklered* in conformance with Section 3.2.

(See A-3, Fire Fighting Assumptions, in Appendix A.) (See also Article 3.1.6.3.)

2) The area of the *unprotected openings* in an *exposing building face* shall be the aggregate area of

unprotected openings expressed as a percentage of the area of the *exposing building* face in Table 3.2.3.1.A., Table 3.2.3.1.B., Table 3.2.3.1.C. or Table 3.2.3.1.D. (See Sentence 3.2.3.2.(1).)

3) For the purpose of determining the type of construction and cladding and the *fire-resistance rating* of an exterior wall,

a) the *exposing building face* shall be taken as the projection of the exterior wall onto a vertical plane located so that no portion of the exterior wall of the *building* or of a *fire compartment*, if the *fire compartment* complies with the requirements of Sentences 3.2.3.2.(2), (4) or (6), is between the vertical plane and the line to which the *limiting distance* is measured, and

b) the area of *unprotected openings* shall be determined from Table 3.2.3.1.A., Table 3.2.3.1.B., Table 3.2.3.1.C. or Table 3.2.3.1.D.

4) For the purpose of determining the actual percentage of *unprotected openings* permitted in an exterior wall, the location of the *exposing building face* is permitted to be taken at a vertical plane located so that there are no *unprotected openings* between the vertical plane and the line to which the *limiting distance* is measured. (See Appendix A.)

5) If a *building* has any *storey* that is not *sprinklered* and fire fighting facilities cannot reach it within 10 min of the alarm being received, the *limiting distance* shall be doubled.

6) If the surface temperature on the unexposed surface of a wall assembly exceeds the temperature limit of a standard fire test as permitted by Article 3.1.7.2., an allowance shall be made for the radiation from the hot unexposed wall surface by adding an equivalent area of *unprotected opening* to the area of actual openings as follows:

$$A_C = A + (A_F \times F_{EO})$$

where

A_C = corrected area of *unprotected openings* including actual and equivalent openings,

A = actual area of *unprotected openings*,

A_F = area of exterior surface of the *exposing building face*, exclusive of openings, on which the temperature limit of the standard test is exceeded, and

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

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

T_u = average temperature in degrees Celsius of the unexposed wall surface at the time the required *fire-resistance rating* is reached under test conditions,

T_e = 892°C for a *fire-resistance rating* not less than 45 min, 927°C for *a fire-resistance rating* not less than 1 h, and 1 010°C for a *fire-resistance rating* not less than 2 h.

7) Unless a *closure* used to protect an opening in an *exposing building face* has a protective performance equivalent to that required for the wall assembly in which it is located, an equivalent area of *unprotected opening*, determined in accordance with the procedures of Sentence (6) shall be added to the greater of

a) the actual area of *unprotected openings*, or

b) the corrected area of *unprotected openings.*

with the requirements of Articles 3.2.8.3. to 3.2.8.9. provided the *mezzanine*

a) serves a Group A, Division 1 *major occupancy*,
b) serves a Group A, Division 3 *major occupancy* in a *building* not more than 2 *storeys* in *building* height, or
c) serves a Group A, C, D, E or F *major occupancy* and
   i) is 500 m^2 or less in area,
   ii) has an aggregate area not more than 40% of the *storey* in which it is located,
   iii) is not subdivided by *partitions* or walls if the *mezzanine* is more than 10% of the area of the *storey* in which it is located, and
   iv) has no visual obstruction, except for open bookshelves, more than 1 070 mm above the floor of the *mezzanine* or above the floor of the space below it if the *mezzanine* is more than 10% of the area of the *storey* in which it is located.

2) Except for floors referred to in Sentence 3.1.10.3.(1) and Article 3.2.1.2., openings through a horizontal *fire separation* for vehicular ramps in a *storage garage* are not required to be protected with *closures* and need not conform to this Subsection.

3) If a *closure* in an opening in a *fire separation* would disrupt the nature of a manufacturing process, such as a continuous flow of material from *storey* to *storey*, the *closure* for the opening is permitted to be omitted provided precautions are taken to offset the resulting hazard. (See Appendix A.)

4) An *interconnected floor space* in a Group B, Division 1 *occupancy* need not conform to the requirements of Articles 3.2.8.3. to 3.2.8.9. provided the *interconnected floor space* does not interconnect more than 2 adjacent *storeys*.

5) Except as permitted by Sentence (6), openings for escalators and inclined moving walks need not conform to the requirements in Articles 3.2.8.3. to 3.2.8.9 provided

a) the opening for each escalator or walk does not exceed 10 m^2,
b) the *building* is *sprinklered* throughout, and
c) the *interconnected floor space* contains only Group A, Division 1, 2 or 3, Group D or Group E *major occupancies*. (See A-3.2.8.2.(6)(c) in Appendix A.)

6) An *interconnected floor space* need not conform to the requirements of Articles 3.2.8.3. to 3.2.8.9. provided

a) the *interconnected floor space* consists of the *first storey* and the *storey* next above or below it, but not both,
b) the openings through the floor are used only for stairways, escalators or moving walks or the *interconnected floor space* is *sprinklered* throughout (see Appendix A),
c) the *interconnected floor space* contains only Group A, Division 1, 2 or 3, Group D, Group E or Group F, Division 3 *major occupancies* (see Appendix A), and
d) the *building area* is not more than one half of the area permitted by Subsection 3.2.2.

3.2.8.3. Construction Requirements

1) A *building* 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 if Subsection 3.2.2. permits the *building* to be constructed of *combustible construction*.

3.2.8.4. Sprinklers

1) A *building* containing an *interconnected floor space* shall be *sprinklered* throughout.

3.2.8.5. Vestibules

1) An *exit* opening into an *interconnected floor space* shall be protected at each opening into the *interconnected floor space* by a vestibule

a) with doorways that are not less than 1.8 m apart,
b) which is 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 is designed to limit the passage of smoke so that the level of contamination in an *exit* stair shaft does not exceed the limit described in Sentence 3.2.6.2.(2).

2) An *exit* opening into an *interconnected floor space* shall conform to Sentence 3.4.3.3.(2).

3) If an elevator hoistway opens into an *interconnected floor space* and into *storeys* above the *interconnected floor space*, either the elevator doors opening into the *interconnected floor space* or the elevator doors opening into the *storeys* above the *interconnected floor space* shall be protected by vestibules conforming to Sentence (1).

3.2.8.6. 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* in which it is located and in which openings through the vertical *fire separation* are protected by vestibules conforming to Sentence 3.2.8.5.(1).

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

3.2.8.7. Draft Stops

1) A draft stop shall be provided at each floor level within an *interconnected floor space*, immediately adjacent to and surrounding the opening, and shall be not less than 500 mm deep measured from ceiling level down to the underside of the draft stop.

3.2.8.8. Mechanical Exhaust System

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

2) The mechanical exhaust system required by Sentence (1) shall be actuated by a switch located on the *storey* containing the entrance for fire fighter access referred to in Articles 3.2.5.4 and 3.2.5.5. near the annunciator for the fire alarm system.

3.2.8.9. Combustible Content Limits

1) An *interconnected floor space* shall be designed so that the *combustible* contents, excluding interior finishes, in those parts of a *floor area* in which the ceiling is more than 8 m above the floor, are limited to not more than 16 g of *combustible* material for each cubic metre of volume of the *interconnected floor space*.

Section 3.3. Safety within Floor Areas

(See Appendix A.)

3.3.1. All Floor Areas

3.3.1.1. Separation of Suites

1) Except as permitted by Sentences (2) and (3), 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* not less than 1 h. (See also Subsection 3.3.3. for *care or detention occupancies*, Article 3.3.4.2. for *residential occupancies* and Article 3.1.8.7. for *fire dampers*.) e

2) The *fire-resistance rating* of the *fire separation* required by Sentence (1) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or
b) the floor assembly below the *floor area*, if there is no floor assembly above.

3) *Occupancies* that are served by *public corridors* conforming to Sentence 3.3.1.4.(4) in a *building* that is *sprinklered* throughout, are not required to be separated from one another by *fire separations* provided the *occupancies* are e

a) *suites* of *business and personal services occupancy*,
b) fast food vending operations that do not provide seating for customers,
c) *suites* of *mercantile occupancy*, or
d) any combination of these *occupancies*. e

3.3.1.2. Hazardous Substances, Equipment and Processes

1) If hazardous substances are used in connection with the activities of any *occupancy* other than as permitted by Subsection 3.3.5. for a *high hazard industrial occupancy*, the storage, handling and use of the hazardous substances shall be in conformance with

a) provincial, territorial or municipal regulations, or
b) the National Fire Code of Canada 1995, in the absence of regulations referred to in Clause (a).

(See Appendix A.)

2) Cooking equipment, not within a *dwelling unit*, used in processes producing grease-laden vapours shall be designed and installed in conformance with Part 6. (See Appendix A.)

3) A fuel-fired *appliance* shall not be installed in a corridor serving as an *access to exit*.

3.3.1.3. Means of Egress

1) *Access to exit* within *floor areas* shall conform to Subsections 3.3.2. to 3.3.5., in addition to the requirements of this Subsection.

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

3) *Means of egress* shall be provided from every roof which is intended for *occupancy*, and from every podium, terrace, platform or contained open space.

4) If a roof is used or intended for an *occupant load* more than 60, at least 2 separate *means of egress* shall be provided from the roof to stairs,

a) designed in conformance with the requirements for *exit* stairs, and
b) located so that the distance between the stairs conforms to the requirements of Article 3.4.2.3. for *exits*.

door is readily apparent, by attaching non-transparent hardware, bars or other permanent fixtures to it.

2) A glass door shall be constructed of
a) laminated or tempered safety glass conforming to CAN/CGSB-12.1-M, "Tempered or Laminated Safety Glass," or
b) wired glass conforming to CAN/CGSB-12.11-M, "Wired Safety Glass."

3) Except as permitted by Sentence (4), transparent panels used in an *access to exit* which, because of their physical configuration or design, could be mistaken as a *means of egress* shall be made inaccessible by barriers or railings.

4) Sliding glass *partitions* which separate a *public corridor* from an adjacent *occupancy* and which are open during normal working hours need not conform to Sentences (1) and (3), provided the *partitions* are suitably marked to indicate their existence and position.

5) Glass in doors and in sidelights that could be mistaken for doors, within or at the entrances to *dwelling units* and in public areas, shall conform to the requirements of Article 9.6.6.2.

6) A window in a public area that extends to less than 1 000 mm above the floor and is located above the second *storey* in a *building* of *residential occupancy*, shall be protected by a barrier or railing to not less than 1 070 mm above the floor, or the window shall be non-openable and designed to withstand the lateral design loads for balcony *guards* required by Article 4.1.10.1.

3.3.1.19. Exhaust Ventilation

1) An exhaust ventilation system designed in conformance with the appropriate requirements of Part 6 shall be provided in a *building* or part of a *building* in which dust, fumes, gases, vapour or other impurities or contaminants have the potential to create a fire or explosion hazard. (See also Article 4.2.4.15.)

2) Explosion relief devices, vents or other protective measures conforming to Subsection 6.2.2. shall be provided for a space in which substances or conditions that have the potential to create an explosion hazard are present as a result of the principal use of a *building*.

3.3.1.20. Janitors' Rooms

1) Except as permitted by Sentences (2) and (3), a room or space within a *floor area* for the storage of janitorial supplies shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

2) The *fire-resistance rating* of the *fire separation* required by Sentence (1) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for
a) the floor assembly above the *floor area*, or
b) the floor assembly below the *floor area*, if there is no floor assembly above.

3) The *fire separation* required by Sentence (1) is not required to have a *fire-resistance rating* if the *floor area* in which the room or space is located is *sprinklered* throughout.

3.3.1.21. Common Laundry Rooms

1) Except as permitted by Sentences (2) and (3), in a *building* of *residential occupancy*, a laundry room in a *floor area* that is not within a *dwelling unit* shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

2) The *fire-resistance rating* of the *fire separation* required by Sentence (1) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for
a) the floor assembly above the *floor area*, or
b) the floor assembly below the *floor area*, if there is no floor assembly above.

3) The *fire separation* required by Sentence (1) is not required to have a *fire-resistance rating* if the *floor area* in which the laundry room is located is *sprinklered* throughout.

3.3.1.22. Obstructions

1) No obstruction shall be permitted in any *occupancy* that would restrict the width of a normal *means of egress* from any part of a *floor area* to less than 750 mm unless an alternative *means of egress* is provided adjacent to, accessible from, and plainly visible from the obstructed *means of egress*. (See Appendix A.)

3.3.1.23. Signs in Service Spaces

1) Illuminated signs conforming to Sentences 3.4.5.1.(3) and (5) shall be provided to indicate the direction to egress points in a *service space* referred to in Sentence 3.2.1.1.(7).

3.3.1.24. Welding and Cutting

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

3.3.2. Assembly Occupancy

3.3.2.1. Scope

1) This Subsection applies to *floor areas* or parts thereof used or intended for use as *assembly occupancies*.

3.3.2.2. Fire Separations

1) Except as permitted by Sentence (2), the seating area of a Group A, Division 1 *occupancy* shall be separated from adjacent *occupancies* in the *floor area* by a *fire separation* having a *fire-resistance rating* not less than 1 h if the *occupant load* in the seating area exceeds 200.

2) The *fire-resistance rating* of the *fire separation* required by Sentence (1) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or
b) the floor assembly below the *floor area*, if there is no floor assembly above.

3) If usable space exists under tiers of seats in arena type *buildings*, a *fire separation* with a *fire-resistance rating* not less than 45 min shall be provided between the space and the seats or the space shall be *sprinklered*.

3.3.2.3. Fixed Seats

1) Except for the requirements of Article 3.3.2.7. for bench-type seats and except as required or permitted by Sentence (2) and Articles 3.3.2.9. and 3.3.2.10., fixed seats in places of assembly shall be

a) attached or secured to the floor, platform or platform riser,
b) provided with arms and back, and
c) arranged in rows having an unobstructed passage not less than 400 mm wide measured horizontally between plumb lines from the backs of the seats in one row and the edges of the furthest forward projection of the seats in the next row in the unoccupied position.

2) For fixed seats with backs and with folding tablet arms, the value of 400 mm required by Clause (1)(c) shall be measured when the tablet arms are in the use position, but is permitted to be measured in the stored position provided

a) there are not more than 7 seats between any seat and the nearest aisle,
b) the seats are located in a lecture hall or an auditorium used for instructional purposes, and
c) the tablet arm, when raised manually to a vertical position, falls by the force of gravity to the stored position.

(See Appendix A.)

3) Except as permitted by Sentence (4), aisles shall be located so that there are not more than 7 seats with backs or 20 seats without backs between any seat and the nearest aisle.

4) The requirements of Sentence (3) do not apply if

a) egress doorways are provided to serve both ends of rows of seats,
b) each doorway referred to in Clause (a) serves not more than 3 rows of seats, and
c) each row contains not more than 100 seats.

3.3.2.4. Aisles

1) Except as required by Articles 3.3.2.9. and 3.3.2.10., aisles leading to *exits* shall be provided in conformance with Sentences (2) to (17) in places of assembly which contain fixed seats. *e*

2) The minimum clear width of aisles shall be not less than 1 100 mm, except that the width is permitted to be reduced to not less than

a) 750 mm if serving not more than 60 seats, and
b) 900 mm if serving seats on one side only.

3) Except in the case of bleacher seats, the minimum clear width of aisles referred to in Sentence (2) shall be measured at the point farthest from an *exit*, cross aisle or foyer and shall be increased by 25 mm for each metre of distance toward the *exit*, cross aisle or foyer.

4) Aisles shall terminate in a cross aisle, foyer or *exit*, and the width of the cross aisle, foyer or *exit* shall be not less than the required width of the widest aisle plus 50% of the total required width of the remaining aisles that it serves.

5) Dead-end aisles shall be not more than 6 m long.

6) The length of travel to an *exit* door by any aisle shall be not more than 45 m.

7) Side aisles shall be not less than 1 100 mm wide if seating is provided in conformance with Sentence 3.3.2.3.(4).

8) An aisle that has a slope not more than 1 in 8 shall not be stepped.

9) An aisle that slopes more than 1 in 8 shall be stepped.

10) The passageway between rows of seats served by a stepped aisle shall be level at right angles to the line of travel.

11) The riser of a step in an aisle shall be

a) not less than 110 mm high, and
b) not more than 200 mm high.

12) Variations are permitted in riser height provided

3) The required width of *means of egress* serving a Group A, Division 4 *occupancy* shall be determined by multiplying the *occupant load* of the area served by

a) 1.8 mm per person for
   i) aisles,
   ii) stairs other than *exit* stairs, and
   iii) ramps and passageways in vomitories and *exits*, and
b) 2.4 mm per person for *exit* stairs.

3.4.3.5. Exit Width Reduction

1) Except as permitted by Sentences (2) to (4), no fixture, turnstile or construction shall project into or be fixed within the required width of an *exit*.

2) *Exit* doors shall be hung so that, when open, they shall neither diminish nor obstruct the required width of the *exit* by more than 50 mm for each door leaf.

3) Swinging doors in their swing shall not reduce the required width of *exit* stairs or landings to less than 750 mm or reduce the width of an *exit* passageway to less than the minimum required width.

4) Handrails and construction below handrails are permitted to project into the required width of *means of egress* but the projections shall be not more than 100 mm on each side of the required width.

3.4.3.6. Headroom Clearance

1) Except as permitted by Sentences (2) to (4), every *exit* shall have a headroom clearance of not less than 2 100 mm.

2) The headroom clearance for stairways measured vertically above any landing or the nosing of any stair tread shall be not less than 2 050 mm.

3) The headroom clearance for doorways shall be not less than 2 030 mm.

4) No door closer or other device shall be installed so as to reduce the headroom clearance of a doorway to less than 1 980 mm.

3.4.4. Fire Separation of Exits

3.4.4.1. Fire-Resistance Rating of Exit Separations

1) Except as permitted by Sentences (2), 3.3.5.4.(3), 3.4.4.2.(2) and 3.4.4.3.(1), every *exit* shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than that required by Subsection 3.2.2., but not less than 45 min, for

a) the floor assembly above the *storey*, or
b) the floor assembly below the *storey*, if there is no floor assembly above.

2) The *fire-resistance rating* of the *fire separation* referred to in Sentence (1) need not be more than 2 h.

3) If an *exit* stair in an assembly hall or *theatre* serves more than one balcony level, the *exit* stair shall be separated from the remainder of the *building* in conformance with Sentence (1).

3.4.4.2. Exits through Lobbies

1) Except as permitted by Sentence (2), no *exit* from a *floor area* above or below the *first storey* shall lead through a lobby.

2) Not more than one *exit* from a *floor area* is permitted to lead through a lobby provided

a) the lobby floor is not more than 4.5 m above *grade*,
b) the path of travel through the lobby to the outdoors is not more than 15 m,
c) the adjacent rooms or premises having direct access to the lobby do not contain a *residential occupancy* or an *industrial occupancy*,
d) the lobby is not located within an *interconnected floor space* other than as described in Sentence 3.2.8.2.(6),
e) the lobby conforms to the requirements for *exits*, except that
   i) rooms other than *service rooms* and storage rooms are permitted to open onto the lobby,
   ii) the *fire separation* between the lobby and a room used for the sole purpose of control and supervision of the *building* need not have a *fire-resistance rating*, and
   iii) the *fire separation* between the lobby and adjacent *occupancies* that are permitted to open onto the lobby need not have a *fire-resistance rating* provided the lobby and adjacent *occupancies* are *sprinklered*, and

   (see Appendix A)
f) a *fire separation*, constructed in accordance with Sentence 3.4.4.1.(1), is maintained between the lobby and any *exit* permitted by this Sentence to lead through the lobby.

3.4.4.3. Exterior Passageway Exceptions

1) The requirements of Sentences 3.4.4.1.(1) and 3.2.3.12.(1) and (3) do not apply to an exterior *exit* passageway provided

a) not less than 50% of the exterior side is open to the outdoors, and
b) an *exit* stair is provided at each end of the passageway.

3.4.4.4. Integrity of Exits

1) A *fire separation* that separates an *exit* from the remainder of the *building* shall have no openings except for

a) standpipe and sprinkler piping,
b) electrical wires and cables, totally enclosed *noncombustible* raceways and *noncombustible* piping that serve only the *exit*,
c) openings required by the provisions of Subsection 3.2.6.,
d) *exit* doorways, and
e) wired glass and glass block permitted by Article 3.1.8.14.

2) *Exits* within scissors stairs and other contiguous *exit* stairways shall be separated from each other by a smoke-tight *fire separation* having a *fire-resistance rating* not less than that required for the floor assembly through which they pass.

3) *Fire separations* separating contiguous stairs described in Sentence (2) shall not be pierced by doorways, ductwork, piping or any other openings that affect the continuity of the separation.

4) A fuel-fired *appliance* shall not be installed in an *exit*.

5) An *exit* shall not be used as a *plenum* for a heating, ventilating or air-conditioning system.

6) An *exit* shall be designed for no purpose other than for exiting, except that an *exit* is permitted also to be designed to serve as an access to a *floor area*.

7) A *service room* shall not open directly into an *exit*.

8) Storage rooms, washrooms, toilet rooms, laundry rooms and similar ancillary rooms shall not open directly into an *exit*.

9) *Service spaces* referred to in Sentence 3.2.1.1.(7) shall not open directly into an *exit*.

3.4.5. Exit Signs

3.4.5.1. Exit Signage

1) Every *exit* door other than the main entrance to a room or *building* shall have an *exit* sign placed over or adjacent to it if the *exit* serves

a) a *building* more than 2 *storeys* in *building height*,
b) a *building* having an *occupant load* more than 150, or
c) a room or *floor area* that has a fire escape as part of a required *means of egress*.

2) Every *exit* sign shall

a) be visible from the *exit* approach,
b) have the word EXIT or SORTIE displayed in plain legible letters, and
c) be illuminated continuously while the *building* is occupied.

3) *Exit* signs shall consist of

a) red letters on a contrasting background or contrasting letters on a red background, with the letters not less than 114 mm high and having a 19 mm stroke, if the sign is internally illuminated, and
b) white letters on a red background or red letters on a contrasting background that is white or a light tint, with letters not less than 150 mm high and having a 19 mm stroke, if the sign is externally illuminated.

4) If illumination of an *exit* sign is provided from an electrical circuit, that circuit shall

a) serve no equipment other than emergency equipment, and
b) be connected to an emergency power supply as described in Sentence 3.2.7.4.(1).

5) If necessary, the direction of egress in *public corridors* and passageways shall be indicated by a sign conforming to Sentence (3) with a suitable arrow or pointer indicating the direction of egress.

6) Except for egress doorways described in Sentence 3.3.2.3.(4) and except for the main entrance door, an *exit* sign conforming to Sentences (2), (3) and (4) shall be placed over or adjacent to every egress doorway from rooms with an *occupant load* more than 60 in Group A, Division 1 *occupancies*, dance halls, licensed beverage establishments and other similar *occupancies* that, when occupied, have lighting levels below that which would provide easy identification of the egress doorway.

3.4.5.2. Signs for Basement Stairs and Ramps

1) In a *building* more than 2 *storeys* in *building height*, any part of an *exit* ramp or stair that continues past an exterior *exit* door down to a *basement* shall be clearly marked by a sign indicating that it does not lead to an *exit*. *e*

3.4.6. Types of Exit Facilities

(See Appendix A.)

3.4.6.1. Slip Resistance of Ramps and Stairs

1) The surfaces of ramps, and landings and treads

a) shall have a finish that is slip resistant, and
b) if accessible to the public, shall have either a colour contrast or a distinctive pattern to demarcate the leading edge of the tread and the leading edge of the

landing, as well as the beginning and end of a ramp.

2) Treads and landings of exterior *exit* stairs more than 10 m high shall be designed to be free of ice and snow accumulations.

3.4.6.2. Minimum Number of Risers

1) Except as permitted by Sentence 3.3.2.13.(1), every flight of interior stairs shall have not less than 3 risers.

3.4.6.3. Landings and Maximum Vertical Rise of Stair Flights

1) No flight of stairs shall have a vertical rise of more than 3.7 m between floors or landings, except that a flight of stairs serving as an *exit* in a Group B, Division 2 *occupancy* shall have a vertical rise not more than 2.4 m between floors or landings.

2) The length and width of a landing shall be at least the width of the stairway in which it occurs, except that in a straight run the length of the landing need not be more than 1 100 mm.

3) Where a doorway or stairway empties onto a ramp through a side wall, there shall be a level area extending across the full width of the ramp, and for a distance of 300 mm on either side of the wall opening, except one side if it abuts on an end wall.

4) Where a doorway or stairway empties onto a ramp through an end wall, there shall be a level area extending across the full width of the ramp and along its length for not less than 900 mm.

5) A landing shall be provided at the top and bottom of every flight of stairs.

3.4.6.4. Handrails

1) An *exit* ramp or stairway shall have a handrail on at least one side, and if 1 100 mm or more in width, shall have handrails on both sides.

2) If the required width of a ramp or flight of stairs is more than 2 200 mm, one or more intermediate handrails continuous between landings shall be provided, and located so that there will be not more than 1 650 mm between handrails.

3) Handrails shall be continuously graspable along their entire length and shall have

a) a circular cross-section with an outside diameter not less than 30 mm and not more than 50 mm, or
b) any non-circular shape with a graspable portion that has a perimeter not less than 100 mm and not more than 155 mm and whose largest cross-sectional dimension is not more than 57 mm.

4) Handrails on stairs and ramps shall be not less than 865 mm and not more than 965 mm high, 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 handrail.

5) At least 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 Appendix A.)

6) Handrails shall be terminated in a manner which will not obstruct pedestrian travel or create a hazard. (See A-3.4.6.4.(5) in Appendix A.)

7) At least one handrail at the side of a stairway or ramp shall extend horizontally not less than 300 mm beyond the top and bottom of the stairway or ramp. (See A-3.4.6.4.(5) in Appendix A.)

8) A clearance of not less than 40 mm shall be provided between a handrail and any wall to which it is fastened.

9) Handrails and their supports shall be designed and constructed to withstand the loading values obtained from the nonconcurrent application of

a) a concentrated load not less than 0.9 kN applied at any point and in any direction for all handrails, and
b) a uniform load not less than 0.7 kN/m applied in any direction to handrails not located within *dwelling units*.

3.4.6.5. Guards

1) Every *exit* shall have a wall or a well-secured *guard* on each side.

2) Except as required by Sentence (4), the height of *guards* for *exit* stairs shall be not less than 920 mm measured vertically to the top of the *guard* from a line drawn through the outside edges of the stair nosings and 1 070 mm around landings.

3) The height of *guards* for *exit* ramps and their landings shall be not less than 1 070 mm measured vertically to the top of the *guard* from the ramp surface.

4) The height of *guards* for exterior stairs and landings more than 10 m above adjacent ground level shall be not less than 1 500 mm measured vertically to the top of the *guard* from a line drawn through the outside edges of the stair nosings.

5) Unless it can be shown that the size of openings that exceed this limit does not present a hazard, there shall be no opening that permits the passage of a sphere whose diameter is more than 100 mm through a *guard* for an *exit*.

6) In a stairway, a window for which the distance measured vertically between the bottom of the window and a line drawn through the outside edges of the stair nosings is less than 900 mm, or a window that extends to less than 1 070 mm above the landing, shall

a) be protected by a *guard* that is
   i) located approximately 900 mm above a line drawn through the outside edges of the stair nosings, or
   ii) not less than 1 070 mm high measured to the top of the *guard* from the surface of the landing, or
b) be fixed in position and designed to resist the lateral design loads specified for *guards* and walls in Articles 4.1.10.1. and 4.1.10.3.

7) Unless it can be shown that the location and size of openings do not present a hazard, a *guard* shall be designed so that no member, attachment or opening located between 140 mm and 900 mm above the level being protected by the *guard* will facilitate climbing.

3.4.6.6. Ramp Slope

e (See also Article 3.8.3.4.)

1) Except as required for aisles by Article 3.3.2.4., the maximum slope of a ramp shall be

a) 1 in 10 in any *assembly occupancy*, *care or detention occupancy* or *residential occupancy*,
b) 1 in 6 in rooms or *floor areas* classified as *mercantile occupancy* or *industrial occupancy*,
c) 1 in 8 in any other *floor area*, and
d) 1 in 10 for an exterior ramp.

3.4.6.7. Treads and Risers

1) Except as permitted for *dwelling units* and by Sentence 3.4.7.5.(1) for fire escapes, steps for stairs shall have a run of not less than 280 mm between successive steps.

2) Steps for stairs referred to in Sentence (1) shall have a rise between successive treads not less than 125 mm and not more than 180 mm.

3) Treads and risers in every *exit* stair, except a fire escape stair, shall have uniform run and rise in any one flight, and shall not alter significantly in run and rise in successive flights in any stair system. (See Appendix A.)

4) The leading edge of a stair tread shall have either a radius or a bevel between 8 mm and 13 mm in horizontal dimension.

5) The front edge of stair treads in *exits* and public *access to exits* shall be at right angles to the direction of *exit* travel.

3.4.6.8. Curved Stairs

1) Except as permitted by Sentence (2), tapered treads shall not be used in an *exit*.

2) A curved stair used as an *exit* shall have

a) a handrail on each side,
b) treads with a minimum run of 240 mm exclusive of nosings,
c) treads that conform to Article 3.4.6.7. where they are measured 230 mm away from the handrail at the narrow end of the tread, and
d) an inside radius that is not less than twice the stair width.

3.4.6.9. Horizontal Exits

1) The *floor area* on each side of a *horizontal exit* shall be sufficient to accommodate the occupants of both *floor areas*, allowing not less than 0.5 m^2 of clear floor space per person, except that 1.5 m^2 shall be provided for each person in a wheelchair and 2.5 m^2 for each bedridden patient.

2) If vestibules, enclosed balconies or bridges are used as parts of a *horizontal exit*, their clear width shall be not less than that of the *exit* doorways opening into them, except that handrails are not permitted to project into this clear width more than 100 mm.

3) In a *horizontal exit* where there is a difference in level between the connected *floor areas*, slopes not more than those specified for ramps in Article 3.4.6.6. are permitted to be used.

4) No stairs or steps shall be used in a *horizontal exit*.

5) If 2 doors are provided in a *horizontal exit* that comprises a part of the required number of *exits* from the *floor areas* on both sides of the *exit*

a) the doors shall be mounted adjacent to each other with the door on the right side in the direction of travel through the *horizontal exit* swinging in the direction of travel through the *horizontal exit*, and
b) signs shall be provided on each side of the *horizontal exit* to indicate the door that swings in the direction of travel from that side.

(See Appendix A.)

6) If a *horizontal exit* utilizes bridges between *buildings* or outside balconies, the bridges or balconies shall conform to Article 3.2.3.18.

3.4.6.10. Doors

1) The distance between a stair riser and the leading edge of a door during its swing shall be not less than 300 mm.

4.1.6.6. Loads for Dining Areas

1) The minimum specified load in Table 4.1.6.3. for dining areas may be reduced to 2.4 kPa for dining areas in *buildings* to be converted for such purposes provided that the *floor area* does not exceed 100 m^2 and use of the dining area for other assembly purposes, including dancing, is precluded.

4.1.6.7. Floor Loads Due to Intended Use

1) Equipment areas and *service rooms*, factories, storage areas and warehouses shall be designed for the loads due to their intended use but not less than the specified loads listed in Table 4.1.6.3.

4.1.6.8. More Than One Occupancy

1) Where an area of floor or roof is intended for 2 or more *occupancies* at different times, the value to be used from Table 4.1.6.3. shall be the greatest value for any of the *occupancies* concerned.

4.1.6.9. Variation with Tributary Area

(See Appendix A.)

1) An area used for *assembly occupancies* designed for a *live load* of less than 4.8 kPa shall have no reduction for tributary area.

2) Where a structural member supports a tributary area of floor, roof or combination thereof greater than 80 m^2 used for *assembly occupancies* designed for a *live load* of 4.8 kPa or more, or for storage, manufacturing, retail stores, garages or as a footbridge, the specified *live load* due to use and *occupancy*, excluding snow, is the load provided for in Article 4.1.6.3. multiplied by

$$0.5 + \sqrt{20/A}$$

where A is the tributary area in square metres for this type of use and *occupancy*, excluding the area supporting snow.

3) Where a structural member supports a tributary area of floor, roof or combination of these greater than 20 m^2 for any use or *occupancy* other than those indicated in Sentences (1) and (2), the specified live load due to use and *occupancy*, excluding snow, is the load provided for in Article 4.1.6.3. multiplied by

$$0.3 + \sqrt{9.8/B}$$

where B is the tributary area in square metres for this type of use and *occupancy*, excluding the area supporting snow.

4.1.6.10. Concentrated Loads

1) The specified load due to possible concentrations of load resulting from the use of an area of floor or roof shall not be less than that listed in Table 4.1.6.10. applied over an area of 750 mm by 750 mm located so as to cause maximum effects, except that for *occupancies* not listed in Table 4.1.6.10. the concentrations of load shall be determined in accordance with Article 4.1.6.2.

Table 4.1.6.10.
Specified Concentrated Live Loads on an Area of Floor or Roof
Forming Part of Article 4.1.6.10.

Area of Floor or Roof	Minimum Specified Concentrated Load, kN
Roof surfaces	1.3
Floors of classrooms	4.5
Floors of offices, manufacturing *buildings*, hospital wards and *stages*	9.0
Floors and areas used by passenger cars	11
Floors and areas used by vehicles not exceeding 3 600 kg gross weight	18
Floors and areas used by vehicles exceeding 3 600 kg but not exceeding 9 000 kg gross weight	36
Floors and areas used by vehicles exceeding 9 000 kg gross weight(1)	54
Driveways and sidewalks over areaways and *basements*(1)	54

Notes to Table 4.1.6.10.:
(1) See Appendix A.

4.1.6.11. Bleacher Seats

1) Bleacher seats shall be designed for a uniformly distributed load of 1.75 kN for each linear metre or for a concentrated load of 2.2 kN distributed over a length of 0.75 m, whichever produces the greatest effect on the supporting members.

4.1.6.12. Helicopter Landing Areas

1) Helicopter landing areas on roofs shall be constructed in conformance with requirements contained in the "Airport Regulations of the Aeronautics Act" of Transport Canada.

4.1.6.13. Roof Parking Decks

1) Roof parking decks shall be designed for the uniformly distributed loads in Table 4.1.6.3., the concentrated loads in Table 4.1.6.10. or the roof snow load, whichever produces the greatest effect in the members concerned.

4.1.7. Live Loads Due to Snow, Ice and Rain

(See Appendix A.)

4.1.7.1. Specified Snow Loading

1) The specified loading, S, due to snow accumulation on a roof or any other *building* surface subject to snow accumulation shall be calculated from the formula

$$S = S_s(C_b C_w C_s C_a) + S_r$$

where

S_s = the ground snow load in kPa, determined in accordance with Subsection 2.2.1.,

S_r = the associated rain load in kPa, determined in accordance with Subsection 2.2.1., but not greater than $S_s(C_b C_w C_s C_a)$,

C_b = the basic roof snow load factor of 0.8,

C_w = the wind exposure factor in Sentences (2) and (3),

C_s = the slope factor in Sentences (4), (5) and (6), and

C_a = the accumulation factor in Sentence (7).

2) Except as provided for in Sentence (3), the wind exposure factor, C_w, shall be 1.0.

3) The wind exposure factor in Sentence (2) may be reduced to 0.75, or in exposed areas north of the treeline to 0.5, where

a) the *building* is in an exposed location, so that the roof is exposed to the winds on all sides, with no obstructions higher than the roof located closer to the *building* than a distance equal to 10 times the height of the obstruction above the roof,

b) the area of roof under consideration is exposed to the wind on all sides with no significant obstructions on the roof, such as parapet walls, within a distance of at least 10 times the difference between the height of the obstruction and $C_b C_w S_s/\gamma$ metres, where γ is the unit weight of snow on roofs, and

c) the loading does not involve accumulation of snow due to drifting from adjacent surfaces.

4) Except as provided for in Sentences (5) and (6), the slope factor, C_s, shall be

a) 1.0 when the roof slope, α, is equal to or less than 30°,

b) $(70° - \alpha)/40°$ when α is greater than 30°, but not greater than 70°, and

c) 0 when α exceeds 70°.

5) The slope factor, C_s, for unobstructed slippery roofs where snow and ice can slide completely off the roof shall be

a) 1.0 when the roof slope, α, is equal to or less than 15°,

b) $(60° - \alpha)/45°$ when α is greater than 15°, but not greater than 60°, and

c) 0 when α exceeds 60°.

6) The slope factor, C_s, shall be 1.0 when used in conjunction with accumulation factors for increased snow load as given in Clauses (7)(c)(ii) and (7)(c)(v).

7) The accumulation factor, C_a,

a) shall be 1.0, except that

b) for large flat upper or lower roofs it shall be

i) $1.2[1 - (30/l^*)^2]$, but not less than 1.0, for roofs with $C_w = 1.0$, or

ii) $1.6[1 - (120/l^*)^2]$, but not less than 1.0, for roofs with $C_w = 0.75$ or 0.5

where

l^* = the characteristic length of the upper or lower roof defined as $l^* = 2w - w^2/l$, in metres,

w = the smaller plan dimension of the roof, in metres,

l = the larger plan dimension of the roof, in metres,

and

c) where appropriate for the shape of the roof, shall be assigned other values which account for

i) non-uniform snow loads on gable, arched or curved roofs and domes,

ii) increased snow loads in valleys,

iii) increased non-uniform snow loads due to snow drifting onto a roof which is at a level lower than other parts of the same *building* or at a level lower than another *building* within 5 m of it,

iv) increased non-uniform snow loads on areas adjacent to roof projections, such as penthouses, large *chimneys* and equipment, and

v) increased snow or ice loads due to snow sliding or drainage of melt water from adjacent roofs.

(See Appendix A.)

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Part 5
Environmental Separation
(See Appendix A.)

Section 5.1. General

5.1.1. Scope

5.1.1.1. Scope

1) The scope of this Part shall be as described in Section 2.1. (See Appendix A.)

5.1.2. Application

5.1.2.1. Separation of Environments

1) This Part applies to
- a) the control of condensation in and on, and the transfer of heat, air and moisture through *building* elements and interfaces between *building* elements that separate
  - i) interior space from exterior space,
  - ii) interior space from the ground, and
  - iii) environmentally dissimilar interior spaces, and
- b) site conditions that may affect moisture loading on *building* elements that separate interior space from exterior space, and interior space from the ground.

(See Appendix A.)

5.1.3. Definitions

5.1.3.1. Defined Words

1) Words that appear in italics are defined in Part 1.

5.1.4. Environmental Separation Requirements

5.1.4.1. Resistance to Environmental Loads

1) *Building* components and assemblies that separate dissimilar environments shall
- a) be designed to have sufficient capacity and integrity to resist or accommodate all environmental loads and effects of those loads that may be reasonably expected, having regard to
  - i) the intended use of the *building*, and
  - ii) the environment to which the components and assemblies are subject, and
- b) satisfy the requirements of this Part.

5.1.4.2. Resistance to Deterioration
(See Appendix A.)

1) Except as provided in Sentence (2), materials that comprise *building* components and assemblies that separate dissimilar environments shall be:
- a) compatible with adjoining materials, and
- b) resistant to any mechanisms of deterioration which would be reasonably expected, given the nature, function and exposure of the materials.

2) Material compatibility and deterioration resistance are not required where it can be shown that incompatibility or uncontrolled deterioration will not adversely affect any of
- a) the health or safety of *building* users,
- b) the intended use of the *building*, or
- c) the operation of *building* services.

5.1.5. Other Requirements

5.1.5.1. Requirements in Other Parts of the Code

1) Acoustical, structural and fire safety requirements of other Parts of this Code shall apply.

Section 5.2. Loads and Procedures

5.2.1. Environmental Loads

5.2.1.1. Exterior Environmental Loads

1) Except as provided in Sentences (2) and (3), climatic loads shall be determined according to Section 2.2.

2) Except as provided in Sentence (3), below ground exterior environmental loads not described

in Section 2.2. shall be determined from existing geological and hydrological data or from site tests.

3) Where local design and construction practice has shown *soil* temperature analysis to be unnecessary, *soil* temperatures need not be determined. (See Appendix A.)

5.2.1.2. Interior Environmental Loads

1) Interior environmental loads shall be derived from the intended use of the space. (See Appendix A.)

5.2.2. Procedures

5.2.2.1. Calculations

1) Heat, air and moisture transfer calculations shall conform to good practice such as described in the ASHRAE Handbooks.

2) For the purposes of any analysis conducted to indicate conformance to the thermal resistance levels required in Article 5.3.1.2., *soil* temperatures shall be determined based on annual average *soil* temperature, seasonal amplitude of variation and attenuation of variation with depth.

3) Wind load calculations shall conform to Subsection 4.1.8.

Section 5.3. Heat Transfer

(See Appendix A.)

5.3.1. Thermal Resistance of Assemblies

5.3.1.1. Required Resistance to Heat Transfer

(See Appendix A.)

1) Except as provided in Sentence (2), where a *building* component or assembly will be subjected to an intended temperature differential, the component or assembly shall include materials to resist heat transfer in accordance with the remainder of this Subsection.

2) The installation of materials to resist heat transfer in accordance with the remainder of this Subsection is not required where it can be shown that uncontrolled heat transfer will not adversely affect any of

a) the health or safety of *building* users,
b) the intended use of the *building*, or
c) the operation of *building* services.

5.3.1.2. Properties to Resist Heat Transfer

(See Appendix A.)

1) Materials and components installed to provide the required resistance to heat transfer shall provide sufficient resistance, for the interior and exterior design temperatures,

a) to minimize surface condensation on the warm side of the component or assembly,
b) in conjunction with other materials and components in the assembly, to minimize condensation within the component or assembly, and
c) in conjunction with systems installed for space conditioning, to meet the interior design thermal conditions for the intended *occupancy*.

2) Except as provided in Sentence (3), where materials or components are installed to provide the required resistance to heat transfer and are covered in the scope of the standards listed below, the materials and components shall conform to the requirements of the respective standards:

a) CAN/CGSB-12.8-M, "Insulating Glass Units,"
b) CAN/ULC-S701, "Thermal Insulation, Polystyrene, Boards and Pipe Covering," r
c) CGSB 51-GP-21M, "Thermal Insulation, Urethane and Isocyanurate, Unfaced,"
d) CAN/CGSB-51.23, "Spray-Applied Rigid Polyurethane Cellular Plastic Thermal Insulation,"
e) CAN/CGSB-51.25-M, "Thermal Insulation, Phenolic, Faced,"
f) CAN/CGSB-51.26-M, "Thermal Insulation, Urethane and Isocyanurate, Boards, Faced,"
g) CGSB 51-GP-27M, "Thermal Insulation, Polystyrene, Loose Fill,"
h) CAN/CGSB-51.60-M, "Cellulose Fibre Loose Fill Thermal Insulation,"
i) CAN/CGSB-82.1-M, "Sliding Doors,"
j) CAN/CGSB-82.5-M, "Insulated Steel Doors,"
k) CAN/ULC-S702, "Thermal Insulation, Mineral Fibre, for Buildings," or r
l) CAN/CSA-A247-M, "Insulating Fibreboard."

(See Appendix A.)

3) The requirements for *flame-spread ratings* contained in the standards listed in Sentence (2) need be applied only as required in Part 3.

4) Except as provided in Sentence (5), all metal-framed glazed assemblies separating interior *conditioned space* from interior unconditioned space or exterior space shall incorporate a thermal break to minimize condensation.

5) Metal framed glazed assemblies need not comply with Sentence (4) where these assemblies are
a) storm windows or doors, or
b) windows or doors which are required to have a *fire resistance rating*.
(See Appendix A.)

5.3.1.3. Location and Installation of Materials Providing Thermal Resistance

1) Where a material required by Article 5.3.1.1. is intersected by a *building* assembly, penetrated by a high conductance component or interrupted by expansion, control or construction joints, and where condensation is likely to occur at these intersections, penetrations or interruptions, sufficient thermal resistance shall be provided so as to minimize condensation at these locations.

2) Materials providing required thermal resistance shall have sufficient inherent resistance to air flow or be positioned in the assembly so as to prevent convective air flow through and around the material. (See Appendix A.)

3) Spray-in-place polyurethane insulation shall be installed in accordance with the requirements of CAN/CGSB-51.39, "Sprayed Application of Rigid Polyurethane Cellular Plastic Thermal Insulation for Building Construction."

Section 5.4. Air Leakage

5.4.1. Air Barrier Systems

5.4.1.1. Required Resistance to Air Leakage

(See Appendix A.)

1) Except as provided in Sentence (2), where a *building* component or assembly separates interior *conditioned space* from exterior space, interior space from the ground, or environmentally dissimilar interior spaces, the component or assembly shall contain an *air barrier system*.

2) An *air barrier system* is not required where it can be shown that uncontrolled air leakage will not adversely affect any of
a) the health or safety of *building* users,
b) the intended use of the *building*, or
c) the operation of *building* services.

5.4.1.2. Air Barrier System Properties

1) Except as provided in Sentence (2), sheet and panel type materials intended to provide the principal resistance to air leakage shall have an air leakage characteristic not greater than 0.02 L/(s • m^2) measured at an air pressure difference of 75 Pa. (See Appendix A.)

2) The air leakage limit specified in Sentence (1) is permitted to be increased where it can be shown that the higher rate of leakage will not adversely affect any of
a) the health or safety of the *building* users,
b) the intended use of the *building*, or
c) the operation of *building* services.
(See Appendix A.)

3) Except as provided in Sentence (6), where components of the *air barrier system* are covered in the scope of the standards listed below, the components shall conform to the requirements of the respective standards:
a) CAN/CGSB-63.14-M, "Plastic Skylights,"
b) CAN/CGSB-82.1-M, "Sliding Doors,"
c) CAN/CGSB-82.5-M, "Insulated Steel Doors," or
d) CAN/CSA-A440-M, "Windows."
(See Appendix A.)

4) Skylights not covered in the scope of CAN/CGSB-63.14-M, "Plastic Skylights," shall conform to the performance requirements of that standard.

5) Except as provided in Sentence (6), windows and sliding doors covered in the scope of CAN/CGSB-82.1-M, "Sliding Doors," or CAN/CSA-A440-M, "Windows," and installed as components in an *air barrier system* shall conform at least to the airtightness requirements in CSA A440.1-M, "User Selection Guide to CAN/CSA-A440-M90 Windows."

6) Where a wired glass assembly is installed as a component in an *air barrier system* in a required *fire separation*, the assembly need not conform to CAN/CSA-A440-M, "Windows" or CSA A440.1-M, "User Selection Guide to CAN/CSA-A440-M90 Windows." (See Appendix A.)

7) The *air barrier system* shall be continuous
a) across construction, control and expansion joints,
b) across junctions between different *building* assemblies, and
c) around penetrations through the *building* assembly.

8) An *air barrier system* installed in an assembly subject to wind load, and other elements of the separator that will be subject to wind load, shall transfer that load to the structure.

9) Except as provided in Sentence (11), an *air barrier system* installed in an assembly subject to wind load shall be designed and constructed to resist 100% of the specified wind load as determined according to Subsection 4.1.8. for cladding. r

10) Except as provided in Sentence (11), deflections of the *air barrier system* and other elements

of the separator that will be subject to wind load shall not adversely affect non-structural elements at 1.5 times the specified wind load.

11) Where it can be shown by test or analysis that an *air barrier system* installed in an assembly will be subject to less than 100% of the specified wind load,

a) the *air barrier system* is permitted to be designed and constructed to resist the lesser load, and
b) deflections of the *air barrier system* and other elements of the separator that will be subject to wind load shall not adversely affect non-structural elements at 1.5 times the lesser load.

Section 5.5. Vapour Diffusion

5.5.1. Vapour Barriers

5.5.1.1. Required Vapour Barrier

1) Except as provided in Sentence (2), where a *building* component or assembly will be subjected to a temperature differential and a differential in water vapour pressure, the component or assembly shall include a *vapour barrier*.

2) A *vapour barrier* is not required where it can be shown that uncontrolled vapour diffusion will not adversely affect any of

a) the health or safety of *building* users,
b) the intended use of the *building*, or
c) the operation of *building* services.

5.5.1.2. Vapour Barrier Properties and Installation

(See A-5.3.1.2 in Appendix A.)

1) The *vapour barrier* shall have sufficiently low permeance and shall be positioned in the *building* component or assembly so as to

a) minimize moisture transfer by diffusion, to surfaces within the assembly that would be cold enough to cause condensation at the design temperature and humidity conditions, or
b) reduce moisture transfer by diffusion, to surfaces within the assembly that would be cold enough to cause condensation at the design temperature and humidity conditions, to a rate that will not allow sufficient accumulation of moisture to cause deterioration or otherwise adversely affect any of
   i) the health or safety of *building* users,
   ii) the intended use of the *building*, or
   iii) the operation of *building* services.

(See Appendix A.)

2) Where materials installed to provide the required resistance to vapour diffusion are covered in the scope of the standards listed below, the materials shall conform to the requirements of the respective standards:

a) CAN/CGSB-51.33-M, "Vapour Barrier, Sheet, Excluding Polyethylene, for Use in Building Construction," or
b) CAN/CGSB-51.34-M, "Vapour Barrier, Polyethylene Sheet for Use in Building Construction."

