Errata

Issued by the Canadian Commission on Building and Fire Codes

The Change History table that follows describes errata and editorial updates that apply to the National Energy Code of Canada for Buildings 2011:

- Errata are corrections to existing text.
- Editorial updates are provided for information purposes only.

Code pages containing errata are identified with the words “Amended Page” in the footer; pages with editorial updates and index pages with changes are not flagged.

Contact your local authority having jurisdiction to find out if these errata apply in your province or territory.

Change History — National Energy Code of Canada for Buildings 2011

Division	Code Reference	Change	Date (Y-M-D)	Description of Change
B	Table 1.3.1.2.	erratum	2012-12-21	Entry was added for standard “DOE 10 CFR, Part 430-2011”
B	Table 1.3.1.2.	erratum	2012-12-21	Entry for NRCan standard was corrected to read “SOR/94-651-2008”
B	1.3.2.1.(1)	editorial update	2012-12-21	Entry was added for DOE
B	3.2.1.4.(1)	erratum	2012-12-21	Equations for FDWR values were modified for clarity
B	Table 3.5.1.1.	erratum	2012-12-21	Attributions for Sentences 3.2.4.4.(2) and (3) were deleted
B	4.2.3.1.(3)	erratum	2012-12-21	Sentence was corrected to read “... shall not be greater than the individual allowance for that application taken from Table 4.2.3.1.C. ...”
B	5.2.5.3.(5)	erratum	2012-12-21	Ratio was corrected to read “u2/u1”
B	5.2.5.3.(6)	erratum	2012-12-21	Ratio was corrected to read “u2/u1”
B	5.2.10.2.(2)	erratum	2012-12-21	Sentence was corrected to read “... that provides at least 80% of the dehumidification ...”
B	Table 5.2.12.1.	erratum	2012-12-21	Table Note (5) was added to entries for furnaces
B	Table 5.5.1.1.	erratum	2012-12-21	Attribution for Sentence 5.2.5.3.(2) was deleted
B	Table 6.2.2.1.	erratum and editorial update	2012-12-21	Under entry for gas-fired service water heaters, input value “22–117 kW” was deleted Table Note (5) was deleted
B	6.2.3.1.(2)	erratum	2012-12-21	Ratio was corrected to read “u2/u1”
B	6.2.3.1.(3)	erratum	2012-12-21	Ratio was corrected to read “u2/u1”
B	Table 6.2.3.1.	erratum	2012-12-21	Second value under column entitled “Mean Rating Temperature, °C” was corrected to read “38”
B	Table 6.5.1.1.	erratum	2012-12-21	Attribution was added for Sentence 6.2.1.1.(1)
B	7.2.4.1.(1)	erratum	2012-12-21	Reference in Sentence was corrected to read “... Tables 3 and 5 of CSA C390, ...”
B	Table 8.4.4.22.A.	erratum	2012-12-21	In entry for Furnace Part-Load Performance Curve(s), values listed for variable c under Condensing Furnace and Atmospheric Furnace were interchanged
B	Table 8.5.1.1.	erratum	2012-12-21	Functional Statement F99 was deleted from attribution for Clauses 8.4.4.20.(3)(b) and (c)
Index	Letter H	erratum	2012-12-21	Reference under Heaters/heating systems, recessed, was corrected to read “3.2.1.2.” Reference under Heating, ventilating and air-conditioning (HVAC) systems, baseboard heaters, was corrected to read “3.2.1.2.”

Table 1.3.1.2. (Continued)