(See Appendix A.)

3) Coatings applied to gypsum wallboard to provide required resistance to vapour diffusion shall be shown to conform with the requirements of Sentence (1) when tested in accordance with CAN/CGSB-1.501-M, "Method for Permeance of Coated Wallboard."

4) Coatings applied to materials other than gypsum wallboard to provide required resistance to vapour diffusion shall be shown to conform with the requirements of Sentence (1) when tested in accordance with ASTM E 96, "Water Vapor Transmission of Materials," by the desiccant method (dry cup).

Section 5.6. Precipitation

5.6.1. Protection from Precipitation

5.6.1.1. Required Protection from Precipitation

(See Appendix A.)

1) Except as provided in Sentence (2), where a *building* component or assembly is exposed to precipitation, the component or assembly shall

a) minimize ingress of precipitation into the component or assembly, and
b) prevent ingress of precipitation into interior space.

2) Protection from ingress of precipitation is not required where it can be shown that such ingress will not adversely affect any of

a) the health or safety of *building* users,
b) the intended use of the *building*, or
c) the operation of *building* services.

5.6.1.2. Protective Material and Component Properties

1) Where materials or components applied to sloped or horizontal assemblies are installed to

provide required protection from precipitation and are covered in the scope of the standards listed below, the materials or components shall conform to the requirements of the respective standards:

a) ASTM D 2178, "Asphalt Glass Felt Used in Roofing and Waterproofing,"
b) CAN/CGSB-37.4-M, "Fibrated, Cutback Asphalt, Lap Cement for Asphalt Roofing,"
c) CAN/CGSB-37.5-M, "Cutback Asphalt Plastic Cement,"
d) CAN/CGSB-37.8-M, "Asphalt, Cutback, Filled, for Roof Coating,"
e) CGSB 37-GP-9Ma, "Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing,"
f) CGSB 37-GP-21M, "Tar, Cutback, Fibrated, for Roof Coating,"
g) CAN/CGSB-37.50-M, "Hot Applied Rubberized Asphalt for Roofing and Waterproofing,"
h) CGSB 37-GP-52M, "Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric,"
r i) CAN/CGSB-37.54, "Polyvinyl Chloride Roofing and Waterproofing Membrane,"
j) CGSB 37-GP-56M, "Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing,"
k) CGSB 37-GP-64M, "Mat Reinforcing, Fibrous Glass, for Membrane Waterproofing Systems and Built-Up Roofing,"
l) CGSB 41-GP-6M, "Sheets, Thermosetting Polyester Plastics, Glass Fiber Reinforced,"
m) CAN/CGSB-51.32-M, "Sheathing, Membrane, Breather Type,"
n) CAN/CGSB-63.14-M, "Plastic Skylights,"
o) CSA A123.1-M, "Asphalt Shingles Surfaced with Mineral Granules,"
p) CSA A123.2-M, "Asphalt Coated Roofing Sheets,"
q) CSA A123.3-M, "Asphalt or Tar Saturated Roofing Felt,"
r) CSA A123.4-M, "Bitumen for Use in Construction of Built-Up Roof Coverings and Dampproofing and Waterproofing Systems,"
s) CAN/CSA-A123.5-M, "Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules,"
t) CSA A123.17, "Asphalt-Saturated Felted Glass-Fibre Mat for Use in Construction of Built-Up Roofs,"
u) CAN/CSA-A220.0-M, "Performance of Concrete Roof Tiles,"
r v) CSA O118.1, "Western Cedars, Shakes and Shingles," not less than No. 2 grade, or
w) CSA-O118.2-M, "Eastern White Cedar Shingles," not less than B grade.

(See Appendix A.)

2) Skylights that are not covered in the scope of CAN/CGSB-63.14-M, "Plastic Skylights," shall conform to the performance requirements of that standard.

3) Except as provided in Sentence (5), where materials or components applied to vertical assemblies are installed to provide required protection from precipitation and are covered in the scope of the standards listed below, the materials or components shall conform to the requirements of the respective standards:

a) ASTM C 212, "Structural Clay Facing Tile,"
b) CAN/CGSB-11.3-M, "Hardboard," types 1, 2 or 5 when not factory finished,
c) CAN/CGSB-11.5-M, "Hardboard, Precoated, Factory Finished, for Exterior Cladding,"
d) CAN/CGSB-34.4-M, "Siding, Asbestos-Cement, Shingles and Clapboards,"
e) CAN/CGSB-34.5-M, "Sheets, Asbestos-Cement, Corrugated,"
f) CAN/CGSB-34.14-M, "Sheets, Asbestos-Cement, Decorative,"
g) CAN/CGSB-34.16-M, "Sheets, Asbestos-Cement, Flat, Fully Compressed,"
h) CAN/CGSB-34.17-M, "Sheets, Asbestos-Cement, Flat, Semicompressed,"
i) CAN/CGSB-34.21-M, "Panels, Sandwich, Asbestos-Cement with Insulating Cores,"
j) CAN/CGSB-41.24, "Rigid Vinyl Siding, Soffits and Fascia," r
k) CAN/CGSB-51.32-M, "Sheathing, Membrane, Breather Type," r
l) CAN/CGSB-82.1-M, "Sliding Doors," r
m) CAN/CGSB-82.5-M, "Insulated Steel Doors," r
n) CAN/CGSB-93.1-M, "Sheet, Aluminum Alloy, Prefinished, Residential," r
o) CAN/CGSB-93.2-M, "Prefinished Aluminum Siding, Soffits and Fascia, for Residential Use," r
p) CAN/CGSB-93.3-M, "Prefinished Galvanized and Aluminum-Zinc Alloy Steel Sheet for Residential Use," r
q) CAN/CGSB-93.4, "Galvanized and Aluminum-Zinc Alloy Coated Steel Siding, Soffits and Fascia, Prefinished, Residential," r
r) CSA A371, "Masonry Construction for Buildings," Section 4, r
s) CAN/CSA-A440-M, "Windows," r
t) CSA O115-M, "Hardwood and Decorative Plywood," r
u) CSA O118.1, "Western Cedars, Shakes and Shingles," with shakes not less than No. 1 grade and shingles not less than No. 2 grade, except that No. 3 grade may be used for undercoursing, r

r v) CSA O118.2-M, "Eastern White Cedar Shingles," not less than B (clear) grade, except that C grade may be used for undercoursing,
r w) CSA O121-M, "Douglas Fir Plywood,"
r x) CSA O151-M, "Canadian Softwood Plywood,"
r y) CSA O153-M, "Poplar Plywood,"
r z) CAN/CSA-O325.0, "Construction Sheathing," or
r aa) CSA O437.0, "OSB and Waferboard."
(See Appendix A.)

4) Except as provided in Sentence (5), windows and sliding doors exposed to the exterior and covered in the scope of CAN/CSA-A440-M, "Windows," or CAN/CGSB-82.1-M, "Sliding Doors," shall conform at least to the water tightness requirements in CSA A440.1-M, "User Selection Guide to CAN/CSA-A440-M90 Windows."

5) Where a wired glass assembly in a required *fire separation* is exposed to the exterior, the assembly need not conform to CAN/CSA-A440-M, "Windows," or CSA A440.1-M, "User Selection Guide to CAN/CSA-A440-M90 Windows." (See Appendix A.)

5.6.1.3. Installation of Protective Materials

1) Where a material applied to a sloped or horizontal assembly is installed to provide required protection from precipitation and its installation is covered in the scope of one of the standards listed below, installation shall conform to the requirements of the respective standard:

a) CAN/CGSB-37.51-M, "Application of Hot-Applied Rubberized Asphalt for Roofing and Waterproofing,"
b) CGSB 37-GP-55M, "Application of Sheet Applied Flexible Polyvinyl Chloride Roofing Membrane,"
c) CAN3-A123.51-M, "Asphalt Shingle Application on Roof Slopes 1:3 and Steeper," or
d) CAN3-A123.52-M, "Asphalt Shingle Application on Roof Slopes 1:6 to Less Than 1:3."

2) Protective materials applied to sloped or horizontal assemblies shall be installed to resist wind-uplift loads determined according to Subsection 4.1.8.

3) Where masonry applied to vertical assemblies is installed to provide required protection from precipitation, installation shall conform to the requirements of CSA A371, "Masonry Construction for Buildings."

4) Where protective materials applied to assemblies are installed to provide required protection from precipitation, the materials shall be installed to shed precipitation or otherwise minimize its entry into the assembly and prevent its penetration through the assembly.

5.6.2. Sealing, Drainage, Accumulation and Disposal

5.6.2.1. Sealing and Drainage

(See Appendix A.)

1) Except as provided in Sentence (2), materials, components, assemblies, joints in materials, junctions between components and junctions between assemblies exposed to precipitation shall be

a) sealed to prevent ingress of precipitation, or
b) drained to direct precipitation to the exterior.

2) Sealing or drainage are not required where it can be shown that the omission of sealing and drainage will not adversely affect any of

a) the health or safety of *building* users,
b) the intended use of the *building*, or
c) the operation of *building* services.

5.6.2.2. Accumulation and Disposal

1) Where water, snow or ice can accumulate on a *building*, provision shall be made to minimize the likelihood of hazardous conditions arising from such accumulation.

2) Where precipitation can accumulate on sloped or horizontal assemblies, provision shall be made for drainage conforming with the relevant provincial, territorial or municipal regulations or, in the absence of such regulations, with Article 4.10.4. of the National Plumbing Code of Canada 1995.

3) Where downspouts are provided and are not connected to a sewer, provisions shall be made to

a) divert the water from the *building*, and
b) prevent *soil* erosion.

4) Junctions between vertical assemblies, and sloped or horizontal assemblies, shall be designed and constructed to minimize the flow of water from the sloped or horizontal assembly onto the vertical assembly.

Section 5.7. Surface Water

5.7.1. Protection from Surface Water

5.7.1.1. Prevention of Accumulation and Ingress

1) Except as provided in Sentence (2), the *building* shall be located, the *building* site graded, catch basins installed, or *foundation* walls constructed so that surface water will not e

a) accumulate against or enter into the *building*, or
b) damage moisture-susceptible materials.

2) *Buildings* specifically designed to accommodate accumulation of water at the *building* or water ingress need not comply with Clause (1)(a).

Section 5.8. Moisture in the Ground

5.8.1. Foundation and Floor Drainage

5.8.1.1. Required Drainage

1) Except where a wall or floor is subject to continuous hydrostatic pressure, or unless it can be shown to be unnecessary, the bottom of every exterior *foundation* wall and every floor-on-ground shall be provided with drainage. (See Appendix A.)

5.8.1.2. Drainage Materials and Installation

1) Drainage shall be specified and installed to accommodate the drainage load.

5.8.2. Protection from Moisture in the Ground

(See Appendix A.)

5.8.2.1. Required Moisture Protection

1) Except as provided in Sentence (2), where a *building* element separates interior space from the ground, materials, components or assemblies shall be installed to prevent moisture transfer into the space.

2) Materials, components or assemblies need not be installed to prevent moisture transfer from the ground where it can be shown that such transfer will not adversely affect any of

a) the health or safety of *building* users,
b) the intended use of the *building*, or
c) the operation of *building* services.

5.8.2.2. Protective Material and Component Properties

1) Except where it can be shown that lesser protection will not lead to adverse conditions, or as provided in Article 5.8.2.3., materials and components installed to provide required moisture protection shall conform to the requirements of this Article.

2) Except as provided in Sentence (3), materials installed to provide required moisture protection shall be capable of bridging

a) construction, control and expansion joints,
b) junctions between different *building* assemblies, and
c) junctions between *building* assemblies and elements penetrating *building* assemblies.

3) Where the required moisture protection material is not capable of bridging construction, control and expansion joints, those joints shall be designed to maintain the continuity of the moisture protection.

4) Moisture protection materials and components shall have sufficiently low water permeance to resist moisture loads.

5) Moisture protection shall be designed and constructed to resist design hydrostatic pressures as determined in accordance with Section 4.2.

6) Where materials installed to provide the required resistance to moisture transfer are covered in the scope of the standards listed below, the materials shall conform to the requirements of the respective standards:

a) CAN/CGSB-37.2-M, "Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings,"
b) CGSB 37-GP-9Ma, "Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing,"
c) CAN/CGSB-37.16-M, "Filled Cutback Asphalt for Dampproofing and Waterproofing,"
d) CAN/CGSB-37.50-M, "Hot Applied Rubberized Asphalt for Roofing and Waterproofing,"
e) CGSB 37-GP-52M, "Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric,"
f) CAN/CGSB-37.54, "Polyvinyl Chloride Roofing and Waterproofing Membrane," r
g) CGSB 37-GP-56M, "Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing," or

h) CSA A123.4-M, "Bitumen for Use in Construction of Built-Up Roof Coverings and Dampproofing and Waterproofing Systems."

(See Appendix A.)

7) Except as provided in Sentence (8), materials covered in the scope of the standards listed below shall not be installed to provide the required resistance to moisture transfer:

a) CGSB 37-GP-6Ma, "Asphalt, Cutback, Unfilled, for Dampproofing," or
b) CGSB 37-GP-18Ma, "Tar, Cutback, Unfilled, for Dampproofing."

8) Where the substrate is cast-in-place concrete, and a drainage layer is installed between the *building* assembly and the *soil*, and the assembly will not be subject to hydrostatic pressure,

a) materials and components installed to provide the required resistance to moisture transfer need not conform with Sentences 5.8.2.2.(1) to (5), and
b) materials covered in the scope of
   i) CGSB 37-GP-6Ma, "Asphalt, Cutback, Unfilled, for Dampproofing," or
   ii) CGSB 37-GP-18Ma, "Tar, Cutback, Unfilled, for Dampproofing,"

   are permitted to be installed to provide the required resistance to moisture transfer where those materials conform to the requirements of the standards.

(See Appendix A.)

5.8.2.3. Installation of Moisture Protection

1) Except as provided in Sentence (2), where materials are installed to provide the required resistance to moisture transfer and their installation is covered in the scope of the standards listed below, installation shall conform to the waterproofing requirements of the respective standards:

a) CAN/CGSB-37.3-M, "Application of Emulsified Asphalts for Dampproofing or Waterproofing,"
b) CGSB 37-GP-36M, "Application of Filled Cutback Asphalts for Dampproofing and Waterproofing,"
c) CGSB 37-GP-37M, "Application of Hot Asphalt for Dampproofing or Waterproofing," or
d) CAN/CGSB-37.51-M, "Application of Hot-Applied Rubberized Asphalt for Roofing and Waterproofing."

2) Where the substrate is cast-in-place concrete, and a drainage layer is installed between the *building* assembly and the *soil*, and the assembly will not be subject to hydrostatic pressure

a) materials and components installed to provide the required resistance to moisture transfer and whose installation is covered in the scope of the standards listed in Sentence (1), are permitted to be installed in conformance with the dampproofing requirements of the standards listed in Sentence (1), or
b) materials installed to provide the required resistance to moisture transfer and whose installation is covered in the scope of the standards listed below, shall be installed in conformance with the requirements of the respective standards:
   i) CGSB 37-GP-12Ma, "Application of Unfilled Cutback Asphalt for Dampproofing," or
   ii) CAN/CGSB-37.22-M, "Application of Unfilled Cutback Tar Foundation Coating for Dampproofing."

(See A-5.8.2.2.(8) in Appendix A.)

Part 6
Heating, Ventilating and Air-Conditioning

Section 6.1. General

6.1.1. Application

6.1.1.1. Scope

1) The scope of this Part shall be as described in Section 2.1.

6.1.1.2. Application

1) This Part applies to systems and equipment for heating, ventilating and air-conditioning services.

6.1.2. Definitions

6.1.2.1. Defined Terms

1) Words that appear in italics are defined in Part 1.

6.1.3. Plans and Specifications

6.1.3.1. Required Plans and Specifications

1) Plans, specifications and other information for heating, ventilating and air-conditioning systems shall conform to Subsection 2.3.5.

Section 6.2. Design and Installation

6.2.1. General

6.2.1.1. Good Engineering Practice

1) 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

a) the ASHRAE Handbooks and Standards,
b) the HRAI Digest,
c) the Hydronics Institute Manuals,
d) the NFPA standards,
e) the SMACNA Manuals,
f) the Industrial Ventilation Manual published by the American Conference of Governmental Industrial Hygienists, and
g) CAN/CSA-Z317.2-M, "Special Requirements for Heating,Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities."

6.2.1.2. Fire Safety Requirements

1) The fire safety characteristics of heating, ventilating and air-conditioning systems shall comply with Subsection 3.6.5.

2) Characteristics referred to in Sentence (1) include but are not limited to

a) use of *combustible* materials in duct systems,
b) *flame-spread ratings* and smoke-developed ratings of duct and pipe materials and coverings,
c) installation of equipment relative to property lines, and
d) requirements for *fire dampers* and *fire-stop flaps*.

6.2.1.3. Capacity of Heating Appliances in Dwelling Units

1) The required capacity of a space heating *appliance* located in a *dwelling unit* and serving only that *dwelling unit*, shall be determined in accordance with CAN/CSA-F280-M, "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.

6.2.1.4. Structural Movement

1) Mechanical systems and equipment shall be designed and installed to accommodate the maximum relative structural movement provided for in the construction of the *building*. (See Article 4.1.1.5., Subsection 4.1.9. and Article 4.1.10.5. for information on the types of structural movements that may be encountered.) (See Appendix A.)

6.2.1.5. Installation Standards

1) Except as provided in Articles 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 or territorial requirements or, in the absence of such requirements, to the requirements of

a) CAN/CGA-B149.1-M, "Natural Gas Installation Code,"
b) CAN/CGA-B149.2-M, "Propane Installation Code,"
c) CSA B51, "Boiler, Pressure Vessel, and Pressure Piping Code,"
d) CSA B52, "Mechanical Refrigeration Code,"
e) CAN/CSA-B139-M, "Installation Code for Oil Burning Equipment,"
f) CAN/CSA-B365-M, "Installation Code for Solid-Fuel-Burning Appliances and Equipment," and
g) CSA C22.1, "Canadian Electrical Code, Part I."

6.2.1.6. Fireplaces

1) Fireplaces shall conform to the requirements of Section 9.22.

6.2.1.7. Heat Recovery Ventilators

1) Heat recovery ventilators with rated capacities of not less than 25 L/s and not more than 200 L/s shall be installed in accordance with Subsection 9.32.3.

6.2.1.8. Outside Design Conditions

1) 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 requiring periodic maintenance and forming part of a heating, ventilating or air-conditioning system shall be installed with provision for access for inspection, maintenance, repair and cleaning. (See Appendix A.)

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 shall be protected from freezing if

a) it may be adversely affected by freezing temperatures; and
b) it is located in an unheated area.

6.2.1.10. Expansion, Contraction and System Pressure

1) Heating and cooling systems shall be designed to allow for expansion and contraction of the heat transfer fluid and to maintain the system pressure within the rated working pressure limits of all components of the system.

6.2.1.11. Asbestos

1) 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

1) Any covering of an access opening through which a person could enter shall be openable from the inside without the use of keys where there is a possibility of the opening being accidentally closed while the system or equipment is being serviced.

6.2.2. Ventilation

6.2.2.1. Required Ventilation

1) Except as provided in Sentence (3), all rooms and spaces in *buildings* shall be ventilated in accordance with this Part.

2) Except in *storage garages* covered by Article 6.2.2.3., the rates at which outdoor air is supplied to rooms and spaces in *buildings* by ventilation systems shall be not less than the rates required by ASHRAE Standard 62, "Ventilation for Acceptable Indoor Air Quality."

3) Self-contained mechanical ventilation systems serving only one *dwelling unit* which conform to the requirements of Subsection 9.32.3. shall be considered to satisfy the requirements of this Article.

6.2.2.2. Natural Ventilation

1) The ventilation required by Article 6.2.2.1. shall be provided by mechanical ventilation except that it can be provided by natural ventilation or a combination of natural and mechanical ventilation in

a) *buildings* of other than *residential occupancy* having an *occupant load* of not more than one person per 40 m^2 during normal use,
b) *buildings* of *industrial occupancy* where the nature of the process contained therein permits or requires the use of large openings in the *building* envelope even during the winter, and
c) seasonal *buildings* not intended to be occupied during the winter.

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

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) Outdoor air intakes and exhaust outlets at the *building* exterior shall be designed or located so that air entering the *building* system will not contain more contaminants than the normal exterior air of the locality in which the *building* is situated.

3) Exterior openings for outdoor air intakes and exhaust outlets shall be shielded from the entry of snow and rain and shall be fitted with corrosion-resistant screens of mesh having openings not larger than 15 mm, except where experience has shown that climatic conditions require larger openings to avoid icing over of the screen openings.

4) Screens required in Sentence (3) 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 ULC-S111, "Fire Tests for Air Filter Units."

2) When electrostatic-type filters are used, they shall be installed so as to ensure that the electric circuit is automatically de-energized when filter access doors are opened or, in *dwelling units*, when the *furnace* 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
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 from sources of ignition such as *chimneys* or incinerators of not less than

a) 12 m when the tower exterior construction is *noncombustible*, and
b) 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 m^3 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

1) The design, construction and installation of air duct distribution systems serving heating systems in which the rated heat input does not exceed 120 kW shall conform to this Subsection and Subsection 6.2.3.

6.2.4.2. Duct Design

1) The design of ducts and fittings shall conform to SMACNA, "HVAC Duct Construction Standards – Metal and Flexible."

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.

8) *Combustible* ducts in concrete slabs-on-ground that are connected to a *furnace* supply *plenum* shall be located not less than

a) 600 mm from that *plenum*, and
b) 600 mm from its connection to a riser or register.

9) Ducts in or beneath concrete slabs-on-ground shall be watertight and corrosion-, decay-, and mildew-resistant.

6.2.4.4. Warm-Air Supply Outlets

1) In a *dwelling unit*, a warm-air supply outlet shall be provided in each finished room which is located adjacent to unheated space.

2) Except as provided in Sentence (3), when a room described in Sentence (1) is located adjacent to exterior walls, a warm air supply outlet shall be located so as to bathe at least one exterior wall or window with warm air, except in bathrooms, utility rooms or kitchens, where this may not be practical.

3) Where the heating system is also designed to provide ventilation air, ceiling outlets or outlets located high on interior walls may be installed provided the outlets are

a) designed for this purpose, and
b) installed with diffusers.

4) At least one warm-air supply outlet shall be provided for each 40 m^2 of *floor area* in unfinished *basements* serving *dwelling units*.

5) The warm air supply outlet required in Sentence (4) shall be located so as to provide adequate distribution of warm air throughout the *basement*.

6) Except for pipeless *furnaces* and floor *furnaces*, the capacity of warm-air supply outlets serving *dwelling units*

a) shall be not less than the design heat loss from the area served, and
b) shall not exceed 3 kW per outlet.

7) In *basements* and heated crawl spaces, the calculated heat gain from the *supply ducts* and *plenum* surfaces may be considered in calculating the design heat loss.

8) Warm-air supply outlets located in finished areas

a) shall be provided with diffusers and adjustable openings, and
b) shall not be located on a *furnace plenum*.

9) The temperature of supply air at warm-air supply outlets shall not exceed 70°C.

6.2.4.5. Concrete Slabs-on-Ground

1) Warm-air supply systems for *buildings* of *residential occupancy* built on concrete slabs-on-ground

a) shall be installed in the slab, and
b) shall be of the perimeter loop type or radial perimeter type.

6.2.4.6. Adjustable Dampers and Balance Stops

1) All branch *supply ducts* which are not fitted with diffusers with adjustable balance stops shall be

a) supplied with adjustable dampers, and
b) fitted with devices to indicate the positions of the dampers.

6.2.4.7. Return-Air System

1) A *public corridor* or public stairway shall not be used as a return-air *plenum*.

2) Except for a return-air *plenum* located within a *dwelling unit*, where a ceiling assembly is used as a *plenum*, the requirements of Subsection 6.2.3. shall apply.

6.2.5. Heating Appliances, General

6.2.5.1. Location of Appliances

1) Except for *appliances* installed in *dwelling units*, fuel-fired heating *appliances* shall be located, enclosed or separated from the remainder of the *building* in conformance with Section 3.6. (See also Subsection 9.10.10.)

6.2.5.2. Appliances Installed outside the Building

1) Fuel-fired *appliances* installed on the roof of a *building* or otherwise outside the *building* shall be designed for outdoor use.

6.2.6. Incinerators

6.2.6.1. Applicable Standard

1) The design, construction, installation and *alteration* of every indoor incinerator shall conform to NFPA 82, "Incinerators, Waste and Linen Handling Systems and Equipment."

Part 9
Housing and Small Buildings

Section 9.1. General

9.1.1. Scope

9.1.1.1. Scope

1) The scope of this Part shall be as described in Section 2.1. (See Appendix A regarding application to seasonally and intermittently occupied *buildings*.)

Section 9.2. Definitions

9.2.1. General

9.2.1.1. Defined Words

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

1) Concrete shall be designed, mixed, placed, cured and tested in accordance with CAN3-A438-M, "Concrete Construction for Housing and Small Buildings."

9.3.1.2. Cement

1) Cement shall meet the requirements of CAN/CSA-A5, "Portland Cement."

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 Clause 15.5 of CSA A23.1, "Concrete Materials and Methods of Concrete Construction."

9.3.1.4. Aggregates

1) Aggregates shall
a) consist of sand, gravel, crushed *rock*, crushed air-cooled blast *furnace* slag, expanded shale or expanded clay conforming to CSA A23.1, "Concrete Materials and Methods of Concrete Construction," and
b) be clean, well-graded and free of injurious amounts of organic and other deleterious material.

9.3.1.5. Water

1) Water shall be clean and free of injurious amounts of oil, organic matter, sediment or any other deleterious material.

9.3.1.6. Compressive Strength

(See also Articles 9.12.4.1., 9.15.4.1. and 9.18.6.1.)

1) Except as provided elsewhere in this Part, the compressive strength of unreinforced concrete after 28 days shall be not less than
a) 15 MPa for walls, columns, fireplaces and *chimneys*, *foundation* walls, grade beams, piers, and floors other than those for garages and carports, and
b) 25 MPa for garage and carport floors, and exterior steps.

2) Concrete used for garage and carport floors and exterior steps shall have air entrainment of 5 to 8%.

9.3.1.7. Concrete Mixes

1) The concrete mixes described in Table 9.3.1.7. shall be considered acceptable if, when measured according to the slump test described in Appendix A of CAN3-A438-M, "Concrete Construction for Housing and Small Buildings," the slump does not exceed
a) 150 mm for footings for walls, columns, fireplaces and *chimneys*, *foundation* walls, grade beams and piers, or
b) 100 mm for slabs-on-ground.

Table 9.3.1.7.
Concrete Mixes
Forming Part of Sentence 9.3.1.7.(1)

Maximum Size of Coarse Aggregate, mm	Materials, volume					
	Cement		Fine Aggregate (damp average coarse sand)		Coarse Aggregate (gravel or crushed stone)	
	Parts	L[1]	Parts	L	Parts	L
14	1	28	1.75	49	2	56
20	1	28	1.75	49	2.5	70
28	1	28	2	56	3	84
40	1	28	2	56	3.5	98

Notes to Table 9.3.1.7.:
(1) A 40 kg bag of cement contains 28 L.

2) Aggregate for unreinforced concrete mixes referred to in Sentence (1) shall not exceed in size

a) 1/5 the distance between the sides of vertical forms, or
b) 1/3 the thickness of flatwork.

9.3.1.8. Admixtures

1) Admixtures shall conform to ASTM C 260, "Air-Entraining Admixtures for Concrete," or ASTM C 494, "Chemical Admixtures for Concrete," as applicable.

9.3.1.9. Reinforced Concrete

1) Reinforced concrete shall be designed to conform to the requirements of Part 4.

9.3.1.10. Cold Weather Requirements

1) When the air temperature is below 5°C, concrete shall be

a) kept at a temperature of not less than 10°C or more than 25°C while being mixed and placed, and
b) maintained at a temperature of not less than 10°C for 72 h after placing.

2) No frozen material or ice shall be used in concrete described in Sentence (1).

9.3.2. Lumber and Wood Products

9.3.2.1. Grade Marking

1) Lumber for joists, rafters, trusses and beams and for the uses listed in Table 9.3.2.1. shall be identified by a grade stamp to indicate its grade as determined by the NLGA "Standard Grading Rules for Canadian Lumber." (See Appendix A.)

9.3.2.2. Lumber Grades

1) Except for joists, rafters, trusses and beams, visually graded lumber shall conform to the grades in Table 9.3.2.1. (See Article 9.23.4.2. for joists, rafters and beams and Article 9.23.13.11. for trusses.)

9.3.2.3. Machine Stress Rated Lumber

1) Machine stress rated lumber shall conform to the requirements of Subsection 4.3.1.

9.3.2.4. OSB, Waferboard and Plywood Marking

1) OSB, waferboard and plywood used for roof sheathing, wall sheathing and subflooring shall be legibly identified on the face of the material indicating

a) the manufacturer of the material,
b) the standard to which it is produced, and
c) that the material is of an exterior type.

9.3.2.5. Moisture Content

1) Moisture content of lumber shall be not more than 19% at the time of installation.

9.3.2.6. Lumber Dimensions

1) Lumber dimensions referred to in this Part are actual dimensions determined in conformance with CAN/CSA-O141, "Softwood Lumber."

9.3.2.7. Panel Thickness Tolerances

1) The thicknesses specified in this Part for plywood, hardboard, particleboard, OSB and waferboard shall be subject to the tolerances permitted in the standards referenced for these products unless specifically indicated herein.

9.3.2.8. Undersized Lumber

1) Joist, rafter, lintel and beam members up to 5% less than the actual Canadian standard sizes are permitted to be used provided the allowable spans for the grade and species of lumber under consideration are reduced 5% from those shown in the span tables for full size members. (See Appendix A.)

Table 9.3.2.1.
Minimum Lumber Grades for Specific End Uses
Forming Part of Sentence 9.3.2.1.(1)

Use	Boards[1]			Framing
	Paragraph in the NLGA grading rules under which boards are graded			
	All Species		Eastern White Pine & Red Pine	All Species
	Para 113	Para 114	Para 118	
Stud wall framing (*loadbearing* members)	—	—	—	Stud, Standard, No. 2
Stud wall framing (non-*loadbearing* members)	—	—	—	Stud, Utility, No. 3
Plank frame construction (*loadbearing* members)	No. 3 Common	—	No. 3 Common	No. 2
Plank frame construction (non-*loadbearing* members)	No. 5 Common	—	No. 5 Common	Economy, No. 3
Posts and beams less than 114 mm in thickness	—	—	—	Standard, No. 2
Posts and beams not less than 114 mm in thickness	—	—	—	Standard
Roof sheathing	No. 3 Common	Standard	No. 4 Common	—
Subflooring	No. 3 Common	Standard	No. 3 Common	—
Wall sheathing when required as a nailing base	No. 4 Common	Utility	No. 4 Common	—
Wall sheathing not required as a nailing base	No. 5 Common	Economy	No. 5 Common	—

Notes to Table 9.3.2.1.:
(1) See Appendix A.

9.3.2.9. Termite and Decay Protection

1) In localities where termites are known to occur, the clearance between structural wood elements and the ground shall be not less than 450 mm, unless the structural wood elements are pressure treated with a chemical that is toxic to termites.

2) Structural wood elements shall be pressure treated with a preservative to resist decay where

a) the structural wood elements are in contact with the ground, or
b) the vertical clearance between structural wood elements and the ground is less than 150 mm. (See also Articles 9.23.2.2. and 9.23.2.3.)

3) Where wood is required by this Article to be treated to resist termites or decay, such treatment shall be in accordance with the requirements of

r a) CSA O80.1, "Preservative Treatment of All Timber Products by Pressure Processes,"
b) CSA O80.2, "Preservative Treatment of Lumber, Timber, Bridge Ties, and Mine Ties by Pressure Processes," r
c) CSA O80.9, "Preservative Treatment of Plywood by Pressure Processes," or r
d) CSA O80.15, "Preservative Treatment of Wood for Building Foundation Systems, Basements, and Crawl Spaces by Pressure Processes." r

9.3.3. Metal

9.3.3.1. Sheet Metal Thickness

1) 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, include the thickness of the coating unless otherwise indicated.

9.3.3.2. Galvanized Sheet Metal

1) 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

r a) ASTM A 653/A 653M, "Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process," or

r b) ASTM A 924/A 924M, "Steel Sheet, Metallic-Coated by the Hot Dip Process."

Section 9.4. Structural Requirements

(See Appendix A.)

9.4.1. General

9.4.1.1. Structural Design

1) Except as provided in Sentence (2), Sentence 9.23.4.2.(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

1) Except for columns described in Section 9.17. and beams described in Subsection 9.23.4., 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. Specified Loads

9.4.2.1. Application

1) 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. Specified Snow Loads

1) Except as provided in Sentences (2) and (3), specified snow loads shall be not less than those calculated using the following formula:

$$S = C_b \bullet S_s + S_r$$

where

S = the specified 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 in kPa, determined according to Subsection 2.2.1., and

S_r = the associated rain load in kPa, determined according to Subsection 2.2.1.

2) In no case shall the specified snow load be less than 1 kPa.

3) Bow string, arch or semi-circular roof trusses having an unsupported span greater than 6 m shall be designed in conformance with the snow load requirements in Subsection 4.1.7.

9.4.2.3. Balconies

1) Residential balconies not used as passageways shall be designed to carry the specified roof snow load or 1.9 kPa, whichever is greater.

9.4.2.4. Attics

1) Residential attics having limited accessibility to preclude storage of equipment or material may be designed for a total specified load of 0.5 kPa, where the total specified load is the sum of the specified *dead load* plus the specified live ceiling load.

9.4.3. Deflections

9.4.3.1. Deflections

1) The maximum deflection of structural members shall conform to Table 9.4.3.1.

2) *Dead loads* need not be considered in computing deflections referred to in Sentence (1).

Table 9.4.3.1.
Maximum Deflections
Forming Part of Sentence 9.4.3.1.(1)

Structural Members	Type of Ceiling Supported	Max. Allowable Deflection as an Expressed Ratio of the Clear Span
Roof rafters, roof joists, roof beams and roof decking of plank and beam construction	No ceiling Other than plaster or gypsum board Plaster or gypsum board	1/180 1/240 1/360
Ceiling joists	Other than plaster or gypsum board Plaster or gypsum board	1/240 1/360
Floor beams, floor joists and floor decking	All cases	1/360

9.4.4. Foundation Conditions

9.4.4.1. Allowable Bearing Pressures

1) 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 9.4.4.1.

Table 9.4.4.1.
Allowable Bearing Pressure for Soil or Rock
Forming Part of Sentence 9.4.4.1.(1)

Type and Condition of *Soil* or *Rock*	Maximum Allowable Bearing Pressure, kPa
Dense or compact sand or gravel(1)	150
Loose sand or gravel(1)	50
Dense or compact silt(1)	100
Stiff clay(1)	150
Firm clay(1)	75
Soft clay(1)	40
Till	200
Clay shale	300
Sound *rock*	500

Notes to Table 9.4.4.1.:
(1) See 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

1) Where a *foundation* bears on gravel, sand or silt, and the water table is within a distance below the *bearing surface* equal to the width of the *foundation*, the allowable bearing pressure shall be 50% of that determined in Article 9.4.4.1.

9.4.4.4. Soil Movement

1) Where a *foundation* is located in an area 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

1) 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/m^3 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. Design of Areas and Spaces

9.5.1. General

9.5.1.1. Method of Measurement

1) Unless otherwise indicated herein, dimensions of rooms or spaces shall be measured between finished wall surfaces and between finished floor and ceiling surfaces.

9.5.2. Barrier-Free Design

9.5.2.1. General

1) Except as provided in Articles 9.5.2.3. and 3.8.1.1., every *building* shall be designed in conformance with Section 3.8.

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

1) Where a *barrier-free* path of travel required in Article 9.5.2.1. is provided to any *storey* above the *first storey*, the requirements in Article 3.3.1.7. shall apply.

9.5.2.3. Exception for Apartment Buildings

1) Except as provided in Sentence (2), if the *building* is not equipped with an elevator, the *barrier-free* path of travel described in Section 3.8. need only be provided on the entrance level of an apartment *building*.

2) The *barrier-free* path of travel described in Section 3.8. need not be provided where the difference in floor elevation between the entrance level and every *dwelling unit* exceeds 600 mm.

9.5.3. Ceiling Heights

9.5.3.1. Heights of Rooms or Spaces

1) Heights of rooms or spaces in *residential occupancies* shall conform to Table 9.5.3.1.

2) Areas in rooms or spaces over which ceiling height is not less than the minimum specified in Table 9.5.3.1. shall be contiguous with the entry or entries to those rooms or spaces.

9.5.3.2. Mezzanines

1) The clear height above and below a *mezzanine* floor assembly in all *occupancies* shall be not less than 2.1 m.

9.5.3.3. Storage Garages

1) The clear height in a *storage garage* shall be not less than 2 m.

9.5.4. Hallways

9.5.4.1. Hallway Width

1) The unobstructed width of a hallway within a *dwelling unit* shall be not less than 860 mm, except that the hallway width is permitted to be 710 mm where

Table 9.5.3.1.
Room Heights
Forming Part of Sentence 9.5.3.1.(1)

Room or Space	Minimum Heights, m	Minimum Area over which Minimum Height shall be Provided (1)
Living room or space	2.3	Lesser of area of the space or 10.0 m^2
Dining room or space	2.3	Lesser of 100% of actual floor area or 5.2 m^2
Kitchen or kitchen space	2.3	Lesser of 100% of actual floor area or 3.2 m^2
Master bedroom or bedroom space	2.3	Lesser of 100% of actual floor area or 4.9 m^2
Other bedroom or sleeping space	2.3	Lesser of 100% of actual floor area or 3.5 m^2
Unfinished *basement* including laundry area therein	1.95	Area 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 *grade*	2.1	Lesser of 100% of actual floor area or 2.2 m^2
Passage, hall or main entrance vestibule and finished rooms not specifically mentioned above	2.1	Area of the space

(1) Area of the space shall be measured at floor area.

9.8.8. Guards

(See Appendix A regarding loads on guards.)

9.8.8.1. Required Guards

(See Appendix A.)

1) Every surface to which access is provided for other than maintenance purposes, including but not limited to exterior landings, porches, balconies, *mezzanines*, galleries, and raised *walkways*, shall be protected by a *guard* on each side which is not protected by a wall and where there is a difference in elevation to adjacent surfaces of more than 600 mm.

2) Every exterior stair with more than 6 risers and every ramp shall be protected with *guards* on all open sides where the difference in elevation between the adjacent ground level and the stair or ramp 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 stairwell shall be

a) enclosed by walls, or
b) protected by *guards*.

9.8.8.2. Height of Guards

(See Appendix A.)

1) Except as provided in Sentences (2) to (4), all *guards*, including those for balconies, shall be not less than 1 070 mm high.

2) *Guards* for porches, decks, landings and balconies are permitted to be a minimum of 900 mm high where

a) the walking surface of the porch, deck, landing or balcony served by the *guard* is not more than 1 800 mm above the finished ground level, and
b) the porch, deck, landing or balcony serves not more than one *dwelling unit*.

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 high at landings.

4) All required *guards* within *dwelling units* shall be not less than 900 mm high.

9.8.8.3. Guards for Floors and Ramps in Garages

1) 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

1) Except as provided in Sentence (2), openings through any *guard* which is required by Article 9.8.8.1. shall be of a size which will prevent the passage of a spherical object having a diameter of 100 mm unless it can be shown that the location and size of openings which exceed this limit do not represent a hazard. (See A-9.8.8.4.(1) and (2) in Appendix A.)

2) Openings through any *guard* which is required by Article 9.8.8.1. and which is installed in a *building* of *industrial occupancy* shall be of a size which will prevent the passage of a spherical object having a diameter of 200 mm unless it can be shown that the location and size of openings which exceed this limit do not represent a hazard. (See A-9.8.8.4.(1) and (2) in Appendix A.)

3) Unless it can be shown that the location and size of openings that do not comply with the following limits do not represent a hazard, openings through any *guard* that is not required by Article 9.8.8.1. and that serves a *building* of other than *industrial occupancy*, shall be of a size that: *e*

a) will prevent the passage of a spherical object having a diameter of 100 mm, or
b) will permit the passage of a spherical object having a diameter of 200 mm.

(See Appendix A.)

9.8.8.5. Design to Prevent Climbing

(See Appendix A.)

1) *Guards* required by Article 9.8.8.1. and serving *buildings* of *residential occupancy* shall be designed so that no member, attachment or opening located between 100 mm and 900 mm above the floor or walking surface protected by the *guard* will facilitate climbing.

9.8.8.6. Glass in Guards

1) Glass in *guards* shall be

a) safety glass of the laminated or tempered type conforming to CAN/CGSB-12.1-M, "Tempered or Laminated Safety Glass," or
b) wired glass conforming to CAN/CGSB-12.11-M, "Wired Safety Glass."

9.8.9. 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 in cross section, or

b) cantilevered from the main *foundation* wall.

2) Stairs described in Sentence (1), when cantilevered from the *foundation* wall, shall be constructed and installed in conformance with Subsection 9.8.10.

3) The depth below ground level for *foundations* for exterior steps shall conform to the requirements in Section 9.12.

9.8.9.2. Exterior Wood Steps

1) Exterior wood steps shall not be in direct contact with the ground unless suitably treated with a wood preservative.

9.8.9.3. 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. Treads

1) Stair treads of lumber, plywood or O-2 grade OSB within *dwelling units* shall be not less than 25 mm actual thickness, except that if open risers are used and the distance between stringers exceeds 750 mm, the treads shall be not less than 38 mm actual thickness.

2) Stair treads of plywood or OSB shall have their face grain or direction of face orientation at right angles to the stringers.

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

1) Exterior concrete steps and their anchorage system that are cantilevered from a *foundation* wall shall be designed and installed to support the loads to which they may be subjected.

9.8.10.2. Anchorage

1) Cantilevered concrete steps referred to in Article 9.8.10.1. shall be anchored to concrete *foundation* walls not less than 200 mm thick.

9.8.10.3. Prevention of Damage Due to Frost

1) Suitable precautions shall be taken during backfilling and grading operations to ensure that subsequent freezing of the *soil* will not cause uplift forces on the underside of cantilevered concrete steps to the extent that the steps or the walls to which they are attached will be damaged.

Section 9.9. Means of Egress

9.9.1. Scope

9.9.1.1. Application

1) Stairways, handrails and *guards* in a *means of egress* shall conform to the requirements in Section 9.8. as well as to the requirements in this Section.

9.9.1.2. Fire Protection

1) *Flame-spread ratings*, *fire-resistance ratings* and *fire-protection ratings* shall conform to Section 9.10.

9.9.1.3. Occupant Load

1) Except for *dwelling units*, the *occupant load* of a *floor area* or part of a *floor area* shall be the number of persons for which such areas are designed, but not fewer than that determined from Table 3.1.16.1., unless it can be shown that the area will be occupied by fewer persons.

2) The *occupant load* for *dwelling units* shall be based on 2 persons per bedroom or sleeping area.

9.9.2. 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, at least 2 separate *means of egress* shall be provided from the roof to stairs designed in conformance with the requirements for *exit* stairs and located remote from each other.

3) Where a podium, terrace, platform or contained open space is provided, egress requirements shall conform to the appropriate requirements for rooms or *suites* in Article 9.9.7.3.

9.9.2.2. Types of Exits

1) An *exit* from any *floor area* shall be one of the following used singly or in combination:

a) an exterior doorway,
b) an exterior passageway,
c) an exterior ramp,
d) an exterior stairway,
e) a fire escape (as described in Subsection 3.4.7.),
f) a *horizontal exit*,
g) an interior passageway,
h) an interior ramp, or
i) an interior stairway.

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 Subsection 3.4.7.

2) Fire escapes shall not be installed on any new *building*.

9.9.2.4. Elevators, Slide Escapes and Windows

1) Elevators, slide escapes or windows shall not be considered as part of a required *means of egress*.

9.9.2.5. Purpose of Exits

1) An *exit* shall be designed for no purpose other than for exiting except that an *exit* may also serve as an access to a *floor area*.

9.9.2.6. Horizontal Exits

1) Where a *horizontal exit* is used, it shall conform to Article 3.4.6.9.

9.9.3. Dimensions of Means of Egress

9.9.3.1. Application

1) This Subsection applies to every *means of egress* except *exits* that serve not more than one *dwelling unit* and *access to exits* within *dwelling units*.

9.9.3.2. Exit Width

1) Except for doors and corridors, the width of every *exit* facility shall be not less than 900 mm. (See Article 9.9.6.4. for doors and Subsection 9.8.3. for stairs.)

9.9.3.3. Width of Corridors

1) The width of every *public corridor*, corridor used by the public, and *exit* corridor shall be not less than 1 100 mm. (See also Subsection 9.9.5. for obstructions in corridors.)

9.9.3.4. Headroom Clearance

1) Except for stairways, doorways and *storage garages*, the minimum headroom clearance in *exits* and *access to exits* shall be 2.1 m. (See Articles 9.8.3.4. and 9.8.4.4. for stairways and Subsection 9.9.6. for doorways.)

2) The clear height of every *storey* in a *storage garage* shall be not less than 2 m.

9.9.4. Fire Protection of Exits

9.9.4.1. Application

1) Except as provided in Article 9.9.4.4., this Subsection applies to the fire protection of all *exits* except *exits* serving not more than one *dwelling unit*.

9.9.4.2. Fire Separations for Exits

1) Except as provided in Sentence (5) and Article 9.9.8.5., every *exit* other than an exterior doorway shall be separated from each adjacent *floor area* or from another *exit* by a *fire separation* having a *fire-resistance rating* not less than that required for the floor assembly above the *floor area*. (See Article 9.10.9.10.)

2) Where there is no floor assembly above, the *fire-resistance rating* required in Sentence (1) shall not be less than that required by Subsection 9.10.8. for the floor assembly below, but in no case shall the *fire-resistance rating* be less than 45 min.

3) A *fire separation* common to 2 *exits* shall be smoke-tight and not be pierced by doorways, duct work, piping or any other opening that may affect the continuity of the separation.

4) A *fire separation* that separates an *exit* from the remainder of the *building* shall have no

openings except those for electrical wiring, *noncombustible* conduit and *noncombustible* piping that serve only the *exit*, and for standpipes, sprinkler piping, *exit* doorways and wired glass and glass block permitted in Article 9.9.4.3.

5) The requirements in Sentence (1) do not apply to an exterior *exit* passageway provided the passageway has not less than 50% of its exterior sides open to the outdoors and is served by an *exit* stair at each end of the passageway.

9.9.4.3. Wired Glass or Glass Block

(See A-3.1.8.17.(1) in Appendix A.)

1) This Article applies to wired glass in doors, and wired glass or glass block in sidelights, where these are installed in *fire separations* between *exit* enclosures and *floor areas*.

2) Except as provided in Sentence (3), the combined area of glazing in doors and sidelights shall not exceed 0.8 m^2.

3) Where an *exit* enclosure connects with a *floor area* through an enclosed vestibule or corridor separated from the *floor area* by *fire separations* having not less than a 45 min *fire-resistance rating*, the glazed areas described in Sentence (1) need not be limited as required in Sentence (2).

9.9.4.4. Openings Near Unenclosed Exit Stairs and Ramps

1) Where an unenclosed exterior *exit* stair or ramp provides the only *means of egress* from a *suite*, and is exposed to fire from openings in the exterior walls of another *fire compartment*, the openings in the exterior walls of the *building* shall be protected with wired glass in fixed steel frames or glass block conforming to Articles 9.10.13.5. and 9.10.13.7. when the openings in the exterior walls of the *building* are within 3 m horizontally and less than 10 m below or less than 5 m above the *exit* stair or ramp.

9.9.4.5. Openings in Exterior Walls of Exits

1) Either openings in exterior walls of an *exit* or openings in adjacent exterior walls of the *building* the *exit* serves shall be protected with wired glass in fixed steel frames or glass block installed in accordance with Articles 9.10.13.5. and 9.10.13.7., where

a) the *exit* enclosure has exterior walls that intersect the exterior walls of the *building* at an angle of less than 135° measured on the outside of the *building*, and
b) the openings in the exterior walls of the *building* are within 3 m horizontally and less than 2 m above the openings in the exterior walls of the *exit*.

(See Appendix A.)

9.9.4.6. Openings Near Exit Doors

1) Where an exterior *exit* door in one *fire compartment* is within 3 m horizontally of an *unprotected opening* in another *fire compartment* and the exterior walls of these *fire compartments* intersect at an exterior angle of less than 135°, the opening shall be protected with wired glass in fixed steel frames or glass block conforming to Articles 9.10.13.5. and 9.10.13.7.

9.9.4.7. Stairways in 2 Storey, Group D or E Buildings

1) Where a *suite* of Group D or E *occupancy* is located partly on the *first storey* and partly on the second *storey*, stairways serving the second *storey* of that *suite* need not be constructed as *exit* stairs provided,

a) the *building* is not greater than 2 *storeys* in *building height*,
b) the *suite* is separated from other *occupancies* by at least a 45 min *fire separation*,
c) the area occupied by the *suite* is not greater than 100 m^2 per *storey*,
d) the maximum travel distance from any point in the *suite* to an exterior *exit* is not greater than 25 m,
e) the floor assemblies have a *fire-resistance rating* of not less than 45 min or are of *noncombustible construction*, and
f) the *basement* and *first storey* are separated by a *fire separation* having a *fire-resistance rating* of not less than 45 min.

9.9.5. Obstructions and Hazards in Means of Egress

9.9.5.1. Application

1) This Subsection applies to obstructions and hazards in every *means of egress* except those within a *dwelling unit* or serving not more than one *dwelling unit*.

9.9.5.2. Occupancies in Public Corridors

1) Where a *public corridor* or a corridor used by the public contains an *occupancy*, such *occupancy* shall not reduce the unobstructed width of the corridor to less than the required width of the corridor.

9.9.5.3. Obstructions in Public Corridors

1) Except as permitted in Sentence (2), obstructions located within 1 980 mm of the floor shall not project horizontally more than 100 mm into *exit* passageways, corridors used by the public or *public corridors* in a manner that would create a hazard for visually impaired persons travelling adjacent to walls.

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 for a period of at least 30 min when the electric lighting in the affected area is interrupted.

4) Illumination from lighting required in Sentence (1) shall be provided to average levels of not less than 10 lx at floor or tread level.

5) Where incandescent lighting is provided, lighting equal to 1 W/m^2 of *floor area* shall be considered to meet the requirement in Sentence (4).

6) Where self-contained emergency lighting units are used, they shall conform to CSA C22.2 No. 141-M, "Unit Equipment for Emergency Lighting."

Section 9.10. Fire Protection

9.10.1. General

9.10.1.1. Support of Noncombustible Construction

1) Where an assembly is required to be of *noncombustible* construction and to have a *fire-resistance* rating, it shall be supported by *noncombustible* construction.

9.10.1.2. Sloped Roofs

1) 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. Items under Part 3 Jurisdiction

1) Tents, *air-supported structures*, transformer vaults, *walkways*, elevators and escalators shall conform to Part 3.

2) Where rooms or spaces are intended for an *assembly occupancy*, such rooms or spaces shall conform to Part 3.

3) *Basements* containing more than 1 *storey* or exceeding 600 m^2 in area shall conform to Part 3.

4) Where rooms or spaces are intended for the storage, manufacture or use of hazardous or explosive material, such rooms or spaces shall conform to Part 3. (See A-3.3.1.2.(1) in Appendix A.)

5) Except as provided in Article 3.3.5.8., facilities for the dispensing of fuel shall not be installed in any *building*.

6) Openings through floors that are not protected by shafts or *closures* shall be protected in conformance with Subsection 3.2.8. (See also Sentence 9.9.4.7.(1).)

7) Chutes and shafts shall conform to Subsection 3.6.3. except where they are entirely contained within a *dwelling unit*.

8) Where sprinkler, standpipe and hose systems are installed, they shall be installed in conformance with Part 3.

9.10.1.4. Items under Part 3 or Part 6 Jurisdiction

1) In kitchens containing commercial cooking equipment used in processes producing grease-laden vapours, the equipment shall be designed and installed in conformance with Article 6.2.2.6. (See Appendix A.)

2) Where fuel-fired *appliances* are installed on a roof, such *appliances* shall be installed in conformance with Article 3.6.1.4. *e*

9.10.2. Occupancy Classification

9.10.2.1. Occupancy Classification

1) Except as provided in Article 9.10.2.2., every *building* or part thereof shall be classified according to its *major occupancy* as belonging to one of the groups or divisions described in Table 9.10.2.1.

Table 9.10.2.1.
Occupancy Classifications
Forming Part of Sentence 9.10.2.1.(1)

Group	Division	Description of *Major Occupancies*[1]
C	—	*Residential occupancies*
D	—	*Business and personal services occupancies*
E	—	*Mercantile occupancies*
F	2	*Medium hazard industrial occupancies*
F	3	*Low hazard industrial occupancies* (Does not include *storage garages* serving individual *dwelling units*)

Notes to Table 9.10.2.1.:
(1) See A-3.1.2.1. in Appendix A.

9.10.2.2. Custodial and Convalescent Homes

1) Children's custodial homes and convalescent homes for ambulatory occupants living as a

single housekeeping unit in a *dwelling unit* with sleeping accommodation for not more than 10 persons are permitted to be classified as *residential occupancies* (Group C).

9.10.2.3. Major Occupancies above Other Major Occupancies

1) Except as permitted in Article 9.10.2.4., in any *building* containing more than one *major occupancy* in which one *major occupancy* is located entirely above another, the requirements of Article 9.10.8.1. for each portion of the *building* containing a *major occupancy* shall be applied to that portion as if the entire *building* was of that *major occupancy*.

9.10.2.4. Buildings Containing More Than One Major Occupancy

1) In a *building* containing more than one *major occupancy*, where the aggregate area of all *major occupancies* in a particular group or division does not exceed 10% of the *floor area* on the *storey* on which they are located, they need not be considered as *major occupancies* for the purposes of Articles 9.10.8.1. and 9.10.2.3. provided they are not classified as Group F, Division 2 *occupancies*.

9.10.3. Ratings

9.10.3.1. Fire-Resistance and Fire-Protection Ratings

1) Where a *fire-resistance rating* or a *fire-protection rating* is required in this Section for an element of a *building*, such rating shall be determined in conformance with the test methods described in Part 3, A-9.10.3.1. in Appendix A, or Appendix D.

9.10.3.2. Flame-Spread Ratings

1) Where a *flame-spread rating* is required in this Section for an element of a *building*, such rating shall be determined in accordance with the test methods described in Part 3, or in accordance with Appendix D.

2) Unless the *flame-spread rating* is referred to herein as a "surface *flame-spread rating*," it shall apply to any surface of the element being considered that would be exposed by cutting through it as well as to the exposed surface of the element.

9.10.3.3. Fire Exposure

1) Floor, roof and ceiling assemblies shall be rated for exposure to fire on the underside.

2) Exterior walls shall be rated for exposure to fire from inside the *building*, except that such walls need not comply with the temperature rise limitations required by the standard tests referred to in Article 9.10.3.1. if such walls have a *limiting distance* of not less than 1.2 m, and due allowance is made for the effects of heat radiation in accordance with the requirements in Part 3.

3) Interior vertical *fire separations* required to have *fire-resistance ratings* shall be rated for exposure to fire on each side.

9.10.3.4. Suspended Membrane Ceilings

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

9.10.4. Building Size Determination

9.10.4.1. Mezzanines not Considered as Storeys

(See A-3.2.1.1.(3) in Appendix A.)

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% 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% 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.

9.10.4.2. More Than One Level of Mezzanine

1) 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

1) Where a *basement* is used primarily as a *storage garage*, the *basement* is permitted to be considered as a separate *building* for the purposes of this Section provided the floor above the *basement* and the exterior walls of the *basement* above the adjoining ground level are constructed as *fire separations* of masonry or concrete having a *fire-resistance rating* of not less than 2 h.

9.10.4.4. Roof-Top Enclosures

1) Roof-top enclosures provided for elevator machinery, stairways and *service rooms*, used for no purpose other than for service to the *building*, shall

9.10.9.6. Service Equipment Penetrating a Fire Separation

1) Piping, tubing, ducts, *chimneys*, wiring, conduit, electrical outlet boxes and other similar service equipment that penetrate a required *fire separation* shall be tightly fitted or fire stopped to maintain the integrity of the separation. (See Appendix A.)

2) Except as provided in Sentences (3) to (9) and Article 9.10.9.7., pipes, ducts, electrical boxes, totally enclosed raceways or other similar service equipment that partly or wholly penetrate an assembly required to have a *fire-resistance rating* shall be *noncombustible* unless the assembly has been tested incorporating such equipment.

3) Electrical wires or similar wiring enclosed in *noncombustible* totally enclosed raceways are permitted to partly or wholly penetrate an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required in Sentence (2).

4) Electrical wires or cables, single or grouped, with *combustible* insulation or jacketing that is not totally enclosed in raceways of *noncombustible* material, are permitted to partly or wholly penetrate an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required in Sentence (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 cm^2.

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) *Combustible* piping for central vacuum systems is permitted to penetrate a *fire separation* provided the installation conforms to the requirements that apply to *combustible* drain, waste and vent piping specified in Sentences 9.10.9.7.(2) to (6).

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 contributes to the required *fire-resistance rating* of an assembly.

2) *Combustible* drain, waste and vent piping not located in a vertical shaft is permitted to penetrate a *fire separation* required to have a *fire-resistance rating* or a membrane that forms part of an assembly required to have a *fire-resistance rating* provided the piping is sealed at the penetration by a 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 ULC-S115, "Fire Tests for Fire Stop Systems," with a pressure differential of 50 Pa between the exposed and unexposed sides, with the higher pressure on the exposed side. r

4) *Combustible* drain piping is permitted to penetrate a horizontal *fire separation* or a membrane that contributes to the required *fire-resistance rating* of a horizontal *fire separation*, provided it leads directly from a *noncombustible* watercloset through a concrete floor slab.

5) *Combustible* drain, waste and vent piping is permitted on one side of a vertical *fire separation* provided it is not located in a vertical shaft.

6) In *buildings* containing 2 *dwelling units* only, *combustible* drain, waste and vent piping is permitted on one side of a horizontal *fire separation*.

9.10.9.8. Collapse of Combustible Construction

1) *Combustible construction* that abuts on or is supported by a *noncombustible fire separation* shall be constructed so that its collapse under fire conditions will not cause collapse of the *fire separation*.

9.10.9.9. Reduction in Thickness of Fire Separation by Beams and Joists

1) Where pockets for the support of beams or joists are formed in a masonry or concrete *fire separation*, there shall be left a total thickness of solid masonry and/or grout and/or concrete not less than the required equivalent thickness shown for Type S monolithic concrete in Table D-2.1.1. in Appendix D for the required *fire-resistance rating*. r

9.10.9.10. Concealed Spaces above Fire Separations

1) Except as provided in Sentence (2), a *horizontal service space* or other concealed space located above a required vertical *fire separation* shall be divided at the *fire separation* by an equivalent *fire separation* within the space.

2) Where a *horizontal service space* or other concealed space is located above a required vertical *fire separation* other than a vertical shaft, such space need not be divided as required in Sentence (1) provided the construction between such space and the space below is constructed as a *fire separation* having a *fire-resistance rating* not less than that required for the vertical *fire separation*, except that where the vertical *fire separation* is not required to have a *fire-resistance rating* greater than 45 min, the *fire-resistance rating* of the ceiling may be reduced to 30 min.

9.10.9.11. Separation of Residential Occupancies

1) Except as provided in Sentence (2), *residential occupancies* shall be separated from all other *major occupancies* by a *fire separation* having a *fire-resistance rating* of not less than 1 h.

2) Except as provided in Sentence (3), a *major occupancy* classified as a *residential occupancy* shall be separated from other *major occupancies* classified as *mercantile* or *medium hazard industrial occupancies* by a *fire separation* having a *fire-resistance rating* of not less than 2 h.

3) Where not more than 2 *dwelling units* are located in a *building* containing a *mercantile occupancy*, such *mercantile occupancy* shall be separated from the *dwelling units* by a *fire separation* having not less than 1 h *fire-resistance rating*.

9.10.9.12. Residential Suites in Industrial Buildings

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

9.10.9.13. Separation of Suites

1) Except as required in Article 9.10.9.14. and as permitted by 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 corridor*s conforming with Sentence 3.3.1.4.(4) are not required to be separated from each other by *fire separation*s.

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 corridor*s 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 separation*s between a *public corridor* and the remainder of the *building* if

a) the *floor area* is *sprinklered*,
b) the sprinkler system is electrically supervised in conformance with Sentence 3.2.4.9.(2), and
c) the operation of the sprinkler system will cause a signal to be transmitted to the fire department in conformance with Sentence 3.2.4.7.(4).

3) In other than *residential occupancies*, no *fire separation* is required between a *public corridor* and the remainder of the *building* if

a) the *floor area* is *sprinklered*,
b) the sprinkler system is electrically supervised in conformance with Sentence 3.2.4.9.(2),
c) the operation of the sprinkler system will cause a signal to be transmitted to the fire department in conformance with Sentence 3.2.4.7.(4), and
d) the corridor exceeds 5 m in width.

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

9.10.14.2. Area of Exposing Building Face

1) The area of an *exposing building face* shall be calculated as the total area of exterior wall facing in one direction on any side of a *building* measured from the finished ground level to the uppermost ceiling, except that where a *building* is divided by *fire separations* into *fire compartments*, the area of *exposing building face* may be calculated for each *fire compartment* provided such separations have not less than a 45 min *fire-resistance rating.*

9.10.14.3. Inadequate Fire Fighting Facilities

1) Where there is no fire department or where a fire department is not organized, trained and 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 for a *building* that is not *sprinklered*.

Table 9.10.14.1.
Maximum Percentage Area of Unprotected Openings in Exterior Walls
Forming Part of Sentence 9.10.14.1.(1)

Occupancy Classification of *Building*	Maximum Area of *Exposing Building Face*, m^2	Maximum Aggregate Area of *Unprotected Openings*, % of *Exposing Building Face* Area											
		Limiting Distance, m											
		Less than 1.2	1.2	1.5	2.0	4.0	6.0	8.0	10.0	12.0	16.0	20.0	25.0
Residential, *business and personal services*, and *low hazard industrial*	30	0	7	9	12	39	88	100	—	—	—	—	—
	40	0	7	8	11	32	69	100	—	—	—	—	—
	50	0	7	8	10	28	57	100	—	—	—	—	—
	100	0	7	8	9	18	34	56	84	100	—	—	—
	Over 100	0	7	7	8	12	19	28	40	55	92	100	—
Mercantile and *medium hazard industrial*	30	0	4	4	6	20	44	80	100	—	—	—	—
	40	0	4	4	6	16	34	61	97	100	—	—	—
	50	0	4	4	5	14	29	50	79	100	—	—	—
	100	0	4	4	4	9	17	28	42	60	100	—	—
	Over 100	0	4	4	4	6	10	14	20	27	46	70	100

9.10.14.4. Alternate Method of Determining Limiting Distance

1) The *limiting distance* shown in Table 9.10.14.1. may be reduced provided it is not less than the square root of

a) 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
b) 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

1) Openings in a wall having a *limiting distance* of less than 1.2 m shall be protected by *closures*, of other than wired glass or glass block, whose *fire protection rating* is in conformance with the *fire-resistance rating* required for the wall. (See Table 9.10.13.1.)

9.10.14.6. Allowance for Sprinklers and Wired Glass or Glass Block

(See A-3.2.3.11. in Appendix A.)

1) The maximum area of *unprotected openings* is permitted to be doubled where the *building* is *sprinklered* provided all rooms, including closets and bathrooms, that are adjacent to the *exposing building face* and that have *unprotected openings* are *sprinklered*, notwithstanding any exemptions in the sprinkler standards referenced in Article 3.2.5.13.

2) The maximum area of *unprotected openings* is permitted to be doubled 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.

9.10.14.7. Exterior Wall Construction for Irregularly-Shaped or Skewed Walls

e **1)** Except as provided in Sentence 9.10.14.12.(1), for the purpose of using Table 9.10.14.11. to determine the required type of construction, cladding and *fire-resistance rating* for an irregularly-shaped or skewed exterior wall,

a) the *exposing building face* shall be taken as the projection of the exterior wall onto a vertical plane located so that no portion of the *exposing building face* of the *building* is between the vertical plane and the line to which the *limiting distance* is measured, and

b) the permitted area of *unprotected openings* shall be determined from Table 9.10.14.1. 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. Percentage of Unprotected Openings for Irregularly-Shaped or Skewed Walls

1) For the purpose of using Table 9.10.14.1. to determine the actual percentage of *unprotected openings* permitted in an irregularly-shaped or skewed 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

1) 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

1) 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

1) Except as permitted in Sentence (2) and 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 9.10.14.11. and Subsection 9.10.8.

2) Cladding installed on *exposing building faces* and exterior walls located above *exposing building faces* that enclose an *attic or roof space* need not conform to "Type of Cladding Required" in Table 9.10.14.11. provided

a) the *limiting distance* is not less than 0.6 m,

b) the exposing face is constructed with no *unprotected openings*, and

c) the cladding conforms to Clauses 9.10.14.12.(4)(a) to (d).

Table 9.10.14.11.
Minimum Construction Requirements for Exposing Building Faces
Forming Part of Sentence 9.10.14.11.(1)

Occupancy Classification of *Building*	Maximum Area of *Unprotected Openings* Permitted, % of *Exposing Building Face* Area	Minimum Required *Fire-Resistance Rating*	Type of Construction Required	Type of Cladding Required
Residential, *business and personal services*, and *low hazard industrial*	0 – 10	1 h	*Noncombustible*	*Noncombustible*
	11 – 25	1 h	*Combustible* or *noncombustible*	*Noncombustible*
	26 – <100	45 min	*Combustible* or *noncombustible*	*Combustible* or *noncombustible*
Mercantile, and *medium hazard industrial*	0 – 10	2 h	*Noncombustible*	*Noncombustible*
	11 – 25	2 h	*Combustible* or *noncombustible*	*Noncombustible*
	26 – <100	1 h	*Combustible* or *noncombustible*	*Combustible* or *noncombustible*

9.10.14.12. Exposing Building Face of Houses

1) For the purposes of this Article, an *exposing building face* may be considered to be made up of any number of separate portions and the requirements for *fire-resistance rating* and cladding material and the limits on glazed openings for each portion maybe determined based on the limiting distance for that portion. (See Appendix A.)

2) Except as required in Article 9.10.14.3. and as provided in Sentence (4), 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*

a) has a *fire-resistance rating* of not less than 45 min where the *limiting distance* is less than 1.2 m, and
b) is clad with *noncombustible* material where the *limiting distance* is less than 0.6 m.

3) Glazed openings in the *exposing building face* referred to in Sentence (2)

a) shall not be permitted where the *limiting distance* is less than 1.2 m, and
b) 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.

4) Cladding on the *exposing building face* described in Sentence (2) may be vinyl when the *limiting distance* is less than 0.6 m provided the cladding

a) conforms to Subsection 9.27.13.,
b) is installed directly over 12.7 mm gypsum sheathing,
c) has a *flame spread rating* not greater than 25 when tested in accordance with Sentence 3.1.12.1.(2), and
d) does not exceed 2 mm in thickness exclusive of fasteners, joints and local reinforcements.

9.10.14.13. Combustible Projections

1) 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

a) 1.2 m of a property line or the centreline of a *public way*, or
b) 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 garage or accessory *building* that serves one *dwelling unit* only and is detached from any *building* 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 or accessory *buildings* described in Sentence

(1) is not required to be *noncombustible* regardless of the *limiting distance*.

3) The percentage of window openings permitted in the *exposing building face* of detached garages or accessory *buildings* described in Sentence (1) shall conform to the requirements for *unprotected openings* in Article 9.10.14.1.

4) The requirements for *limiting distance* shall not apply between a detached garage or accessory *building* and a *dwelling unit* where

a) the detached garage or accessory *building* serves only one *dwelling unit*,
b) the detached garage or accessory *building* is located on the same property as that *dwelling unit*, and
c) the *dwelling unit* served by the detached garage or accessory *building* is the only *major occupancy* on the property.

9.10.14.15. Heavy Timber and Steel Columns

1) 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

1) 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 manufacture 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) Vertical concealed spaces in interior walls and exterior walls shall be separated by fire stops

a) one from the other, and
b) from horizontal concealed spaces.

2) Horizontal concealed spaces in attics, roof spaces, ceilings, floors, and crawl spaces shall be separated by fire stops

a) one from the other, and
b) from vertical concealed spaces.

3) 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.

4) 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.

5) 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

a) not more than 60 m in greatest dimension, and
b) where such space contains exposed construction materials having a surface *flame-spread rating* greater than 25, not more than 300 m^2 in area.

6) No dimension of the concealed space described in Clause (5)(b) shall exceed 20 m. *e*

7) Concealed spaces in mansard or gambrel style roofs, exterior cornices, balconies and canopies of *combustible construction* in which the exposed construction materials within the space have a surface *flame-spread rating* exceeding 25 shall have vertical fire 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 Sentence (2), fire stops shall be provided to block off concealed spaces within wall assemblies, including spaces created by furring,

a) at each floor level,
b) at each ceiling level where the ceiling contributes to part of the required *fire-resistance rating*, and
c) at other locations within the wall, so that the distance between fire stops does not exceed 20 m horizontally and 3 m vertically.

2) Fire stops described in Sentence (1) are not required provided

a) the width of the concealed wall space does not exceed 25 mm,
b) the exposed construction materials within the space are *noncombustible*,
c) the exposed construction materials within the space, including insulation, but not including wiring, piping or similar services, have a *flame-spread rating* of not more than 25, or
d) the concealed wall space is filled with insulation.

9.10.15.3. Fire Stop Materials

1) Fire stops shall be constructed of not less than

r 9.10.21. Fire Protection for Gas and Electric Ranges

(See A-9.10.21. in Appendix A.)

9.10.21.1. Installation of Ranges

1) Except as required in Sentence (2), natural gas *ranges* shall be installed in accordance with CAN/CGA-B149.1-M, "Natural Gas Installation Code." (See Article 9.34.1.1.)

2) Clearances for gas and electric *ranges* shall be not less than those provided in Articles 9.10.21.2. and 9.10.21.3.

9.10.21.2. Vertical Clearances

1) Except as provided in Sentence (2), framing, finishes and cabinetry installed directly above the location of the *range* shall be not less than 750 mm above the level of *range* burners or elements.

2) The vertical clearance described in Sentence (1) for framing, finishes and cabinets located directly above the location of the *range* may be reduced to 600 mm above the level of the elements or burners provided the framing, finishes and cabinets

a) are *noncombustible*, or
b) are protected by
   i) asbestos millboard not less than 6 mm thick, covered with sheet metal not less than 0.33 mm thick, or
   ii) a metal hood with a 125 mm projection beyond the framing, finishes and cabinets.

9.10.21.3. Horizontal Clearances

1) Except as provided in Sentences (2) and (3), *combustible* wall framing, finishes or cabinets within 450 mm of the area where the *range* is to be located shall be protected above the level of the heating elements or burners by material providing fire resistance not less than that of a 9.5 mm thickness of gypsum board.

2) Counter-top splash boards or back plates that extend above the level of heating elements or burners need not be protected as described in Sentence (1).

3) Except for cabinetry described in Article 9.10.21.2., cabinetry located not less than 450 mm above the level of the heating elements or burners need not be protected as described in Sentence (1).

Section 9.11. Sound Control

9.11.1. Sound Transmission Class Rating (Airborne Sound)

9.11.1.1. Determination of Sound Transmission Class Ratings

1) Sound transmission class ratings shall be determined in accordance with ASTM E 413, "Classification for Rating Sound Insulation," using results from measurements in accordance with

a) ASTM E 90, "Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements," or
b) ASTM E 336, "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 as 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 as 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 termite infestation is known to be a problem, all stumps, roots and other wood debris shall be removed from the *soil* to a depth of not less than 300 mm in unexcavated areas under a *building*.

3) The bottom of every *excavation* shall be free of all organic material.

9.12.1.2. Standing Water

1) *Excavations* shall be kept free of standing water.

9.12.1.3. Protection from Freezing

1) The bottom of *excavations* shall be kept from freezing throughout the entire construction period.

9.12.2. Depth

9.12.2.1. Excavation to Undisturbed Soil

1) *Excavations* for *foundations* shall extend to undisturbed *soil*.

9.12.2.2. Minimum Depth of Foundations

1) Except as provided in Sentences (4) and (5), the minimum depth of *foundations* below finished ground level shall conform to Table 9.12.2.2.

2) Where a *foundation* is insulated in a manner that will reduce heat flow to the *soil* beneath the footings, the *foundation* depth shall conform to that required for *foundations* containing no heated space. (See Appendix A.)

3) The minimum depth of *foundations* for exterior concrete steps with more than 2 risers shall conform to Sentences (1) to (5).

4) Concrete steps with 1 and 2 risers are permitted to be laid on ground level.

5) The *foundation* depths required in Sentence (1) are permitted to be decreased where experience with local *soil* conditions shows that lesser depths are satisfactory, or where the *foundation* is designed for lesser depths.

6) The *foundation* depths required in Sentence (1) do not apply to *foundations* for *buildings* of other than masonry or masonry veneer construction

a) whose superstructure conforms with the requirements of the deformation resistance test in CAN/CSA-Z240.2.1, "Structural Requirements for Mobile Homes," or
b) used as accessory *buildings* of not more than 1 *storey* in *building height* and not more than 55 m^2 in *building area*.

Table 9.12.2.2.
Minimum Depths of Foundations
Forming Part of Sentence 9.12.2.2.(1)

Type of *Soil*	Minimum Depth of *Foundation* Containing Heated *Basement* or Crawl Space[1]		Minimum Depth of *Foundation* Containing No Heated Space[2]	
	Good *Soil* Drainage[3]	Poor *Soil* Drainage	Good *Soil* Drainage[3]	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[4]	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

Notes to Table 9.12.2.2.:
(1) *Foundation* not insulated to reduce heat loss through the footings.
(2) Including *foundations* insulated to reduce heat loss through the footings.
(3) To not less than the depth of frost penetration.
(4) See Appendix A.

9.12.3. Backfill

9.12.3.1. Placement of Backfill

1) Backfill shall be placed to avoid damaging the *foundation* wall, the drainage tile, externally applied thermal insulation and waterproofing or dampproofing of the wall.

9.12.3.2. Grading of Backfill

1) Backfill shall be *graded* to prevent drainage towards the *foundation* after settling.

9.12.3.3. Deleterious Debris and Boulders

1) Backfill 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. Support of Footings

1) The *soil* in trenches beneath footings for sewers and watermains shall be compacted by tamping up to the level of the footing base, or shall be filled with concrete having a strength not less than 10 MPa to support the footing.

Section 9.13. Dampproofing, Waterproofing and Soil Gas Control

9.13.1. General

9.13.1.1. Required Dampproofing

1) Except as provided in Article 9.13.1.2., where the exterior finished ground level is at a higher elevation than the ground level inside the *foundation* walls, exterior surfaces of *foundation* walls below ground level shall be dampproofed.

2) Except as provided in Sentence (3) and Article 9.13.1.2., floors-on-ground shall be dampproofed.

3) Floors in garages, floors in unenclosed portions of *buildings* and floors installed over granular *fill* in conformance with Article 9.16.2.1. need not be dampproofed.

9.13.1.2. 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.

9.13.1.3. Required Soil Gas Control

(See Appendix A.)

1) Except as provided in Sentence (2), all wall, roof and floor assemblies in contact with the ground shall be constructed to resist the leakage of *soil* gas from the ground into the *building*.

2) Construction to resist leakage of *soil* gas into the *building* is not required for

a) garages and unenclosed portions of *buildings*,
b) *buildings* constructed in areas where it can be demonstrated that *soil* gas does not constitute a hazard, or
c) *buildings* that contain a single *dwelling unit* and are constructed to provide for sub-floor depressurization in accordance with Article 9.13.8.2.

9.13.1.4. 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) Except as otherwise specified in this Section, materials used for exterior dampproofing or waterproofing shall conform to

a) CAN/CGSB-37.1-M, "Chemical Emulsified Type, Emulsified Asphalt for Dampproofing,"
b) CAN/CGSB-37.2-M, "Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings,"
c) CGSB 37-GP-6Ma, "Asphalt, Cutback, Unfilled, for Dampproofing,"
d) CAN/CGSB-37.16-M, "Filled Cutback Asphalt for Dampproofing and Waterproofing,"
e) CGSB 37-GP-18Ma, "Tar, Cutback, Unfilled, for Dampproofing,"

f) CAN/CGSB-51.34-M, "Vapour Barrier, Polyethylene Sheet for Use in Building Construction," or
g) CSA A123.4-M, "Bitumen for Use in Construction of Built-Up Roof Coverings and Dampproofing and Waterproofing Systems."

2) Materials used to provide a barrier to *soil* gas ingress through floors-on-ground shall conform to CAN/CGSB-51.34-M,"Vapour Barrier, Polyethylene Sheet for Use in Building Construction."

9.13.3. Dampproofing of Walls

9.13.3.1. Preparation of Surface

1) Unit masonry walls to be dampproofed shall be
a) parged on the exterior face below ground level with not less than 6 mm of mortar conforming to Section 9.20., and
b) coved 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.

9.13.3.2. Application of Dampproofing Material

1) Dampproofing material shall be applied over the parging or concrete below ground level.

9.13.3.3. Interior Dampproofing of Walls

1) Where a separate interior finish is applied to a concrete or unit masonry wall which is in contact with the *soil*, or where wood members are placed in contact with 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 terminate at ground level.

3) No membrane or coating with a permeance less than 170 ng/(Pa•s•m^2) shall be applied to the interior surface of the *foundation* wall above ground level between the insulation and the *foundation* wall.

9.13.4. Dampproofing of Floors-on-Ground

9.13.4.1. Location of Dampproofing

1) When floors are dampproofed, the dampproofing shall be installed below the floor, except that where a separate floor is provided over a slab, the dampproofing is permitted to be applied to the top of the slab.

9.13.4.2. Dampproofing below the Floor

1) When installed below the floor, dampproofing membranes shall consist of polyethylene not less than 0.15 mm thick, or type S roll roofing.

2) Joints in dampproofing membranes described in Sentence (1) shall be lapped not less than 100 mm.

9.13.4.3. Dampproofing above the Slab

1) When installed above the slab, dampproofing shall consist of not less than
a) 2 mopped-on coats of bitumen,
b) 0.05 mm polyethylene, or
c) other material providing equivalent performance.

9.13.5. Waterproofing of Walls

9.13.5.1. 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.

9.13.5.2. Application of Waterproofing Membranes

1) Concrete or unit masonry walls to be waterproofed shall be covered with not less than 2 layers of bitumen-saturated membrane, with each layer cemented in place with bitumen and coated over-all with a heavy coating of bitumen.

9.13.6. Waterproofing of Floors-on-Ground

9.13.6.1. Floor Waterproofing System

1) *Basement* floors-on-ground to be waterproofed shall have a system of membrane waterproofing provided between 2 layers of concrete, each of which shall be not less than 75 mm thick, with the floor membrane mopped to the wall membrane to form a complete seal.

9.13.7. Soil Gas Control in Walls

(See A-9.13.7. and 9.13.8. in Appendix A.)

9.13.7.1. Sealing of Masonry Walls

1) Masonry walls required to provide a barrier to *soil* gas and which are not dampproofed on their interior surface as required in Sentence 9.13.3.3.(1) shall

a) include a course of masonry units without voids, or
b) be sealed with flashing material extending across the full width of the masonry
   i) at or below the level of the adjoining floor slab, or
   ii) in the absence of a floor slab, at the level of the ground cover required in Article 9.18.6.1.

9.13.8. Soil Gas Control in Floors

(See A-9.13.7. and 9.13.8. in Appendix A.)

9.13.8.1. Soil Gas Barriers

1) Except as provided in Article 9.13.8.2., a *soil* gas barrier shall be installed.

2) Where the floor-on-ground is a concrete slab, the *soil* gas barrier shall be

a) installed below the slab, or
b) applied to the top of the slab, provided a separate floor is installed over the slab.

(See A-9.13.8.1.(2) and (3) in Appendix A.)

3) When the *soil* gas barrier is installed below a slab-on-ground, joints in the barrier shall be lapped not less than 300 mm. (See A-9.13.8.1.(2) and (3) in Appendix A.)

4) When the *soil* gas barrier is installed above a slab-on-ground, joints in the barrier shall be sealed.

5) When installed in conjunction with a framed floor-on-ground, the *soil* gas barrier shall be installed in accordance with Articles 9.25.3.2. and 9.25.3.3.

9.13.8.2. Providing for Sub-Floor Depressurization

(See Appendix A.)

1) A *soil* gas barrier is permitted to be omitted provided the *building*,

a) contains a single *dwelling unit* only, and
b) is protected against *soil* gas ingress according to the requirements of this Article.

2) Except as required in Sentence (4), granular material shall be installed below the floor-on-ground according to Sentence 9.16.2.1.(1).

3) A pipe, not less than 100 mm in diameter, shall be installed vertically through the floor, at or near its centre, such that

a) its bottom end opens into the granular *fill* described in Sentence (2), and
b) its top end will permit connection to depressurization equipment.

4) The granular material described in Sentence (2), near the centre of the floor, shall be not less than 150 mm deep for a radius of not less than 300 mm centred on the pipe described in Sentence (3).

5) The upper end of the pipe described in Sentence (3) shall be provided with a removable seal.

6) The pipe described in Sentence (3) shall be clearly labelled to indicate that it is intended only for the removal of *soil* gas from below the floor-on-ground.

7) Except as provided in Sentence (9), when a *building* constructed in accordance with Sentences (2) to (6) is complete, testing shall be conducted according to the U.S. Environmental Protection Agency standard EPA 402-R-92-003, "Protocols for Radon and Radon Decay Product Measurements in Homes," to determine the radon concentration in the *building*. *e*

8) A copy of the results of testing required in Sentence (7) shall be provided by the *building owner* to the *authority having jurisdiction*.

9) The testing required in Sentence (7) shall include *basement* concentration measurements.

10) Where the radon concentration determined as described in Sentences (7) and (9) exceeds the Canadian Action Level for radon in residential indoor air, as specified in HC H 49-58, "Exposure Guidelines for Residential Indoor Air Quality," a sub-floor depressurization system shall be installed to reduce the radon concentration to a level below the Canadian Action Level.

11) Where a sub-floor depressurization system is installed,

a) make-up air shall be provided when and as specified in accordance with Article 9.32.3.8., and
b) measures shall be taken to ensure that any resultant decrease in *soil* temperature will not adversely affect the *foundation*.

9.13.8.3. Sealing of the Perimeter and Penetrations

(See A-9.13.7. and 9.13.8. in Appendix A.)

1) A floor-on-ground shall be sealed around its perimeter to the inner surfaces of adjacent walls using flexible sealant.

2) All penetrations of a floor-on-ground by pipes or other objects shall be sealed against *soil* gas leakage.

3) All penetrations of a floor-on-ground which are required to drain water from the floor surface shall be sealed in a manner which prevents the upward flow of *soil* gas without preventing the downward flow of liquid water.

Section 9.14. Drainage

9.14.1. Scope

9.14.1.1. Application

1) This Section applies to subsurface drainage and to surface drainage.

9.14.1.2. Crawl Spaces

1) Drainage for crawl spaces shall conform to Section 9.18.

9.14.1.3. Floors-on-Ground

1) Drainage requirements beneath floors-on-ground shall conform to Section 9.16.

9.14.2. Foundation Drainage

9.14.2.1. Foundation Wall Drainage

1) Unless it can be shown to be unnecessary, the bottom of every exterior *foundation* wall shall be drained by drainage tile or pipe laid around the exterior of the *foundation* in conformance with Subsection 9.14.3. or by a layer of gravel or crushed *rock* in conformance with Subsection 9.14.4.

2) Where mineral fibre insulation or crushed *rock* backfill is provided adjacent to the exterior surface of a *foundation* wall, 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 C 4, "Clay Drain Tile,"
b) ASTM C 412M, "Concrete Drain Tile (Metric),"
c) ASTM C 444M, "Perforated Concrete Pipe (Metric),"
d) ASTM C 700, "Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated,"
r e) CAN/CGSB-34.22, "Asbestos-Cement Drain Pipe,"
f) CSA B182.1, "Plastic Drain and Sewer Pipe and Pipe Fittings," r
g) CSA G401, "Corrugated Steel Pipe Products," or
h) NQ 3624-115, "Thermo-Plastic Pipe – Flexible Corrugated Tubing and Fittings for Soil Drainage."

9.14.3.2. Minimum Size

1) Drain tile or pipe used for *foundation* drainage shall be not less than 100 mm in diam.

9.14.3.3. Installation

1) Drain tile or pipe shall be laid on undisturbed or well-compacted *soil* so that the top of the tile or pipe is below the bottom of the floor slab or crawl space.

2) Drain tile or pipe with butt joints shall be laid with 6 mm to 10 mm open joints.

3) The top half of joints referred to in Sentence (2) shall be covered with sheathing paper, 0.10 mm polyethylene or No. 15 asphalt or tar-saturated felt.

4) The top and sides of drain pipe or tile shall be covered with not less than 150 mm of crushed stone or other coarse clean granular material containing not more than 10% of material that will pass a 4 mm sieve.

9.14.4. Granular Drainage Layer

9.14.4.1. Type of Granular Material

1) Granular material used to drain the bottom of a *foundation* shall consist of a continuous layer of crushed stone or other coarse clean granular material containing not more than 10% of material that will pass a 4 mm sieve.

9.14.4.2. Installation

1) Granular material described in Article 9.14.4.1. shall be laid on undisturbed or compacted *soil* to a minimum depth of not less than 125 mm beneath the *building* and extend not less than 300 mm beyond the outside edge of the footings.

9.14.4.3. Grading

1) The bottom of an *excavation* drained by a granular layer shall be graded so that the entire area described in Article 9.14.4.2. is drained to a sump conforming to Article 9.14.5.2.

9.14.4.4. Wet Site Conditions

1) Where because of wet site conditions *soil* becomes mixed with the granular drainage material,

footing width shall be not less than twice the width required by Article 9.15.3.3.

9.15.3.5. Non-Loadbearing Walls

1) Footings for interior non-*loadbearing* masonry walls shall be not less than 200 mm wide for walls up to 5.5 m high and shall be increased by 100 mm for each additional 2.7 m of height.

9.15.3.6. Thickness

1) Footings shall be not less than 100 mm thick except when greater thicknesses are required because of the projection of the footing beyond the supported element.

9.15.3.7. Footing Projection

1) The projection of an unreinforced footing beyond the supported element shall be not greater than the thickness of the footing.

9.15.3.8. Step Footings

1) When step footings are used,

a) the vertical rise between horizontal portions shall not exceed 600 mm, and

b) the horizontal distance between risers shall not be less than 600 mm.

9.15.4. Foundation Walls

9.15.4.1. Foundation Wall Thickness

1) Where average stable *soils* are encountered, the thickness of *foundation* walls subject to lateral earth pressure shall conform to Table 9.15.4.1. for walls not exceeding 2.5 m in unsupported height.

Table 9.15.4.1.
Thickness of Foundation Walls
Forming Part of Sentence 9.15.4.1.(1)

Type of *Foundation* Wall	Minimum Wall Thickness, mm	Maximum Height of Finish Ground Above *Basement* Floor or Crawl Space Ground Cover, m	
		Foundation Wall Laterally Unsupported at the Top (1)	*Foundation* Wall Laterally Supported at the Top (1)
Solid concrete, 15 MPa min. strength	150	0.80	1.50
	200	1.20	2.15
	250	1.40	2.30
	300	1.50	2.30
Solid concrete, 20 MPa min. strength	150	0.80	1.80
	200	1.20	2.30
	250	1.40	2.30
	300	1.50	2.30
Unit masonry	140	0.60	0.80
	190	0.90	1.20
	240	1.20	1.80
	290	1.40	2.20

Notes to Table 9.15.4.1.:
(1) See Article 9.15.4.2.

9.15.4.2. Lateral Support

1) For the purposes of Article 9.15.4.1., *foundation* walls shall be considered laterally supported at the top if such walls support solid masonry superstructure or if the floor joists are embedded in the top of the *foundation* walls.

2) *Foundation* walls shall also be considered supported at the top if the floor system is anchored to the top of the *foundation* walls with anchor bolts, in which case the joists may run either parallel or perpendicular to the *foundation* wall.

3) When a *foundation* wall contains an opening more than 1.2 m long or contains openings in more than 25% of its length, that portion of the wall beneath such openings shall be considered laterally unsupported, unless the wall around the opening is reinforced to withstand the earth pressure.

4) When the length of solid wall between windows is less than the average length of the windows, the combined length of such windows shall be considered as a single opening for the purposes of Sentence (3).

9.15.4.3. Extension above Ground Level

1) Exterior *foundation* walls shall extend not less than 150 mm above finished ground level.

9.15.4.4. Reduction in Thickness

1) Where the top of a *foundation* wall is reduced in thickness to permit the installation of floor joists, the reduced section shall be not more than 350 mm high and not less than 90 mm thick.

2) Where the top of a *foundation* wall is reduced in thickness to permit the installation of a masonry exterior facing, the reduced section shall be

a) not less than 90 mm thick, and
b) tied to the facing material with metal ties conforming to Article 9.20.9.4.(3) spaced not more than
   i) 200 mm o.c. vertically, and
   ii) 900 mm o.c. horizontally.

3) The space between wall and facing described in Sentence (2) shall be filled with mortar.

9.15.4.5. Corbelling

1) Corbelling of masonry *foundation* walls supporting cavity walls shall conform to Article 9.20.12.2.

9.15.4.6. Crack Control Joints

1) Crack control joints shall be provided in *foundation* walls more than 25 m long at intervals of not more than 15 m.

2) Joints required in Sentence (1) shall be designed to resist moisture penetration and shall be keyed to prevent relative displacement of the wall portions adjacent to the joint.

9.15.4.7. Interior Masonry Walls

1) Interior masonry *foundation* walls not subject to lateral earth pressure shall conform to Section 9.20.

9.15.5. Support of Joists and Beams on Masonry Foundation Walls

9.15.5.1. Support of Floor Joists

1) Except as permitted in Sentence (2), *foundation* walls of hollow masonry units supporting floor joists shall be capped with not less than 50 mm of solid masonry or concrete, or have the top course filled with mortar or concrete.

2) Capping required in Sentence (1) need not be provided

a) in localities where termites are not known to occur,
b) when the joists are supported on a wood plate not less than 38 mm by 89 mm, and
c) when the siding overlaps the *foundation* wall not less than 12 mm.

9.15.5.2. Support of Beams

1) Not less than 190 mm depth of solid masonry shall be provided beneath beams supported on masonry.

2) Where the beam referred to in Sentence (1) is supported below the top of the *foundation* walls, the ends of such beams shall be protected from the weather.

9.15.5.3. Pilasters

1) Pilasters shall be provided under beams that frame into unit masonry *foundation* walls 140 mm or less in thickness.

2) Pilasters required in Sentence (1) shall be not less than 90 mm by 290 mm and shall be bonded or tied into the wall.

3) The top 200 mm of pilasters required in Sentence (1) shall be solid.

9.15.6. Parging and Finishing of Masonry Foundation Walls

9.15.6.1. Foundation Walls below Ground

1) Concrete block *foundation* walls shall be parged on the exterior face below ground level as required in Section 9.13.

9.15.6.2. Foundation Walls above Ground

1) Exterior surfaces of concrete block *foundation* walls above ground level shall have tooled joints, or shall be parged or otherwise suitably finished.

9.15.6.3. Form Ties

1) All form ties shall be removed at least flush with the concrete surface.

Section 9.16. Floors-On-Ground

9.16.1. Scope

9.16.1.1. Application

1) This Section applies to floors supported on ground or on granular *fill* which do not provide structural support for the superstructure.

9.16.1.2. Structural Floors

1) Floors-on-ground that support loads from the superstructure shall be designed in conformance with Part 4.

9.16.1.3. Required Floors-on-Ground

1) All spaces within *dwelling units*, except crawl spaces, shall be provided with a floor-on-ground, where

a) access is provided to the space, and
b) a floor supported by the structure is not provided.

9.16.1.4. Dampproofing and Waterproofing

1) Dampproofing and waterproofing shall conform to Section 9.13.

r 9.16.2. Material beneath Floors

9.16.2.1. Required Installation of Granular Material

1) Except as provided in Sentence (2), not less than 100 mm of coarse clean granular material containing not more than 10% of material that will pass a 4 mm sieve shall be placed beneath floors-on-ground. (See Clause 9.13.1.3.(2)(c), Article 9.13.8.2., and A-9.13.1.3. and A-9.13.8.2. in Appendix A.)

2) Granular material need not be installed under

a) slabs in garages, carports or accessory *buildings*,
b) *buildings* of *industrial occupancy* where the nature of the process contained therein permits or requires the use of large openings in the *building* envelope even during the winter, or
c) *buildings* constructed in areas where it can be demonstrated that *soil* gas does not constitute a hazard.

r 9.16.2.2. Support of Floors

1) Except as provided in Sentence (2), fill beneath floors-on-ground shall be compacted.

2) Fill beneath floors-on-ground need not be compacted where the material is clean coarse aggregate containing not more than 10% of material that will pass a 4 mm sieve.

9.16.3. Drainage

9.16.3.1. Control of Water Ingress

1) Except as provided in Article 9.16.3.2. or where it can be shown to be unnecessary, ingress of water underneath a floor-on-ground shall be prevented by grading or drainage.

9.16.3.2. Hydrostatic Pressure

1) Where ground water levels may cause hydrostatic pressure beneath a floor-on-ground, the floor-on-ground shall be

a) a poured concrete slab, and
b) designed to resist such pressures.

9.16.3.3. Floor Drains

1) When floor drains are required (see Section 9.31.), the floor surface shall be sloped so that no water can accumulate.

9.16.4. Concrete

9.16.4.1. Surface Finish

1) The finished surface of concrete floor slabs shall be trowelled smooth and even.

2) Dry cement shall not be added to the floor surfaces to absorb surplus water.

9.16.4.2. Topping Course

1) When a topping course is provided for a concrete floor slab, it shall consist of 1 part cement to 2.5 parts clean, well graded sand by volume, with a water/cement ratio approximately equal to that of the base slab.

2) When concrete topping is provided, it shall not be less than 20 mm thick.

9.16.4.3. Thickness

1) Concrete slabs shall not be less than 75 mm thick exclusive of concrete topping.

9.16.4.4. Bond Break

1) A bond-breaking material shall be placed between the slab and footings or *roc*k.

9.16.5. Wood

9.16.5.1. Wood Frame Floors

1) Floors-on-ground constructed of wood shall conform to CAN/CSA-S406, "Construction of Preserved Wood Foundations."

Section 9.17. Columns

9.17.1. Scope

9.17.1.1. Application

1) This Section applies to columns used to support carport roofs (see Section 9.35.) and beams carrying loads from not more than 2 wood-frame floors where the supported length of joists bearing on such beams does not exceed 5 m and the *live load* on any floor does not exceed 2.4 kPa. (See Table 4.1.6.3.)

2) Columns for applications other than as described in Sentence (1) shall be designed in accordance with Part 4.

9.17.2. General

9.17.2.1. Location

1) Columns shall be centrally located on a footing conforming to Section 9.15.

9.17.2.2. Fastening

1) Columns shall be securely fastened to the supported member to prevent lateral movement.

9.17.3. Steel Columns

9.17.3.1. Size and Thickness

1) Except as permitted in Sentence (2), steel pipe columns shall have an outside diameter of not less than 73 mm and a wall thickness of not less than 4.76 mm.

2) Columns of sizes other than as specified in Sentence (1) are permitted to be used where the *loadbearing* capacities are shown to be adequate.

9.17.3.2. End Bearing Plates

1) Except as permitted in Sentence (2), steel columns shall be fitted with not less than 100 mm by 100 mm by 6.35 mm thick steel plates at each end, and where the column supports a wooden beam, the top plate shall extend across the full width of the beam.

2) The top plate required in Sentence (1) need not be provided where a column supports a steel beam and provision is made for the attachment of the column to the beam.

9.17.3.3. Paint

1) Steel columns shall be treated on the outside surface with at least one coat of rust-inhibitive paint.

9.17.3.4. Adjustable Steel Columns

1) Adjustable steel columns shall conform to CAN/CGSB-7.2, "Adjustable Steel Columns."

9.17.4. Wood Columns

9.17.4.1. Column Sizes

1) The width or diameter of a wood column shall be not less than the width of the supported member.

2) Except as provided in Article 9.35.4.2., columns shall be not less than 184 mm for round columns and 140 mm by 140 mm for rectangular columns, unless calculations are provided to show that lesser sizes are adequate.

9.17.4.2. Materials

1) Wood columns shall be either solid, glued-laminated or built-up.

2) Built-up columns shall consist of not less than 38 mm thick full-length members

a) bolted together with not less than 9.52 mm diam bolts spaced not more than 450 mm o.c., or
b) nailed together with not less than 76 mm nails spaced not more than 300 mm o.c.

3) Glued-laminated columns shall conform to Section 4.3.

9.17.4.3. Columns in Contact with Concrete

1) Wood columns shall be separated from concrete in contact with the ground by 0.05 mm polyethylene film or Type S roll roofing.

9.17.5. Unit Masonry Columns

9.17.5.1. Materials

1) Unit masonry columns shall be built of masonry units

a) conforming to CSA A165.1, "Concrete Masonry Units," and
b) having a compressive strength over the net area of the block of not less than 15 MPa.

9.17.5.2. Sizes

1) Unit masonry columns shall be not less than 290 mm by 290 mm or 240 mm by 380 mm in size.

9.17.6. Solid Concrete Columns

9.17.6.1. Materials

1) Concrete shall conform to Section 9.3.

9.17.6.2. Sizes

1) Concrete columns shall be not less than 200 mm by 200 mm for rectangular columns and 230 mm diam for circular columns.