Issuing Agency	Document Number[1]	Document Title[2]	Code Reference
AHRI	ANSI/AHRI 390-2003	Performance Rating of Single Package Vertical Air-Conditioners and Heat Pumps	Table 5.2.12.1.
AHRI	ANSI/AHRI 1060-2005	Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation	5.2.10.1.(5)
AMCA	500-89	Louvers, Dampers and Shutters	5.2.4.2.(2)
ANSI/CSA	ANSI Z21.10.3-2004/ CSA 4.3-04	Gas Water Heaters – Volume III, Storage Water Heaters With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous	Table 6.2.2.1.
ANSI/CSA	ANSI Z21.13-2004/ CSA 4.9-04	Gas-Fired Low Pressure Steam and Hot Water Boilers	Table 5.2.12.1.
ANSI/CSA	ANSI Z21.47-2006/ CSA 2.3-2006	Gas-Fired Central Furnaces	Table 5.2.12.1.
ANSI/CSA	ANSI Z21.56-2006/ CSA 4.7-2006	Gas-Fired Pool Heaters	Table 6.2.2.1.
ANSI/CSA	ANSI Z83.8-2006/ CSA 2.6-2006	Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters and Gas-Fired Duct Furnaces	Table 5.2.12.1.
ASHRAE	2009	ASHRAE Handbook – Fundamentals	3.1.1.5.(4)
ASHRAE	ANSI/ASHRAE 127-2007	Rating Computer and Data Processing Room Unitary Air-Conditioners	Table 5.2.12.1.
ASHRAE	ANSI/ASHRAE 140-2007	Evaluation of Building Energy Analysis Computer Programs	3.3.4.4.(4) 8.4.2.2.(5)
ASME	PTC 4-2008	Fired Steam Generators - Performance Test Codes	Table 5.2.12.1.
ASME/CSA	ASME A112.18.1-05/ CAN/CSA-B125.1-05	Plumbing Supply Fittings	6.2.6.1.(1) 6.2.6.2.(1)
ASTM	C 177-10	Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus	3.1.1.5.(1)
ASTM	C 335/C 335M-05	Steady-State Heat Transfer Properties of Pipe Insulation	5.2.5.3.(7) 6.2.3.1.(4)
ASTM	C 518-10	Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus	3.1.1.5.(1)
ASTM	C 1363-05	Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus	3.1.1.5.(4) 3.1.1.5.(5)
ASTM	E 283-04	Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen	3.2.4.3.(2) 3.2.4.4.(1) to (3)
CCBFC	NRCC 53301	National Building Code of Canada 2010	1.1.1.1.(1)[3] 1.1.1.3.(1)[3] 1.1.1.3.(2)[3] 1.1.4.1.(1) 1.4.1.2.(1)[3] 3.1.1.5.(1) 3.2.2.1.(3) 5.2.1.1.(1) 5.2.2.1.(1) 5.2.2.8.(2) 5.2.5.1.(1) 5.2.10.4.(2)
CCBFC	NRCC 53302	National Plumbing Code of Canada 2010	6.2.1.1.(1)
CSA	AAMA/WDMA/CSA 101/I.S.2/A440-08	NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights	3.2.4.3.(3) 3.2.4.3.(4)
CSA	A440.2-09/A440.3-09	Fenestration Energy Performance/User Guide to CSA A440.2-09, Fenestration Energy Performance	3.1.1.5.(3)
CSA	CAN/CSA-B125.3-05	Plumbing Fittings	6.2.6.1.(1) 6.2.6.2.(1)
CSA	CAN/CSA-B140.4-04	Oil-Fired Warm Air Furnaces	Table 5.2.12.1.
CSA	CAN/CSA-B211-00	Energy Efficiency of Oil-Fired Storage Tank Water Heaters	Table 6.2.2.1.
CSA	B212-00	Energy Utilization Efficiencies of Oil-Fired Furnaces and Boilers	Table 5.2.12.1.

Table 1.3.1.2. (Continued)