Section 9.18. Crawl Spaces

9.18.1. General

9.18.1.1. Application

1) This Section applies to crawl spaces whose exterior walls have less than 25% of their total area above exterior ground level open to the outdoors.

9.18.1.2. Foundations

1) *Foundations* enclosing crawl spaces shall conform to Section 9.15.

9.18.1.3. Heated and Unheated Crawl Spaces

1) Crawl spaces shall be considered to be heated where the space
- a) is used as a hot air *plenum*,
- b) contains heating ducts that are not sealed and insulated to minimize heat loss to the space, or
- c) is not separated from heated space in accordance with Section 9.25.

2) Heating of heated crawl spaces shall conform to Section 9.33.

3) Insulation, an *air barrier system* and a vapour barrier shall be installed in the walls of heated crawl spaces in accordance with Section 9.25.

9.18.2. Access

9.18.2.1. Access Openings

1) An access opening of not less than 500 mm by 700 mm shall be provided to each crawl space where the crawl space serves a single *dwelling unit*, and not less than 550 mm by 900 mm for other crawl spaces.

2) Access openings shall be fitted with a door or hatch, except when the crawl space is heated and the access opening into the crawl space is from an adjacent heated space.

9.18.3. Ventilation

9.18.3.1. Ventilation of Unheated Crawl Spaces

1) Unheated crawl spaces shall be ventilated by natural or mechanical means.

2) Where an unheated crawl space is ventilated by natural means, ventilation shall be provided to the outside air by not less than 0.1 m^2 of unobstructed vent area for every 50 m^2 of *floor area*.

3) Vents shall be
- a) uniformly distributed on opposite sides of the *building*, and
- b) designed to prevent the entry of snow, rain and insects.

9.18.3.2. Ventilation of Heated Crawl Spaces

1) Heated crawl spaces shall be ventilated in accordance with Section 9.32.

9.18.4. Clearance

(See also Article 9.3.2.9.)

9.18.4.1. Access Way to Services

1) Where equipment requiring service such as plumbing cleanouts, traps and burners is located in crawl spaces, an access way with a height and width of not less than 600 mm shall be provided from the access door to the equipment and for a distance of 900 mm on the side or sides of the equipment to be serviced.

9.18.5. Drainage

9.18.5.1. Drainage

1) Except where it can be shown to be unnecessary, the ingress of water into a crawl space shall be controlled by grading or drainage.

2) Drainage of *foundation* walls shall conform to Article 9.14.2.1.

3) Drainage of the ground cover or floor-on-ground in the crawl space shall conform to Subsection 9.16.3. *e*

4) Drains shall conform to Section 9.14.

9.18.6. Ground Cover

9.18.6.1. Ground Cover in Unheated Crawl Spaces

1) Where a crawl space is unheated, a ground cover shall be provided consisting of not less than
- a) 50 mm of asphalt,
- b) 100 mm of 15 MPa Portland cement concrete,
- c) Type S roll roofing, or
- d) 0.10 mm polyethylene.

2) Joints in sheet-type ground cover required in Sentence (1) shall be lapped not less than 100 mm and weighted down.

9.18.6.2. Ground Cover in Heated Crawl Spaces

1) Where a crawl space is heated, a ground cover consisting of not less than 0.15 mm polyethylene sheet conforming to CAN/CGSB-51.34-M, "Vapour Barrier, Polyethylene Sheet for Use in Building Construction," shall be provided.

2) The ground cover required in Sentence (1) shall *e*
- a) have its joints lapped not less than 300 mm, and sealed and weighted down, or
- b) be covered with a concrete skim coat not less than 50 mm thick.

3) The perimeter of the ground cover required in Sentence (1) shall be sealed to the *foundation* wall. (See A-9.13.1.3., A-9.13.7. and 9.13.8., and A-9.13.8.1.(2) and (3) in Appendix A.)

9.18.7. Fire Protection

9.18.7.1. Crawl Spaces as Warm Air Plenums

1) Only crawl spaces under 1-*storey* portions of *dwelling units* shall be used as warm-air *plenums*.

2) Enclosing material in crawl spaces described in Sentence (1), including insulation, shall have a surface *flame-spread rating* not greater than 150.

3) *Combustible* ground cover in crawl spaces described in Sentence (1) shall be protected beneath each register opening with *noncombustible* material.

4) The *noncombustible* register protection described in Sentence (3) shall

a) extend not less than 300 mm beyond the projection of the register opening, and
b) have up-turned edges.

(See Appendix A.)

Section 9.19. Roof Spaces

9.19.1. Venting

9.19.1.1. Required Venting

1) Except where it can be shown to be unnecessary, where insulation is installed between a ceiling and the underside of the roof sheathing, a space shall be provided between the insulation and the sheathing, and vents shall be installed to permit the transfer of moisture from the space to the exterior. (See Appendix A.)

9.19.1.2. Vent Requirements

1) Except as provided in Sentence (2), the unobstructed vent area shall be not less than 1/300 of the insulated ceiling area.

2) Where the roof slope is less than 1 in 6 or in roofs that are constructed with roof joists, the unobstructed vent area shall be not less than 1/150 of the insulated ceiling area.

3) Required vents may be roof type, eave type, gable-end type or any combination thereof, and shall be distributed

a) uniformly on opposite sides of the *building*,
b) with not less than 25% of the required openings located at the top of the space, and
c) with not less than 25% of the required openings located at the bottom of the space.

4) Except where each joist space is separately vented, roof joist spaces shall be interconnected by installing purlins not less than 38 mm by 38 mm on the top of the roof joists.

5) Vents shall be designed to prevent the entry of rain, snow and insects.

6) The unobstructed vent area required in Sentences (1) and (2) shall be determined in conformance with CAN3-A93-M, "Natural Airflow Ventilators for Buildings."

9.19.1.3 Clearances

1) Not less than 63 mm of space shall be provided between the top of the insulation and the underside of the roof sheathing.

2) Ceiling insulation shall be installed in a manner that will not restrict a free flow of air through roof vents or through any portion of the *attic or roof space*.

9.19.1.4. Mansard or Gambrel Roof

1) The lower portion of a mansard or gambrel style roof need not be ventilated.

2) The upper portion of roofs described in Sentence (1) shall be ventilated in conformance with Articles 9.19.1.1. to 9.19.1.3.

9.19.2. Access

9.19.2.1. Access

1) Every *attic or roof space* shall be provided with an access hatch where the *attic or roof space* measures:

a) not less than 3 m^2 in area,
b) not less than 1 m in length or width, and
c) not less than 600 mm in height over at least the area described in Clauses (a) and (b).

2) The hatch required in Sentence (1) shall be not less than 550 mm by 900 mm except that, where the hatch serves not more than one *dwelling unit*, the hatch may be reduced to 500 mm by 700 mm.

3) Hatchways to *attic or roof spaces* shall be fitted with doors or covers.

Section 9.20. Above-Grade Masonry

9.20.1. Scope

9.20.1.1. Application

1) Except as provided in Article 9.20.1.2., 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 specified loads and allowable stresses, Subsection 4.3.2. shall apply.

9.20.1.2. Earthquake Reinforcement

(See Appendix A.)

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.

9.20.2. Masonry Units

9.20.2.1. Masonry Unit Standards

1) Masonry units shall comply with

a) ASTM C 126, "Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units,"
b) ASTM C 212, "Structural Clay Facing Tile,"
c) CAN/CSA-A82.1-M, "Burned Clay Brick (Solid Masonry Units Made from Clay or Shale),"
d) CSA A82.3-M, "Calcium Silicate (Sand-Lime) Building Brick,"
e) CSA A82.4-M, "Structural Clay Load-Bearing Wall Tile,"
f) CSA A82.5-M, "Structural Clay Non-Load-Bearing Tile,"
g) CAN3-A82.8-M, "Hollow Clay Brick,"
h) CSA A165.1, "Concrete Masonry Units,"
i) CSA A165.2, "Concrete Brick Masonry Units,"
j) CSA A165.3, "Prefaced Concrete Masonry Units," or
k) CAN3-A165.4-M, "Autoclaved Cellular Units."

9.20.2.2. Used Brick

1) Used bricks shall be free of old mortar, soot or other surface coating and shall conform to Article 9.20.2.1.

9.20.2.3. Glass Blocks

1) Glass blocks shall not be used as *loadbearing* units or in the construction of fireplaces or *chimneys*.

9.20.2.4. Cellular Concrete

1) Masonry made with cellular concrete shall not be used in contact with the *soil* or exposed to the weather.

9.20.2.5. Stone

1) Stone shall be sound and durable.

9.20.2.6. Concrete Blocks Exposed to the Weather

1) Concrete blocks exposed to the weather shall have weight and water absorption characteristics conforming to Classes A, B or C, described in CSA 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

1) The compressive strength of concrete blocks shall conform to Table 9.20.2.7.

Table 9.20.2.7.
Compressive Strength of Concrete Blocks
Forming Part of Sentence 9.20.2.7.(1)

Type of Unit	Minimum Compressive Strength Over Net Area, MPa	
	Exposed to Weather	Not Exposed to Weather
Solid or hollow concrete blocks	15	10
Solid *loadbearing* cellular blocks	Not permitted	5
Solid non-*loadbearing* cellular blocks	Not permitted	2

9.20.3. Mortar

9.20.3.1. Mortar Materials

1) Cementitious materials and aggregates for mortar shall comply with

a) ASTM C 5, "Quicklime for Structural Purposes,"
b) ASTM C 207, "Hydrated Lime for Masonry Purposes,"
c) CAN/CSA-A5, "Portland Cement,"
d) CAN/CSA-A8, "Masonry Cement," or
e) CSA A82.56-M, "Aggregate for Masonry Mortar."

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 9.20.3.2.

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 is permitted to 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 9.20.3.2.

4) Mortar for glass block shall consist of 1 part portland cement and 1 part hydrated lime to not more than 4 parts aggregate by volume.

Table 9.20.3.2.
Mortar Mix Proportions (by volume)
Forming Part of Sentence 9.20.3.2.(1)

Permissible Use of Mortar	Portland Cement	Masonry Cement	Lime	Aggregate
All locations but not for use with sand-lime or concrete brick	0.5 to 1 1	1 —	— 0.25 to 0.5	Not less than 2.25 and not more than 3 times the sum of the volumes of the cement and the lime
All locations except *foundation* walls and piers, but not for use with sand-lime or concrete brick	— 1	1 —	— 0.5 to 1.25	
All locations except *loadbearing* walls of hollow units, parapet walls and *chimneys*	1	—	1.25 to 2.5	
All non-*loadbearing* interior walls and all *loadbearing* walls of solid units, except *foundation* walls, parapet walls and *chimneys*	1 —	— —	2.25 to 4 1	

9.20.4. Mortar Joints

9.20.4.1. Thickness

1) Except as provided in Sentence (2), mortar joint thickness for burned clay brick and concrete masonry units shall be 10 mm.

2) Permitted tolerances in head and bed joints shall be not more than ± 5 mm.

9.20.4.2. Solid Masonry Units

1) Solid masonry units shall be laid with full head and bed joints.

9.20.4.3. Hollow Masonry Units

1) Hollow masonry units shall be laid with mortar applied to head and bed joints of both inner and outer face shells.

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).

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

(See Appendix A.)

1) Masonry veneer of hollow units resting on a bearing support shall not project more than

a) 30 mm beyond the supporting base where the veneer is not less than 90 mm thick, and
b) 12 mm beyond the supporting base where the veneer is less than 90 mm thick.

2) Masonry veneer of solid units resting on bearing support shall not project more than one third of the width of the veneer.

3) Where the masonry veneer described in Sentence (2) is rough stone masonry,

a) the projection shall be measured as the average projection of the units, and
b) the width of the veneer shall be measured as the average width of the veneer.

9.20.9. Bonding and Tying

9.20.9.1. Joints to be Offset or Reinforced

1) Vertical joints in adjacent masonry courses shall be offset unless each wythe of masonry is reinforced with the equivalent of not less than 2 corrosion-resistant steel bars of 3.76 mm diam placed in the horizontal joints at vertical intervals not exceeding 460 mm.

2) Where joints in the reinforcing referred to in Sentence (1) occur, the bars shall be lapped not less than 150 mm.

9.20.9.2. Bonding or Tying of Other than Masonry Veneer

1) Masonry walls, other than masonry veneer walls, that consist of 2 or more wythes shall have the wythes bonded or tied together with masonry bonding units as described in Article 9.20.9.3. or with metal ties as described in Article 9.20.9.4.

9.20.9.3. Bonding

1) Where wythes are bonded together with masonry units, the bonding units shall comprise not less than 4% of the wall surface area.

2) Bonding units described in Sentence (1) shall be spaced not more than 600 mm vertically and horizontally in the case of brick masonry and 900 mm o.c. in the case of block or tile.

3) Units described in Sentence (1) shall extend not less than 90 mm into adjacent wythes.

9.20.9.4. Tying

1) Where 2 or more wythes are tied together with metal ties of the individual rod type, the ties shall conform to the requirements in Sentences (3) to (6).

2) Other ties may be used where it can be shown that such ties provide walls that are at least as strong and as durable as those made with the individual rod type.

3) Metal ties of the individual rod type shall

a) be corrosion-resistant,
b) have a minimum cross-sectional area of not less than 17.8 mm^2, and
c) have not less than a 50 mm portion bent at right angles at each end.

4) Metal ties of the individual rod type shall

a) extend from within 25 mm of the outer face of the wall to within 25 mm of the inner face of the wall,
b) be completely embedded in mortar except for the portion exposed in cavity walls, and
c) be staggered from course to course.

5) Where 2 or more wythes in walls other than cavity walls and masonry veneer/masonry back-up walls are tied together with metal ties of the individual rod type, the space between wythes shall be completely filled with mortar.

6) Ties described in Sentence (5) shall be

a) located within 300 mm of openings and spaced not more than 900 mm apart around openings, and
b) spaced not more than 900 mm apart horizontally and 460 mm apart vertically at other locations.

7) Except as required in Sentences (8) and (9), where the inner and outer wythes of cavity walls are tied with individual wire ties, the ties shall be spaced not more than 900 mm apart horizontally and 400 mm apart vertically.

8) Within 100 mm of the bottom of each floor or roof assembly where the cavity extends below the assemblies, the ties described in Sentence (7) shall be spaced not more than 600 mm apart horizontally.

9) Within 300 mm of any openings, the ties described in Sentence (7) shall be spaced not more than 900 mm apart.

9.20.9.5. Ties for Masonry Veneer

1) Masonry veneer 75 mm or more in thickness and resting on a bearing support shall be tied to masonry back-up or to wood framing members with straps that are

a) corrosion-resistant,
b) not less than 0.76 mm thick,
c) not less than 22 mm wide,
d) shaped to provide a key with the mortar, and
e) spaced in accordance with Table 9.20.9.5.

Table 9.20.9.5.
Veneer Tie Spacing
Forming Part of Sentence 9.20.9.5.(1)

Maximum Vertical Spacing, mm	Maximum Horizontal Spacing, mm
400	800
500	600
600	400

2) Straps described in Sentence (1) which are fastened to wood framing members, shall be

a) bent at a right angle within 6 mm from the fastener, and
b) fastened with corrosion resistant 3.18 mm diam screws or spiral nails having a wood penetration of not less than 63 mm.

3) Masonry veneer individually supported by masonry or wood-frame 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

a) spaced at vertical intervals of not more than 600 mm for units 190 mm or less in height, and
b) installed 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 laterally supported by floor or roof construction or by intersecting masonry walls or buttresses.

2) The spacing of supports required in Sentence (1) shall be not more than *e*

a) 20 times the wall thickness for all *loadbearing* walls and exterior non-*loadbearing* walls, and
b) 36 times the wall thickness for interior non-*loadbearing* walls.

3) In applying Sentence (2), the thickness of *cavity walls* shall be taken as the greater of *e*

a) two-thirds of the sum of the thicknesses of the wythes, or
b) the thickness of the thicker wythe.

4) Floor and roof constructions providing lateral support for walls as required in Sentence (1) shall be constructed to transfer lateral loads to walls or buttresses approximately at right angles to the laterally supported walls.

9.20.11. Anchorage of Roofs, Floors and Intersecting Walls

9.20.11.1. Anchorage of Floor or Roof Assemblies

1) Where required to receive lateral support (see Subsection 9.20.10.), masonry walls shall be anchored to each floor or roof assembly at maximum intervals of 2 m, except that anchorage 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. Bonding and Tying Intersecting Masonry Walls

1) Where required to provide lateral support, intersecting walls shall be bonded or tied together.

2) Where bonding is used to satisfy the requirements of Sentence (1), 50% of the adjacent masonry units in the intersecting wall, distributed uniformly over the height of the intersection, shall be embedded in the laterally supported wall.

3) Where tying is used to satisfy the requirements of Sentence (1), the ties shall be

a) corrosion-resistant metal,
b) equivalent to not less than 4.76 mm by 40 mm steel strapping,
c) spaced not more than 800 mm o.c. vertically, and

d) shaped at both ends to provide sufficient mechanical key to develop the strength of the ties.

9.20.11.3. 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,

a) spaced not more than 2.4 m apart,
b) embedded not less than 90 mm into the masonry, and
c) fastened to a rafter plate of not less than 38 mm thick lumber.

2) The roof system described in Sentence (1) is permitted to be anchored by nailing the wall furring strips to the side of the rafter plate.

9.20.11.5. Cornices, Sills and Trim

1) Cornices, sills or other trim of masonry material which project beyond the wall face shall have not less than 65% of their mass, but not less than 90 mm, within the wall or shall be adequately anchored to the wall with corrosion-resistant anchors.

9.20.11.6. Piers

1) Where anchor bolts are to be placed in the top of a masonry pier, the pier shall conform to the requirements of Sentence 9.15.2.4.(4) and shall be capped with concrete or reinforced masonry not less than 200 mm thick.

9.20.12. Corbelling

9.20.12.1. Corbelling

1) All corbelling shall consist of solid units.

2) The units referred to in Sentence (1) shall be corbelled so that the horizontal projection of any unit does not exceed 25 mm and the total projection does not exceed one third of the total wall thickness.

9.20.12.2. Corbelling for Cavity Walls

1) Cavity walls of greater thickness than the *foundation* wall on which they rest shall not be corbelled but may project 25 mm over the outer face of the *foundation* wall disregarding parging.

2) Where the *foundation* wall referred to in Sentence (1) is unit masonry, it is permitted to be corbelled to meet flush with the inner face of a cavity wall provided

a) the projection of each course does not exceed half the height or one third the width of the corbelled unit, and
b) the total corbel does not exceed one third of the *foundation* wall thickness.

(See Appendix A.)

9.20.12.3. Corbelling for Masonry Veneer

1) Masonry veneer resting on a bearing support shall not project more than 25 mm beyond the supporting base where the veneer is not less than 90 mm thick, and 12 mm beyond the supporting base where the veneer is less than 90 mm thick.

2) In the case of rough stone veneer, the projection, measured as the average projection of the stone units, shall not exceed one-third the bed width beyond the supporting base.

9.20.13. Control of Rain Water Penetration

9.20.13.1. Materials for Flashing

1) Materials used for flashing shall conform to Table 9.20.13.1.

Table 9.20.13.1.
Flashing Materials
Forming Part of Sentence 9.20.13.1.(1)

Material	Minimum Thickness, mm	
	Exposed Flashing	Concealed Flashing
Aluminum	0.48	—
Copper	0.46	0.46
Copper or aluminum laminated to felt or kraft paper	—	0.05
Galvanized steel	0.33	0.33
Lead sheet	1.73	1.73
Polyethylene	—	0.50
Roll roofing, Type S	—	standard
Zinc	0.46	0.46

2) Aluminum flashing in contact with masonry or concrete shall be effectively coated or separated from the masonry or concrete by an impervious membrane.

9.20.13.2. Fastening of Flashing

1) Fastening devices for flashing shall be corrosion-resistant and, where metal flashing is used, shall be compatible with the flashing with respect to galvanic action.

9.20.13.3. Location of Flashing

1) Flashing shall be installed in masonry and masonry veneer walls

a) beneath jointed masonry window sills,
b) over the back and top of parapet walls,
c) over the heads of glass block panels,
d) beneath weep holes, and
e) over the heads of window or door openings in exterior walls when the vertical distance between the top of a window or door frame and the bottom edge of the eave exceeds one-quarter of the horizontal eave overhang.

9.20.13.4. Extension of Flashing

1) When installed beneath jointed masonry window sills or over the heads of openings, flashing shall extend from the front edge of the masonry up behind the sill or lintel.

9.20.13.5. Flashing for Weep Holes in Masonry/Masonry Walls

1) Flashing beneath weep holes in cavity walls and masonry veneer/masonry back-up walls shall

a) be bedded not less than 25 mm in the inside wythe,
b) extend to not less than 5 mm beyond the outer face of the *building* element below the flashing, and
c) be installed with a nominally horizontal slope toward the outside wythe.

9.20.13.6. Flashing for Weep Holes in Veneer

1) Flashing beneath weep holes in masonry veneer over masonry back-up walls shall conform to the flashing requirements for cavity walls and masonry veneer/masonry back-up walls in Article 9.20.13.5.

2) Flashing beneath weep holes in masonry veneer over wood-frame walls shall be installed so that it extends from a point not less than 5 mm beyond the outer face of the *building* element below the flashing to a point 150 mm up the wood frame wall.

3) Where the frame wall is sheathed with a sheathing membrane, a non-wood-based rigid exterior insulating sheathing or a semi-rigid insulating sheathing with an integral sheathing membrane, the flashing shall be installed behind the sheathing membrane or insulating sheathing.

4) Flashing described in Sentence (2) is permitted to conform to the requirements for concealed flashing in Table 9.20.13.1.

9.20.13.7. Flashing Joints

1) Joints in flashing shall be made watertight.

9.20.13.8. Required Weep Holes

1) Weep holes spaced not more than 800 mm apart shall be provided at the bottom of

a) cavities in cavity walls, and
b) cavities or air spaces in masonry veneer walls.

2) The cavities or air spaces described in Sentence (1) shall include those above lintels over window and door openings required to be flashed in conformance with Article 9.20.13.3.

9.20.13.9. Protection of Interior Finish

1) Except as provided in Sentence (3), where the interior finish of the exterior walls of a *building* is a type which may be damaged by moisture, exterior masonry walls, other than cavity walls or walls that are protected for their full height by a roof of a carport or porch, shall be covered on the interior surface with sheathing membrane conforming to CAN/CGSB-51.32-M, "Sheathing, Membrane, Breather Type," lapped not less than 100 mm at the joints. *e*

2) In situations described in Sentence (1), flashing shall be provided where water will accumulate, to lead it to the exterior.

3) Where insulation that effectively limits the passage of water is applied by a waterproof adhesive or mortar directly to parged masonry, the requirements for sheathing paper in Sentence (1) do not apply. (See Appendix A.)

9.20.13.10. Mortar Droppings

1) Cavity walls shall be constructed so that mortar droppings are prevented from forming a bridge to allow the passage of rain water across the cavity.

9.20.13.11. Caulking at Door and Window Frames

1) The junction of door and window frames with masonry shall be caulked in conformance with Subsection 9.27.4.

9.20.13.12. Drips beneath Window Sills

1) Where no flashing is installed beneath window sills, such sills shall be provided with a drip not less than 25 mm from the wall surface.

3) Wall studs that support only a load from an attic not accessible by a stairway are permitted to be placed on the flat within the limits permitted in Article 9.23.10.1. provided

a) the studs are clad on not less than one side with plywood, OSB or waferboard sheathing fastened to the face of the studs with a structural adhesive, and
b) the portion of the roof supported by the studs does not exceed 2.1 m in width.

9.23.10.4. Continuity of Studs

1) Wall studs shall be continuous for the full *storey* height except at openings and shall not be spliced except by fingerjoining with a structural adhesive. (See Appendix A.)

9.23.10.5. Support for Cladding, Sheathing and Finishing Materials

1) Corners and intersections shall be designed to provide adequate support for the vertical edges of interior finishes, sheathing and cladding materials, and in no instance shall exterior corners be framed with less than the equivalent of 2 studs.

2) Where the vertical edges of interior finishes at wall intersections are supported at vertical intervals by blocking or furring, the vertical distance between such supports shall not exceed the maximum distance between supports specified in Section 9.29.

9.23.10.6. Studs at Sides of Openings

1) Except as provided in Sentence (2), studs shall be doubled on each side of openings so that the inner studs extend from the lintel to the bottom wall plate and the outer studs extend from the top wall plate to the bottom wall plate.

2) Single studs are permitted to be used on either side of openings

a) in non-*loadbearing* interior walls not required to have *fire-resistance ratings*, provided the studs extend from the top wall plate to the bottom wall plate, or
b) in *loadbearing* or non-*loadbearing* interior or exterior walls, provided
   i) the opening is less than and within the required stud spacing, and
   ii) no 2 such openings of full stud-space width are located in adjacent stud spaces.

(See Appendix A.)

9.23.11. Wall Plates

9.23.11.1. Size of Wall Plates

1) Except as provided in Sentence (2), wall plates shall be

a) not less than 38 mm thick, and
b) not less than the required width of the wall studs.

2) In non-*loadbearing* walls and in *loadbearing* walls where the studs are located directly over framing members, the bottom wall plate is permitted to be 19 mm thick.

9.23.11.2. Bottom Wall Plates

1) A bottom wall plate shall be provided in all cases.

2) The bottom plate in exterior walls shall not project more than one-third the plate width over the support.

9.23.11.3. Top Plates

1) Except as permitted in Sentences (2) to (4), at least 2 top plates shall be provided in *loadbearing* walls.

2) A single top plate is permitted to be used in a section of a *loadbearing* wall containing a lintel provided the top plate forms a tie across the lintel.

3) A single top plate is permitted to be used in *loadbearing* walls where the concentrated loads from ceilings, floors and roofs are not more than 50 mm to one side of the supporting studs and in all non-*loadbearing* walls.

4) The top plates need not be provided in a section of *loadbearing* wall containing a lintel provided the lintel is tied to the adjacent wall section with not less than

a) 75 mm by 150 mm by 0.91 mm thick galvanized steel, or
b) 19 mm by 89 mm by 300 mm wood splice nailed to each wall section with at least three 63 mm nails.

9.23.11.4. Joints in Top Plates

1) Joints in the top plates of *loadbearing* walls shall be staggered not less than one stud spacing.

2) The top plates in *loadbearing* walls shall be lapped or otherwise tied at corners and intersecting walls in accordance with Sentence (4).

3) Joints in single top plates used with *loadbearing* walls shall be tied in accordance with Sentence (4).

4) Ties referred to in Sentences (2) and (3) shall be the equivalent of not less than 75 mm by 150 mm by 0.91 mm thick galvanized steel nailed to each wall with at least three 63 mm nails.

9.23.12. Framing over Openings

9.23.12.1. Openings in Non-Loadbearing Walls

1) Except as provided in Sentence (2), openings in non-*loadbearing* walls shall be framed with not less than 38 mm material the same width as the studs, securely nailed to adjacent studs.

2) Openings for doors in non-*loadbearing* walls required to be *fire separations* with a *fire-resistance rating* shall be framed with the equivalent of at least two 38 mm thick members that are the same width as the wall plates.

9.23.12.2. Openings in Loadbearing Walls

1) Openings in *loadbearing* walls greater than the required stud spacing shall be framed with lintels designed to carry the superimposed loads to adjacent studs. (See A-9.23.10.6.(2) in Appendix A.)

2) Except as provided in Sentence 9.23.12.3.(2), where 2 or more members are used in lintels, they shall be fastened together with not less than 82 mm nails in a double row, with nails not more than 450 mm apart in each row.

3) Lintel members are permitted to be separated by filler pieces.

9.23.12.3. Lintel Spans and Sizes

1) Spans and sizes of wood lintels shall conform to the spans shown in Tables A-13 to A-20

a) for *buildings* of *residential occupancy*,
b) where the wall studs exceed 38 mm by 64 mm in size,
c) where the spans of supported joists do not exceed 4.9 m, and
d) where the spans of trusses do not exceed 9.8 m.

2) In *loadbearing* exterior and interior walls of 38 mm by 64 mm framing members, lintels shall consist of

a) 64 mm thick members on edge, or
b) 38 mm thick and 19 mm thick members fastened together with a double row of nails not less than 63 mm long and spaced not more than 450 mm apart.

3) Lintels referred to in Sentence (2)

a) shall be not less than 50 mm greater in depth than those shown in Tables A-13 to A-20 for the maximum spans shown, and
b) shall not exceed 2.24 m in length.

9.23.13. Roof and Ceiling Framing

9.23.13.1. Continuity of Rafters and Joists

1) Roof rafters and joists and ceiling joists shall be continuous or shall be spliced over vertical supports that extend to suitable bearing.

9.23.13.2. Framing around Openings

1) Roof and ceiling framing members shall be doubled on each side of openings greater than 2 rafter or joist spacings wide.

9.23.13.3. End Bearing Length

1) The length of end bearing of joists and rafters shall be not less than 38 mm.

9.23.13.4. Location and Attachment of Rafters

1) Rafters shall be located directly opposite each other and tied together at the peak, or may be offset by their own thickness if nailed to a ridge board not less than 17.5 mm thick.

2) Except as permitted in Sentence (3), framing members shall be connected by gusset plates or nailing at the peak in conformance with Table 9.23.3.4.

3) Where the roof framing on opposite sides of the peak is assembled separately, such as in the case of factory-built houses, the roof framing on opposite sides is permitted to be fastened together with galvanized-steel strips not less than 200 mm by 75 mm by 0.41 mm thick spaced not more than 1.2 m apart and nailed at each end to the framing by at least two 63 mm nails.

9.23.13.5. Shaping of Rafters

1) Rafters shall be shaped at supports to provide even bearing surfaces and supported directly above the exterior walls.

9.23.13.6. Hip and Valley Rafters

1) Hip and valley rafters shall be not less than 50 mm greater in depth than the common rafters and not less than 38 mm thick, actual dimension.

9.23.13.7. Intermediate Support for Rafters and Joists

1) Ceiling joists and collar ties of not less than 38 mm by 89 mm lumber are permitted to be assumed to provide intermediate support to reduce the span for rafters and joists where the roof slope is 1 in 3 or greater.

2) The joint connections used in trusses described in Sentence (1) shall be designed in conformance with the requirements in Subsection 4.3.1. (See Appendix A.)

3) Where the length of compression web members in roof trusses described in Sentence (1) exceeds 1.83 m, such web members shall be provided with continuous bracing to prevent buckling.

4) Bracing required in Sentence (3) shall consist of not less than 19 mm by 89 mm lumber nailed at right angles to the web members near their centres with at least two 63 mm nails for each member.

5) Where the ability of a truss design to satisfy the requirements of Sentence (1) is demonstrated by testing, it shall consist of a full scale load test carried out in conformance with CSA S307-M, "Load Test Procedure for Wood Roof Trusses for Houses and Small Buildings."

6) Where the ability of a truss design to satisfy the requirements of Sentence (1) is demonstrated by analysis, it shall be carried out in accordance with good engineering practice such as described in "Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses," published by the Truss Plate Institute of Canada.

9.23.14. Subflooring

9.23.14.1. Subflooring Required

1) Subflooring shall be provided beneath finish flooring where the finish flooring does not have adequate strength to support the specified *live loads* (see Subsection 9.30.3.).

9.23.14.2. Material Standards

1) Except as provided in Sentence (2), wood-based panels for subfloors shall conform to

a) CSA O121-M, "Douglas Fir Plywood,"
b) CSA O151-M, "Canadian Softwood Plywood,"
c) CSA O153-M, "Poplar Plywood,"
d) CAN/CSA-O325.0, "Construction Sheathing," or
e) CSA O437.0, "OSB and Waferboard."

2) Particleboard subflooring may be used only where a *building* is constructed in a factory so that the subfloor will not be exposed to the weather.

3) Subflooring described in Sentence (2) shall conform to grade D-2 or D-3 in ANSI A208.1, "Particleboard, Mat-Formed Wood."

4) Subflooring described in Sentence (2) shall have its upper surface and all edges treated to restrict water absorption where the subfloor is used in bathrooms, kitchens, laundry rooms or other areas subject to periodic wetting. (See Appendix A.)

9.23.14.3. Edge Support

1) Where the edges of panel-type subflooring are required to be supported (see Sentence 9.30.2.1.(2)), such support shall consist of tongue-and-groove panel edges or not less than 38 mm by 38 mm blocking securely nailed between framing members.

9.23.14.4. 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) OSB subflooring conforming to O-1 and O-2 grades in CSA O437.0 and waferboard subflooring conforming to R-1 grade in CSA 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 9.23.14.5.A. or Table 9.23.14.5.B.

Table 9.23.14.5.A.
Thickness of Subflooring
Forming Part of Sentences 9.23.14.5.(1) and 9.23.15.6.(1)

Maximum Spacing of Supports, mm	Minimum Thickness, mm			
	Plywood and OSB, O-2 Grade	OSB, O-1 Grade, and Waferboard, R-1 Grade	Particleboard	Lumber
400	15.5	15.9	15.9	17.0
500	15.5	15.9	19.0	19.0
600	18.5	19.0	25.4	19.0

Table 9.23.14.5.B.
Rating for Subfloor when Applying CAN/CSA-O325.0
Forming Part of Sentences 9.23.14.5.(1) and 9.23.15.6.(1)

Maximum Spacing of Supports, mm	Panel Mark	
	Subfloor	Used with Panel-Type Underlay
400	1F16	2F16
500	1F20	2F20
600	1F24	2F24

2) Where the finished flooring consists of not less than 19 mm matched wood strip flooring laid at right angles to joists spaced not more than

600 mm o.c., subflooring shall be permitted to consist of not less than

a) 12.5 mm thick plywood,
b) 12.5 mm thick OSB conforming to O-2 grade,
c) 12.7 mm thick OSB conforming to O-1 grade, or
d) 12.7 mm thick waferboard conforming to R-1 grade.

3) Except where the flooring consists of ceramic tiles applied with adhesive, where a separate panel-type underlay or concrete topping is applied to a subfloor on joists spaced not more than 400 mm o.c., the subfloor is permitted to consist of not less than

a) 12.5 mm thick plywood,
b) 12.5 mm thick OSB conforming to O-2 grade,
c) 12.7 mm thick OSB conforming to O-1 grade, or
d) 12.7 mm thick waferboard conforming to R-1 grade.

9.23.14.6. Annular Grooved Nails

1) When resilient flooring is applied directly to an OSB, waferboard, particleboard or plywood subfloor, the subfloor shall be fastened to the supports with annular grooved nails.

9.23.14.7. 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-M, "Douglas Fir Plywood,"
b) CSA O151-M, "Canadian Softwood Plywood,"
c) CSA O153-M, "Poplar Plywood,"
d) CAN/CSA-O325.0, "Construction Sheathing," or
e) CSA O437.0, "OSB and Waferboard."

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) OSB roof sheathing conforming to O-1 and O-2 grades as specified in CSA O437.0, "OSB and Waferboard," shall be installed with the direction of face orientation at right angles to the roof framing members. (See A-9.23.14.4.(2) in Appendix A.)

9.23.15.3. Joints in Panel-Type Sheathing

1) Panel-type sheathing board shall be applied so that joints perpendicular to the roof ridge are staggered where

a) the sheathing is applied with the surface grain parallel to the roof ridge, and
b) the thickness of the sheathing is such that the edges are required to be supported.

2) A gap of not less than 2 mm shall be left between sheets of plywood, OSB or waferboard.

9.23.15.4. Lumber Roof Sheathing

1) Lumber roof sheathing shall not be more than 286 mm wide and shall be applied so that all ends are supported with end joints staggered.

9.23.15.5. Edge Support

1) Where panel-type roof sheathing requires edge support, the support shall consist of metal H clips or not less than 38 mm by 38 mm blocking securely nailed between framing members.

9.23.15.6. 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 9.23.14.5.A. or Table 9.23.14.5.B. for subfloors.

2) The thickness or rating of roof sheathing on a roof not used as a walking deck shall conform to either Table 9.23.15.6.A. or Table 9.23.15.6.B.

Table 9.23.15.6.A.
Thickness of Roof Sheathing
Forming Part of Sentence 9.23.15.6.(2)

Maximum Spacing of Supports, mm	Minimum Thickness, mm				
	Plywood, and OSB, O-2 Grade		OSB, O-1 Grade, and Waferboard, R-1 Grade		Lumber
	Edges Supported	Edges Unsupported	Edges Supported	Edges Unsupported	
300	7.5	7.5	9.5	9.5	17.0
400	7.5	9.5	9.5	11.1	17.0
600	9.5	12.5	11.1	12.7	19.0

Table 9.23.15.6.B.
Rating for Roof Sheathing When Applying CSA O325.0
Forming Part of Sentence 9.23.15.6.(2).

Maximum Spacing of Supports, mm	Panel Mark	
	Edges Supported	Edges Unsupported
400	2R16	1R16
500	2R20	1R20
600	2R24	1R24

3) Asphalt-coated or asphalt-impregnated fibreboard not less than 11.1 mm thick conforming to CAN/CSA-A247-M, "Insulating Fibreboard," is permitted to be used as a roof sheathing over supports spaced not more than 400 mm o.c. provided the roofing consists of

a) a continuous sheet of galvanized steel not less than 0.33 mm in thickness, or
b) a continuous sheet of aluminum not less than 0.61 mm in thickness.

4) All edges of sheathing described in Sentence (3) shall be supported by blocking or framing.

9.23.16. Wall Sheathing

9.23.16.1. Required Sheathing

1) Exterior walls and gable ends shall be sheathed when the exterior cladding requires intermediate fastening between supports or if the exterior cladding requires solid backing.

9.23.16.2. Thickness, Rating and Material Standards

1) Where wall sheathing is required, it shall conform to either Table 9.23.16.2.A. or Table 9.23.16.2.B.

Table 9.23.16.2.A.
Wall Sheathing Thickness and Specifications
Forming Part of Sentence 9.23.16.2.(1)

Type of Sheathing	Minimum Thickness, mm[1]		Material Standards
	With Supports 400 mm o.c.	With Supports 600 mm o.c.	
Fibreboard (insulating)	9.5	11.1	CAN/CSA-A247-M
Gypsum sheathing	9.5	12.7	CAN/CSA-A82.27-M ASTM C 79
Lumber	17.0	17.0	See Table 9.3.2.1.
Mineral Fibre, Rigid Board, Type 2	25	25	CAN/ULC-S702
OSB, O-2 Grade	6.0	7.5	CSA O437.0
OSB, O-1 Grade, and Waferboard, R-1 Grade	6.35	7.9	CSA O437.0
Phenolic, faced	25	25	CAN/CGSB-51.25-M

Table 9.23.16.2.A. (Continued)

Type of Sheathing	Minimum Thickness, mm(1)		Material Standards
	With Supports 400 mm o.c.	With Supports 600 mm o.c.	
Plywood (exterior type)	6.0	7.5	CSA O121-M CSA O151-M CSA O153-M
Polystyrene, expanded Types 1 and 2	38	38	CAN/ULC-S701 r
Polystyrene, expanded Types 3 and 4	25	25	CAN/ULC-S701 r
Urethane and Isocyanurate Types 1, 2 and 4	38	38	CGSB 51-GP-21M
Urethane and Isocyanurate Type 3	25	25	CGSB 51-GP-21M
Urethane and Isocyanurate Types 1 and 2, faced	25	25	CAN/CGSB-51.26-M

Notes to Table 9.23.16.2.A.:
(1) See also Sentences 9.27.5.1.(2) to (4)

Table 9.23.16.2.B.
Rating for Wall Sheathing when Applying CAN/CSA-O325.0 e
Forming Part of Sentence 9.23.16.2.(1)

Maximum Spacing of Supports, mm	Panel Mark
400	W16
500	W20
600	W24

9.23.16.3. Attachment of Cladding to Sheathing

1) Gypsum sheathing, rigid insulation and fibreboard shall not be used for the attachment of cladding materials.

9.23.16.4. Lumber Sheathing

1) Lumber wall sheathing shall be applied so that all ends are supported.

2) Where lumber wall sheathing is required to provide bracing according to Article 9.23.10.2., it shall be applied with end joints staggered.

9.23.16.5. Joints in Panel-Type Sheathing

1) A gap of not less than 2 mm shall be left between sheets of plywood, OSB, waferboard or fibreboard.

9.23.16.6. Mansard Style Roofs

1) Where the bottom portions of mansard style roofs are vented, the vertical framing members behind the sloping portions shall be considered on the same basis as exterior wall studs and shall conform to Subsection 9.23.17.

9.23.17. Wall Sheathing Membrane

9.23.17.1. Material Standard

1) Sheathing membrane shall conform to the performance requirements of CAN/CGSB-51.32-M, "Sheathing, Membrane, Breather Type." e

9.23.17.2. Sheathing Membrane beneath Stucco

1) Tar-saturated felts or papers shall not be used as a sheathing paper beneath stucco. (See Appendix A.) r

9.23.17.3. Required Sheathing Membrane and Installation

1) Except as provided in Articles 9.23.17.4., 9.23.17.5. and 9.23.17.6., at least one layer of sheathing membrane shall be applied beneath siding, stucco or masonry veneer.

2) Sheathing membrane required in Sentence (1) shall be applied so that joints are lapped not less than 100 mm.

3) Where sheathing membrane required in Sentence (1) is applied horizontally, the upper sheets shall overlap the lower sheets.

9.23.17.4. Insulating Sheathing in Lieu of Sheathing Membrane

1) Where non-wood-based rigid exterior insulating sheathing, or exterior insulating sheathing with an integral sheathing membrane is installed, a separate sheathing membrane is not required.

2) Where insulating sheathing is installed as provided in Sentence (1),

a) sheathing panels subject to moisture deterioration shall be sealed at all joints, and

ends of the studs, securely fastened to the full length studs at the sides of the opening.

9.24.3.2. Fire-Rated Walls

1) Steel studs used in walls required to have a *fire-resistance rating* shall be installed so that there is not less than a 12 mm clearance between the top of the stud and the top of the runner to allow for expansion in the event of fire.

2) Except as provided in Article 9.24.3.6., studs in walls referred to in Sentence (1) shall not be attached to the runners in a manner that will prevent such expansion.

3) Framing above doors with steel door frames in non-*loadbearing fire separations* required to have a *fire-resistance rating* shall consist of 2 runners on the flat fastened back to back. (See Appendix A.)

4) The upper runner required in Sentence (3) shall be bent at each end to extend upwards not less than 150 mm and fastened to the adjacent studs.

5) A gypsum board filler piece, the width and length of the runner, shall be provided between the door frame referred to in Sentence (3) and the adjacent runner.

9.24.3.3. Orientation of Studs

1) Steel studs shall be installed with webs at right angles to the wall face and, except at openings, shall be continuous for the full wall height.

9.24.3.4. Support for Cladding Materials

1) Corners and intersections of walls shall be constructed to provide support for the cladding materials.

9.24.3.5. Framing around Openings

1) Studs shall be doubled on each side of every opening where such openings involve more than one stud space, and shall be tripled where the openings in exterior walls exceed 2.4 m in width.

2) Studs described in Sentence (1) shall be fastened together by screws, crimping or welding to act as a single structural unit in resisting transverse loads.

9.24.3.6. Attachment of Studs to Runners

1) Studs shall be attached to runners by screws, crimping or welding around wall openings and elsewhere where necessary to keep the studs in alignment during construction.

2) Where clearance for expansion is required in Article 9.24.3.2., attachment required in Sentence (1) shall be applied between studs and bottom runners only.

9.24.3.7. Openings for Fire Dampers

1) Openings for *fire dampers* in non-*loadbearing fire separations* required to have a *fire-resistance rating* shall be framed with double studs on each side of the opening.

2) The sill and header for openings described in Sentence (1) shall consist of a runner track with right angle bends made on each end so as to extend 300 mm above the header or below the sill and fastened to the studs.

3) The openings described in Sentence (1) shall be lined with a layer of gypsum board not less than 12.7 mm thick fastened to stud and runner webs.

Section 9.25. Heat Transfer, Air Leakage and Condensation Control

9.25.1. Scope

9.25.1.1. Application

1) This Section applies to thermal insulation and measures to control heat transfer, air leakage and condensation.

2) Insulation and sealing of heating and ventilating ducts shall conform to Sections 9.32. and 9.33.

9.25.1.2. General

(See Appendix A.)

1) Except as provided in Sentence (2), any sheet or panel type material with an air leakage characteristic less than 0.1 L/(s•m^2) at 75 Pa and water vapour permeance less than 60 ng/(Pa•s•m^2) and incorporated in a *building* assembly required by Article 9.25.2.1. to be insulated shall be installed

a) on the warm face of the assembly,
b) at a location where the ratio between the total thermal resistance of all materials outboard of its innermost impermeable surface and the total thermal resistance of all materials inboard of that surface is not less than required in Table 9.25.1.2., or
c) outboard of an air space that is vented to the outdoors and, for walls, drained.

Table 9.25.1.2.
Ratio of Outboard to Inboard Thermal Resistance
Forming Part of Article 9.25.1.2.

Heating Degree Days of *Building* Location[1], Celsius degree-days	Minimum Ratio, Total Thermal Resistance Outboard of Material's Inner Surface to Total Thermal Resistance Inboard of Material's Inner Surface
up to 4999	0.20
5000 to 5999	0.30
6000 to 6999	0.35
7000 to 7999	0.40
8000 to 8999	0.50
9000 to 9999	0.55
10000 to 10999	0.60
11000 to 11999	0.65
12000 or higher	0.75

Notes to Table 9.25.1.2.:
(1) See Sentence 2.2.1.1.(1)

2) Wood-based sheathing materials installed so that, in each framing space, at least one of the gaps required by Article 9.23.15.3. and Sentence 9.23.16.5.(1) does not occur over framing need not comply with Sentence (1).

9.25.2. Thermal Insulation

9.25.2.1. Required Insulation

1) All walls, ceilings and floors separating heated space from unheated space, the exterior air or the exterior *soil* shall be provided with sufficient thermal insulation to prevent moisture condensation on their room side during the winter and to ensure comfortable conditions for the occupants. (See A-9.1.1.1. in Appendix A.)

9.25.2.2. Insulation Materials

1) Except as required in Sentence (2), thermal insulation shall conform to the requirements of r

a) CAN/ULC-S701, "Thermal Insulation, Polystyrene, Boards and Pipe Covering,"
b) CGSB 51-GP-21M, "Thermal Insulation, Urethane and Isocyanurate, Unfaced,"
c) CAN/CGSB-51.23, "Spray-Applied Rigid Polyurethane Cellular Plastic Thermal Insulation,"
d) CAN/CGSB-51.25-M, "Thermal Insulation, Phenolic, Faced,"
e) CAN/CGSB-51.26-M, "Thermal Insulation, Urethane and Isocyanurate, Boards, Faced,"
f) CGSB 51-GP-27M, "Thermal Insulation, Polystyrene, Loose Fill,"
g) CAN/CGSB-51.60-M, "Cellulose Fibre Loose Fill Thermal Insulation. "
h) CAN/ULC-S702, "Thermal Insulation, Mineral Fibre, for Buildings," or r
i) CAN/CSA-A247-M, "Insulating Fibreboard."

2) The *flame-spread ratings* requirements contained in the standards listed in Sentence (1) shall not apply. (See Appendix A.)

3) Insulation in contact with the ground shall be inert to the action of *soil* and water and shall be such that its insulative properties are not significantly reduced by moisture.

4) Type 1 expanded polystyrene insulation as described in CAN/ULC-S701, "Thermal Insulation, Polystyrene, Boards and Pipe Covering," shall not be used in contact with the ground or as roof insulation applied above the roofing membrane. r

9.25.2.3. Installation of Thermal Insulation

1) Insulation shall be installed so that there is a reasonably uniform insulating value over the entire face of the insulated area.

2) Insulation shall be applied to the full width and length of the space between furring or framing.

3) Except where the insulation provides the principal resistance to air leakage, thermal insulation shall be installed so that at least one face is in full and continuous contact with an element with low air permeance. (See Appendix A.)

4) Insulation on the interior of *foundation* walls enclosing a crawl space shall be applied so that there is not less than 50 mm clearance above the crawl space floor, if the insulation is of a type that may be damaged by water.

5) Insulation around concrete slabs-on-ground shall be located so that heat from the *building* is not restricted from reaching the ground beneath the perimeter, where exterior walls are not supported by footings extending below frost level.

6) Where insulation is exposed to the weather and subject to mechanical damage, it shall be protected with not less than

a) 6 mm asbestos-cement board,
b) 6 mm preservative-treated plywood, or
c) 12 mm cement parging on wire lath applied to the exposed face and edge.

7) Insulation located in areas where it may be subject to mechanical damage shall be protected by a covering such as gypsum board, plywood, particleboard, OSB, waferboard or hardboard.

8) Insulation in factory-built *buildings* shall be installed so that it will not become dislodged during transportation.

2) Nails shall be spaced not more than 100 mm o.c. along edge supports and 200 mm o.c. along intermediate supports.

9.29.8.4. Edge Support

1) All fibreboard edges shall be supported by blocking, furring or framing.

9.29.9. Particleboard, OSB or Waferboard Finish

9.29.9.1. Material Standards

r **1)** Particleboard finish shall conform to ANSI A208.1, "Particleboard, Mat-Formed Wood."

2) OSB or waferboard finish shall conform to CSA O437.0, "OSB and Waferboard."

9.29.9.2. Minimum Thickness

1) Except as provided in Sentences (2) and (3), the minimum thickness of O-2 grade OSB used as an interior finish shall conform to that shown for plywood in Table 9.29.6.1.

2) Thicknesses listed in Table 9.29.6.1. shall permit a manufacturing tolerance of – 0.4 mm.

3) No minimum thickness is required where O-2 grade OSB is applied over continuous backing.

4) OSB conforming to O–1 grade, waferboard conforming to R-1 grade and particleboard shall be

a) not less than 6.35 mm thick on supports not more than 400 mm o.c.,
b) not less than 9.5 mm thick on supports not more than 600 mm o.c., and
c) not less than 6.35 mm thick on supports not more than 600 mm o.c. in walls where blocking is provided at midwall height.

9.29.9.3. Nails

1) Nails for fastening particleboard, OSB or waferboard shall be not less than 38 mm casing or finishing nails spaced not more than 150 mm o.c. along edge supports and 300 mm o.c. along intermediate supports.

9.29.9.4. Edge Support

1) All particleboard, OSB or waferboard edges shall be supported by furring, blocking or framing.

9.29.10. Wall Tile Finish

9.29.10.1. Tile Application

1) Ceramic tile shall be set in a mortar base or applied with an adhesive.

2) Plastic tile shall be applied with an adhesive.

9.29.10.2. Mortar Base

1) When ceramic tile is applied to a mortar base the cementitious material shall consist of one part portland cement to not more than one-quarter part lime by volume.

2) The cementitious material described in Sentence (1) shall be mixed with not less than 3 nor more than 5 parts of aggregate per part of cementitious material by volume.

3) Mortar shall be applied over metal lath or masonry.

4) Ceramic tile applied to a mortar base shall be thoroughly soaked and pressed into place forcing the mortar into the joints while the tile is wet.

9.29.10.3. Adhesives

1) Adhesives to attach ceramic and plastic tile shall be applied to the finish coat or brown coat of plaster that has been steel-trowelled to an even surface or to gypsum board or to masonry provided the masonry has an even surface.

9.29.10.4. Moisture Resistant Backing

1) Ceramic and plastic tile installed on walls around bathtubs or showers shall be applied over moisture resistant backing.

9.29.10.5. Joints between Tiles and Bathtub

1) The joints between wall tiles and a bathtub shall be suitably caulked with material conforming to CAN/CGSB-19.22-M, "Mildew Resistant Sealing Compound for Tubs and Tiles."

Section 9.30. Flooring

9.30.1. General

9.30.1.1. Required Finished Flooring

1) Finished flooring shall be provided in all *residential occupancies*.

9.30.1.2. Water Resistance

1) Where water permeable finished flooring in bathrooms, kitchens, public entrance halls and laundry areas is supported by a subfloor of a type that would be damaged by water, such flooring shall be installed over a membrane with a water permeance not exceeding 18 ng/(Pa•s•m^2) when tested in accordance with ASTM E 96, "Water Vapor Transmission of Materials." (See Appendix A.)

9.30.1.3. Sleepers

1) Wood sleepers supporting finished flooring over a concrete base supported on the ground shall be not less than 19 mm by 38 mm and shall be treated with a wood preservative.

9.30.1.4. Finish Quality

1) Finished flooring shall have a surface that is smooth, even and free from roughness or open defects.

9.30.2. Panel-Type Underlay

9.30.2.1. Required Underlay

1) A panel-type underlay shall be provided under resilient flooring, parquet flooring, ceramic tile, felted-synthetic-fibre floor coverings or carpeting laid over lumber subflooring. (See Sentence 9.30.3.2.(1).)

2) Panel-type underlay shall be provided under resilient flooring, parquet flooring, felted-synthetic-fibre floor coverings or carpeting on panel-type subflooring whose edges are unsupported. (See Article 9.23.14.3.)

3) Panel-type underlay shall be provided under ceramic tile applied with adhesive.

9.30.2.2. Materials and Thickness

1) Panel-type underlay shall be not less than 6 mm thick and shall conform to

a) CAN/CGSB-11.3-M, "Hardboard,"
b) CSA O115-M, "Hardwood and Decorative Plywood,"
c) CSA O121-M, "Douglas Fir Plywood,"
d) CSA O151-M, "Canadian Softwood Plywood,"
e) CSA O153-M, "Poplar Plywood,"
f) ANSI A208.1, "Particleboard, Mat-Formed Wood," or
g) CSA O437.0, "OSB and Waferboard."

2) Panel-type underlay under ceramic tile applied with adhesive shall be not less than

a) 6 mm thick where the supports are spaced up to 300 mm o.c., and
b) 11 mm thick where the supports are spaced wider than 300 mm o.c.

9.30.2.3. Fastening

1) Panel-type underlay shall be fastened to the subfloor with staples, annular grooved flooring nails or spiral nails, spaced not more than 150 mm o.c. along the edges and 200 mm o.c. both ways at other locations.

2) Nails for panel-type underlay shall be not less than 19 mm long for 6 mm thick underlay and 22 mm long for 7.9 mm thick underlay.

3) Staples for panel-type underlay shall

a) have not less than a 1.2 mm shank diameter or thickness with a 4.7 mm crown, and
b) be not less than
   i) 22 mm long for 6 mm underlay, and
   ii) 28 mm long for 7.9 mm and 9.5 mm underlay.

9.30.2.4. Joints Offset

1) Where panel-type underlay is required to be installed over plywood, OSB or waferboard, the joints in the underlay shall be offset not less than 200 mm from the joints in the underlying subfloor.

9.30.2.5. Surface Defects

1) Underlay beneath resilient or ceramic floors applied with an adhesive shall have all holes or open defects on the surface patched so that the defects will not be transmitted to the finished surface.

9.30.3. Wood Strip Flooring

9.30.3.1. Thickness

1) The thickness of wood strip flooring shall conform to Table 9.30.3.1.

Table 9.30.3.1.
Thickness of Wood Strip Flooring
Forming Part of Sentence 9.30.3.1.(1)

Type of Flooring	Max. Joist Spacing, mm	Minimum Thickness of Flooring, mm	
		With Subfloor	No Subfloor
Matched hardwood	400	7.9	19.0
(interior use only)	600	7.9	33.3
Matched softwood	400	19.0	19.0
(interior or exterior use)	600	19.0	31.7
Square edge softwood	400	—	25.4
(exterior use only)	600	—	38.1

Table A-11 (Continued)

(2) Spans are valid for glued-laminated timber conforming to CAN/CSA-O122-M and CAN/CSA-O177-M.
(3) Spans are clear spans between supports. For total span, add two bearing lengths.
(4) Provide a minimum bearing length of 89 mm. (Alternatively, the bearing length may be designed in accordance with Part 4.)
(5) Top edge of beam assumed to be fully laterally supported by joists.
(6) Supported length means half the sum of the joist spans on both sides of the beam.
(7) Straight interpolation may be used for other supported lengths.

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Table A-12
Maximum Spans for Built-Up Roof Ridge Beams – No. 1 or No. 2 Grade
Forming Part of Sentence 9.23.4.2.(4)

Commercial Designation	Beam Size, mm	Maximum Span, m[1][2]				
		Specified Snow Load, kPa				
		1.0	1.5	2.0	2.5	3.0
Douglas Fir -Larch (includes Douglas Fir and Western Larch)	3 -38 × 184	2.42	2.08	1.86	1.69	1.56
	4 -38 × 184	2.80	2.41	2.14	1.95	1.80
	5 -38 × 184	3.13	2.69	2.40	2.18	2.01
	3 -38 × 235	2.96	2.55	2.27	2.06	1.91
	4-38 × 235	3.42	2.94	2.62	2.38	2.20
	5-38 × 235	3.83	3.29	2.93	2.67	2.46
	3-38 × 286	3.44	2.96	2.63	2.40	2.21
	4-38 × 286	3.97	3.41	3.04	2.77	2.56
	5-38 × 286	4.44	3.82	3.40	3.09	2.86
Hem-Fir (includes Western Hemlock and Amabilis Fir)	3-38 × 184	2.54	2.18	1.95	1.77	1.64
	4-38 × 184	2.93	2.52	2.25	2.05	1.89
	5-38 × 184	3.28	2.82	2.51	2.29	2.11
	3-38 × 235	3.11	2.67	2.38	2.17	2.00
	4-38 × 235	3.59	3.08	2.75	2.50	2.31
	5-38 × 235	4.01	3.45	3.07	2.80	2.58
	3-38 × 286	3.61	3.10	2.76	2.51	2.32
	4-38 × 286	4.16	3.58	3.19	2.90	2.68
	5-38 × 286	4.66	4.00	3.56	3.24	3.00
Spruce-Pine - Fir (includes Spruce (all species except Coast Sitka Spruce) Jack Pine, Lodgepole Pine, Balsam Fir and Alpine Fir)	3-38 × 184	2.63	2.26	2.02	1.83	1.69
	4-38 × 184	3.04	2.61	2.33	2.12	1.96
	5-38 × 184	3.40	2.92	2.60	2.37	2.19
	3-38 × 235	3.22	2.77	2.46	2.24	2.07
	4-38 × 235	3.72	3.20	2.85	2.59	2.39
	5-38 × 235	4.16	3.57	3.18	2.90	2.68
	3-38 × 286	3.73	3.21	2.86	2.60	2.40
	4-38 × 286	4.31	3.71	3.30	3.01	2.78
	5-38 × 286	4.82	4.15	3.69	3.36	3.10
Northern Species (includes any Canadian species covered by the NLGA Standard Grading Rules)	3-38 × 184	2.11	1.82	1.62	1.47	1.36
	4-38 × 184	2.44	2.10	1.87	1.70	1.57
	5-38 × 184	2.73	2.34	2.09	1.90	1.76
	3-38 × 235	2.58	2.22	1.98	1.80	1.66
	4-38 × 235	2.98	2.56	2.28	2.08	1.92
	5-38 × 235	3.33	2.87	2.55	2.32	2.15
	3-38 × 286	3.00	2.58	2.29	2.09	1.93
	4-38 × 286	3.46	2.98	2.65	2.41	2.23
	5-38 × 286	3.87	3.33	2.96	2.70	2.49

Notes to Table A-12:

(1) The spans are calculated based on a maximum supported length of 4.9 m, where supported length means half the sum of the rafter, joist or truss spans on both sides of the beam. Spans may be increased by 5% for supported lengths not more than 4.3 m, or by 10% for supported lengths not more than 3.7 m.

(2) Provide minimum 89 mm bearing.

building code. These portions contain requirements in many of the areas where the NBC also has requirements and frequently the requirements are different. Because it would be illogical to have two different sets of requirements for houses, one set which applies to site-built houses and one set which applies to factory-built houses, the NBC does not make reference to these portions of the Z240 standards. Other portions of the Z240 standards deal with special requirements for mobile homes related to the fact that these houses must be moved over roads.

The NBC does not have requirements in this area. Therefore, labelling which indicates that a factory-built house complies with the Z240 standards can NOT be taken as an indication that the house complies with the NBC.

A-2.1.6.1.(1) Buildings Divided by Firewalls. 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.

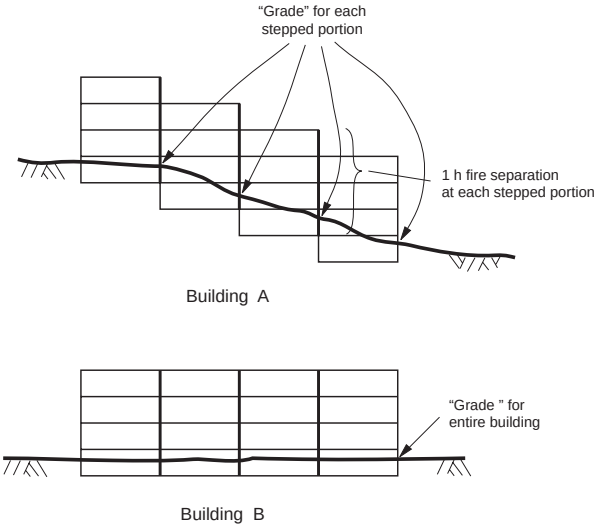

Figure A-2.1.6.2.
Application of the definition of grade

Under this Sentence, Building A can be considered as being 3 storeys in building height instead of 6 storeys in building height. Both Building A and Building B are comparable with regard to fire safety and egress.

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

A-2.2.1.1.(1) Climatic Values. Data for municipalities not listed in Appendix C may be obtained by writing to: Head, Energy and Industrial Application Section, Atmospheric Environment Service, Environment Canada, 4905 Dufferin Street, Downsview, Ontario M3H 5T4.

A-2.2.1.1.(2) Winter Design Temperatures. The 2.5% values stated in Sentence 2.2.1.1.(2) are the least restrictive temperatures that can be used. If a designer chooses to use the 1% values given in Appendix C, they would be in excess of the Code minimums and would be considered acceptable.

A-2.3.5.2.(1) Information on Drawings. Examples of information that should be shown on architectural plans and plans for heating, ventilating and air-conditioning systems are:

(a) the name, type and location of the building,
(b) the name of the owner,
(c) the name of the architect,
(d) the name of the engineer or designer,
(e) the north point,
(f) the dimensions and height of all rooms,
(g) the intended use of all rooms,
(h) the details or description of the wall, roof, ceiling and floor construction, including insulation,
(i) the details or description of the windows and outside doors, including the size, weatherstripping, storm sashes, sills and storm doors,
(j) the size and continuity of all pipes, ducts, shafts, flues and fire dampers,
(k) the location, size, capacity and type of all principal units of equipment,
(l) the size, shape and height of all chimneys and gas vents,
(m) the size and location of all combustion air and ventilation openings, and
(n) the location and fire-resistance rating of required fire separations.

A-2.5.2. Structural Equivalents. Subsection 2.5.2. provides for the use of design methods not specified in Part 4 of the Code. These include full scale testing and model analogues. Normally this provision is used to permit acceptance of new and innovative structures or to permit acceptance of model tests such as those used to determine structural behavior or snow or wind loads. Subsection 2.5.2. specifically requires a level of safety and performance at least equivalent to that provided by design to Part 4 and requires loadings and design requirements to conform to Section 4.1.

Subsection 2.5.2. or other parts of Section 2.5. are not intended to allow structural design using design

standards other than those listed in Part 4. The acceptance of structures which have been designed to other design standards would require the designer to prove to the appropriate authority that the structure provides the required level of safety and performance. The equivalence of safety can only be established by analyzing the structure for the loads and load factors set out in Section 4.1. and demonstrating that the structure at least meets the requirements of the design standards listed in Sections 4.3. and 4.4.

A-2.7.3.2. Applicable Editions. Where documents are referenced in this Appendix, Appendix B or Appendix C, they shall be the editions designated in Table A-2.7.3.2.

Table A-2.7.3.2.
Documents Referenced in the Appendices A, B and C of the National Building Code of Canada 1995

	Issuing Agency	Document Number	Title of Document	Code Reference
	ANSI	B18.6.1-1981	Slotted and Recessed Wood Screws (Inch Series)	A-9.23.3.1.(2)
	ANSI/ ASCE	8-90	Design of Cold Formed Stainless Steel Structural Members	A-4.3.4.2.
r	ASTM	C 516-80 (1996)	Vermiculite Loose Fill Thermal Insulation	A-9.25.2.4.(5)
r	ASTM	D 1037-96a	Evaluating the Properties of Wood-Base Fiber and Particle Panel Materials	A-9.23.14.2.(4)
	ASTM	D 1143-81 (1994)	Piles Under Static Axial Compressive Load	A-4.2.7.2.(2)
r	ASTM	E 336-97	Measurement of Airborne Sound Insulation in Buildings	A-9.11.1.1.(1)
	ASTM	E 492-90	Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using The Tapping Machine	A-9.11.1.1.(1)
r	ASTM	E 597-95	Determining a Single Number Rating of Airborne Sound Insulation in Multi-Unit Building Specifications	A-9.11.1.1.(1)
r	ASTM	E 1007-97	Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures	A-9.11.1.1.(1)
r	ASTM	F 476-84 (1996)	Security of Swinging Door Assemblies	A-9.6.8.10.(1)
	CCBFC	NRCC 30629	Supplement to the National Building Code of Canada 1990	Appendix C
	CCBFC	NRCC 38727	National Fire Code of Canada 1995	A-1.1.2.1. A-3.1.2.3.(1) A-3.2.4.6.(2) A-3.2.7.8.(3) A-3.3.1.4.(1) A-3.3.1.7.(1) A-3.3.3.1. B-3.2.6.
	CCBFC	NRCC 38728	National Plumbing Code of Canada 1995	Appendix C
	CCBFC	NRCC 38732	National Farm Building Code of Canada 1995	A-1.1.3.2. A-5.1.1.1.(1)

Table A-2.7.3.2. (Continued)

	Issuing Agency	Document Number	Title of Document	Code Reference
e	CCBFC	NRCC 38826	Structural Commentaries on the National Building Code of Canada 1995	A-1.1.2.1. A-4.1.1.3.(1) A-4.1.1.5.(1) A-4.1.1.5.(4) A-4.1.1.6.(1) A-4.1.1.6.(2) A-4.1.2.1.(1) A-4.1.3. A-4.1.4.3. A-4.1.6.9. A-4.1.7. A-4.1.7.1. A-4.1.7.2.(2) A-4.1.7.3.(1) A-4.1.8.1.(1), (2) A-4.1.8.1.(5)(c) A-4.1.8.1.(6)(a) A-4.1.8.1.(6)(d) and A-4.1.8.2.(1)(b) A-4.1.8.3.(1) A-4.1.9.1.(2) A-4.1.9.1.(3) A-4.1.9.1.(8) and A-Table 4.1.9.1.B. A-4.1.9.1.(13)(b) A-Table 4.1.9.1.D. A-Table 4.1.9.1.E. A-4.1.9.1.(28) A-4.1.9.1.(29) A-4.1.9.4.(5) A-4.1.10.4. A-4.1.10.6.(1) A-4.2.4.4. A-4.2.4.5. A-4.2.5.1. A-4.2.6.1. A-4.2.7.2.(1) A-5.1.4.2. Appendix C
r	CGA	CAN/CGA-B149.1-M95	Natural Gas Installation Code	A-9.10.21.
	CGSB	CAN/CGSB-12.20-M89	Structural Design of Glass for Buildings	A-9.7.3.2.(1)
e	CGSB	37-GP-52M-1984	Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric	A-5.8.2.2.(6)
	CGSB	37-GP-56M-1985	Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing	A-5.6.1.2. (1) and (3)
r	CGSB	CAN/CGSB-51.34-M86 (Amended 1988)	Vapour Barrier, Polyethylene Sheet for Use in Building Construction	A-5.5.1.2.(2)
	CGSB	CAN/CGSB-71.26-M88	Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems	Table A-9.23.4.2.C.
	CGSB	CAN/CGSB-82.6-M86	Doors, Mirrored Glass, Sliding or Folding, Wardrobe	A-9.6.6.3.(1)
	CMHC		Testing of Fresh Air Mixing Devices	A-9.32.3.6.
	CMHC		Air Permeance of Building Materials	A-5.4.1.2.(1) and (2)
	CSA	A23.3-94	Design of Concrete Structures	A-4.3.3.1.
	CSA	A23.4-94	Precast Concrete Materials and Construction	A-4.3.3.1.

Table A-2.7.3.2. (Continued)

Issuing Agency	Document Number	Title of Document	Code Reference
CSA	CAN/CSA-A82.1-M87	Burned Clay Brick (Solid Masonry Units Made from Clay or Shale)	A-5.6.1.2. (1) and (3)
CSA	A82.31-M80	Gypsum Board Application	Table A-9.10.3.1.A. Table A-9.10.3.1.B.
CSA	CAN/CSA-A277-90	Certification of Factory-Built Houses	A-2.1.4.1.(1)
CSA	A370-94	Connectors for Masonry	A-9.21.4.5.(2)
CSA	A371-94	Masonry Construction for Buildings	A-5.6.1.2. (1) and (3)
CSA	CAN/CSA-A440-M90	Windows	A-5.4.1.2.(3) A-9.7.2.1.(1)
CSA	A440.1-M1990	User Selection Guide to CAN/CSA-A440-M90 Windows	A-9.7.2.1.(1)
CSA	CAN/CSA-B44-M94 (Supplement 1– B44S1-97)	Safety Code for Elevators	A-3.5.2.1.(1)
CSA	CAN/CSA-B365-M91	Installation Code for Solid-Fuel-Burning Appliances and Equipment	A-9.33.1.1.(2)
CSA	C22.1-94	Canadian Electrical Code, Part 1	A-3.1.4.3.(1)(b)(i)
CSA	CAN/CSA-F326-M91	Residential Mechanical Ventilation Systems	A-9.32.3. A-9.33.6.14.
CSA	O86.1-94	Engineering Design in Wood (Limit States Design)	A-9.15.1.3.(3) A-9.23.4.2.
CSA	CAN/CSA-O141-91	Softwood Lumber	A-9.3.2.1.(1)
CSA	O437.0-93	OSB and Waferboard	A-9.23.14.4.(2)
CSA	CAN/CSA-S6-88	Design of Highway Bridges	A-Table 4.1.6.10.
CSA	CAN/CSA-S16.1-94	Limit States Design of Steel Structures	A-4.3.4.1.
CSA	CAN/CSA-S406-92	Construction of Preserved Wood Foundations	A-9.15.1.3.(3)
CSA	CAN/CSA Z32.4-M86	Essential Electrical Systems for Hospitals	A-3.2.7.6.(1)
CSA	CAN/CSA-Z240 MH Series-92	Mobile Homes	A-2.1.4.1.(1)
CWC		The Span Book (Second Revision, 1993)	A-9.23.4.2.
FCC	Project 03-50-10-008	Serviceability Criteria for Residential Floors Based on a Field Study of Consumer Response (1985)	A-9.23.4.2.(2)
FMEC	FM 2008	Early Suppression-Fast Response Sprinklers	A-3.2.5.13.(7)
FPS		Performance Criteria for Residential Floors Based on Consumer Responses (1988)	A-9.23.4.2.(2)
HC	H49-58	Exposure Guidelines for Residential Indoor Air Quality	A-9.13.8.2.
IRC	BPN 61	Shear Resistance of Wood Frame Walls	A-9.23.10.2.
IRC	CBD 222	Airtight Houses and Carbon Monoxide Poisoning	A-9.33.1.1.(2)
IRC	CBD 230	Applying Building Codes to Existing Buildings	A-1.1.2.1.
IRC	CBD 231	Moisture Problems in Houses	A-9.25.3.1.(1)

Table A-2.7.3.2. (Continued)

	Issuing Agency	Document Number	Title of Document	Code Reference
	IRC	NRCC 28822	Performance and Acceptability of Wood Floors – Forintek Studies	A-9.23.4.2.(2)
	ISO	7731:1986	Danger signals for workplaces – Auditory danger signals	A-3.2.4.22.(1)(b)
	ISO	8201:1987	Acoustics – Audible emergency evacuation signal	A-3.2.4.19.(2)
r	NFPA	13-1996	Installation of Sprinkler Systems	A-3.2.4.9.(2)(f) A-3.2.5.13.(1) A-3.2.5.13.(6) A-3.2.5.13.(7) A-3.2.5.14.(1) A-3.2.8.2.(3)
r	NFPA	13D-1996	Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes	A-3.2.5.13.(7) A-3.2.5.14.(1)
r	NFPA	13R-1996	Installation of Sprinkler Systems in Residential Occupancies up to and including Four Stories in Height	A-3.2.5.13.(7) A-3.2.5.14.(1)
r	NFPA	20-1996	Installation of Centrifugal Fire Pumps	A-3.2.4.9.(2)(f) A-3.2.5.19.(1)
r	NFPA	30-1996	Flammable and Combustible Liquids Code	A-6.2.2.5.
r	NFPA	32-1996	Drycleaning Plants	A-6.2.2.5.
r	NFPA	33-1995	Spray Application Using Flammable or Combustible Materials	A-6.2.2.5.
r	NFPA	34-1995	Dipping and Coating Processes Using Flammable or Combustible Liquids	A-6.2.2.5.
r	NFPA	35-1995	Manufacture of Organic Coatings	A-6.2.2.5.
r	NFPA	36-1997	Solvent Extraction Plants	A-6.2.2.5.
r	NFPA	40-1997	Storage and Handling of Cellulose Nitrate Motion Picture Film	A-6.2.2.5.
	NFPA	50A-1994	Gaseous Hydrogen Systems at Consumer Sites	A-6.2.2.5.
	NFPA	50B-1994	Liquefied Hydrogen Systems at Consumer Sites	A-6.2.2.5.
r	NFPA	51-1997	Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes	A-6.2.2.5.
r	NFPA	51A -1996	Acetylene Cylinder Charging Plants	A-6.2.2.5.
r	NFPA	61-1995	Prevention of Fires and Dust Explosions in Agricultural and Food Products Facilities	A-6.2.2.5.
	NFPA	65-1993	Processing and Finishing of Aluminum	A-6.2.2.5.
r	NFPA	68-1994	Venting of Deflagrations	A-6.2.2.5.
r	NFPA	69-1997	Explosion Prevention Systems	A-6.2.2.5.

Table A-2.7.3.2. (Continued)

	Issuing Agency	Document Number	Title of Document	Code Reference
r	NFPA	80-1995	Fire Doors and Fire Windows	A-3.1.8.1.(2) A-3.2.8.2.(3)
r	NFPA	80A-1996	Protection of Buildings from Exterior Fire Exposures	A-3
	NFPA	81-1986	Fur Storage, Fumigation and Cleaning	A-6.2.2.5.
r	NFPA	86-1995	Ovens and Furnaces	A-6.2.2.5.
r	NFPA	88A -1995	Parking Structures	A-6.2.2.5.
r	NFPA	88B-1997	Repair Garages	A-6.2.2.5.
r	NFPA	91-1995	Exhaust Systems for Air Conveying of Materials	A-6.2.2.5.
e	NFPA	96-1994	Ventilation Control and Fire Protection of Commercial Cooking Operations	A-3.3.1.2.(2) A-6.2.2.5. A-9.10.1.4.(1)
	NFPA	204M-1991	Guide for Smoke and Heat Venting	A-6.2.2.5.
r	NFPA	303-1995	Marinas and Boatyards	A-6.2.2.5.
r	NFPA	307-1995	Construction and Fire Protection of Marine Terminals, Piers and Wharfs	A-6.2.2.5.
r	NFPA	325-1994	Fire Hazard Properties of Flammable Liquids, Gases and Volatile Solids	A-6.2.2.5.
e	NFPA	326-1993	Safe Entry of Underground Storage Tanks	A-8.2.2.12.(3)
	NFPA	327-1993	Cleaning or Safeguarding Small Tanks and Containers Without Entry	A-8.2.2.12.(3)
	NFPA	395-1993	Storage of Flammable and Combustible Liquids at Farms and Isolated Sites	A-6.2.2.5.
r	NFPA	409-1995	Aircraft Hangars	A-6.2.2.5.
r	NFPA	415-1997	Airport Terminal Buildings, Fueling, Ramp Drainage, Loading Walkways	A-6.2.2.5.
	NFPA	480-1993	Storage, Handling and Processing of Magnesium Solids and Powders	A-6.2.2.5.
r	NFPA	481-1995	Production, Processing, Handling and Storage of Titanium	A-6.2.2.5.
r	NFPA	482-1996	Production, Processing, Handling and Storage of Zirconium	A-6.2.2.5.
	NFPA	490-1993	Storage of Ammonium Nitrate	A-6.2.2.5.
	NFPA	650-1990	Pneumatic Conveying Systems for Handling Combustible Materials	A-6.2.2.5.
	NFPA	651-1993	Manufacture of Aluminum Powder	A-6.2.2.5.
r	NFPA	654-1997	Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids	A-6.2.2.5.
	NFPA	655-1993	Prevention of Sulfur Fires and Explosions	A-6.2.2.5.
	NFPA	664-1993	Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities	A-6.2.2.5.
r	NFPA	8503-97	Pulverized Fuel Systems	A-6.2.2.5.

Table A-2.7.3.2. (Continued)

Issuing Agency	Document Number	Title of Document	Code Reference
NLGA	1994	Standard Grading Rules for Canadian Lumber	A-9.3.2.1.(1) Table A-9.3.2.1.A. A-9.3.2.8.(1) A-9.23.10.4.(1)
NLGA	SPS-1	Fingerjoined Structural Lumber	A-9.23.10.4.(1)
NLGA	SPS-3	Fingerjoined Stud – Vertical Use Only	A-9.23.10.4.(1)
ONHWP		Details of Air Barrier Systems for Houses	Table A-9.25.1.2.B.
UL	UL 199 (1990)	Automatic Sprinklers for Fire-Protection Service	A-3.2.5.13.(7)
UL	UL 1626 (1994)	Residential Sprinklers for Fire-Protection Service	A-3.2.5.13.(7)
ULC	CAN/ULC-S101-M89	Fire Endurance Tests of Building Construction and Materials	A-3.1.5.11.(2)(e) B-3.2.6.5.(6)(b)
ULC	CAN/ULC-S112-M90	Fire Test of Fire Damper Assemblies	Table B-3.2.6.6.C.
ULC	CAN4-S113-79	Wood Core Doors Meeting the Performance Required by CAN4-S104-77 for Twenty Minute Fire Rated Closure Assemblies	A-9.10.13.2.(1)
ULC	CAN4-S114-M80	Test for the Determination of Non-Combustibility in Building Materials	A-3.1.5.2.(1)(b)
ULC	CAN4-S124-M85	Test for the Evaluation of Protective Coverings for Foamed Plastic	A-3.1.5.11.(2)(e)
ULC	ULC-S332-93	Burglary Resisting Glazing Material	A-9.6.8.1.
ULC	CAN/ULC-S526-M87	Visual Signal Appliances for Fire Alarm Systems	A-3.2.4.20.(1)
ULC	CAN/ULC-S702-97	Thermal Insulation, Mineral Fibre, for Buildings	A-5.3.1.2.(2)
WCLIB	No. 17 (1993)	Standard Grading Rules	A-Table 9.3.2.1.
WWPA	1995	Western Lumber Grading Rules	A-Table 9.3.2.1.

A-3 Application of Part 3. In applying the requirements of this Part, it is intended that they be applied with discretion to buildings of unusual configuration that do not clearly conform to the specific requirements, or to buildings in which processes are carried out which make compliance with particular requirements in this Part impracticable. The definition of "building" as it applies to this Code is general and encompasses most structures, including those which would not normally be considered as buildings in the layman's sense. This occurs more often in industrial uses, particularly those involving manufacturing facilities and equipment that require specialized design that may make it impracticable to follow the specific requirements of this Part. Steel mills, aluminum plants, refining, power generation and liquid storage facilities are examples. A water tank or an oil refinery, for example, has no floor area, so it is obvious that requirements for exits from floor areas would not apply. Requirements for structural fire protection in large steel mills and pulp and paper mills, particularly in certain portions, may not be practicable to achieve in terms of the construction normally used and the operations for which the space is to be used. In other portions of the same building, however, it may be quite reasonable to require that the provisions of this Part be applied (e.g., the office portions). Similarly, areas of industrial occupancy which may be occupied only periodically by service staff, such as equipment penthouses, normally would not need to have the same type of exit facility as floor areas occupied on a continuing basis. It is expected that judgment will be exercised in evaluating the application of a requirement in those cases when extenuating circumstances require special consideration, provided the occupants' safety is not endangered.

The provisions in this Part for fire protection features installed in buildings are intended to provide a minimum acceptable level of public safety. It is intended that all fire protection features of a building, whether required or not, will be designed in conformance with good fire protection engineering

practice and will meet the appropriate installation requirements in relevant standards. Good design is necessary to ensure that the level of public safety established by the Code requirements will not be reduced by a voluntary installation.

Fire Fighting Assumptions

The requirements of this Part are based on the assumption that fire fighting capabilities are available in the event of a fire emergency. These fire fighting capabilities may take the form of a paid or volunteer public fire department or in some cases a private fire brigade. If these fire fighting capabilities are not available, additional fire safety measures may be required.

Fire fighting capability can vary from municipality to municipality. Generally, larger municipalities have greater fire fighting capability than smaller ones. Similarly, older, well established municipalities may have better fire fighting facilities than newly formed or rapidly growing ones. The level of municipal fire protection considered to be adequate will normally depend on both the size of the municipality (i.e., the number of buildings to be protected) and the size of buildings within that municipality. Since larger buildings tend to be located in larger municipalities, they are generally, but not always, favoured with a higher level of municipal protection.

Although it is reasonable to consider that some level of municipal fire fighting capability was assumed in developing the fire safety provisions in Part 3, this was not done on a consistent or defined basis. The requirements in the Code, while developed in the light of commonly prevailing municipal fire protection levels, do not attempt to relate the size of building to the level of municipal protection. The responsibility for controlling the maximum size of building to be permitted in a municipality in relation to local fire fighting capability rests with the municipality. If a proposed building is too large, either in terms of floor area or building height, to receive reasonable protection from the municipal fire department, fire protection requirements in addition to those prescribed in this Code, may be necessary to compensate for this deficiency. Automatic sprinkler protection may be one option to be considered.

Alternatively, the municipality may, in light of its fire fighting capability, elect to introduce zoning restrictions to ensure that the maximum building size is related to available municipal fire protection facilities. This is, by necessity, a somewhat arbitrary decision and should be made in consultation with the local fire fighting service, who should have an appreciation of their capability to fight fires.

The requirements of Subsection 3.2.3. are intended to prevent fire spread from thermal radiation assuming there is adequate fire fighting available. It has been found that periods of from 10 to 30 minutes usually elapse between the outbreak of fire in a building that is not protected with an automatic sprinkler system and the attainment of high radiation levels. During this period, the specified spatial separations should prove adequate to inhibit ignition of an exposed building face or the interior of an adjacent building by radiation. Subsequently, however, reduction of the fire intensity by fire fighting and the protective wetting of the exposed building face will often be necessary as supplementary measures to inhibit fire spread.

In the case of a building that is sprinklered throughout, the automatic sprinkler system should control the fire to an extent that radiation to neighbouring buildings should be minimal. Although there will be some radiation effect on a sprinklered building from a fire in a neighbouring building, the internal sprinkler system should control any fires that might be ignited in the building and thereby minimize the possibility of the fire spreading into the exposed building. NFPA 80A, "Protection of Buildings from Exterior Fire Exposures," provides additional information on the possibility of fire spread at building exteriors.

The water supply requirements for fire protection installations depend on the requirements of any automatic sprinkler installations and also on the number of fire streams that may be needed at any fire, having regard to the length of time the streams will have to be used. Both these factors are largely influenced by the conditions at the building to be equipped, and the quantity and pressure of water needed for the protection of both the interior and exterior of the building must be ascertained before the water supply is decided upon. Acceptable water supplies may be a public waterworks system that has adequate pressure and discharge capacity, automatic fire pumps, pressure tanks, manually controlled fire pumps in combination with pressure tanks, gravity tanks, and manually controlled fire pumps operated by remote control devices at each hose station.

A-3.1.2. Use Classification. The purpose of classification is to determine which requirements apply. This Code requires classification in accordance with every major occupancy for which the building is used or intended to be used. Where necessary, an application clause has been inserted in this Part to explain how to choose between the alternative requirements which multiple occupancy classification may present.

A-3.1.2.1.(1) Major Occupancy Classification. The following are examples of the

annunciator, the signals must be routed to the annunciator through the control unit and the same functionality must be available at the control unit for operation and maintenance functions.

A-3.2.4.9.(2)(f) Supervision for Fire Pumps. Specific electrical supervision for fire pumps is stated in NFPA 20, "Installation of Centrifugal Fire Pumps," which is referenced in NFPA 13, "Installation of Sprinkler Systems."

A-3.2.4.11. Smoke Detector Location. In the design and installation of the smoke detection system, consideration must be given to all features which could have a bearing on the location and sensitivity of the detectors, including ceiling height, sloped ceilings, diffusion from air conditioning and ventilating currents, obstructions, baffles, and other pertinent physical configurations that might interfere with the proper operation of the system.

A-3.2.4.17.(1) Manual Pull Station. Only one manual pull station need be provided near a group of doors serving as a principal entrance or as a single exit facility.

A-3.2.4.19. Acoustic Measurement and Terminology. The following notes on acoustic measurement and terminology are intended to assist in the application of the requirements for audibility of fire alarm system sounding devices.

The background or ambient measurement should be a spatial averaged A-weighted equivalent sound level measured for 60 s. This can be obtained using an integrating sound level meter with the integration time set to 60 s. During the measurement period the meter should be slowly moved about so as to sample the space uniformly but coming no closer than 0.5 m from any solid wall, floor or ceiling. Alternatively, measurements can be made at 3 or more positions throughout the space and an energy average calculated.

The measurement of the alarm level depends on the type of alarm signal. If the signal is a continuous signal from a bell or siren, the spatial averaged A-weighted equivalent sound level should be obtained. The integration time should be long enough to obtain a reasonable spatial average of the space, but not less than 10 s.

If the alarm has a temporal pattern, then the A-weighted sound level should be measured using the 'fast' time constant during the 'on' part of the cycle. In this situation it is not appropriate to use an integrating sound level meter. Since the duty cycle of the alarm is only 37.5% at best, that type of meter would give a reading that is 4 or more decibels lower than the level while the alarm is 'on.' A number of measurements should be made about the space in question and the average value used to obtain a good spatial representation. Strictly speaking, the energy average of the measurements should be used; however, the frequency spectrum associated with most alarms is of a type that should give little variation about the space. If the measured levels don't vary by more than 2 to 3 dB, then an arithmetic average rather than an energy average can be used.

Effect of Furnishings

The final inspection of a fire alarm system is seldom made when the building is furnished and ready for occupancy. This results in measured levels which may be several decibels higher than will be found in the occupied building. The importance of this difference depends on the situation.

If the building is complete except for furnishings, so that the sources of ambient noise are present, then the amount by which the alarm signal exceeds the ambient level will not change appreciably with the introduction of furnishings. In this case both levels will be reduced by about the same amount.

If the primary source of ambient noise will be office equipment and workers, as would be expected in an open plan office, then measurements made prior to occupancy may differ substantially from those made afterwards. This may be true for both the absolute sound levels and the difference between the alarm level and the ambient.

A problem arises in trying to estimate what the absolute sound levels will be after the building is occupied.

In general, if the measurement is made in a totally bare room then the level will be about 3 dB higher than if the room were carpeted, assuming a reasonable carpet with an underlay. In most cases this will account for most of the absorption in the room and no further correction will be necessary. Adding heavy drapes and absorptive furnishings to a carpeted room can reduce the sound level by a further 2 to 3 dB.

Commercial buildings are more problematic. For example, if an open plan office is measured before any office screens are installed, there could be a substantial difference in the before and after levels, depending on the distance to the nearest alarm device.

Glossary of Acoustical Terms

Audible: A signal is usually considered to be clearly audible if the A-weighted sound level exceeds the level of ambient noise by 15 dB or more.

Awakening threshold: The level of sound that will awaken a sleeping subject 50% of the time.

A-weighted: A frequency weighting network which emphasizes the middle frequency components similar to the response of the human ear. The A-weighted sound level correlates well with subjective assessment of the disturbing effects of sounds. The quantity is expressed in dBA.

Masked threshold: The level of sound at which a signal is just audible in ambient noise.

Sound level: A sound pressure level obtained using a signal to which a standard frequency-weighting has been applied.

Sound pressure: A fluctuating pressure superimposed on the static pressure by the presence of sound. The unqualified term means the root-mean-square sound pressure. In air, the static pressure is barometric pressure.

Sound pressure level: Ten times the common logarithm of the ratio of the square of the sound pressure under consideration to the square of the standard reference pressure of 20 mPa. The quantity obtained is expressed in decibels.

A-3.2.4.19.(1) Alert and Alarm Signals. Alert signals are part of a 2 stage fire alarm system. The intent of the first, alert, stage is to notify persons in authority of a potential threat to building occupants. If a continuously staffed location is available, the alert signal can be restricted to that location.

A-3.2.4.19.(2) Alarm Signal Temporal Pattern. The temporal pattern of an alarm signal relates to the time during which the signal is produced and the intervals between the individual signal pulses. The international standard ISO 8201, "Acoustics – Audible emergency evacuation signal," includes a pattern that is becoming widely used in different countries and it is appropriate for this pattern to be adopted in Canada. The temporal pattern can be produced on most signalling devices. Most existing alarm systems can be modified, and this pattern could be phased in when the systems require modification. The characteristic of the pattern is a 3-pulse phase followed by an off phase. The 3 pulses each consist of an on phase lasting for 0.5 ± 0.05 s followed by an off phase lasting for 0.5 ± 0.05 s sounded for 3 successive on periods and then followed by an off phase lasting for 1.5 ± 0.15 s. Figure A-3.2.4.19.(2).A. indicates the pattern that is intended.

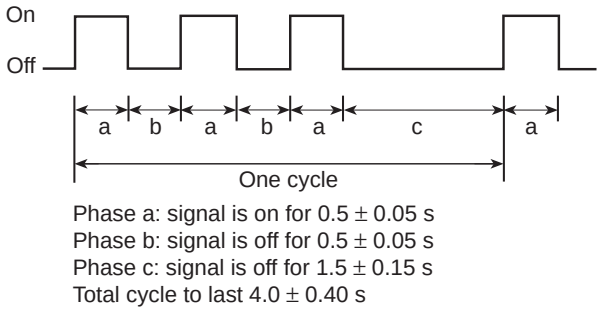

Figure A-3.2.4.19.(2).A.
Temporal pattern for fire alarm signal

Although the diagram shows a square wave form, the wave can have other shapes that produce a similar effect.

If single stroke bells are to be used, the temporal pattern can be produced by having the bell struck three times at a rate of one stroke per second followed by an interval of 2 s of silence. Figure A-3.2.4.19.(2).B. shows the pattern that results.

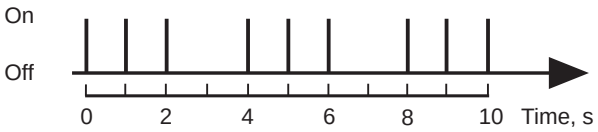

Figure A-3.2.4.19.(2).B.

Temporal pattern imposed on a single stroke bell or chime *e*

Note to Figure A-3.2.4.19.(2).B. The on phase represents the time that the striker mechanism is actuated. The sound produced by the bell or chime will continue at a level that decreases until the striker mechanism is re-actuated.

A-3.2.4.19.(4) Sound Pressure Level. For the purposes of this requirement, an audible signalling device should not produce a sound pressure level more than 110 dBA when measured at a distance of 3 m.

A-3.2.4.19.(5) Residential Sound Level. In a building in which corridors or hallways serve more than one suite or dwelling unit, there will be situations in which an audible signal device cannot be placed in the corridor or hallway to alert persons sleeping in suites and dwelling units, because the sound level in the vicinity of the device would exceed that permitted by Sentence 3.2.4.19.(4). In these situations it will be necessary to supplement the building fire alarm system with an audible signal device in the suite or dwelling unit. These devices could be piezoelectric devices similar to the sounding units in many smoke alarms, subject to the device emitting the appropriate temporal pattern required by Sentence 3.2.4.19.(2).

A-3.2.4.19.(9) Disconnect Device for Dwelling Units. In order to minimize the annoyance caused by false and unwanted alarms, the

seconds before it begins to close might be desirable. However, closers with this feature have limited back-check, a feature of a normal door closer where resistance to opening increases as the door reaches the full arc of swing. Doors equipped with a delayed action closer are therefore more susceptible to damage should the door be opened with too much force or should someone try to force it closed, thinking the closer has failed to operate. Delayed action closers are not recommended for such occupancies as schools.

A-3.8.3.3.(10) Clearances at Doorways. Sufficient clearance must be provided on the latch side of doors for a user to operate the door opening mechanism and open the door without interference from the wheelchair. This is particularly important where the door swings towards the approach side. Although the requirement applies only to doors equipped with closers, this clearance should be provided for all doors.

e

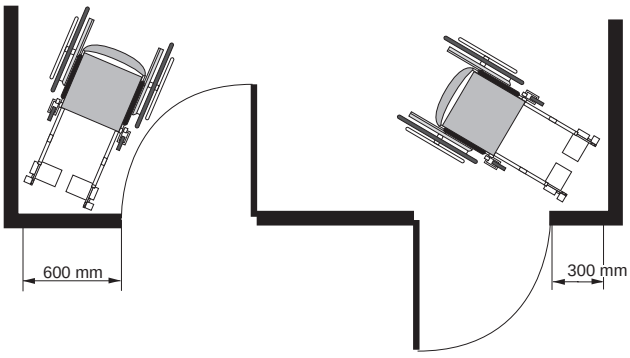

Figure A-3.8.3.3.(10)
Doorway clearance

A-3.8.3.4.(1)(b) Ramp Slopes. Ramps with a slope of more than 1 in 16 can be very difficult for persons with physical disabilities with upper body mobility to manage. Even though they pose less of a problem for persons in motorized wheelchairs, these ramps can be unsafe to descend, especially in cold climates. Although Article 3.8.3.4. permits slopes on ramps as great as 1 in 12 for distances of up to 9 m, slopes of 1 in 20 are safer and less strenuous. When limited space is available, as may be the case during renovations, ramps with a slope of up to 1 in 12 should be restricted to lengths not exceeding 3 m whenever possible. A strip contrasting in colour and texture should be used at the top and bottom of ramps to warn blind and visually impaired persons.

A-3.8.3.4.(1)(c) Landing Design at Doorways Leading to Ramps

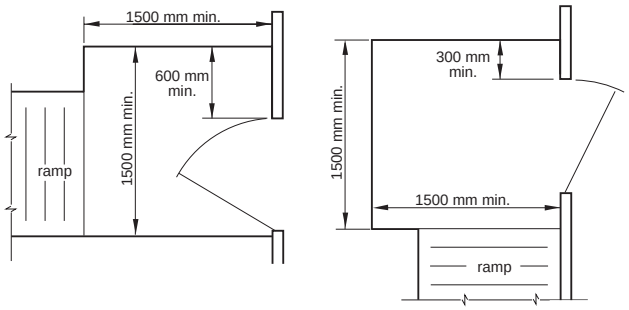

Figure A-3.8.3.4.(1)(c)
Landing design at doorways leading to ramps

A-3.8.3.7. Assistive Listening Systems. Wireless sound transmission systems, including FM, infrared or magnetic induction loop systems, improve sound reception for persons with hearing disabilities by providing amplification which can be adjusted by each user while blocking out unwanted background noise. These systems transmit a signal that is picked up by a special receiver available for use by a person with a hearing disability, whether or not a hearing aid is used. Neither system interferes with the listening enjoyment of others.

The transmitter can be jacked into an existing P.A. system amplifier or used independently with microphones. The induction loop system requires users to sit in the area circumscribed by the loop; though installation of the loop is relatively simple, the installer should be knowledgeable about these systems if proper functioning is to be achieved. FM or infrared systems can be designed to broadcast signals which cover the entire room and thus do not restrict seating to any one area. Figures A-3.8.3.7.A. and A-3.8.3.7.B. show the general configuration of FM and infrared systems. Although portable systems (FM in particular) are available, these are best suited to small audiences. Generally, the systems installed in church halls, auditoria, theatres and similar places of assembly are not easily portable, as they are installed in a fixed location by a sound technician and form an integral part of the P.A. system of the room or building.

Hard-wired systems (where a jack is provided at a particular seat) will not meet this requirement unless adequate provisions are made to accommodate persons with hearing aids. In choosing the most appropriate system, a number of factors must be taken into account including cost, installation and maintenance, suitability to the audience, ease of operation and the need for privacy. Information on designers and suppliers of these systems may be obtained from the Canadian Hearing Society.

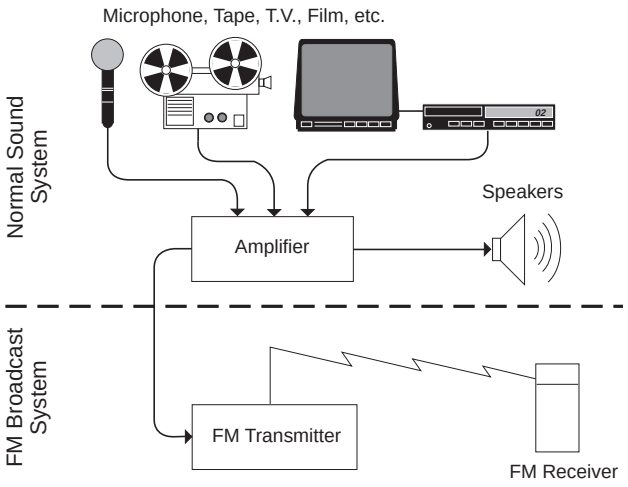

Figure A-3.8.3.7.A.

FM sound transmission system

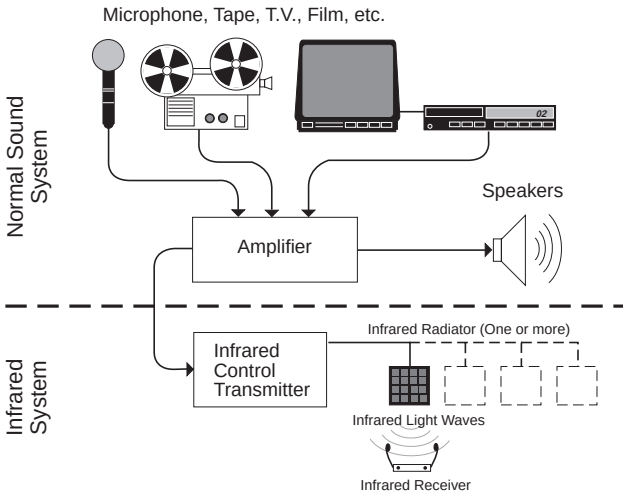

Figure A-3.8.3.7.B.

Infrared sound transmission system

A-3.8.3.8.(1)(b)(iii) Water Closet Stalls. Doors to water closet stalls for persons with physical disabilites should swing outward, preferably against a side wall.

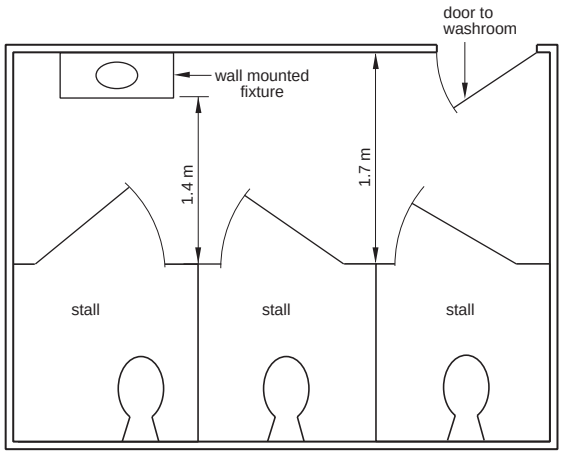

Figure A-3.8.3.8.(1)(b)(iii)

Water closet stalls

A-3.8.3.8.(1)(b)(iv) Door Pulls. The door pull should consist of a D-shaped handle mounted either horizontally or vertically. The centerlines are the lines drawn through the long axis and the short axis of the handle. If the handle is installed in the horizontal position, the short or transverse axis is the centerline which must be located at between 200 and 300 mm from the hinged side of the door, and the long or longitudinal axis is the one which is located between 900 and 1 000 mm from the floor. If the handle is installed in the vertical position, the distance is measured from the longitudinal axis to the hinged side of the door, while the distance from the floor is measured to the transverse axis.

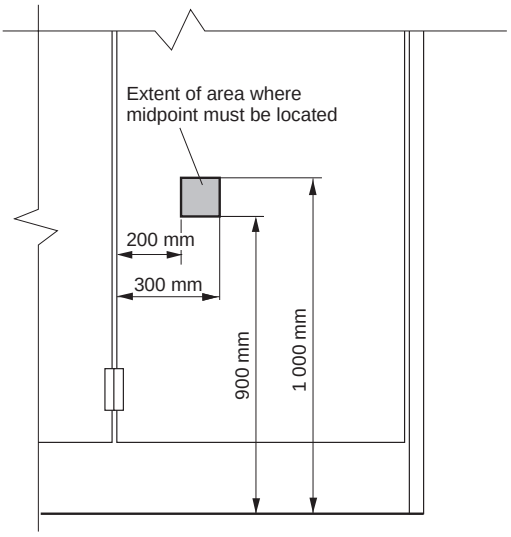

Figure A-3.8.3.8.(1)(b)(iv).A.

Door pull location

building to the night sky and the time lag in temperature change due to the thermal mass of the building and its contents. If this temperature difference is not "intended," no special consideration need be given to the control of heat flow.

If the warehouse is heated or cooled, thus making the temperature difference "intended," some consideration would have to be given to the control of heat flow.

It should be noted, however, that in many cases, such as with adjacent interior spaces, there will be an intended temperature difference but the difference will not be great. In these cases, the provisions to control heat flow may be little or no more than would be provided by any standard interior separator. That is, materials typically used in the construction of partitions may provide the separation needed to meet the requirements of Section 5.3. without adding what are generally considered to be "insulating" materials.

A-5.3.1.2. Material and Component Properties and Condensation. Total prevention of condensation is generally unnecessary and its achievement is rarely a certainty at design conditions. Part 5, therefore, requires that condensation be minimized. The occurrence of condensation should be sufficiently rare, or the quantities accumulated should be sufficiently small and dry rapidly enough, to avoid material deterioration and the growth of mould and fungi.

A-5.3.1.2.(2) Materials Providing Resistance to Heat Transfer. It is important to note that Sentence 5.3.1.2.(2), pertaining to materials intended to provide resistance to heat transfer, is stated in such a fashion that the selection of materials is not limited to those traditionally recognized as insulation materials or those for which a standard is identified. This approach permits more flexibility than is provided by the equivalent requirements in Part 9. So long as the selected material meets the performance requirements provided elsewhere in the Section, the material may be used to provide the necessary resistance to heat transfer.

Where the selected material falls within the scope of any of the standards that have been listed, however, the material must also comply with that standard. For example, if some resistance to heat transfer is required between two interior spaces and standard partition construction will provide the necessary resistance, the installation of one of the "thermal insulation" materials identified in the standard list is not required. If, on the other hand, one decides to install glass fibre insulation, the material must conform to CAN/ULC-S702.

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A-5.3.1.2.(5) Heat Transfer through Fire Rated Glazed Assemblies. Thermal bridging through fire rated glazed assemblies should not be ignored; measures should be taken to minimize condensation consistent with the intent of Sentence 5.3.1.2.(4).

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A-5.3.1.3.(2) Position of Materials Providing Thermal Resistance. For a material providing thermal resistance to be effective, it must not be short-circuited by convective air flow through or around the material. The material must therefore be either

- the component of the air barrier system providing principal resistance to air leakage, or
- installed in full and continuous contact with a continuous low air permeance component.

A-5.4.1.1. Resistance to Air Leakage. The air barrier system in above grade building components and assemblies separating conditioned space from the exterior will reduce the likelihood of condensation due to air leakage, discomfort from drafts, infiltration of dust and other pollutants, and interference in the performance of building services such as HVAC and plumbing. These can all lead to serious health or safety hazards.

Currently, the most obvious and significant problems are due to moisture-related material deterioration such as rot and corrosion, which can lead to failure of component connections. Infiltration of dust and other pollutants can lead to a wide range of health problems. Where the separator is subject to high moisture levels, the pollutants may include fungus spores. Interference with the performance of building services can lead to unhealthy conditions, and potentially hazardous conditions during the heating season in many regions of the country.

Where adjacent interior environments are sufficiently different, control of air flow between those spaces is necessary to maintain conditions.

An air barrier system may be required in components and assemblies in contact with the ground to control the transfer of soil gases such as radon and methane.

A-5.4.1.2.(1) and (2) Air Leakage through the Air Barrier System

Material Requirements

The current requirements specify only a maximum air leakage rate for the material in the air barrier system that provides the principal resistance to air leakage.

The report, "Air Permeance of Building Materials," prepared by AIR-INS Inc. for CMHC (1988) identifies, from 36 common building materials, 19 which would comply with the leakage limit of

0.02 L/(s • m^2) at 75 Pa. Air leakage characteristics greater than the maximum of 0.02 L/(s • m^2) at 75 Pa may be acceptable where

- exterior temperatures are mild,
- the moisture content of the indoor air is low,
- the assembly is resistant to moisture-related deterioration,
- higher vapour permeance materials are installed toward the cold side of the assembly, or
- the air barrier system separates two interior spaces that are not intended to provide significantly different environments.

System Requirements

Ideally, a maximum air leakage rate for the complete air barrier system would be specified. The maximum acceptable rate would ultimately depend on warm and cold side temperature and humidity conditions, and on the susceptibility of the environmental separator to moisture deterioration. Recommended maximum leakage rates for the air barrier system in an exterior envelope in most locations in Canada, depending on indoor relative humidity, are as shown in Table A-5.4.1.2.

Table A-5.4.1.2.
Recommended Maximum Air Leakage Rates

Warm side relative humidity at 21°C	Recommended maximum system air leakage rate, L/(s • m^2) at 75 Pa
< 27%	0.15
27 to 55%	0.10
>55%	0.05

Determining the leakage rate of a particular assembly, however, is problematic. There is little information available on the airtightness of the many air barrier systems used in building construction, and testing requires specialized equipment and expertise. Depending on the type of test,

- testing may not represent the performance of the complete installed system
- location of deficiencies may be difficult to identify
- rectification of deficiencies may not be feasible.

Despite the difficulties, it is recommended, when using a system whose performance is not known, that tests be conducted. Testing options include:

- laboratory tests of small sections of the air barrier system, including joints and intersections of different assemblies
- laboratory tests of large wall sections
- in-situ tests of characteristic envelope areas.

A-5.4.1.2.(3) Airtightness of Components. It is important to note that Sentence 5.4.1.2.(3), pertaining to components of the air barrier system, is stated in such a fashion that the selection of components is not limited to those for which a standard is identified. This approach permits more flexibility than is provided by similar requirements in Part 9. So long as the selected component meets the performance requirements provided elsewhere in the Section, the component may be used to provide the necessary resistance to air leakage.

Where the selected component falls within the scope of any of the standards listed, however, the component must also comply with that standard. For example, if curtain wall is selected to clad a residential building, the glazed areas of the wall constitute part of the air barrier system and must provide the required airtightness. As curtain wall is not within the scope of the CAN/CSA-A440-M standard, these glazed areas need not comply with that standard. If, on the other hand, one decides to install standard residential windows, these must conform to CAN/CSA-A440-M.

A-5.4.1.2.(6) Airtightness of Wired Glass Windows. Fixed wired glass assemblies are sometimes permitted as closures in vertical fire separations. The exception to the airtightness requirements for these windows recognizes that the availability of assemblies which would meet the requirements of the window standards and requirements for fire resistance may be limited. Control of air leakage should not be ignored; measures should be taken to attempt to comply with the requirements in Sentence 5.4.1.2.(5).

A-5.5.1.2.(1) Vapour Barrier Materials and Installation. In the summer, many buildings are subject to conditions where the interior temperature is lower than the exterior temperature. Vapour transfer during these periods is from the exterior to the interior. In general, in Canada, the duration of these periods is sufficiently short, the driving forces are sufficiently low, and assemblies are constructed such that any accumulated moisture will dissipate before deterioration will occur.

Buildings such as freezer plants, however, may operate for much of the year at temperatures that are below the ambient exterior temperature. In these cases, the "warm" side of the assembly would be the exterior and a detailed analysis on an annual basis is required.

Steady state heat transfer and vapour diffusion calculations may be used to determine acceptable permeance levels for the vapour barrier and to identify appropriate positions for the vapour barrier within the building assembly.

A-5.5.1.2.(2) Vapour Barriers. It is important to note that Sentence 5.5.1.2.(2), pertaining to materials intended to provide resistance to vapour

diffusion, is stated in such a fashion that the selection of materials is not limited to those traditionally recognized as vapour barrier materials or those for which a standard is identified. This approach permits more flexibility than is provided by the equivalent requirements in Part 9. So long as the selected material meets the performance requirements provided elsewhere in the Section, the material may be used to provide the necessary resistance to vapour diffusion.

Where the selected material falls within the scope of either of the standards listed, however, the material must comply with that standard. For example, if a peel-and-stick modified bituminous membrane is selected and will provide the necessary vapour diffusion resistance, the installation of one of the 'vapour barrier' materials identified in the standard list is not required. If, on the other hand, one decides to install polyethylene as the vapour barrier, the material must conform to CAN/CGSB-51.34-M.

A-5.6.1.1. Required Protection from Precipitation. Windows, cast-in-place concrete walls, and metal and glass curtain wall systems are examples of components and assemblies that, properly designed and constructed, would be expected to prevent ingress of precipitation into a building. Assemblies such as roofs and veneer walls have materials installed in the assembly specifically for the purpose of screening precipitation.

Components and assemblies separating interior conditioned space from the exterior are generally required to provide protection from ingress of precipitation. Components and assemblies separating interior unconditioned space from the exterior may or may not be required to provide protection from ingress of precipitation. Buildings such as stadia, parking garages and some seasonally occupied buildings, for example, may not require complete protection from precipitation.

A-5.6.1.2. (1) and (3) Roofing and Cladding. It is important to note that Sentences 5.6.1.2.(1) and (3), pertaining to materials intended to provide protection from precipitation, are stated in such a fashion that the selection of materials is not limited to those traditionally recognized as roofing or cladding materials or those for which a standard is identified. This approach permits more flexibility than is provided by the equivalent requirements in Part 9. So long as the selected material meets the performance requirements provided elsewhere in the Section, the material may be used to provide the necessary protection from precipitation.

For example, if a chlorosulphonated polyethylene (CSPE) roofing membrane is selected and will provide the necessary resistance, the installation of one of the roofing materials identified in the standard list is not required. If, on the other hand, one decides to install a prefabricated reinforced modified bituminous membrane, the material must conform to CGSB 37-GP-56M. If acrylic stucco has been selected and has been detailed to provide the necessary resistance, the installation of one of the cladding materials identified in the standard list is not required. If, on the other hand, one decides to install burned clay brick, the material must conform to CAN/CSA-A82.1-M as specified in Section 4 of CSA A371.

A-5.6.1.2.(5) Watertightness of Wired Glass Windows. Fixed wired glass windows are sometimes permitted as closures in vertical fire separations. The exception to the watertightness requirements for these windows recognizes that the availability of assemblies which would meet the requirements of the window standards and requirements for fire resistance may be limited. Control of water leakage through these windows should not be ignored; measures should be taken toward compliance with the requirements in Sentence 5.6.1.2.(4).

A-5.6.2.1. Sealing and Drainage. Providing a surface-sealed, durable, watertight cover on the outside of a building is difficult. Where there is a likelihood of some penetration by precipitation into a component or assembly, drainage is generally required to direct the moisture to the exterior.

Information on the installation of flashing to drain water to the exterior of roof and wall assemblies may be found in a number of publications including, but not limited to:

- "Architectural Sheet Metal," Sheet Metal and Air-Conditioning Contractors National Association, Inc.
- "High-Rise Residential Construction Guide 1995, "Ontario New Home Warranty Program
- "Technical Notes," National Concrete Masonry Association
- "Roofing Specifications," Canadian Roofing Contractors' Association
- "Roofing and Waterproofing Manual," National Roofing Contractors Association
- "Technical Notes on Brick Construction," Brick Institute of America.

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A-5.8.1.1.(1) Required Drainage. A wall or floor located below the water table or in the path of a watercourse will be subject to continuous hydrostatic pressure. In such cases, the provision of drainage will be ineffective and the wall or floor must be made waterproof to prevent water ingress.

Where a wall or floor is subject to intermittent hydrostatic pressure, as may result from seasonal flooding, proper drainage will facilitate the drying out of the soil. In some cases, reducing exposure to high moisture levels will extend the life of the moisture protection.

Where a wall or floor is not subject to hydrostatic pressure, drainage again reduces the exposure to high moisture levels and allows less than waterproof treatment of the wall or floor.

A-5.8.2. Moisture Protection. Moisture protection for building elements in contact with the ground is generally categorized as either waterproofing or dampproofing. Waterproofing provides a continuous protection against water ingress and is intended to resist hydrostatic load. Dampproofing, on the other hand, does not provide a seal against water ingress and cannot withstand hydrostatic pressure.

In general, Part 5 requires walls, floors and roofs in contact with the ground to be waterproofed. Properties of waterproofing are specified in Sentences 5.8.2.2.(2) to (5), and waterproofing material standards are referenced in Sentence 5.8.2.2.(6). Materials intended to be used as dampproofing rather than waterproofing are generally not permitted [Sentence 5.8.2.2.(7)]. Standards for installing waterproofing are also specified [Sentence 5.8.2.3.(1)].

Part 5 does permit the use of dampproofing in lieu of waterproofing where the substrate is cast-in-place concrete, a drainage layer is installed and where the assembly will not be exposed to hydrostatic pressure. Material standards are referenced in Clause 5.8.2.2.(8)(b) and installation methods in Sentence 5.8.2.3.(2).

A-5.8.2.2.(6) Protective Materials. It is important to note that Sentence 5.8.2.2.(6), pertaining to waterproofing materials intended to provide protection from moisture in the ground, is stated in such a fashion that the selection of materials is not limited to those traditionally recognized as waterproofing or dampproofing, or those for which a standard is identified. This approach permits more flexibility than is provided by the equivalent requirements in Part 9. So long as the selected material meets the performance requirements provided elsewhere in the Section, the material may be used to provide the necessary protection from moisture in the ground.

Where the selected material falls within the scope of any of the standards listed, however, the material must comply with that standard. For example, if bentonite clay panels are selected and will provide the necessary resistance, the installation of one of the waterproofing materials listed in Sentence 5.8.2.2.(6) is not required. If, on the other hand, one decides to install an elastomeric membrane, the material must conform to CGSB 37-GP-52M.

A-5.8.2.2.(8) Drainage Layers. Drainage layers reduce both structural and moisture loading on the building envelope by breaking capillary flow and allowing water to percolate quickly to the drainage system. A drainage layer may consist of permeable materials including granular back-fill, geosynthetic drainage products or mineral fibreboard with oriented fibres to facilitate drainage. Where a granular material is used, it should be protected from contamination by fines from the adjacent native soil or additional material should be installed to ensure that an adequate thickness of the granular material remains free of fines.

A-6.2.1.4. Structural Movement. This article is intended to remind designers and installers of mechanical systems of one aspect of the "good engineering practice" referred to in Article 6.2.1.1. r

In determining how to accommodate structural movement, there are 2 important principles to bear in mind:

- The prime concern of the NBC is the safety of people in and around the building, as opposed to protection of the mechanical systems and equipment.
- The nature of the accommodation will vary with the type of movement being considered, taking into account particularly how often the movement is likely to be encountered over the life of the building.

For example, a gas line supported on columns that also support a crane must be installed in such a way that the movement of the columns, which occurs many times daily, does not cause the lines to break, thus creating a hazard. Even if the gas line installation could somehow be designed to break in a non-hazardous manner, it would hardly be recognized as good engineering practice if movement that occurs so frequently could disrupt the operation of the mechanical system.

On the other hand, earthquakes occur far less frequently and it would not be surprising to have a non-critical mechanical system fail as a result of an earthquake. However, even in this situation, the failure must occur in a manner that does not create a hazard to building occupants. For example, heavy mechanical equipment should be properly anchored so that it does not topple on building occupants during an earthquake. The design of the anchors should take into account accelerations consistent with the seismic data given in Appendix C for the location of the building. Part 4 provides guidance on the calculation of the loads such equipment would exert on the building structure during an earthquake; these same loads can be used in designing the anchors.

Some mechanical equipment can be an important component of post-disaster life safety systems. In these cases, the measures needed to accommodate the movements caused by an earthquake become even more critical since failure of the equipment would not be acceptable.

Clearly, complying with this requirement will, in most cases, necessitate close coordination between the mechanical designer and the structural designer.

A-6.2.1.9.(1) Installation General. Ducts or pipes without dampers or valves are generally not considered to constitute "equipment" and are therefore not subject to this requirement.

A-6.2.2.4.(3) Minimizing Growth of Micro-organisms. Sources for microbial growth causing hypersensitivity, pneumonitis and humidifier fever include drain pans, spray-water air-washers, contaminated filters, poorly maintained cooling coils, water incursion into ductwork, cafeteria dishwasher drainage leaks, high humidity and stagnant water. Some of the control measures are as follows:

(a) Drain pans should be pitched toward the drain outlet and the outlet bottom should be flush with the drain pan bottom, otherwise there will be standing water in the pan, exposed to the supply air passing through the cooling section of the air-handling unit.

(b) Access into air-handling equipment should be provided for maintenance of filters, cooling coils and condensate drain pans located below the cooling coils. Access doors should be large and easy to open to facilitate thorough and regular maintenance. Hinged access doors are preferable to bolted access panels.

(c) If moisture is added to commercial building ventilation air (such as in hospital operating rooms and dedicated computer rooms) to maintain humidity levels in a designated range (for example, 40% to 50% relative humidity), humidifiers that inject steam or water vapour into central air-handling units or main supply ducts are normally used. Injection nozzles should not be located in air-handling unit plenums or ductwork that is insulated with internal fibrous lining. If the lining becomes wet, conditions conducive to microbial growth will result.

The above only addresses built-in features of an HVAC system that can help to minimize growth of micro-organisms. Even more important than the built-in features is a program of regular maintenance and cleaning of those portions of the system where such growth is likely to occur.

A-6.2.2.5. 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 or 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, Cutting, and Allied Processes"
NFPA 51A, "Acetylene Cylinder Charging Plants" r
NFPA 61, "Prevention of Fires and Dust Explosions in Agricultural and Food Products Facilities"
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 86, "Ovens and Furnaces"
NFPA 88A, "Parking Structures"
NFPA 88B, "Repair Garages"
NFPA 91, " Exhaust Systems for Air Conveying of Materials"
NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations"
NFPA 204M, "Guide for Smoke and Heat Venting"
NFPA 303, "Marinas and Boatyards"
NFPA 307, "Construction and Fire Protection of Marine Terminals, Piers and Wharfs"
NFPA 325, "Fire Hazard Properties of Flammable Liquids, Gases and Volatile Solids"
NFPA 395, "Storage of Flammable and Combustible Liquids at Farms and Isolated Sites"
NFPA 409, "Aircraft Hangars"
NFPA 415, "Airport Terminal Buildings, Fueling, Ramp Drainage, Loading Walkways"
NFPA 480, "Storage, Handling and Processing of Magnesium Solids and Powders"
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 for Handling Combustible Materials"
NFPA 651, "Manufacture of Aluminum Powder"
NFPA 654, "Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids"
NFPA 655, "Prevention of Sulfur Fires and Explosions"
NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities"
NFPA 8503, "Pulverized Fuel Systems" r

A-6.2.3.9.(5) and (6) Exhausting to Garages. A frequent practice in the design of ventilation systems serving buildings which have associated parking garages is to discharge exhaust air from the building to the garage in order to reduce the cost of heating the garage or reduce the length of the exhaust ducts. However, this practice entails a certain amount of risk since, when the exhaust system is not running, stack effect may turn the exhaust outlets into intakes and exhaust fumes (including carbon monoxide) can be drawn from the garage into the building. Incorporating a backdraft damper at the exhaust outlet provides some additional protection but backdraft dampers are generally not regarded as being very reliable. Therefore this practice is only permitted in very limited circumstances.

A-6.2.9.2.(2) 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 approxi-

mately 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.(1) Application. The use of streets or public property and vehicular traffic during construction or demolition is normally controlled by regulations of authorities other than the building department (e.g., police department).

A-8.2.2.1.(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.(1) 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-8.2.2.12.(3) Purging of Tanks. Guidance on methods of rendering inert tanks, piping and machinery reservoirs is available in NFPA 326, "Safe Entry of Underground Storage Tanks," or NFPA 327, "Cleaning or Safeguarding Small Tanks and Containers Without Entry."

A-8.2.3.1.(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-9.1.1.1.(1) Application of Part 9 to Seasonally and Intermittently Occupied Buildings. The National Building Code does not provide separate requirements which would apply to seasonally or intermittently occupied buildings. Without compromising the basic health and safety provisions, however, various requirements in Part 9 recognize that leniency may be appropriate in some circumstances. With greater use of "cottages" through the winter months, the proliferation of seasonally occupied multiple-dwelling buildings and the increasing installation of modern conveniences in these buildings, the number and extent of possible exceptions is reduced.

Thermal Insulation

Article 9.25.2.1. specifies that insulation is to be installed in walls, ceilings and floors which separate heated space from unheated space. Cottages intended for use only in the summer and which, therefore, have no space heating appliances, would not be required to be insulated. Should a heating system be installed at some later date, insulation should also be installed at that time. In the case of row units intended for intermittent winter use, the walls between the dwelling units may at times separate heated space from unheated space. In this case, the installation of insulation might be considered.

Air Barrier Systems and Vapour Barriers

Articles 9.25.3.1. and 9.25.4.1. require the installation of air barrier systems and vapour barriers only where insulation is installed. Dwellings with no heating system would thus be exempt from these requirements.

Interior Wall and Ceiling Finishes

The choice of interior wall and ceiling finishes has implications for fire safety. Where a dwelling is a detached building, there are no fire resistance requirements for the walls or ceilings within the dwelling. The exposed surfaces of walls and ceilings are required to have a flame spread rating not greater than 150 (Subsection 9.10.16). There is, therefore, considerable flexibility, even in continuously occupied dwellings, with respect to the materials used to finish these walls. Except where waterproof finishes are required (Subsection 9.29.2.), ceilings and walls may be left unfinished. Where two units adjoin, however, additional fire resistance requirements may apply to interior loadbearing walls, floors and the shared wall (Article 9.10.8.3., and Subsections 9.10.9. and 9.10.11.).

Plumbing and Electrical Facilities

Plumbing fixtures are required only where a piped water supply is available (Subsection 9.31.4.), and electrical facilities only where electrical services are available (Article 9.34.1.2.).

A-Table 9.3.2.1. 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-9.3.2.1.(1) Grade Marking of Lumber. Lumber is generally grouped for marketing into the species combinations contained in Table A-9.3.2.1.A. The maximum allowable spans for those combinations are listed in the span tables for joists, rafters and beams. Some species of lumber are also marketed individually. Since the allowable span for the northern species combination is based on the weakest species in the combination, the use of the span

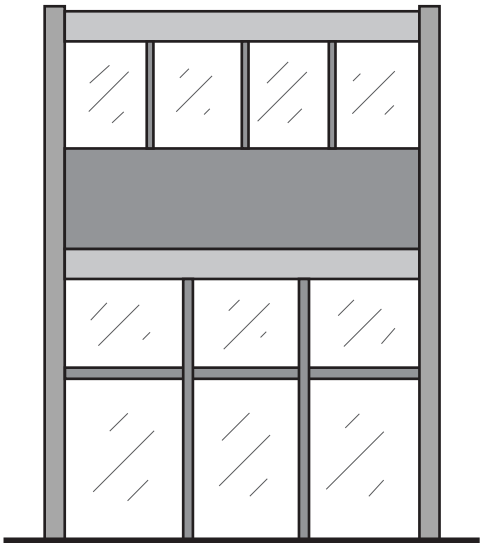


Figure A-9.4.A.
Mercantile building with little resistance to lateral loading

Another example is the practice, in some parts of the country, of building houses on crawl spaces with perimeter walls consisting of short, wood frame "knee" or "pony" walls and with no lateral bracing or interior partitions in the crawl space. The only structural continuity in the foundation-to-knee-wall and knee-wall-to-floor joints comes from nailing and this is inadequate to resist lateral loads from significant earthquakes.

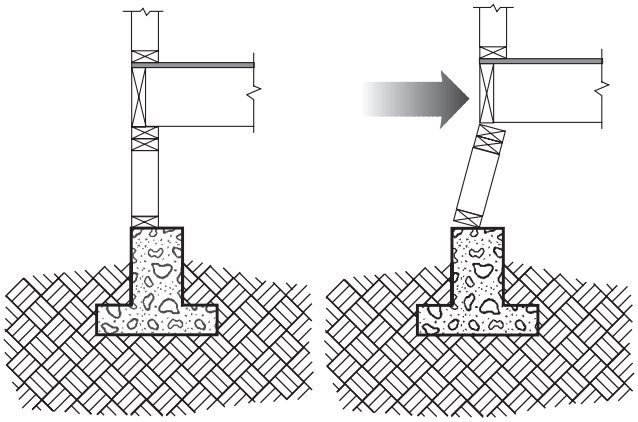


Figure A-9.4.B.
Crawl space knee-wall with little resistance to lateral loading

Thus Part 9 buildings are not exempt from having to comply with the wind and earthquake loading requirements of Part 4. In many cases, these considerations can safely be ignored but, in certain configurations, the building's resistance to wind and earthquake loads must be carefully considered.

See also A-9.23.10.2.

A-Table 9.4.4.1. Classification of Soils. Sand or gravel may be classified by means of a picket test in which a 38 mm by 38 mm picket 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-Table 9.6.6.1. Glass in Doors. Maximum areas in Table 9.6.6.1. for other than fully tempered glazing are cut off at 1.50 m^2, as this would be the practical limit after which safety glass would be required by Sentence 9.6.6.2.(3).

A-9.6.6.3.(1) 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 to be used for walk-in closets.

A-9.6.6.6.(1) Double Glazing for Glass Doors and Glass in Doors. Where a door consists of a large area of glass held in a frame, for example, sliding patio doors, the glass is considered to be glass in a door and would be required to be double glazed. Only where a door is solid glass and has no frame would the glass not be required to be double glazed.

A-9.6.8.1. Forced Entry Via Glazing in Doors and Sidelights. There is no mandatory requirement that special glass be used in doors or sidelights, primarily because of cost. It is, however, a common method of forced entry to break glass in doors and sidelights to gain access to door hardware and unlock the door from the inside. Although insulated glass provides increased resistance over single glazing, the highest resistance is provided by laminated glass. Tempered glass, while stronger against static loads, is prone to shattering under high, concentrated impact loads.

Laminated glass is more expensive than annealed glass and must be used in greater thicknesses. Figure A-9.6.8.1. shows an insulated sidelight made of one pane of laminated glass and one pane of annealed glass. This method reduces the cost premium that would result if both panes were laminated.

Consideration should be given to using laminated glazing in doors and accompanying sidelights regulated by Article 9.6.6.1., in windows located within 900 mm of locks in such doors, and in basement windows.

Underwriters' Laboratories of Canada have produced a document ULC-S332, r

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.

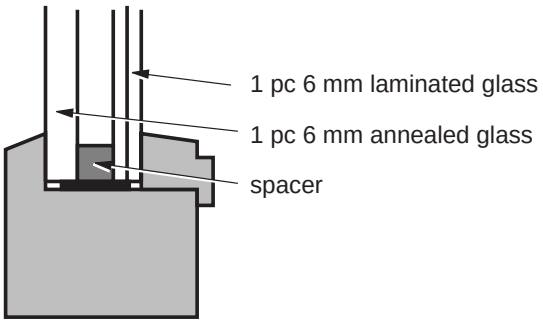


Figure A-9.6.8.1.
Combined laminated/annealed glazing

A-9.6.8.5.(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 strike-plates that are specially designed to provide equal or greater protection.

A-9.6.8.7.(1) Hinged Doors. Methods of satisfying this Sentence include either using non-removable pin hinges or modifying standard hinges by screw fastening a metal pin in a screw hole in one half of the top and bottom hinges. When the door is closed, the projecting portion of the pin engages in the corresponding screw hole in the other half of the hinge and then, even if the hinge pin is taken out, the door cannot be removed.

A-9.6.8.10.(1) Resistance of Doors to Forced Entry. This Sentence designates standard ASTM F 476, "Security of Swinging Door Assemblies," 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-9.7.1.3.(1) Bedroom Window Height. Sentence 9.7.1.3.(1) requires every bedroom that does not have an exterior door to have at least one window that is large enough and easy enough to open that it can be used as an exit in case of a fire that prevents use of the normal building exits. However, the Article does not set a maximum sill height for such a window; it is therefore possible to install a window or skylight which satisfies the requirements of the Article but defeats the Article's intent by virtue of being so high that it cannot be reached for exit purposes. It is recommended that the sills of windows intended for use as emergency exits be not higher than 1.5 m above the floor. Sometimes it is difficult to avoid having the sill higher than this; e.g., skylights, windows in basement bedrooms. In these cases, it is recommended that access to the window be improved by some means such as built-in furniture installed below the window.

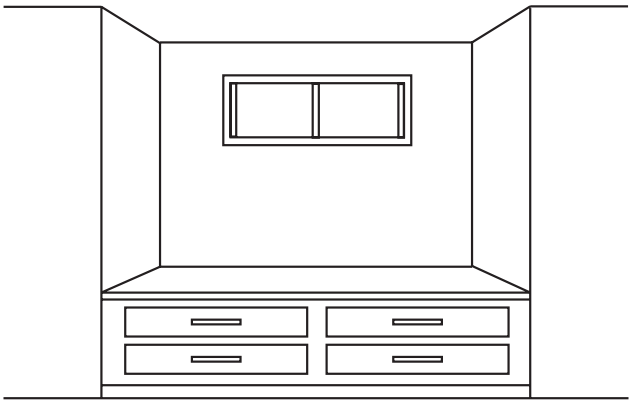


Figure A-9.7.1.3.A.
Built-in furniture to improve access to a window

A-9.7.1.3.(2) Bedroom Window Opening Areas and Dimensions. Although the minimum opening dimensions required for height and width are 380 mm, a window opening that is 380 mm by 380 mm would not comply with the minimum area requirements. (See Figure A-9.7.1.3.B.)

Table A-9.10.3.1.A (Continued)

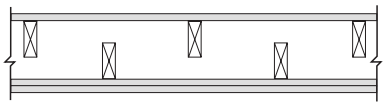
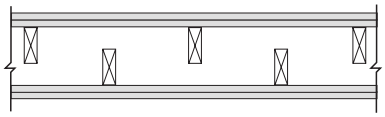
Type of Wall	Wall Number	Description	Fire Resistance Rating[1]		Typical Sound Transmission Class[1][2][3]
			Load-bearing	Non-Load-bearing	
• Loadbearing or Non-Loadbearing	W7a	W7 with • 15.9 mm Type X gypsum board[5]	1 h	1 h	47
	W7b	W7 with • 12.7 mm Type X gypsum board[5]	45 min [1 h[6]]	45 min [1 h[6]]	45
	W7c	W7 with • 12.7 mm regular gypsum board[5][7]	30 min	30 min [45 min[6]]	42
	W8	• Two rows 38 mm x 89 mm studs each spaced 400 mm or 600 mm o.c. staggered on common 38 mm x 140 mm plate • 89 mm thick absorptive material on one side or 65 mm thick on each side[4] • 2 layers of gypsum board on one side • 1 layer of gypsum board on other side			
	W8a	W8 with • 15.9 mm Type X gypsum board[5]	1 h	1.5 h	52
	W8b	W8 with • 12.7 mm Type X gypsum board[5]	45 min	1 h	50
	W9	• two rows 38 mm x 89 mm studs each spaced 400 mm or 600 mm o.c. staggered on common 38 mm x 140 mm plate • with or without absorptive material • 2 layers of gypsum board on each side			
	W9a	W9 with • 89 mm thick absorptive material on one side or 65 mm thick on each side[4] • 15.9 mm Type X gypsum board[5]	1.5 h	2 h	56
	W9b	W9 with • 89 mm thick absorptive material on one side or 65 mm thick on each side[4] • 12.7 mm Type X gypsum board[5]	1 h	1.5 h	55
	W9c	W9 with • 89 mm thick absorptive material on one side or 65 mm thick on each side[4] • 12.7 mm regular gypsum board[5]	45 min	1 h	53

Table A-9.10.3.1.A (Continued)

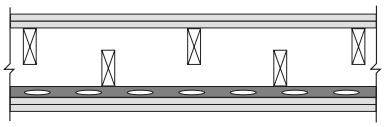
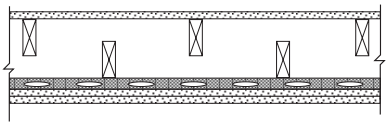
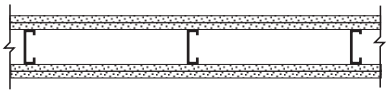
Type of Wall	Wall Number	Description	Fire Resistance Rating[1]		Typical Sound Transmission Class[1][2][3]
			Load-bearing	Non-Load-bearing	
	W9d	W9 with • no absorptive material • 15.9 mm Type X gypsum board[5]	1.5 h	2 h	48
	W10	• two rows 38 mm x 89 mm studs each spaced 400 mm or 600 mm o.c. staggered on common 38 mm x 140 mm plate • with or without absorptive material • resilient metal channels on one side spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on each side			
	W10a	W10 with • 89 mm thick absorptive material on one side or 65 mm thick on each side[4] • 15.9 mm Type X gypsum board[5]	1.5 h	2 h	62
	W10b	W10 with • 89 mm thick absorptive material on one side or 65 mm thick on each side[4] • 12.7 mm Type X gypsum board[5]	1 h	1.5 h	60
	W10c	W10 with • no absorptive material • 15.9 mm Type X gypsum board[5]	1.5 h	2 h	50
	W10d	W10 with • no absorptive material • 12.7 mm Type X gypsum board[5]	1 h	1.5 h	48
	W11	• two rows 38 mm x 89 mm studs each spaced 400 mm or 600 mm o.c. staggered on common 38 mm x 140 mm plate • 89 mm thick absorptive material on one side or 65 mm thick on each side[4] • resilient metal channels on one side spaced 400 mm or 600 mm o.c. • 2 layers of gypsum board on resilient channel side •1 layer of gypsum board on other side			
	W11a	W11 with • 15.9 mm Type X gypsum board[5]	1 h	1 h	56

Table A-9.10.3.1.A (Continued)

Type of Wall	Wall Number	Description	Fire Resistance Rating[1]		Typical Sound Transmission Class[1][2][3]
			Load-bearing	Non-Load-bearing	
	S5c	S5 with • studs spaced 600 mm o.c. • 89 mm thick absorptive material[4] • 12.7 mm Type X gypsum board[5]	–	1 h [1.5 h[6]]	51
	S5d	S5 with • studs spaced 400 mm o.c. • 89 mm thick absorptive material[4] • 12.7 mm Type X gypsum board[5]	–	1 h [1.5 h[6]]	50
	S5e	S5 with • studs spaced 600 mm o.c. • no absorptive material •15.9 mm Type X gypsum board[5]	–	1 h	43
	S5f	S5 with • studs spaced 400 mm o.c. • no absorptive material • 15.9 mm Type X gypsum board[5]	–	1 h	42
	S5g	S5 with • studs spaced 600 mm o.c. • no absorptive material • 12.7 mm Type X gypsum board[5]	–	1 h	41
	S5h	S5 with • studs spaced 400 mm o.c. • no absorptive material • 12.7 mm Type X gypsum board[5]	–	1 h	40
	S6	• 31 mm x 92 mm steel studs spaced 400 mm or 600 mm o.c. • with or without absorptive material • 2 layers of gypsum board on each side			
	S6a	S6 with • studs spaced 600 mm o.c. • 89 mm thick absorptive material[4] • 15.9 mm Type X gypsum board[5]	–	2 h	56

e

Table A-9.10.3.1.A (Continued)

Type of Wall	Wall Number	Description	Fire Resistance Rating[1]		Typical Sound Transmission Class[1][2][3]
			Load-bearing	Non-Load-bearing	
	S6b	S6 with • studs spaced 400 mm o.c. • 89 mm thick absorptive material[4] • 15.9 mm Type X gypsum board[5]	–	2 h	55
	S6c	S6 with • studs spaced 600 mm o.c. • 89 mm thick absorptive material[4] • 12.7 mm Type X gypsum board[5]	–	1.5 h	55
	S6d	S6 with • studs spaced 400 mm o.c. • 89 mm thick absorptive material[4] • 12.7 mm Type X gypsum board[5]	–	1.5 h	54
	S6e	S6 with • studs spaced 600 mm o.c. • 89 mm thick absorptive material[4] • 12.7 mm regular gypsum board[5]	–	1 h	50
	S6f	S6 with • studs spaced 400 mm o.c. • 89 mm thick absorptive material[4] • 12.7 mm regular gypsum board[5]	–	1 h	48
	S6g	S6 with • studs spaced 600 mm o.c. • no absorptive material • 15.9 mm Type X gypsum board[5]	–	2 h	47
	S6h	S6 with • studs spaced 400 mm o.c. • no absorptive material • 15.9 mm Type X gypsum board[5]	–	2 h	45
	S6i	S6 with • studs spaced 600 mm o.c. • no absorptive material • 12.7 mm Type X gypsum board[5]	–	1.5 h	45

Table A-9.10.3.1.A (Continued)

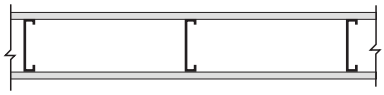
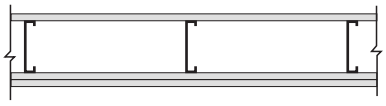
Type of Wall	Wall Number	Description	Fire Resistance Rating[1]		Typical Sound Transmission Class[1][2][3]
			Load-bearing	Non-Load-bearing	
	S6j	S6 with • studs spaced 400 mm o.c. • no absorptive material • 12.7 mm Type X gypsum board[5]	–	1.5 h	44
	S6k	S6 with • studs spaced 600 mm o.c. • no absorptive material • 12.7 mm regular gypsum board[5]	–	1 h	41
	S6l	S6 with • studs spaced 400 mm o.c. • no absorptive material • 12.7 mm regular gypsum board[5]	–	1 h	39
	S7	• 31 mm x 152 mm steel studs spaced 400 mm or 600 mm o.c. • with or without absorptive material • 1 layer of gypsum board on each side			
	S7a	S7 with • 150 mm thick absorptive material[4] • 15.9 mm Type X gypsum board[5]	–	45 min [1 h[6]]	51
	S7b	S7 with • no absorptive material • 15.9 mm Type X gypsum board[5]	–	45 min	41
	S8	• 31 mm x 152 mm steel studs spaced 400 mm or 600 mm o.c. • with or without absorptive material • 1 layer of gypsum board on one side • 2 layers of gypsum board on other side			
	S8a	S8 with • 150 mm thick absorptive material[4] • 15.9 mm Type X gypsum board[5]	–	1 h [1.5 h[6]]	55
	S8b	S8 with • 150 mm thick absorptive material[4] • 12.7 mm Type X gypsum board[5]	–	1 h [1.5 h[6]]	54

Table A-9.10.3.1.A (Continued)

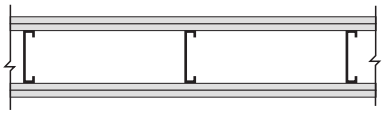
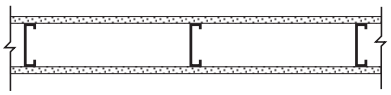
Type of Wall	Wall Number	Description	Fire Resistance Rating[1]		Typical Sound Transmission Class[1][2][3]
			Load-bearing	Non-Load-bearing	
	S8c	S8 with • no absorptive material • 15.9 mm Type X gypsum board[5]	–	1 h	45
	S8d	S8 with • no absorptive material • 12.7 mm Type X gypsum board[5]	–	1 h	44
	S9	• 31 mm x 152 mm steel studs spaced 400 mm or 600 mm o.c. • with or without absorptive material • 2 layers of gypsum board on each side			
	S9a	S9 with • 150 mm thick absorptive material[4] • 15.9 mm Type X gypsum board[5]	–	2 h	59
	S9b	S9 with • 150 mm thick absorptive material[4] • 12.7 mm Type X gypsum board[5]	–	1.5 h	57
	S9c	S9 with • 150 mm thick absorptive material[4] • 12.7 mm regular gypsum board[5]	–	1 h	53
	S9d	S9 with • no absorptive material • 15.9 mm Type X gypsum board[5]	–	2 h	49
	S9e	S9 with • no absorptive material • 12.7 mm Type X gypsum board[5]	–	1.5 h	47
	S9f	S9 with • no absorptive material • 12.7 mm regular gypsum board[5]	–	1 h	43
• Loadbearing Steel Studs	**S10**	• 92 mm loadbearing steel studs spaced 400 mm o.c. • with or without absorptive material • 1 layer gypsum board on each side			

Table A-9.10.3.1.A (Continued)

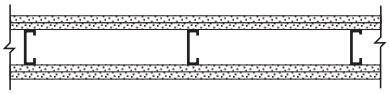
Type of Wall	Wall Number	Description	Fire Resistance Rating[1]		Typical Sound Transmission Class[1][2][3]
			Load-bearing	Non-Load-bearing	
• 0.91 mm or 1.22 mm Thickness (18 or 20 Gauge)	S10a	S10 with • 89 mm thick absorptive material[4] • 15.9 mm Type X gypsum board[5]	–	–	34
	S10b	S10 with • no absorptive material • 15.9 mm Type X gypsum board[5]	–	–	32
	S11	• 92 mm loadbearing steel studs spaced 400 mm o.c. • with or without absorptive material • 2 layers gypsum board on each side			**e**
	S11a	S11 with • 89 mm thick absorptive material[4] • 15.9 mm Type X gypsum board[5]	–	–	38
	S11b	S11 with • 89 mm thick absorptive material[4] • 12.7 mm Type X gypsum board[5]	–	–	38
	S11c	S11 with • 89 mm thick absorptive material[4] • 12.7 mm regular gypsum board[5]	–	–	36
	S11d	S11 with • no absorptive material • 15.9 mm Type X gypsum board[5]	–	–	36
	S11e	S11 with • no absorptive material • 12.7 mm Type X gypsum board[5]	–	–	35
	S11f	S11 with • no absorptive material • 12.7 mm regular gypsum board[5]	–	–	34

Table A-9.10.3.1.A (Continued)

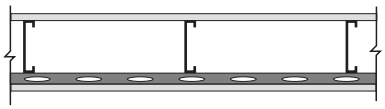
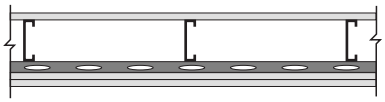
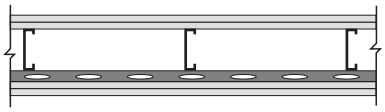
Type of Wall	Wall Number	Description	Fire Resistance Rating[1]		Typical Sound Transmission Class[1][2][3]
			Load-bearing	Non-Load-bearing	
	S12	• 92 mm loadbearing steel studs spaced 400 mm o.c. • with or without absorptive material • resilient metal channels on one side spaced at 600 mm o.c. • 1 layer gypsum board on each side			
	S12a	S12 with • 89 mm thick absorptive material[4] • 15.9 mm Type X gypsum board[5]	–	–	49
	S12b	S12 with • no absorptive material • 15.9 mm Type X gypsum board[5]	–	–	39
	S13	• 92 mm loadbearing steel studs spaced 400 mm o.c. • with or without absorptive material • resilient metal channels on one side spaced at 600 mm o.c. • 2 layers gypsum board on resilient channel side • 1 layer gypsum board on other side			
	S13a	S13 with • 89 mm thick absorptive material[4] • 15.9 mm Type X gypsum board[5]	–	–	54
	S13b	S13 with • no absorptive material • 15.9 mm Type X gypsum board[5]	–	–	44
	S14	• 92 mm loadbearing steel studs spaced 400 mm o.c. • with or without absorptive material • resilient metal channels on one side spaced at 600 mm o.c. • 2 layers gypsum board on each side			
	S14a	S14 with • 89 mm thick absorptive material[4] • 15.9 mm Type X gypsum board[5]	–	–	61

Table A-9.10.3.1.A (Continued)

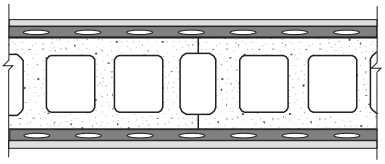
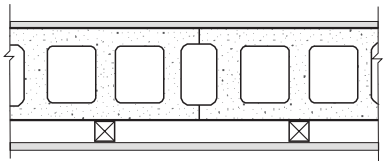
Type of Wall	Wall Number	Description	Fire Resistance Rating[1]		Typical Sound Transmission Class[1][2][3]
			Load-bearing	Non-Load-bearing	
	B3d	B3 with • 190 mm concrete block • 12.7 mm Type X gypsum board[5]	2.5 h	2.5 h	53
	B3e	B3 with • 190 mm concrete block • 12.7 mm regular gypsum board[5][7]	2 h	2 h	51
	B4	•140 mm or 190 mm concrete block • resilient metal channels on each side spaced at 400 mm or 600 mm o.c. • with or without absorptive material • 1 layer gypsum board on each side			
	B4a	B4 with • 140 mm concrete block •12.7 mm Type X gypsum board[5], or 15.9 mm Type X gypsum board[5]	2 h	2 h	47
	B4b	B4 with • 140 mm concrete block • 12.7 mm regular gypsum board[5][7]	1.5 h	1.5 h	42
	B4c	B4 with • 190 mm concrete block • 15.9 mm Type X gypsum board[5]	3 h	3 h	50
	B4d	B4 with • 190 mm concrete block • 12.7 mm Type X gypsum board[5]	2.5 h	2.5 h	49
	B4e	B4 with •190 mm concrete block •12.7 mm regular gypsum board[5][7]	2 h	2 h	45
	B5	• 190 mm concrete block • 38 mm x 38 mm horizontal or vertical wood strapping on one side spaced at 600 mm o.c. • with or without absorptive material • 1 layer gypsum board on each side			

Table A-9.10.3.1.A (Continued)

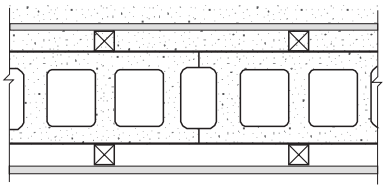
Type of Wall	Wall Number	Description	Fire Resistance Rating[1]		Typical Sound Transmission Class[1][2][3]	
			Load-bearing	Non-Load-bearing		
	B5a	B5 with • 15.9 mm Type X gypsum board[5]	3 h	3 h	54	
	B5b	B5 with • 12.7 mm Type X gypsum board[5]	2.5 h	2.5 h	53	
	B5c	B5 with • 12.7 mm regular gypsum board[5][7]	2 h	2 h	51	
	B6	• 140 mm or 190 mm concrete block • 38 mm x 38 mm horizontal or vertical wood strapping on each side spaced at 600 mm o.c. • absorptive material filling strapping space on each side[4] • 1 layer gypsum board on each side				
	B6a	B6 with • 140 mm concrete block • 12.7 mm Type X gypsum board or 15.9 mm Type X gypsum board[5]	2 h	2 h	57	
	B6b	B6 with • 140 mm concrete block • 12.7 mm regular gypsum board[5][7]	1.5 h	1.5 h	56	*e*
	B6c	B6 with • 190 mm concrete block • 15.9 mm Type X gypsum board[5]	3 h	3 h	60	
	B6d	B6 with • 190 mm concrete block • 12.7 mm Type X gypsum board[5]	2.5 h	2.5 h	59	
	B6e	B6 with • 190 mm concrete block • 12.7 regular gypsum board[5][7]	2 h	2 h	57	*e*

Table A-9.10.3.1.A (Continued)

(8) Where bracing material, such as diagonal lumber or plywood, OSB, gypsum board or fibreboard sheathing is installed on the inner face of one row of studs in double stud assemblies, the STC rating will be reduced by 3 for any assemblies containing absorptive material in both rows of studs or in the row of studs opposite to that to which the bracing material is attached. Attaching such layers on both inner faces of the studs may drastically reduce the STC value but enough data to permit assignment of STC ratings for this situation is not available. The fire resistance rating is not affected by the inclusion of such bracing.

(9) For exterior walls, the finish joints must be taped and finished for the outer layer of the interior side only. The gypsum board on the exterior side may be replaced with gypsum sheathing of the same thickness and type (regular or Type X).

Table A-9.10.3.1.B.
Fire and Sound Resistance of Floors, Ceilings and Roofs

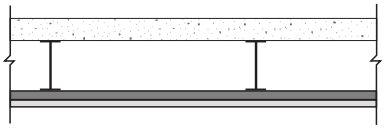
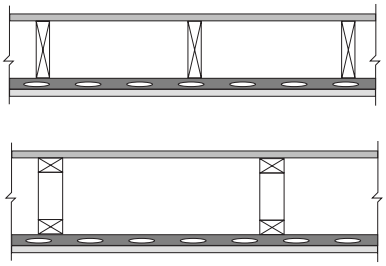
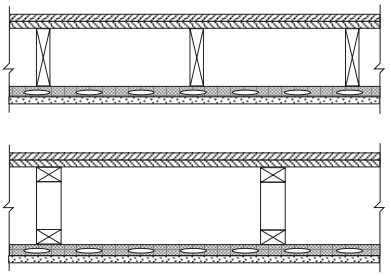
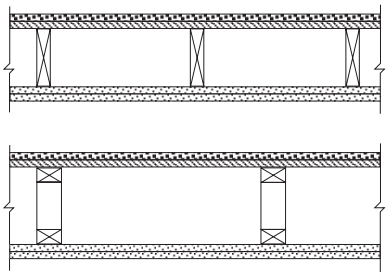
Type of Assembly	Assembly Number	Description	Fire Resistance Rating	Typical Sound Transmission Class[1][2]
Concrete Slabs	**F1**	• reinforced concrete with no finish on either side		
	F1a	• 90 mm reinforced concrete with 20 mm minimum cover over reinforcing steel	1 h	48
	F1b	• 130 mm reinforced concrete with 25 mm minimum cover over reinforcing steel	2 h	52
Open Web Steel Joists	**F2**	• concrete deck, minimum 50 mm thick • on open web steel joists spaced 400 mm o.c. • furring channels spaced not more than 600 mm o.c. wired to underside of joists • 1 layer of gypsum board on ceiling side		
	F2a	F2 with • 15.9 mm Type X gypsum board[3]	45 min	53
Wood Floor Joists or Wood Floor Trusses	**F3**	• subfloor of 19 mm tongue and groove lumber or 15.5 mm plywood, OSB or waferboard • on wood joists spaced not more than 400 mm o.c., or on wood trusses[4] spaced not more than 600 mm o.c. • absorptive material in cavity[5] • resilient metal channels spaced at 200 mm o.c. • 1 layer of gypsum board on ceiling side		
	F3a	F3 with • 15.9 mm Type X gypsum board[3]	45 min	48

Table A-9.10.3.1.B. (Continued)

Type of Assembly	Assembly Number	Description	Fire Resistance Rating	Typical Sound Transmission Class[1][2]	
	F4	• one subfloor layer of 11 mm sanded plywood, OSB or waferboard • one subfloor layer of 19 mm tongue and groove lumber or 15.5 mm plywood, OSB, or waferboard • on wood joists spaced not more than 400 mm o.c., or on wood trusses[4] spaced not more than 600 mm o.c. • absorptive material in cavity[5] • resilient metal channels spaced at 200 mm o.c. • 1 layer of gypsum board on ceiling side			*e*
	F4a	F4 with • 15.9 mm Type X gypsum board[3]	45 min	50	
	F5	• gypsum-concrete or lightweight concrete topping • subfloor of 19 mm tongue and groove lumber or 15.5 mm plywood, OSB or waferboard • on wood joists spaced not more than 400 mm o.c., or on wood trusses[4] spaced not more than 600 mm o.c. • 2 layers of gypsum board on ceiling side			*e*
	F5a	F5 with • 19 mm gypsum-concrete or lightweight concrete topping (at least 34 kg/m^2) • 15.9 mm Type X gypsum board[3]	1 h	52	
	F5b	F5 with • 19 mm gypsum-concrete or lightweight concrete topping (at least 34 kg/m^2) • 12.7 mm Type X gypsum board[3]	45 min	50	
	F5c	F5 with • 38 mm lightweight concrete topping (at least 70 kg/m^2) • 15.9 mm Type X gypsum board[3]	1 h	54	
	F5d	F5 with • 38 mm lightweight concrete topping (at least 70 kg/m^2) • 12.7 mm Type X gypsum board[3]	45 min	52	

A-9.10.12.5.(1) Protection of Overhang of Common Roof Space

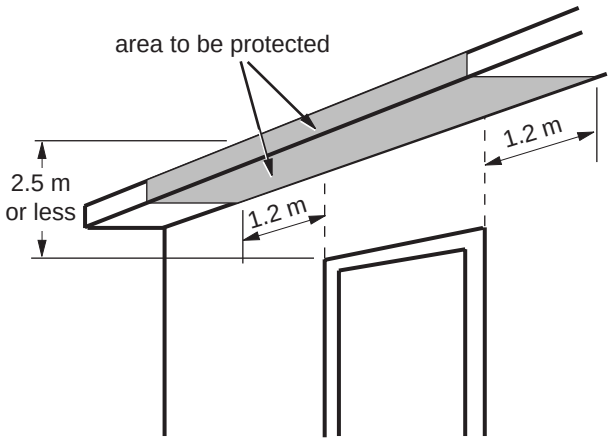


Figure A-9.10.12.5.

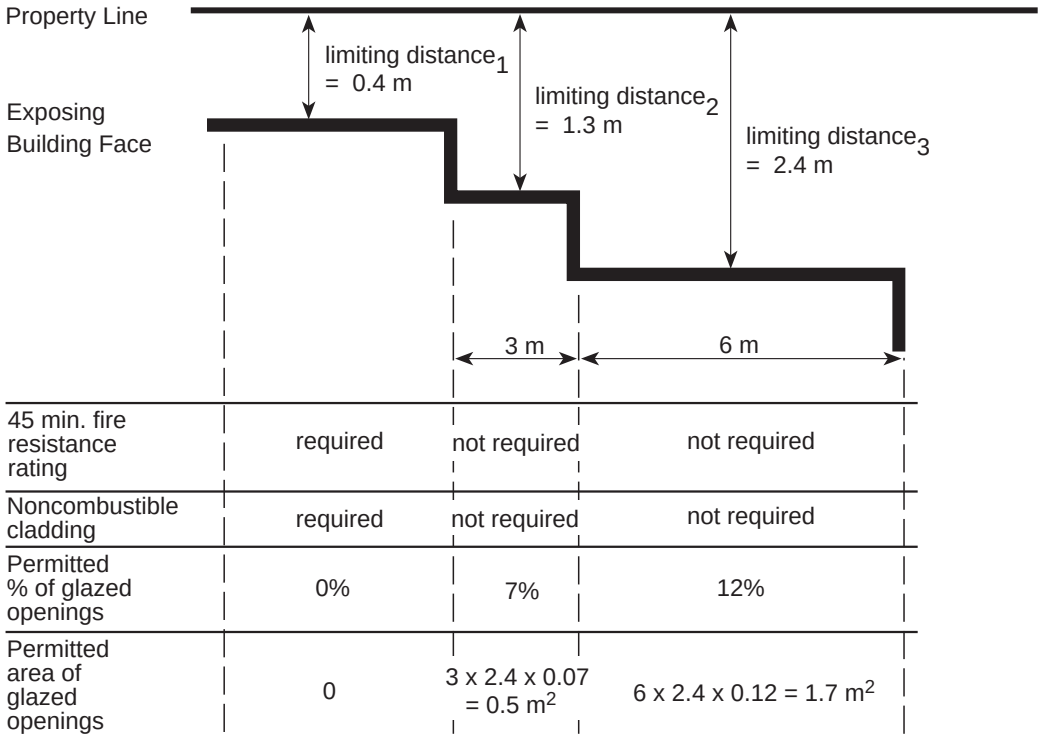
A-9.10.13.2.(1) Wood Doors in Fire Separations.

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-9.10.14.12.(1) Staggered or Skewed Exposing Building Faces of Houses.

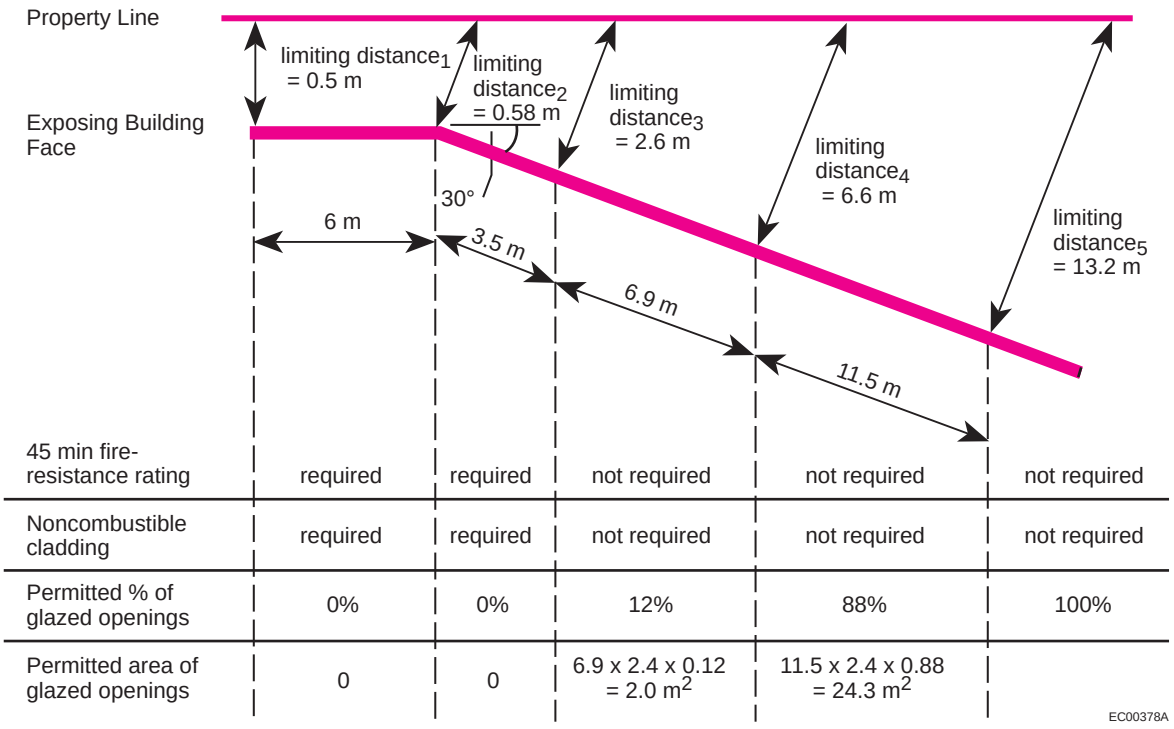
Studies at the National Fire Laboratory of the National Research Council have shown that, where an exposing building face is stepped back from the property line or is at an angle to the property line, it is possible to increase the percentage of glazing in those portions of the exposing building face further from the property line without increasing the amount of radiated energy that would reach the property line in the event of a fire in such a building. The following illustrations show how Sentence 9.10.14.12.(1) could be applied to exposing building faces that are stepped back from or not parallel to the property line.



45 min. fire resistance rating	required	not required	not required
Noncombustible cladding	required	not required	not required
Permitted % of glazed openings	0%	7%	12%
Permitted area of glazed openings	0	3 x 2.4 x 0.07 = 0.5 m^2	6 x 2.4 x 0.12 = 1.7 m^2

Figure A-9.10.14.12.A.

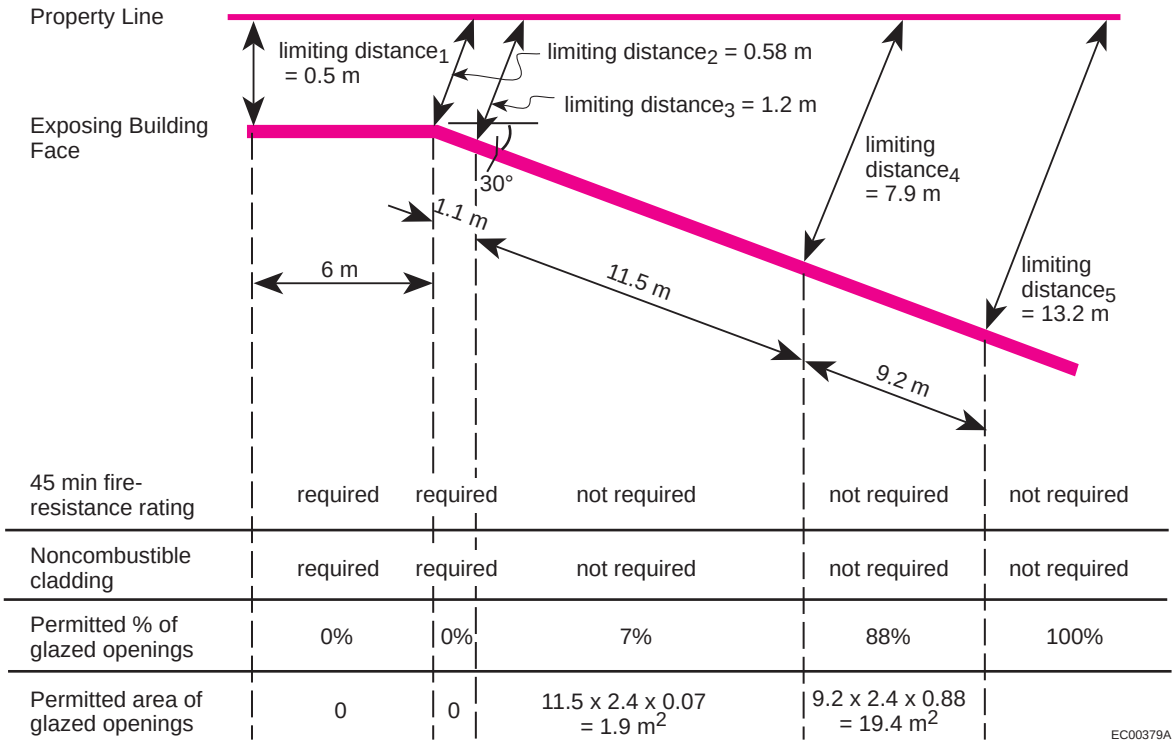
Example of determination of criteria for the exposing building face of a staggered wall



45 min fire-resistance rating	required	required	not required	not required	not required
Noncombustible cladding	required	required	not required	not required	not required
Permitted % of glazed openings	0%	0%	12%	88%	100%
Permitted area of glazed openings	0	0	6.9 x 2.4 x 0.12 = 2.0 m^2	11.5 x 2.4 x 0.88 = 24.3 m^2	

Figure A-9.10.14.12.B.

Example of determination of criteria for the exposing building face of a skewed wall with one arbitrary division of the wall



45 min fire-resistance rating	required	required	not required	not required	not required
Noncombustible cladding	required	required	not required	not required	not required
Permitted % of glazed openings	0%	0%	7%	88%	100%
Permitted area of glazed openings	0	0	11.5 x 2.4 x 0.07 = 1.9 m^2	9.2 x 2.4 x 0.88 = 19.4 m^2	

Figure A-9.10.14.12.C.

Example of determination of criteria for the exposing building face of a skewed wall with a different arbitrary division of the wall

A-9.10.18.2.(1) Location of Smoke Alarms. There are two important points to bear in mind when considering where to locate smoke alarms in dwelling units:

- The most frequent point of origin for fires in dwelling units is the living area.
- The main concern in locating smoke alarms is to provide warning to people asleep in bedrooms.

Thus a smoke alarm located in the living area and wired so as to sound another smoke alarm located near the bedrooms is the ideal solution. However, it is difficult to define exactly what is meant by "living area." It is felt to be too stringent to require a smoke alarm in every part of a dwelling unit that could conceivably be considered a "living area" (living room, family room, study, etc.). Sentence 9.10.18.2.(1) therefore addresses these issues by requiring at least one smoke alarm on every storey and setting a maximum distance that any point on a floor level can be from a smoke alarm. Thus, in a dwelling unit complying with Sentence 9.10.18.2.(1), every living area will probably be located within a reasonable distance of a smoke alarm. Nevertheless, where a choice arises as to where on a storey to locate the required smoke alarm or alarms, one should be located as close as possible to a living area, provided the requirement for proximity to bedrooms is also satisfied.

Regarding location of smoke alarms in bedroom areas, generally the most economical choice will be to locate one alarm in a hallway serving several bedrooms. However, in a small dwelling where the bedrooms may be close to cooking areas, placing one alarm inside each bedroom may be a better choice as it makes them less prone to false alarms.

A-9.10.19.3.(1) Fire Department Access Route Modification. In addition to other considerations taken into account in the planning of fire department access routes, special variations could be permitted for a house or residential building that is protected with an automatic sprinkler system. The sprinkler system must be designed in accordance with the appropriate NFPA standard and there must be assurance that water supply pressure and quantity are unlikely to fail. These considerations could apply to buildings that are located on the sides of hills and are not conveniently accessible by roads designed for fire fighting equipment and also to infill housing units that are located behind other buildings on a given property.

r **A-9.10.21. Clearances from Gas and Electric Ranges.** CSA C22.1, "Canadian Electrical Code, Part 1," referenced in Article 9.34.1.1., and CAN/CGA-B149.1-M, "Natural Gas Installation Code," referenced in Article 9.10.21.1., address clearances directly above, in front of, behind and beside the appliance. Where side clearances are zero,

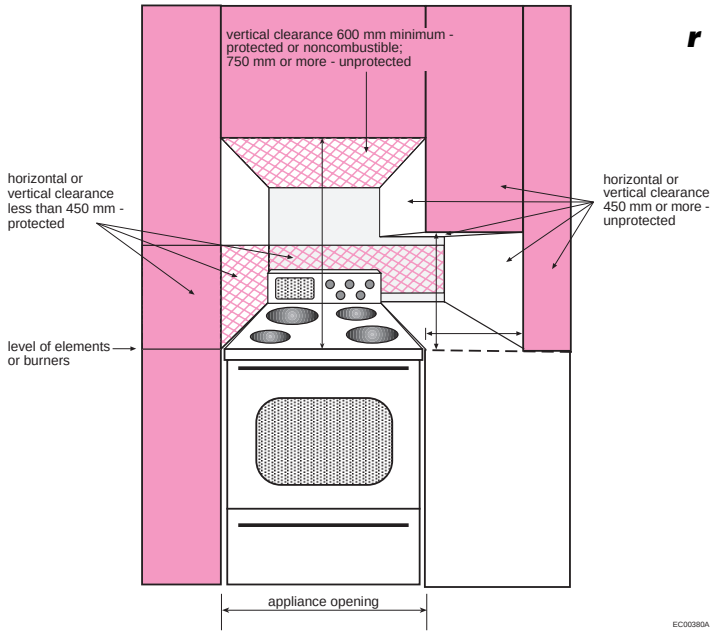


Figure A-9.10.21.
Clearances from ranges to walls and cabinetry

the standards do not address clearances to building elements located both above the level of the range elements or burners and to the side of the appliance. Through reference to the Canadian Electrical Code and the Natural Gas Installation Code and the requirements in Articles 9.10.21.2. and 9.10.21.3., the NBC addresses all clearances. Where clearances are addressed by the NBC and the Canadian Electrical Code or Natural Gas Installation Code, conformance with all relevant criteria is achieved by compliance with the most stringent criteria.

A-9.11.1.1.(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. 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 fire spread should be done so it does not increase vibration transmission from one part of a wall or floor to the other.

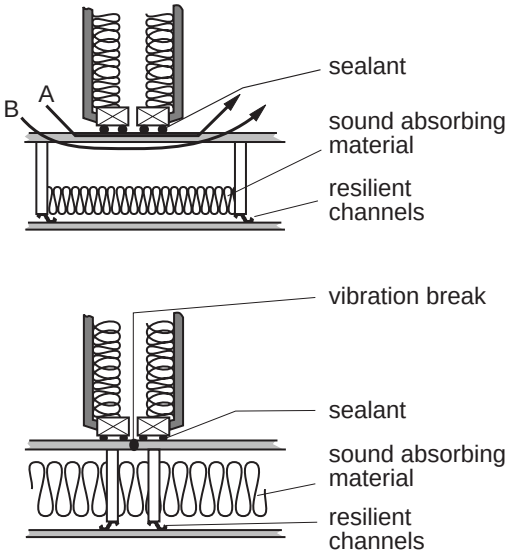


Figure A-9.11.1.1.
Cross section through wall/floor junctions

To verify that acoustical privacy is being achieved, a field test can be done at an early stage in the construction; ASTM E 336 will give a complete measurement. A simpler and less expensive method is ASTM E 597, "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 E 336. It is useful for verifying performance and finding problems during construction. Alterations can then be made prior to project completion.

Impact Noise

Section 9.11 has no requirements for 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 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 E 492, "Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using The Tapping Machine," or ASTM E 1007, "Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures."

Machinery Noise

Elevators, garbage chutes, plumbing, fans, and heat pumps are common sources of noise in buildings. To reduce annoyance from these, they should be placed as far as possible from sensitive areas. Vibrating parts should be isolated from the building structure using resilient materials such as neoprene or rubber.

A-9.12.2.2. Minimum Depths of Foundations. The requirements for clay soils or soils not clearly defined are intended to apply to those soils that are subject to significant volume changes with changes in moisture content.

A-9.12.2.2.(2) Depth and Insulation of Foundations

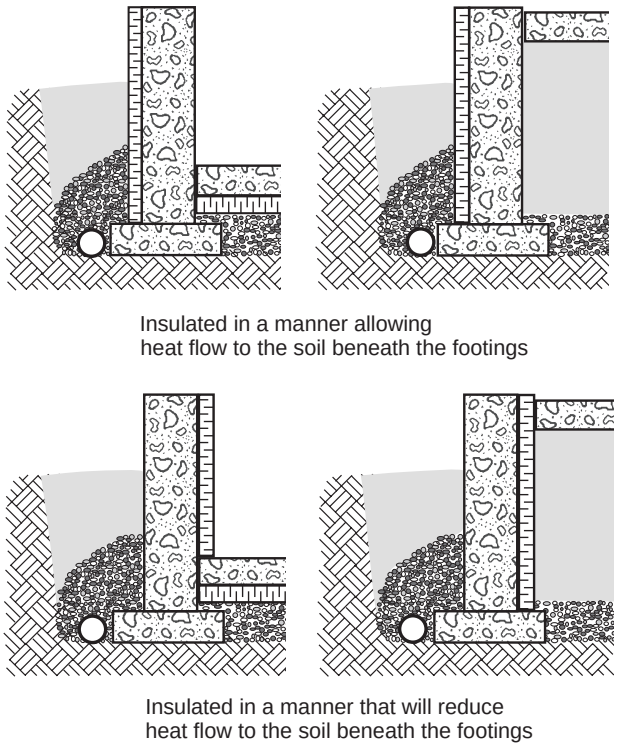


Figure A-9.12.2.2.
Foundation insulation and heat flow to footings

A-9.13.1.3. Exclusion of Soil Gas. 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

- low in cost,
- difficult to retrofit, and
- desirable for other benefits they provide.

There are two principal methods of excluding soil gas:

- 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 soil gas barriers in crawl spaces. Providing control joints to reduce cracking of foundation walls and airtight covers for sump pits are other measures which can help achieve this objective. The requirements provided in Subsection 9.13.7., Soil Gas Control in Walls, Article 9.13.8.1., Soil Gas Barriers, and Article 9.13.8.3., Sealing of the Perimeter and Penetrations, are described in Appendix Notes A-9.13.7. and 9.13.8., and A-9.13.8.1.(2) and (3).
- 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. The requirements provided in Article 9.13.8.2., Providing for Sub-Floor Depressurization, are described in Appendix Note A-9.13.8.2.

A-9.13.7. and 9.13.8. Soil Gas Barriers. The requirements provided in Subsection 9.13.7., Soil Gas Control in Walls, Article 9.13.8.1., Soil Gas Barriers, and Article 9.13.8.3., Sealing of the Perimeter and Penetrations, are illustrated in the following drawings.

The requirement in Sentence 9.13.8.3.(2) 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.

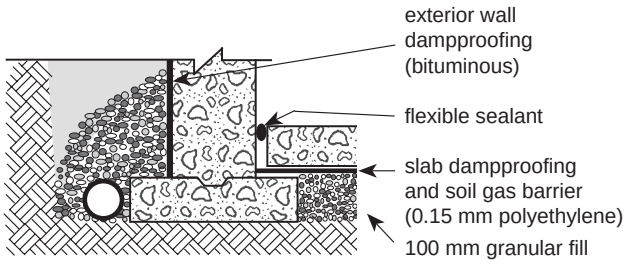


Figure A-9.13.7.A.
Dampproofing and soil gas control at foundation wall/floor junctions with solid walls

The requirement in Sentence 9.13.8.3.(3) 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 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.

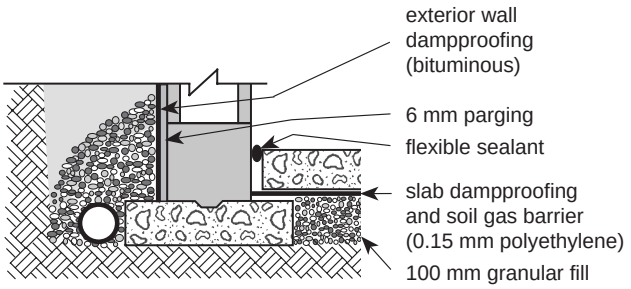


Figure A-9.13.7.B.
Dampproofing and soil gas control at foundation wall/floor junctions with hollow walls

A-9.13.8.1.(2) and (3) Polyethylene Soil Gas Barriers under Slabs-on-Ground. Floors-on-ground serving all types of occupancies other than garages must be constructed to reduce the potential for entry of radon or other soil gases. In most cases, this will be accomplished by placing 0.15 mm polyethylene under the floor.

Finishing a concrete slab placed directly on polyethylene can, in many cases, cause problems for the inexperienced finisher. A rule of finishing, whether concrete is placed on polyethylene or not, is to never finish or "work" the surface of the slab while bleed water is present or before all the bleed water has risen to the surface and evaporated. If finishing operations are performed too early, such as before all the bleed water has risen and evaporated, surface defects such as blisters, crazing, scaling and dusting can result. This is often the case with slabs placed directly on polyethylene. The amount of bleed water that may come to the surface and the time required for this to happen is increased from that of a slab placed on a compacted granular base. The excess water in the mix from the bottom portion of the slab cannot bleed downward and out of the slab and be absorbed into the granular material below, because of the polyethylene. Therefore, all bleed water, including that from the bottom of the slab, must now rise through the slab to the surface. Quite often in such cases, finishing operations are begun too soon and surface defects result.

One solution that is often suggested is to place a layer of sand between the polyethylene and the concrete. However, this is not an acceptable solution for the following reason: it is unlikely that the polyethylene will survive the slab pouring process entirely intact. Nevertheless, the polyethylene will still be effective in retarding the flow of soil gas if it is in intimate contact with the concrete; soil gas will only be able to penetrate where a break in the polyethylene coincides with a crack in the concrete. The majority of concrete cracks will probably be underlain by intact polyethylene. On the other hand, if there is an intervening layer of a porous medium, such as sand, soil gas will be able to travel laterally from a break in the polyethylene to the nearest crack in the concrete and the total system will be much less resistant to soil gas penetration.

To reduce and/or control the cracking of concrete slabs, it is necessary to understand the nature and causes of volume changes of concrete and in particular those relating to drying shrinkage. The total amount of water in a mix is by far the largest contributor to the amount of drying shrinkage and resulting potential cracking that may be expected from a given concrete. The less total amount of water in the mix, the less volume change (due to evaporation of water), which means the less drying shrinkage that will occur. To lessen the volume change and potential cracking due to drying shrinkage, a mix with the lowest total amount of water that is practicable should always be used. To lower the water content of a mix, superplasticizers are often used to provide the needed workability of the concrete during the placing operation. High water/cementing materials ratio concretes usually have high water content mixes. They should be avoided to minimize drying shrinkage and cracking of the slab. The water/cementing materials ratio for slabs-on-ground should be no higher than 0.55.

A-9.13.8.2. Soil Gas Control by Depressurization. As noted in Appendix Note A-9.13.1.3., 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, as discussed in Appendix Note A-9.33.1.1.(2). It also follows from the need to avoid drawing in soil gas, as discussed in Appendix Note A-9.13.1.3.

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.

Sub-floor depressurization systems have been found to be very effective for controlling soil gas entry into houses. At least in areas which are prone to higher than normal radon levels, or other ground pollutants, this practice is recommended.

Article 9.13.8.2. provides for depressurization as an alternative to the installation of polyethylene below floor slabs. Using this option, a vent pipe for use with a sub-floor depressurization system is installed through the floor but is only connected if soil gas levels are found to be excessive.

Radon testing must be performed on the house and copies of the results provided to the home owner and the authority having jurisdiction. Since the radon level in a house can vary significantly during the year, the test should be of sufficient duration to provide a reasonable indication of the concentration. The minimum period for testing should be three months or as recommended by the authority having jurisdiction. The preferred testing location is centrally in the basement or the main floor for houses without basements.

The current Canadian Action Level for radon, as specified by Health Canada, is 800 Bq/m^3 (see H49-58, "Exposure Guidelines for Residential Indoor Air Quality"). If the results of the test indicate a concentration exceeding the Canadian Action Level, the rest of the sub-slab depressurization system must be installed. (It may be noted that Canadian and U.S. action levels are likely to differ.)

Installation of the sub-slab depressurization system requires that the pipe cast through the slab 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 exhaust fan should be located outside the occupied space where noise will not be a nuisance. 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 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.

Since radon concentration of the vent gases can become quite high, soil gases collected by the sub-slab depressurization system should be vented at the roof level. Therefore, it may be desirable to take some simple steps to facilitate future installation of the system. This could include locating the slab vent pipe below a suitable interior partition, through which the vertical riser could be run, and pre-drilling the partition top and bottom plates, particularly those not accessible from a basement or attic.

The house should be re-tested for radon after completion of the depressurization system.

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 damproofing of walls as specified in Section 9.13.

A-9.15.1.3.(3) Preserved Wood Foundations – Design Assumptions. Tabular data and figures in CAN/CSA-S406, "Construction of Preserved Wood Foundations," are based upon the general principles provided in CSA O86.1, "Engineering Design in Wood (Limit States Design)," with the following assumptions: *e*

- soil bearing capacity: 75 kPa or more,
- clear spans for floors: 5 000 mm or less,
- floor loadings: 1.9 kPa for first floor and suspended floor, and 1.4 kPa for second storey floor,
- foundation wall heights: 2 400 mm for slab floor foundation, 3 000 mm for suspended wood floor foundation,
- top of granular layer to top of suspended wood floor: 600 mm,
- lateral load from soil pressure: equivalent to fluid pressure of 4.7 kPa per metre of depth,
- ground snow load: 3 kPa,
- basic snow load coefficient: 0.6,
- roof loads are carried to the exterior wall,
- dead loads:

roof	0.50 kPa,
floor	0.47 kPa,
wall (with siding)	0.32 kPa,
wall (with masonry veneer)	1.94 kPa,
foundation wall	0.27 kPa,
partitions	0.20 kPa.

A-9.15.3.3.(4) Footing Sizes. The footing sizes in Table 9.15.3.3. are based on typical construction consisting of a roof, not more than 3 storeys, and centre bearing walls or beams. For this reason, Sentence (1) stipulates a maximum supported joist span of 4.9 m.

It has become common to use flat wood trusses or wood I-joists to span greater distances in floors of small buildings. Where these spans exceed 4.9 m, minimum footing sizes may be based on the following method:

(a) Determine for each storey the span of joists that will be supported on a given footing. Sum these lengths (sum_1).
(b) Determine the product of the number of storeys times 4.9 m (sum_2).
(c) Determine the ratio of sum_1 to sum_2.
(d) Multiply this ratio by the minimum footing sizes in Table 9.15.3.3. to get the required minimum footing size.

Example: A 2-storey house is built using wood I-joists spanning 6 m.

(a) $sum_1 = 6 + 6 = 12$ m
(b) $sum_2 = 4.9 \times 2 = 9.8$ m
(c) ratio $sum_1/sum_2 = 12/9.8 = 1.22$
(d) required minimum footing size = 1.22 x 350 mm (minimum footing size provided in Table 9.15.3.3.) = 427 mm.

A-9.18.7.1.(4) Protection of Ground Cover in Warm Air Plenums. The purpose of the requirement is to protect combustible ground cover from smoldering cigarette butts that may drop through air registers. The protective material should extend beyond the opening of the register and have up-turned edges, as a butt may be deflected sideways as it falls.

A-9.19.1.1.(1) Venting of Attic and Roof Spaces. Controlling the flow of moisture by air leakage and vapour diffusion into attic and roof spaces is necessary to limit moisture-induced deterioration. Given that imperfections normally exist in the vapour barriers and air barrier systems, recent research indicates that venting of attic and roof spaces is generally still required. The exception provided in Article 9.19.1.1. recognizes that some specialized ceiling-roof assemblies, such as those used in some factory-built buildings, have, over time, demonstrated that their construction is sufficiently tight to prevent excessive moisture accumulation. In these cases, ventilation would not be required.

A-9.20.1.2. Seismic Zones. Information on seismic zones for various localities can be found in Appendix C, Climatic Information for Building Design in Canada.

A-9.20.8.5. Distance from Edge of Masonry to Edge of Supporting Members

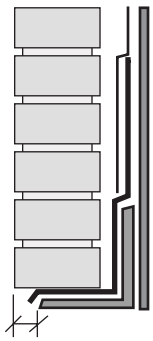


Figure A-9.20.8.5.
Maximum projection of masonry beyond its support

A-9.20.12.2.(2) Corbelling of Masonry Foundation Walls

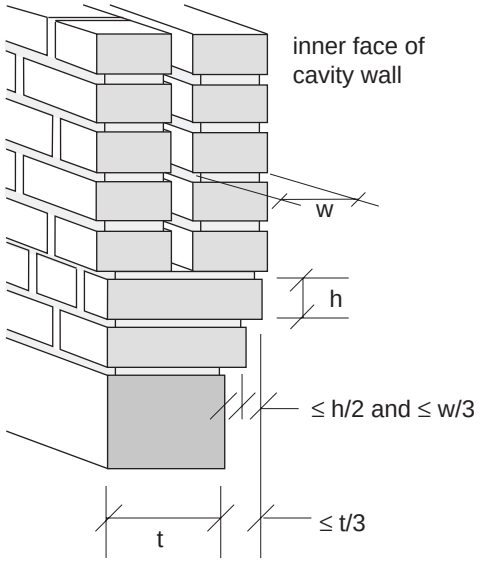


Figure A-9.20.12.2.
Maximum corbel dimensions

A-9.20.13.9.(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

dead load imposed by the concrete must be considered. The addition of 51 mm of concrete topping can impose an added load of 0.8 to 1.2 kPa, depending on the density of the concrete.

Example
Assumptions:
- basic dead load = 0.5 kPa
- topping dead load = 0.8 kPa
- total dead load = 1.3 kPa
- live load = 1.9 kPa
- vibration limit per A-9.23.4.2.(2)
- deflection limit = 1/360
- ceiling attached directly to joists, no bridging

The spacing of joists in the span tables can be conservatively adjusted to allow for the increased load by using the spans in Table A-1 for 600 mm spacing, but spacing the joists 400 mm apart. Similarly, floor beam span tables can be adjusted by using 4.8 m supported length spans for cases where the supported length equals 3.6 m.

A-9.23.8.3. Joint Location in Built-Up Beams

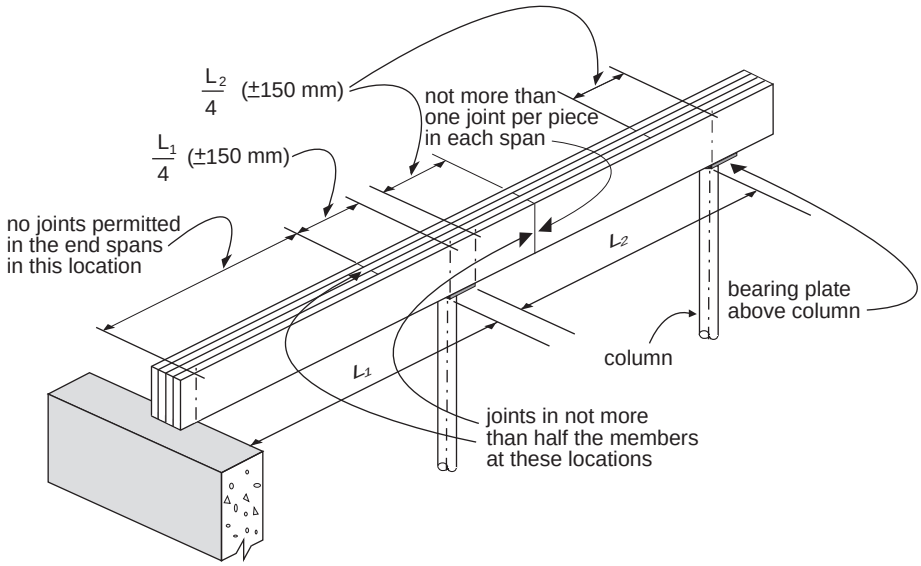


Figure A-9.23.8.3.
Joint location in built-up beams

A-9.23.10.2. 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, OSB, waferboard, 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, which was found to be relatively ineffective.

The permission to omit bracing assumes typical house designs. Some buildings may have reduced resistance to racking forces as a result of their configuration. These include tall narrow buildings 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.

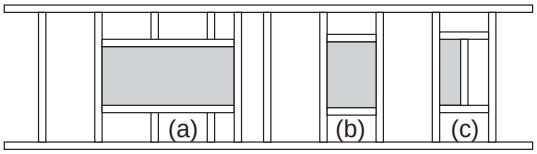
The Code does not address the issue of bracing of the structure during construction. It is often necessary to provide temporary bracing until the interior finish or sheathing is installed; however, this is not a Code requirement.

A-9.23.10.4.(1) Fingerjoined Lumber. The NLGA "Standard Grading Rules for Canadian Lumber," referenced in 9.3.2.1. refers to two special product standards, SPS-1,"Fingerjoined Structural Lumber," and SPS-3, " Fingerjoined Stud Lumber – Vertical Use Only," produced by NLGA. Material identified as conforming to these standards is considered to meet the requirements in this Sentence for joining with a structural adhesive. Lumber fingerjoined in accordance with SPS-3 should be used as a vertical end-loaded member in compression only, where sustained bending or tension-loading conditions are not present, and where the moisture content of the wood will not exceed 19%. Fingerjoined lumber may not be visually regraded or remanufactured into a higher stress grade even if the quality of the lumber containing fingerjoints would otherwise warrant such regrading.

A-9.23.10.6.(2) Single Studs at Sides of Openings

Configurations which comply

(a) full height studs both sides
(b) full height studs both sides and opening within stud space
(c) opening within stud space



Configurations which do not comply

(a) opening wider than stud space without full height studs both sides
(b) opening narrower than but not within stud space

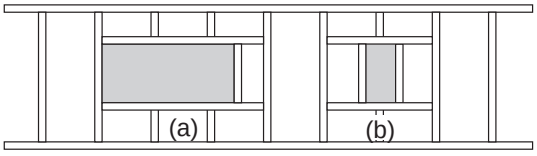
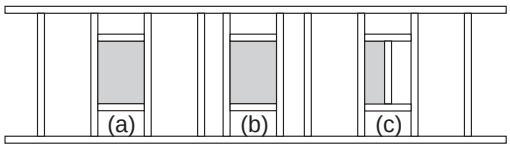


Figure A-9.23.10.6.A.
Single studs at openings in non-loadbearing interior walls

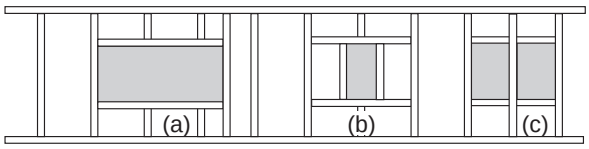
Configurations which comply

(a), (b), (c) openings all narrower than and within stud space; no two full stud space width openings in adjacent stud spaces



Configurations which do not comply

(a) opening wider than stud space
(b) opening narrower than but not within stud space
(c) two openings, full stud space width, in adjacent stud spaces



A-9.23.10.6.B.
Single studs at openings in all other walls

A-9.23.13.11.(2) Wood Roof Truss Connections. Sentence 9.23.13.11.(2) requires that the connections used in wood roof trusses be designed in conformance with Subsection 4.3.1. Sentence 4.1.1.2.(2), which applies to all of Part 4, requires that the designer be a professional engineer or architect skilled in the work concerned. This has the effect of requiring that the trusses themselves be designed by professional engineers or architects. Although this is a departure from the usual practice in Part 9, it is appropriate, since wood roof trusses are complex structures which depend on a number of components (chord members, web members, cross-bracing, connectors) working together to function safely. This complexity precludes the standardization of truss design into tables comprehensive enough to satisfy the variety of roof designs required by the housing industry.

A-9.23.14.2.(4) Water Absorption Test. A method for determining water absorption is described in ASTM D 1037, "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% when tested in the horizontal position.

A-9.23.14.4.(2) OSB. The CSA Standard requires that Type O (aligned or oriented) panels be marked to show the grade and the direction of face alignment.

A-9.23.17.2.(1) Sheathing Membrane beneath Stucco. This article is intended to preclude the use, under stucco, of sheathing paper saturated with coal tar since there is a tendency for the tar to bleed through the stucco and cause stains. This is not a problem with the more commonly used asphalt-impregnated sheathing paper.

A-9.23.17.4.(2) Detailing of Joints in Exterior Insulating Sheathing. The shape of a

Province and Location	Elev., m	Design Temperature				Degree-Days Below 18°C	15 Min. Rain, mm	One Day Rain, mm	Ann. Tot. Ppn., mm	Ground Snow Load, kPa		Hourly Wind Pressures			Seismic Data		
		January		July 2.5%													
		2.5% °C	1% °C	Dry °C	Wet °C					S_s	S_r	1/10 kPa	1/30 kPa	1/100 kPa	Z_a	Z_v	Zonal Velocity Ratio, v
Pembroke	125	-28	-31	30	22	5000	23	100	825	2.3	0.4	0.26	0.32	0.39	4	2	0.10
Penetanguishene	220	-23	-26	29	22	4300	25	90	1050	2.6	0.4	0.25	0.34	0.45	1	1	0.05
Perth	130	-25	-27	30	23	4650	25	85	900	2.1	0.4	0.29	0.37	0.46	3	1	0.05
Petawawa	135	-29	-31	30	22	5150	23	85	825	2.4	0.4	0.26	0.32	0.39	4	2	0.10
Peterborough	200	-23	-25	30	23	4400	28	85	840	1.8	0.4	0.29	0.37	0.47	1	1	0.05
Petrolia	195	-16	-18	31	24	3850	25	100	920	1.2	0.4	0.35	0.43	0.52	0	0	0.00
Pickering (Dunbarton)	85	-19	-21	30	23	4000	23	85	825	0.9	0.4	0.43	0.52	0.64	1	1	0.05
Picton	95	-21	-23	29	23	4050	23	85	940	1.8	0.4	0.37	0.45	0.54	1	1	0.05
Plattsville	300	-18	-20	29	23	4200	28	95	950	1.7	0.4	0.30	0.37	0.46	1	0	0.05
Point Alexander	150	-29	-32	30	22	5050	23	85	850	2.3	0.4	0.26	0.32	0.39	4	2	0.10
Port Burwell	195	-15	-17	30	24	4000	25	85	1000	1.1	0.4	0.34	0.43	0.53	0	0	0.00
Port Colborne	180	-15	-17	30	24	3750	23	105	1000	2.1	0.4	0.37	0.43	0.50	1	0	0.05
Port Elgin	205	-17	-19	28	22	4250	23	85	850	2.6	0.4	0.40	0.50	0.62	1	0	0.05
Port Hope	100	-21	-23	30	23	4050	23	90	825	1.1	0.4	0.46	0.55	0.65	1	1	0.05
Port Perry	270	-22	-24	30	23	4350	25	90	850	2.2	0.4	0.31	0.39	0.50	1	1	0.05
Port Stanley	180	-15	-17	31	24	4000	25	85	975	1.1	0.4	0.34	0.43	0.53	0	0	0.00
Prescott	90	-23	-25	29	23	4250	25	95	975	2.0	0.4	0.32	0.39	0.49	3	2	0.10
Princeton	280	-17	-19	29	23	4100	25	90	925	1.4	0.4	0.30	0.37	0.46	1	0	0.05
Raith	475	-35	-37	28	22	6150	20	90	750	2.5	0.4	0.21	0.25	0.29	0	0	0.00
Rayside-Balfour (Chelmsford)	270	-28	-30	29	21	5400	25	85	850	2.3	0.4	0.29	0.39	0.53	1	0	0.05
Red Lake	360	-34	-36	28	22	6350	18	80	630	2.2	0.3	0.22	0.26	0.31	0	0	0.00
Renfrew	115	-27	-30	30	23	4900	23	95	810	2.3	0.4	0.26	0.32	0.39	4	2	0.10
Richmond Hill	230	-20	-22	31	24	4200	25	90	850	1.4	0.4	0.39	0.48	0.59	1	0	0.05
Rockland	50	-26	-28	30	23	4800	23	85	950	2.2	0.4	0.30	0.37	0.45	4	2	0.10
Sarnia	190	-16	-18	31	23	3950	23	95	825	1.0	0.4	0.35	0.43	0.52	0	0	0.00
Sault Ste. Marie	190	-25	-28	29	21	5100	25	95	950	2.8	0.4	0.32	0.37	0.43	0	0	0.00
Schreiber	310	-35	-38	27	21	6200	20	100	850	3.0	0.4	0.30	0.36	0.43	0	0	0.00
Seaforth	310	-17	-19	30	23	4300	25	100	1025	2.3	0.4	0.37	0.48	0.60	0	0	0.00
Simcoe	210	-17	-19	30	23	4000	28	110	950	1.2	0.4	0.33	0.39	0.47	1	0	0.05
Sioux Lookout	375	-34	-36	28	22	6200	28	90	710	2.2	0.3	0.21	0.25	0.29	0	0	0.00
Smiths Falls	130	-25	-27	30	23	4600	28	85	850	2.1	0.4	0.29	0.37	0.46	3	2	0.10
Smithville	185	-16	-18	30	23	3800	23	110	900	1.4	0.4	0.33	0.39	0.46	1	0	0.05
Smooth Rock Falls	235	-34	-36	29	21	6400	20	85	850	2.5	0.3	0.24	0.29	0.36	1	0	0.05
South River	355	-27	-29	28	21	5200	28	90	975	2.6	0.4	0.23	0.29	0.36	1	1	0.05
Southampton	180	-17	-19	28	22	4250	23	85	830	2.5	0.4	0.38	0.48	0.59	1	0	0.05
St. Catharines	105	-16	-18	30	23	3675	23	85	850	0.9	0.4	0.36	0.43	0.50	1	0	0.05
St. Mary's	310	-18	-20	30	23	4250	28	100	1025	2.0	0.4	0.35	0.45	0.58	0	0	0.00
St. Thomas	225	-16	-18	31	23	4000	25	100	975	1.3	0.4	0.33	0.43	0.54	0	0	0.00
Stirling	120	-23	-25	30	23	4450	25	90	850	1.6	0.4	0.28	0.36	0.46	1	1	0.05
Stratford	360	-18	-20	29	23	4350	28	115	1050	2.1	0.4	0.33	0.43	0.54	0	0	0.00
Strathroy	225	-17	-19	31	23	3950	25	95	950	1.7	0.4	0.36	0.45	0.57	0	0	0.00
Sturgeon Falls	205	-27	-29	29	21	5250	28	90	910	2.0	0.4	0.25	0.32	0.40	1	1	0.05
Sudbury	275	-28	-30	29	21	5400	25	90	875	2.3	0.4	0.29	0.40	0.55	1	1	0.05
Sundridge	340	-27	-29	28	21	5200	28	90	975	2.6	0.4	0.23	0.29	0.37	2	1	0.05
Tavistock	340	-18	-20	29	23	4350	28	115	1010	1.9	0.4	0.34	0.43	0.53	1	0	0.05

Appendix C

Province and Location	Elev., m	Design Temperature				Degree-Days Below 18°C	15 Min. Rain, mm	One Day Rain, mm	Ann. Tot. Ppn., mm	Ground Snow Load, kPa		Hourly Wind Pressures			Seismic Data		
		January		July 2.5%													
		2.5% °C	1% °C	Dry °C	Wet °C					S_s	S_r	1/10 kPa	1/30 kPa	1/100 kPa	Z_a	Z_v	Zonal Velocity Ratio, v
Temagami	300	-30	-33	30	21	5400	25	85	875	2.4	0.4	0.27	0.34	0.42	2	1	0.05
Thamesford	280	-18	-20	30	23	4200	28	100	975	1.7	0.4	0.33	0.43	0.55	0	0	0.00
Thedford	205	-16	-18	31	23	3900	23	95	900	1.9	0.4	0.41	0.50	0.61	0	0	0.00
Thunder Bay	210	-31	-33	28	21	5650	20	100	710	2.7	0.4	0.30	0.36	0.43	0	0	0.00
Tillsonburg	215	-17	-19	30	23	4000	25	95	980	1.2	0.4	0.31	0.39	0.50	0	0	0.00
Timmins	300	-34	-36	30	21	6200	18	95	875	2.8	0.3	0.25	0.32	0.40	1	0	0.05
Timmins (Porcupine)	295	-34	-36	30	21	6200	18	90	875	2.7	0.3	0.27	0.34	0.42	1	0	0.05
Toronto (Metropolitan)																	
Etobicoke	160	-20	-22	31	24	4050	26	95	800	1.0	0.4	0.39	0.48	0.59	1	0	0.05
North York	175	-20	-22	31	24	4000	25	95	850	1.1	0.4	0.39	0.48	0.59	1	0	0.05
Scarborough	180	-20	-22	31	24	4000	25	85	825	1.1	0.4	0.39	0.48	0.59	1	0	0.05
Toronto	105	-18	-20	31	23	3650	25	90	820	0.8	0.4	0.39	0.48	0.58	1	0	0.05
Trenton	80	-21	-23	29	23	4250	23	95	850	1.5	0.4	0.35	0.43	0.52	1	1	0.05
Trout Creek	330	-27	-29	28	21	5300	28	95	975	2.5	0.4	0.24	0.29	0.36	2	1	0.05
Uxbridge	275	-22	-24	30	23	4400	25	95	850	2.2	0.4	0.29	0.37	0.48	1	1	0.05
Vaughan (Woodbridge)	165	-20	-22	31	24	4250	26	105	800	1.0	0.4	0.39	0.48	0.59	1	0	0.05
Vittoria	215	-15	-17	30	24	3925	25	115	950	1.2	0.4	0.35	0.43	0.52	1	0	0.05
Walkerton	275	-18	-20	30	22	4500	28	105	1025	2.5	0.4	0.35	0.45	0.57	1	0	0.05
Wallaceburg	180	-16	-18	31	24	3700	28	90	825	0.8	0.4	0.32	0.39	0.48	0	0	0.00
Waterloo	330	-19	-21	29	23	4300	28	110	925	1.8	0.4	0.27	0.34	0.42	1	0	0.05
Watford	240	-16	-18	31	24	3900	25	100	950	1.7	0.4	0.34	0.43	0.53	0	0	0.00
Wawa	290	-35	-38	26	21	5800	20	95	950	3.8	0.4	0.30	0.36	0.43	0	0	0.00
Welland	180	-15	-17	30	23	3800	23	95	975	2.0	0.4	0.33	0.39	0.47	1	0	0.05
West Lorne	215	-16	-18	31	24	3850	28	95	900	1.2	0.4	0.34	0.43	0.53	0	0	0.00
Whitby	85	-20	-22	30	23	4000	23	80	850	1.1	0.4	0.43	0.52	0.64	1	1	0.05
Whitby (Brooklin)	160	-20	-22	30	23	4200	23	80	850	1.7	0.4	0.38	0.48	0.59	1	1	0.05
White River	375	-39	-42	28	21	6400	20	85	825	4.1	0.4	0.21	0.25	0.30	0	0	0.00
Wiarton	185	-18	-20	28	22	4500	25	105	1000	2.5	0.4	0.33	0.43	0.55	1	0	0.05
Windsor	185	-16	-18	31	24	3600	28	95	900	0.7	0.4	0.36	0.43	0.52	0	0	0.00
Wingham	310	-18	-20	30	23	4350	28	100	1050	2.4	0.4	0.35	0.45	0.57	0	0	0.00
Woodstock	300	-18	-20	29	23	4100	28	105	930	1.7	0.4	0.31	0.39	0.50	1	0	0.05
Wyoming	215	-16	-18	31	24	3850	25	95	900	1.5	0.4	0.35	0.43	0.52	0	0	0.00
Quebec																	
Acton-Vale	95	-24	-27	30	23	4800	20	100	1050	2.1	0.4	0.24	0.29	0.36	3	2	0.10
Alma	110	-30	-32	29	21	5800	20	85	950	3.0	0.4	0.23	0.29	0.36	3	3	0.15
Amos	295	-34	-36	28	21	6250	20	85	920	2.9	0.3	0.24	0.29	0.35	2	1	0.05
Asbestos	245	-26	-28	29	22	4850	23	90	1050	2.6	0.5	0.26	0.32	0.39	2	2	0.10
Aylmer	90	-25	-28	30	23	4700	23	90	900	2.3	0.4	0.30	0.37	0.46	4	2	0.10
Baie-Comeau	60	-27	-29	25	19	6050	18	85	1000	3.9	0.4	0.45	0.55	0.66	4	2	0.10
Beauport	45	-25	-28	28	22	5200	20	100	1200	3.1	0.5	0.38	0.48	0.58	4	3	0.15
Bedford	55	-23	-25	29	23	4600	23	80	1260	1.9	0.4	0.31	0.37	0.45	3	2	0.10
Beloeil	25	-24	-26	30	23	4550	23	85	1025	2.2	0.4	0.28	0.34	0.41	3	2	0.10
Brome	210	-24	-26	29	22	4800	23	90	1240	2.3	0.4	0.28	0.34	0.41	3	2	0.10

Appendix D
Fire-Performance Ratings

Section D-1 General

The contents of this Appendix have been prepared on the recommendations of the Standing Committee on Fire Performance Ratings, which was established by the Canadian Commission on Building and Fire Codes (CCBFC) for this purpose.

D-1.1. Introduction

D-1.1.1. Scope

1) This fire-performance information is presented in a form closely linked to the performance requirements and the minimum materials specifications of the National Building Code of Canada 1995.

2) The ratings have been assigned only after careful consideration of all available literature on assemblies of common building materials, where they are adequately identified by description. The assigned values based on this information will, in most instances, be conservative when compared to the ratings determined on the basis of actual tests on individual assemblies.

3) The fire-performance information set out in this Appendix applies to materials and assemblies of materials which comply in all essential details with the minimum structural design standards described in Part 4 of the National Building Code of Canada. Additional requirements, where appropriate, are described in other Sections of this Appendix.

4) Section D-2 of this Appendix assigns fire-resistance ratings for walls, floors, roofs, columns and beams related to CAN/ULC-S101-M, "Fire Endurance Tests of Building Construction and Materials," and describes methods for determining these ratings.

5) Section D-3 assigns flame-spread ratings and smoke developed classifications for surface materials related to CAN/ULC-S102-M, "Test for Surface Burning Characteristics of Building Materials and Assemblies," and CAN/ULC-S102.2-M, "Test for Surface Burning Characteristics of Flooring, Floor Covering, and Miscellaneous Materials and Assemblies."

6) Section D-4 describes noncombustibility in building materials when tested in accordance with CAN4-S114-M, "Test for Determination of Non-Combustibility in Building Materials."

7) Section D-5 contains requirements for the installation of fire doors and fire dampers in fire-rated stud wall assemblies and the installation of fire stop flaps in fire-rated membrane ceilings.

8) Section D-6 contains background information regarding fire test reports, obsolete materials and assemblies, assessment of archaic assemblies and the development of the component additive method.

D-1.1.2. Referenced Documents

1) Where documents are referenced in this Appendix, they shall be the editions designated in Table D-1.1.2.

This Appendix is included for explanatory purposes only and does not form part of the requirements. The bold face reference numbers that introduce each item do not relate to specific requirements in the Code.

Table D-1.1.2.
Documents Referenced in Appendix D Fire-Performance Ratings

	Issuing Agency	Document Number	Title of Document	Reference
r	ANSI	A208.1-1993	Particleboard, Mat-Formed Wood	Table D-3.1.1.A.
r	ASTM	C 36-97	Gypsum Wallboard	D-1.5.1. Table D-3.1.1.A.
r	ASTM	C 37-95	Gypsum Lath	D-1.5.1.
r	ASTM	C 330-97	Lightweight Aggregates for Structural Concrete	D-1.4.3.(2)
r	ASTM	C 442-95	Gypsum Backing Board and Coreboard	D-1.5.1. Table D-3.1.1.A.
r	ASTM	C 588-95a	Gypsum Base for Veneer Plaster	D-1.5.1. Table D-3.1.1.A.
r	ASTM	C 630/C 630M-96a	Water Resistant Gypsum Backing Board	D-1.5.1. Table D-3.1.1.A.
	ASTM	C 931M-95a	Exterior Gypsum Soffit Board	D-1.5.1. Table D-3.1.1.A.
r	ASTM	C 960-97	Predecorated Gypsum Board	D-1.5.1.
	CCBFC	NRCC 30629	Supplement to the National Building Code of Canada 1990	D-6.2. D-6.3. D-6.4.
	CGSB	4-GP-36M-1978	Carpet Underlay, Fibre Type	Table D-3.1.1.B.
	CGSB	CAN/CGSB-4.129-93	Carpets for Commercial Use	Table D-3.1.1.B.
	CGSB	CAN/CGSB-11.3-M87	Hardboard	Table D-3.1.1.A.
	CGSB	CAN/CGSB-34.16-M89	Sheets, Asbestos-Cement, Flat, Fully Compressed	Table D-3.1.1.A.
	CGSB	CAN/CGSB-51.60-M90	Cellulose Fibre Loose Fill Thermal Insulation	D-2.3.4.(5)
	CGSB	CAN/CGSB-92.2-M90	Trowel or Spray Applied Acoustical Material	D-2.3.4.(5)
r	CSA	A23.1-94	Concrete Materials and Methods of Concrete Construction	D-1.4.3.(1)
r	CSA	A23.3-94	Design of Concrete Structures	D-2.1.5. D-2.6.6. D-2.8.2.
	CSA	A82.5-M1978	Structural Clay Non-Load-Bearing Tile	Table D-2.6.1.A.
	CSA	A82.22-M1977	Gypsum Plasters	Table D-3.1.1.A.
	CSA	CAN/CSA-A82.27-M91	Gypsum Board	D-1.5.1. Table D-3.1.1.A.
	CSA	A82.30-M1980	Interior Furring, Lathing and Gypsum Plastering	D-1.7.2.(1) D-2.3.9.(1) Table D-2.5.1.
	CSA	A82.31-M1980	Gypsum Board Application	D-2.3.9.
	CSA	A126.1-M1984	Vinyl Asbestos and Vinyl Composition Floor Tile	Table D-3.1.1.B.
	CSA	A165.1-94	Concrete Masonry Units	Table D-2.1.1.

Table D-1.1.2. (Continued)

	Issuing Agency	Document Number	Title of Document	Reference
	CSA	CAN/CSA-A247-M86	Insulating Fibreboard	Table D-3.1.1.A.
	CSA	CAN/CSA-G312.3-M92	Metric Dimensions for Structural Steel Shapes and Hollow Structural Sections	D-2.6.6.
e	CSA	O86.1-94	Engineering Design in Wood (Limit States Design)	D-2.11.2.(1) D-2.11.2.(2)
	CSA	O121-M1978	Douglas Fir Plywood	Table D-3.1.1.A.
	CSA	CAN/CSA-O141-91	Softwood Lumber	D-2.3.6.(2) Table D-2.4.1.
	CSA	O151-M1978	Canadian Softwood Plywood	Table D-3.1.1.A.
	CSA	O153-M1980	Poplar Plywood	Table D-3.1.1.A.
e	CSA	O437.0-93	OSB and Waferboard	Table D-3.1.1.A.
	CSA	CAN/CSA-S16.1-94	Limit States Design of Steel Structures	D-2.6.6.
r	NFPA	80-1995	Fire Doors and Fire Windows	D-5.2.1.
	ULC	CAN/ULC-S101-M89	Fire Endurance Tests of Building Construction and Materials	D-1.1.1.(4) D-1.12.1. D-2.3.2.
	ULC	CAN/ULC-S102-M88	Test for Surface Burning Characteristics of Building Materials and Assemblies	D-1.1.1.(5)
	ULC	CAN/ULC-S102.2-M88	Test for Surface Burning Characteristics of Flooring, Floor Covering, and Miscellaneous Materials and Assemblies	D-1.1.1.(5) Table D-3.1.1.B.
	ULC	CAN4-S114-M80	Test for Determination of Non-Combustibility in Building Materials	D-1.1.1.(6) D-4.1.1. D-4.2.1.
	ULC	S505-1974	Fusible Links for Fire Protection Service	D-5.3.2.
r	ULC	CAN/ULC-S702-97	Thermal Insulation, Mineral Fibre, for Buildings	Table D-2.3.4.A. Table D-2.3.4.D. D-2.3.5. Table D-2.6.1.E. D-6.4.

D-1.1.3. Applicability of Ratings

The ratings shown in this document apply if more specific test values are not available. The construction of an assembly that is the subject of an individual test report must be followed in all essential details if the fire resistance rating reported is to be applied for use with this Code.

D-1.1.4. Higher Ratings

The authority having jurisdiction may allow higher fire-resistance ratings than those derived from this Appendix, where supporting evidence justifies a higher rating. Additional information is provided in summaries of published test information and the reports of fire tests carried out by the Institute for Research in Construction, National Research Council of Canada, included in Section D-6, Background Information.

D-1.1.5. Additional Information on Fire Rated Assemblies

Assemblies containing materials for which there is no nationally recognized standard are not included

in this Appendix. Many such assemblies have been rated by Underwriters' Laboratories of Canada (ULC) or Warnock Hersey. The ULC information is published in their "List of Equipment and Materials," Volume II, Building Construction. Copies of this document may be obtained from Underwriters' Laboratories of Canada, 7 Crouse Road, Scarborough, Ontario M1R 3A9. The Warnock Hersey Certification Listings can be obtained from Warnock Hersey, 3210 American Drive, Mississauga, Ontario L4V 1B3.

D-1.2. Interpretation of Test Results

D-1.2.1. Limitations

1) The fire-performance ratings set out in this Appendix are based on those that would be obtained from the standard methods of test described in the Code. The test methods are essentially a means of comparing the performance of one building component or assembly with another in relation to its performance in fire.

2) Since it is not practicable to measure the fire resistance of constructions in situ, they must be evaluated under some agreed test conditions. A specified fire-resistance rating is not necessarily the actual time that the assembly would endure in situ in a building fire, but is that which the particular construction must meet under the specified methods of test.

3) Considerations arising from departures in use from the conditions established in the standard test methods may, in some circumstances, have to be taken into account by the designer and the authority having jurisdiction. Some of these conditions are covered at present by the provisions of the National Building Code.

4) For walls and partitions, the stud spacings previously specified as 16 or 24 inch have been converted to 400 and 600 mm, respectively, for consistency with other metric values; however, the use of equivalent imperial dimensions for stud spacing is permitted.

D-1.3. Concrete

D-1.3.1. Aggregates in Concrete

Low density aggregate concretes generally exhibit better fire performance than natural stone aggregate concretes. A series of tests on concrete masonry walls, combined with mathematical analysis of the test results, has allowed further distinctions between certain low density aggregates to be made.

D-1.4. Types of Concrete

D-1.4.1. Description

1) For purposes of this Appendix, concretes are described as Types S, N, L, L_1, L_2, L40S, $L_1$20S or $L_2$20S as described in (2) to (8).

2) Type S concrete is the type in which the coarse aggregate is granite, quartzite, siliceous gravel or other dense materials containing at least 30% quartz, chert or flint.

3) Type N concrete is the type in which the coarse aggregate is cinders, broken brick, blast furnace slag, limestone, calcareous gravel, trap rock, sandstone or similar dense material containing not more than 30% of quartz, chert or flint.

4) Type L concrete is the type in which all the aggregate is expanded slag, expanded clay, expanded shale or pumice.

5) Type L_1 concrete is the type in which all the aggregate is expanded shale.

6) Type L_2 concrete is the type in which all the aggregate is expanded slag, expanded clay or pumice.

7) Type L40S concrete is the type in which the fine portion of the aggregate is sand and low density aggregate in which the sand does not exceed 40% of the total volume of all aggregates in the concrete.

8) Type $L_1$20S and Type $L_2$20S concretes are the types in which the fine portion of the aggregate is sand and low density aggregate in which the sand does not exceed 20% of the total volume of all aggregates in the concrete.

D-1.4.2. Determination of Ratings

Where concretes are described as being of Type S, N, L, L_1 or L_2, the rating applies to the concrete containing the aggregate in the group that provides the least fire resistance. If the nature of an aggregate cannot be determined accurately enough to place it in one of the groups, the aggregate shall be considered as being in the group that requires a greater thickness of concrete for the required fire resistance.

D-1.4.3. Description of Aggregates

1) The descriptions of the aggregates in Type S and Type N concretes apply to the coarse aggregates only. Coarse aggregate for this purpose means that retained on a 5 mm sieve using the method of grading aggregates described in CSA A23.1, "Concrete Materials and Methods of Concrete Construction."

2) Increasing the proportion of sand as fine aggregate in low density concretes requires

Table D-2.3.4.A.
Time Assigned to Wallboard Membranes on Fire-Exposed Side

Description of Finish	Time, min
11.0 mm Douglas Fir plywood phenolic bonded	10(1)
14.0 mm Douglas Fir plywood phenolic bonded	15(1)
12.7 mm Type X gypsum wallboard	25
15.9 mm Type X gypsum wallboard	40
Double 12.7 mm Type X gypsum wallboard	80(2)

Notes to Table D-2.3.4.A.:
(1) Non-loadbearing walls only, stud cavities filled with mineral wool conforming to CAN/ULC-S702, "Thermal Insulation, Mineral Fibre, for Buildings," and having a mass of not less than 2 kg/m^2, with no additional credit for insulation according to Table D-2.3.4.D.
(2) Applies to non-loadbearing steel framed walls only.

3) When the membrane on the fire-exposed side of a framed assembly falls off, there is a brief period before structural failure occurs during which the studs or joists are exposed directly to flame. Table D-2.3.4.C. lists the times which have been assigned to the framing members based on the time involved between failure of the membrane and collapse of the assembly.

4) Preformed insulation of glass, rock or slag fibre provides additional protection to wood studs by shielding the studs from exposure to the fire and thus delaying the time of collapse. The use of reinforcement in the membrane exposed to fire also adds to the fire resistance by extending the time to failure. Table D-2.3.4.D. shows the time increments that may be added to the fire resistance if these features are incorporated in the assembly.

5) Cellulose fibre insulation conforming to CAN/CGSB-51.60-M, "Cellulose Fibre Loose Fill Thermal Insulation," applied in conformance with CAN/CGSB-92.2-M, "Trowel or Spray Applied Acoustical Material," does not affect the fire-resistance rating of a steel stud wall assembly, provided that it is sprayed to either face of the wall cavity.

Table D-2.3.4.B.
Time Assigned for Contribution of Lath and Plaster Protection on Fire-Exposed Side, min(1)

Type of Lath	Plaster Thickness, mm	Type of Plaster Finish		
		Portland Cement and Sand(2) or Lime and Sand	Gypsum and Sand or Gypsum Wood Fibred	Gypsum and Perlite or Gypsum and Vermiculite
9.5 mm gypsum	13	—	35	55
	16	—	40	65
	19	—	50	80(1)
Metal	19	20	50	80(1)
	23	25	65	80(1)
	26	30	80	80(1)

Notes to Table D-2.3.4.B.:
(1) Values shown for these membranes have been limited to 80 min because the fire-resistance ratings of framed assemblies derived from these Tables shall not exceed 1.5 h.
(2) For mixture of Portland cement-sand plaster, see D-1.7.2.(2).

Table D-2.3.4.C.
Time Assigned for Contribution of Wood or Light Steel Frame

Description of Frame	Time Assigned to Frame, min
Wood studs 400 mm o.c. maximum	20
Wood studs 600 mm o.c. maximum	15
Steel studs 400 mm o.c. maximum	10
Wood floor and wood roof joists 400 mm o.c. maximum	10
Open web steel joist floors and roofs with ceiling supports 400 mm o.c. maximum	10
Wood roof and wood floor truss assemblies 600 mm o.c. maximum	5

Table D-2.3.4.D.
Time Assigned for Additional Protection

Description of Additional Protection	Time Assigned, min
Add to the fire-resistance rating of wood stud walls, sheathed with gypsum wallboard or lath and plaster, if the spaces between the studs are filled with preformed insulation of rock or slag fibres conforming to CAN/ULC-S702, "Thermal Insulation, Mineral Fibre, for Buildings," and with a mass of not less than 1.22 kg/m^2 of wall surface [(1)]	15
Add to the fire-resistance rating of non-loadbearing wood stud walls, sheathed with gypsum wallboard or lath and plaster, if the spaces between the studs are filled with preformed insulation of glass fibres conforming to CAN/ULC-S702, "Thermal Insulation, Mineral Fibre, for Buildings," and having a mass of not less than 0.6 kg/m^2 of wall surface	5
Add to the fire-resistance rating of plaster on gypsum lath ceilings if 0.76 mm diam wire mesh with 25 mm by 25 mm openings or 1.57 mm diam diagonal wire reinforcing at 250 mm o.c. is placed between lath and plaster	30
Add to the fire-resistance rating of plaster on gypsum lath ceilings if 76 mm wide metal lath strips are placed over joints between lath and plaster	10
Add to the fire-resistance rating of plaster on 9.5 mm thick gypsum lath ceilings (Table D-2.3.4.B.) if supports for lath are 300 mm o.c.	10

Notes to Table D-2.3.4.D.:
(1) There are no test data to justify the 15 min additional protection for preformed glass fibre insulation.

D-2.3.5. Considerations for Various Types of Assemblies

1) Interior vertical fire separations shall be rated for exposure to fire on each side, and a membrane shall be provided on both sides of the assembly. In the calculation of the fire-resistance rating of such an assembly, however, no contribution to fire-resistance can be assigned for a membrane on the non-fire-exposed side, since this membrane may fail when the structural members fail.

2) When an exterior wall assembly is required to be rated from the interior side only, such wall assemblies shall have an outer membrane consisting of sheathing and exterior cladding with spaces between the studs filled with insulation conforming to CAN/ULC-S702, "Thermal Insulation, Mineral Fibre, for Buildings," and having a mass of not less than 1.22 kg/m^2 of wall surface.

3) In the case of a floor or roof, the standard test provides only for testing for fire exposure from below. Floor or roof assemblies of wood, light-gauge steel members or open-web steel joist framing shall have an upper membrane consisting of a subfloor and finish floor conforming to Table D-2.3.5. or any other membrane that has a contribution to fire resistance of not less than 15 min in Table D-2.3.4.A. For the purposes of this requirement, it is not necessary to comply with note (1) to Table D-2.3.4.A.

Table D-2.3.5.
Flooring of Roofing Membranes for Wood, Cold Formed Steel Members or Open-Web Steel Joists

Type of Assembly	Structural Members	Subfloor or Roof Deck	Finish Flooring or Roofing
Floor	Wood or steel joists and wood trusses	12.5 mm plywood or 17 mm T & G softwood	Hardwood or softwood flooring on building paper Resilient flooring, parquet floor, felted synthetic fibre floor coverings, carpeting, or ceramic tile on 8 mm thick panel-type underlay Ceramic tile on 30 mm mortar bed
	Steel joists	50 mm reinforced concrete or 50 mm concrete on metal lath or formed steel sheet, or 40 mm reinforced gypsum-fibre concrete on 12.7 mm gypsum wallboard	Finish flooring
Roof	Wood or steel joists and wood trusses	12.5 mm plywood or 17 mm T & G softwood	Finish roofing material with or without insulation
	Steel joists	50 mm reinforced concrete or 50 mm concrete on metal lath or formed steel sheet, or 40 mm reinforced gypsum-fibre concrete on 12.7 mm gypsum wallboard	Finish roofing material with or without insulation

4) Insulation used in the cavities of a wood floor assembly will not reduce the assigned fire-resistance rating of the assembly provided:

(a) the insulation is preformed of rock, slag or glass fibre conforming to CAN/ULC-S702, "Thermal Insulation, Mineral Fibre, for Buildings," and having a mass of not more than 1.1 kg/m^2 and is installed adjacent to the bottom edge of the framing member, directly above steel furring channels,

(b) the gypsum wallboard ceiling membrane is attached to

(i) wood trusses in conformance with D-2.3.9.(2) by way of steel drywall furring channels spaced not more than 400 mm o.c., and the channels are secured to each bottom truss member with a double strand of 1.2 mm galvanized steel wire, or

(ii) wood joists by way of drywall or resilient steel furring channels spaced not more than 400 mm o.c. in conformance with D-2.3.9.(2) and (3), and

(c) a steel furring channel is installed midway between each furring channel mentioned in (b) to provide additional support for the insulation.

D-2.3.6. Framing Members

1) The values shown in Tables D-2.3.4.A., D-2.3.4.B. and D-2.3.12. apply to membranes supported on framing members installed in their conventional orientation and spaced in conformance with Table D-2.3.4.C.

2) Wood studs and wood roof and floor framing members are assumed to be not less than 38 mm by 89 mm. Wood trusses are assumed to consist of wood chord and web framing members and connector plates fabricated from not less than 1 mm thick galvanized steel with projecting teeth not less than 8 mm long. Dimensions for dressed lumber are given in CAN/CSA-O141, "Softwood Lumber."

3) The allowable spans for wood joists listed in Part 9 of this Code are provided for floors supporting specific occupancies.

4) Except as otherwise required in this Appendix, metal studs shall be of galvanized steel not less than 0.5 mm thick, not less than 63 mm wide and with a flange width of not less than 31 mm.

5) Metal studs in walls required to have a fire-resistance rating shall be installed with not less than 12 mm clearance between the top of the stud and the top of the runner to allow for expansion in

the event of fire. Where attachment of the studs is necessary for alignment purposes during erection, such attachment shall be made to the bottom runners only.

6) Except as required in D-2.3.5.(4), resilient or drywall furring channels may be used to attach a gypsum wallboard ceiling membrane to a floor or roof assembly. The channels must be of galvanized steel not less than 0.5 mm thick, placed at a spacing of not more than 600 mm o.c. perpendicular to the framing members, with an overlap of not less than 100 mm at splices and a minimum end clearance between the channels and walls of 15 mm.

D-2.3.7. Plaster Finish

The thickness of plaster finish shall be measured from the face of gypsum or metal lath.

D-2.3.8. Edge Support for Wallboard

Gypsum wallboard installed over framing or furring shall be installed so that all edges are supported, except that 15.9 mm Type X gypsum wallboard may be installed horizontally with the horizontal joints unsupported when framing members are at 400 mm o.c. maximum.

D-2.3.9. Membrane Fastening

1) Except as provided in (2) to (6), the application of lath and plaster finish shall conform to CSA A82.30-M, "Interior Furring, Lathing and Gypsum Plastering" and gypsum wallboard finish shall conform to CSA A82.31-M, "Gypsum Board Application."

2) Where a membrane referred to in Tables D-2.3.4.A., D-2.3.4.B. and D-2.3.12. is applied to steel framing or furring, fasteners shall penetrate not less than 10 mm through the metal.

3) Except as provided in (4) and (5) where a membrane referred to in Tables D-2.3.4.A., D-2.3.4.B. and D-2.3.12. is applied to wood framing or furring, minimum fastener penetrations into wood members shall conform to Table D-2.3.9. for the time assigned to the membrane.

4) Where a membrane is applied in 2 layers, the fastener penetrations described in Table D-2.3.9. shall apply to the base layer. Fasteners for the face layer shall penetrate not less than 20 mm into wood supports.

Table D-2.3.9.
Minimum Fastener Penetrations for Membrane Protection on Wood Frame, mm

Type of Membrane	Assigned Contribution of Membrane to Fire Resistance,(1) min					
	5 – 25	30 – 35	40	50	55 – 70	80
Single layer	20	29	32	—	—	—
Double layer	20	20	20	29	35	44
Gypsum lath	20	20	23	23	29	29

Notes to Table D-2.3.9.:
(1) Assigned contributions of membranes to fire resistance are determined in Tables D-2.3.4.A., D-2.3.4.B. and D-2.3.12.

5) Where adhesives are used to attach the face layer of gypsum wallboard in a double layer application for walls, the top and bottom of the face layer shall be secured to the supports by mechanical fasteners having lengths as required in (2) and (4) and spaced not more than 150 mm o.c. for wood supports and not more than 200 mm o.c. for steel supports.

6) In a double layer application of gypsum wallboard on wood supports, fastener spacing shall conform to CSA A82.31-M, "Gypsum Board Application."

D-2.3.10. Ceiling Membrane Openings – Combustible Construction

1) Except as permitted in D-2.3.12., where a floor or roof assembly of combustible construction is assigned a fire-resistance rating on the basis of D-2.3. and incorporates a ceiling membrane described in Table D-2.3.4.A. or D-2.3.4.B., the ceiling membrane may be penetrated by openings leading to ducts within concealed spaces above the membrane provided:

(a) the assembly is not required to have a fire-resistance rating in excess of 1 h,
(b) the area of any openings does not exceed 930 cm^2 (see (2)),

(c) the aggregate area of openings does not exceed 1% of the ceiling area of the fire compartment,
(d) the depth of the concealed space above the ceiling is not less than 230 mm,
(e) no dimension of any opening exceeds 310 mm,
(f) supports are provided for openings with any dimension exceeding 150 mm where framing members are spaced greater than 400 mm o.c.,
(g) individual openings are spaced not less than 2 m apart,
(h) the ducts above the membrane are sheet steel and are supported by steel strapping firmly attached to the framing members, and
(i) the clearance between the top surface of the membrane and the bottom surface of the ducts is not less than 100 mm.

2) Where an individual opening permitted in (1) exceeds 130 cm^2 in area, it shall be protected by

(a) a fire stop flap conforming to D-5.3., or
(b) thermal protection above the duct consisting of the same materials as used for the ceiling membrane, mechanically fastened to the ductwork and extending 200 mm beyond the opening on all sides (see Figure D-2.3.10.).

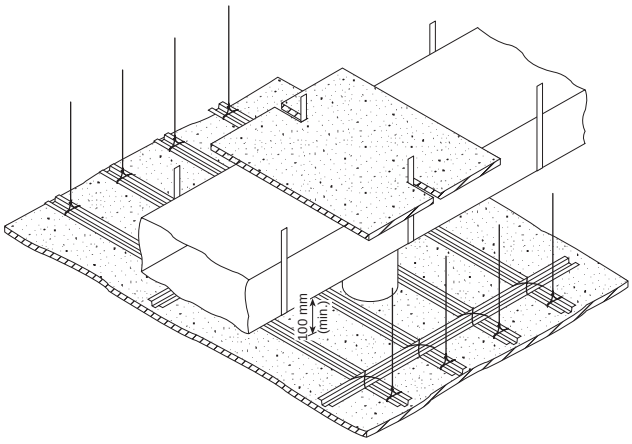


Figure D-2.3.10.
Thermal protection above a duct

D-2.3.11. Ceiling Membrane Openings – Noncombustible Construction

1) Except as permitted in D-2.3.12., where a floor or roof assembly of noncombustible construction is assigned a fire-resistance rating on the basis of D-2.3. and incorporates a ceiling membrane described in Table D-2.3.4.A. or D-2.3.4.B., the ceiling membrane may be penetrated by openings leading to ducts located within concealed spaces provided:

(a) the area of any opening does not exceed 930 cm^2 (see (2)),
(b) the aggregate area of openings does not exceed 2% of the ceiling area of the fire compartment,
(c) no dimension of any opening exceeds 400 mm,
(d) individual openings are spaced not less than 2 m apart,
(e) openings are located not less than 200 mm from major structural members such as beams, columns or joists,
(f) the ducts above the membrane are sheet steel and are supported by steel strapping firmly attached to the framing members, and
(g) the clearance between the top surface of the membrane and the bottom surface of the duct is not less than 100 mm.

2) Where an individual opening permitted in (1) exceeds 130 cm^2 in area, it shall be protected by

(a) a fire stop flap conforming to D-5.3., or
(b) thermal protection above the duct consisting of the same materials as used for the ceiling membrane, mechanically fastened to the ductwork and extending 200 mm beyond the opening on all sides (see Figure D-2.3.10.).

D-2.3.12. Ceiling Membrane Rating

Where the fire-resistance rating of a ceiling assembly is to be determined on the basis of the membrane only and not of the complete assembly, the ratings may be determined from Table D-2.3.12., provided no openings are located within the ceiling membrane.

Table D-2.3.12.
Fire-Resistance Rating for Ceiling Membranes

Description of Membrane	Fire-Resistance Rating, min
15.9 mm Type X gypsum wallboard with ≥75 mm mineral wool batt insulation above wallboard	30
19 mm gypsum-sand plaster on metal lath	30
Double 14.0 mm Douglas Fir plywood phenolic bonded	30
Double 12.7 mm Type X gypsum wallboard	45
25 mm gypsum-sand plaster on metal lath	45
Double 15.9 mm Type X gypsum wallboard	60
32 mm gypsum-sand plaster on metal lath	60

D-2.3.13. Beams

1) Where a beam is included with an open-web steel joist or similar construction and is protected by the same continuous ceiling, the beam is assumed to have a fire-resistance rating equal to that assigned to the rest of the assembly.

2) The ratings in this Appendix assume that the construction to which the beam is related is a normal one and does not carry unusual loads from the floor or slab above.

D-2.3.14. Wired Glass Assembly Support

1) Openings in a vertical fire separation having a fire-resistance rating of not more than 1 h are allowed to be protected by wired glass assemblies, provided the wired glass is

(a) not less than 6 mm thick;
(b) reinforced by a steel wire mesh in the form of diamonds, squares or hexagons having dimensions of
  (i) approximately 25 mm across the flats, using wire of not less than 0.45 mm diam, or
  (ii) 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 with metal not less than 1.35 mm thick and providing a glazing stop of not less than 20 mm on each side of the glass; and
(d) limited in area so that
  (i) individual panes are not more than 0.84 m^2, with neither height nor width more than 1.4 m, and
  (ii) the area not structurally supported by mullions is not more than 7.5 m^2.

2) It is intended that the structural mullions referred to in Subclause (1)(d)(ii) will not distort or be displaced to the extent that there would be a failure of the wired glass closure during the period for which a closure in the fire separation would be expected to function. Hollow structural steel tubing not less than 100 mm square filled with a Portland cement-based grout will satisfy the intent of the Subclause.

D-2.4. Solid Wood Walls, Floors and Roofs

D-2.4.1. Minimum Thickness

The minimum thickness of solid wood walls, floors and roofs for fire-resistance ratings from 30 min to 1.5 h is shown in Table D-2.4.1.

Table D-2.4.1.
Minimum Thickness of Solid Wood Walls, Roofs and Floors, mm[1] [2]

Type of Construction	Fire-Resistance Rating			
	30 min	45 min	1 h	1.5 h
Solid wood floor with building paper and finish flooring on top[3]	89	114	165	235
Solid wood, splined or tongued and grooved floor with building paper and finish flooring on top[4]	64	76	—	—
Solid wood walls of loadbearing vertical plank[3]	89	114	140	184
Solid wood walls of non-loadbearing horizontal plank[3]	89	89	89	140

Notes to Table D-2.4.1.:
(1) See CAN/CSA-O141, "Softwood Lumber," for sizes.

Table D-2.6.1.A. (Continued)

(5) Hollow clay tiles and masonry mortar shall be reinforced with 1.19 mm diam wire mesh with 10 mm by 10 mm openings, laid in every horizontal joint and lapped at corners.
(6) Hollow clay tiles shall conform to CSA A82.5-M, "Structural Clay Non-Load-Bearing Tile."
(7) 50 mm nominal hollow clay tile, reinforced with 1.19 mm diam wire mesh with 10 mm by 10 mm openings laid in every horizontal joint and covered with 19 mm gypsum-sand plaster and with limestone concrete fill in column spaces, has a 4 h fire-resistance rating.

Table D-2.6.1.B.
Minimum Thickness of Plaster Protection to Steel Columns, mm

Description	Fire-Resistance Rating[1][2]						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Gypsum-sand plaster on 9.5 mm gypsum lath[3]	13	13	13	20	—	—	—
Gypsum-perlite or vermiculite plaster on 9.5 mm gypsum lath[3]	13	13	13	20	25	—	—
Gypsum perlite or vermiculite plaster on 12.7 mm gypsum lath[3]	13	13	13	20	25	32	50
Gypsum perlite or vermiculite plaster on double 12.7 mm gypsum lath[3]	13	13	13	20	25	25	32
Portland cement-sand plaster on metal lath[4][5]	25	25	25	—	—	—	—

Notes to Table D-2.6.1.B.:
(1) Fire-resistance ratings of 30 min and 45 min apply to columns whose M/D ratio is 30 or greater. Fire-resistance ratings greater than 45 min apply to columns whose M/D ratio is greater than 60. Where the M/D ratio is between 30 and 60 and the required fire-resistance rating is greater than 45 min, the total thickness of protection specified in the Table shall be increased by 50%. (To determine M/D, refer to D-2.6.4.)
(2) Where the thickness of plaster over gypsum lath is 25 mm or more, wire mesh with 1.57 mm diam wire and openings not exceeding 50 mm by 50 mm shall be placed midway in the plaster.
(3) Lath held in place by 1.19 mm diam wire wrapped around lath 450 mm o.c.
(4) Expanded metal lath 1.36 kg/m^2 fastened to 9.5 mm by 19 mm steel channels held in vertical position around column by 1.19 mm diam wire ties.
(5) For mixture of Portland cement-sand plaster, see D-1.7.2.(2).

Table D-2.6.1.C.
Minimum Thickness of Gypsum-Sand Plaster on Metal Lath Protection to Steel Columns, mm

M/D[1]	Fire-Resistance Rating					
	30 min	45 min	1 h	1.5 h	2 h	3 h
30 to 60	16	16	32	—	—	—
over 60 to 90	16	16	16	32	—	—
over 90 to 120	16	16	16	25	39	—
over 120 to 180	16	16	16	16	25	—
over 180	16	16	16	16	25	39

Notes to Table D-2.6.1.C.:
(1) To determine the M/D ratio, refer to D-2.6.4.

Table D-2.6.1.D.
Minimum Thickness of Gypsum-Perlite or Gypsum-Vermiculite Plaster on Metal Lath Protection to Steel Columns, mm

M/D[1]	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
30 to 60	16	16	20	32	35	—	—
over 60 to 90	16	16	16	20	26	35	45
over 90 to 120	16	16	16	16	26	35	45
over 120 to 180	16	16	16	16	20	32	35
over 180	16	16	16	16	16	26	35

Notes to Table D-2.6.1.D.:
(1) To determine the M/D ratio, refer to D-2.6.4.

Table D-2.6.1.E.
Steel Columns with Sheet-Steel Membrane and Insulation as Shown in Figures D-2.6.1.(a) and D-2.6.1.(b)

Type of Protection	Steel Thickness,[1] mm	Fastening[2]	Insulation	Fire-Resistance Rating
See Figure D-2.6.1.(a)	0.51	No. 8 sheet-metal screws 9.5 mm long, 200 mm o.c.	50 mm mineral wool batts[3]	45 min
See Figure D-2.6.1.(b)	0.64	Self-threading screws or No. 8 sheet-metal screws, 600 mm o.c.	2 layers 12.7 mm gypsum wallboard	1.5 h
See Figure D-2.6.1.(a)	0.64	No. 8 sheet-metal screws, 9.5 mm long 200 mm o.c.	75 mm mineral wool batts,[3] 12.7 mm gypsum wallboard	2 h
See Figure D-2.6.1.(b)	0.76	Crimped joint or No. 8 sheet-metal screws, 300 mm o.c.	2 layers 15.9 mm gypsum wallboard	2 h

Notes to Table D-2.6.1.E.:
(1) Minimum thickness, galvanized or wiped-zinc-coated sheet-steel.
(2) Sheet-steel shall be securely fastened to the floor and superstructure, or where sheet-steel cover does not extend floor to floor, fire stopping shall be provided at the level where sheet-steel protection ends. In the latter case, an alternate type of fire protection shall be applied between the fire stopping and the superstructure.
(3) Conforming to CAN/ULC-S702, "Thermal Insulation, Mineral Fibre, for Buildings," Type 1A, minimum density 30 kg/m^3: column section and batts wrapped with 25 mm mesh chicken wire.

Table D-2.6.1.F.
Minimum M/D Ratio for Steel Columns Covered with Type X Gypsum Wallboard Protection[1]

Minimum Thickness of Type X Gypsum Wallboard Protection,[2] mm	Fire-Resistance Rating			
	1 h	1.5 h	2 h	3 h
12.7	75	—	—	—
15.9	55	—	—	—
25.4	35	60	—	—
28.6	35	50	—	—
31.8	35	40	75	—
38.1	35	35	55	—
41.3	35	35	45	—

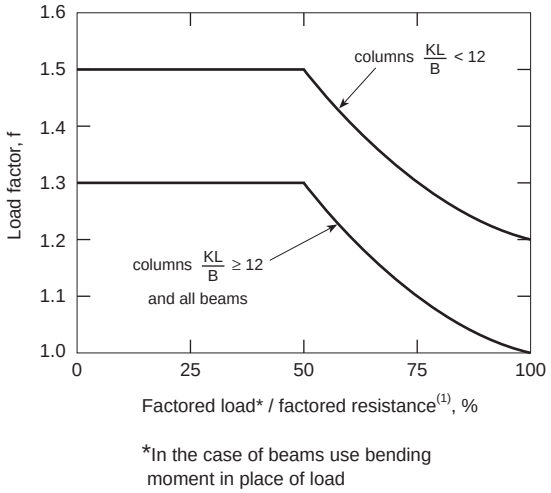


Figure D-2.11.2.(a)

Factors to compensate for partially loaded columns and beams

Note to Figure D-2.11.2.(a):
(1) See D-2.11.2.(2).

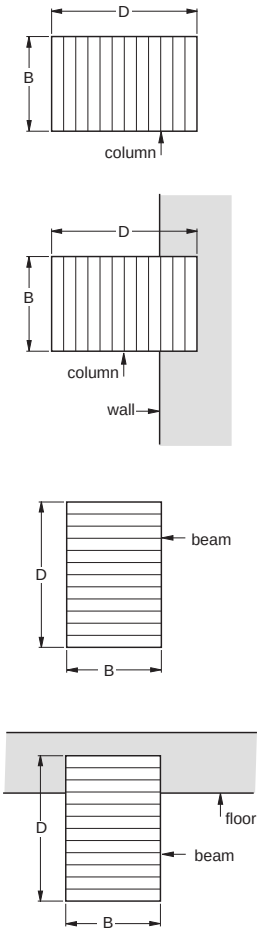


Figure D-2.11.2.(b)

Full dimensions of glued-laminated beams and columns

2) The factored resistance of a beam or column shall be determined by using the specified strengths in CSA O86.1, "Engineering Design in Wood (Limit States Design)."

Section D-3 Flame-Spread Ratings and Smoke Developed Classifications

D-3.1. Interior Finish Materials

D-3.1.1. Scope of Information

Tables D-3.1.1.A. and D-3.1.1.B. show flame-spread ratings and smoke developed classifications for combinations of some common interior finish materials. The values are based on all the evidence available at present. Many materials have not been included because of lack of test evidence or because of inability to classify or describe the material in generic terms for the purpose of assigning ratings.

D-3.1.2. Ratings

The ratings shown in Tables D-3.1.1.A. and D-3.1.1.B. are arranged in groups corresponding to the provisions of this Code. The ratings apply to materials falling within the general categories indicated.

D-3.1.3. Table Entries

In Tables D-3.1.1.A. and D-3.1.1.B., the first number of each entry relates to flame spread and the second number to smoke developed limit. For example:

25/50 represents a flame-spread rating of 0 to 25 and a smoke developed classification of 0 to 50.

150/300 represents a flame-spread rating of 75 to 150 and a smoke developed classification of 100 to 300, and *e*

X/X applied to walls and ceilings means a flame-spread rating over 150 and a smoke developed classification over 300. *e*

Table D-3.1.1.A.
Assigned Flame-Spread Ratings and Smoke Developed Classifications for Combinations of Wall and Ceiling Finish Materials and Surface Coatings[1]

Materials	Applicable Material Standard	Minimum Thickness, mm	Surface Coating	
			Unfinished	Paint or Varnish not more than 1.3 mm Thick, Cellulosic Wallpaper not more than One Layer[2][3]
Asbestos cement board Brick, concrete, tile Steel, copper, aluminum Gypsum plaster	CAN/CGSB-34.16-M None None CSA A82.22-M	None None 0.33 None	0/0	25/50
Gypsum wallboard	CAN/CSA-A82.27-M ASTM C 36 ASTM C 442 ASTM C 588 ASTM C 630/C 630M ASTM C 931/C 931M	9.5	25/50	25/50
Lumber	None	16	150/300	150/300
Douglas Fir plywood[4] Poplar plywood[4] Plywood with Spruce face veneer[4]	CSA O121-M CSA O153-M CSA O151-M	11	150/100	150/300
Douglas Fir plywood[4]	CSA O121-M	6	150/100	150/100
Fiberboard low density	CAN/CSA-A247-M	11	X/100	150/100
Hardboard Type 1 Standard	CAN/CGSB-11.3-M	 9 6	 150/X 150/300	 [5] 150/300
Particleboard	ANSI A208.1	12.7	150/300	[5]
Waferboard	CSA O437.0	—	[5]	[5]

Notes to Table D-3.1.1.A.:

(1) See D-1.1.1.(5) for standards used to assign flame-spread ratings and smoke developed classifications.

(2) Flame-spread ratings and smoke developed classifications for paints and varnish are not applicable to shellac and lacquer.

(3) Flame-spread ratings and smoke developed classifications for paints apply only to alkyd and latex paints.

(4) The flame-spread ratings and smoke developed classifications shown are for those plywoods without a cellulose resin overlay.

(5) Insufficient test information available.

and the remainder considered to be the contribution of the membrane.

The figures obtained for the contribution of membranes were then applied to the test results for open web steel joist floors and wood and steel stud walls and values of 20 min for the contribution of wood stud framing and 10 min for steel framing were derived.

The fire-resistance rating has been limited to 1.5 h as this method of developing ratings for framed assemblies was new and untried. Although this is the subject of current review, no decision has been made to extend the ratings beyond 1.5 h.

(1) M. Galbreath, G. C. Gosselin, and R. B. Chauhan, Historical Guide to Chapter 2 of the Supplement to the National Building Code of Canada, Committee Paper FPR 1-3, Prepared for the Standing Committee on Fire Performance Ratings, May 1987.

Example showing fire-resistance rating of a typical membrane assembly, calculated using the component additive method.

1 hour Gypsum Board/Wood Stud Interior Partition

A 1 h fire-resistance rating is required for an interior wood framed partition, using 12.7 mm Type X gypsum wallboard.

(a) Since gypsum wallboard is used (D-2.3.4.(2) and Table D-2.3.4.A.) time assigned to 12.7 mm Type X gypsum wallboard membrane on the fire-exposed side of the partition = 25 min
(b) Time assigned to wood framing members at 400 mm o.c. (D-2.3.4.(3) and Table D-2.3.4.C.) = 20 min
(c) Time assigned to insulation, if the spaces between the studs are filled with preformed insulation of rock or slag fibres conforming to CAN/ULC-S702, "Thermal Insulation, Mineral Fibre, for Buildings," (D-2.3.4.(4) and Table D-2.3.4.D.) = 15 min
(d) Time assigned to the membrane on the non-fire-exposed side (D-2.3.5.(1)) = 0 min

Fire-resistance rating = 25 + 20 + 15 = 60 min

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