Issuing Agency	Document Number(1)	Document Title(2)	Code Reference
CSA	CAN/CSA-C191-04	Electric Storage Tank Water Heaters for Domestic Hot Water Service	Table 6.2.2.1.
CSA	CAN/CSA-C368.1-M90	Room Air Conditioners	Table 5.2.12.1.
CSA	C390-10	Test Methods, Marking Requirements, and Energy Efficiency Levels for Three-Phase Induction Motors	7.2.4.1.(1)
CSA	CAN/CSA-C439-09	Rating the Performance of Heat/Energy-Recovery Ventilators	5.2.10.4.(2)
CSA	C654-M91	Fluorescent Lamp Ballast Efficacy Measurements	4.2.1.2.(1) and (2)
CSA	CAN/CSA-C656-05	Split-System and Single-Package Central Air Conditioners and Heat Pumps	Table 5.2.12.1.
CSA	CAN/CSA-C743-09	Rating Packaged Water Chillers	Table 5.2.12.1.
CSA	ARI 310/380-2004/ CAN/CSA-C744-04	Packaged Terminal Air Conditioners and Heat Pumps (Bi-National Standard, with ARI 310/380-2004)	Table 5.2.12.1.
CSA	CAN/CSA-C745-03	Energy Efficiency of Electric Storage Tank Water Heaters and Heat Pump Water Heaters	Table 6.2.2.1.
CSA	CAN/CSA-C746-06	Rating Large and Single Packaged Vertical Air Conditioners and Heat Pumps	Table 5.2.12.1.
CSA	C748-94	Direct-Expansion (DX) Ground-Source Heat Pumps	Table 5.2.12.1.
CSA	CAN/CSA-C802.1-00	Minimum Efficiency Values for Liquid-Filled Distribution Transformers	7.2.3.1.(1)
CSA	CAN/CSA-C802.2-06	Minimum Efficiency Values for Dry-Type Transformers	7.2.3.1.(1)
CSA	CAN/CSA-C802.3-01	Maximum Losses for Power Transformers	7.2.3.1.(1)
CSA	CAN/CSA-C828-06	Thermostats Used with Individual Room Electric Space Heating Devices	5.2.8.5.(4)
CSA	CAN/CSA-C860-07	Internally Lighted Exit Signs	4.2.1.1.(1)
CSA	CAN/CSA-C13256-1-01	Water-Source Heat Pumps - Testing and Rating for Performance - Part 1: Water-to-Air and Brine-to-Air Heat Pumps (Adopted ISO 13256-1:1998, with Canadian Deviations)	Table 5.2.12.1.
CSA	CAN/CSA-C13256-2-01	Water-Source Heat Pumps - Testing and Rating for Performance - Part 2: Water-to-Water and Brine-to-Water Heat Pumps (Adopted ISO 13256-2:1998, with Canadian Deviations)	Table 5.2.12.1.
CSA	CAN/CSA-F379 SERIES-09	Packaged Solar Domestic Hot Water Systems (Liquid-to-Liquid Heat Transfer)	6.2.2.3.(1)
CSA	CAN/CSA-P.3-04	Measuring Energy Consumption and Determining Efficiencies of Gas-Fired Storage Water Heaters	Table 6.2.2.1.
CTI	201(04)	Certification of Water-Cooling Tower Thermal Performance	Table 5.2.12.1.
DOE	10 CFR, Part 430-2011	Energy, Energy Conservation Program for Consumer Products	Table 6.2.2.1.
HRAI	SAR-G1	HRAI Digest 2005	1.1.4.2.(1)
ISO	13790:2008	Energy performance of buildings – Calculation of energy use for space heating and cooling	1.1.4.2.(1)
NEMA	NEMA ANSI C82.11:2002	High-Frequency Fluorescent Lamp Ballasts	4.2.1.2.(2)
NFRC	100-2010	Determining Fenestration Product U-factors	3.1.1.5.(3)
NRCan	SOR/94-651-2008	Energy Efficiency Act and its Regulations	5.2.12.3.(1) 6.2.2.4.(1) 6.2.2.5.(1)
SMACNA	ANSI/SMACNA 006-2006	HVAC Duct Construction Standards – Metal and Flexible	5.2.2.3.(1) Table 5.2.2.3.
SMACNA	1985	HVAC Air Duct Leakage Test Manual	5.2.2.4.(1)

Notes to Table 1.3.1.2.:

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

(2) Some titles have been abridged to omit superfluous wording.

(3) Code reference is in Division A.

1.3.2. Organizations

1.3.2.1. Abbreviations of Proper Names

1) The abbreviations of proper names in this Code shall have the meanings assigned to them in this Article (the appropriate addresses of the organizations are shown in brackets).

AAMA ..... American Architectural Manufacturers Association (1827 Walden Office Square, Suite 550, Schaumburg, Illinois 60173-4268 U.S.A.; www.aamanet.org)

AHAM ..... Association of Home Appliance Manufacturers (111 19th Street, NW, Suite 402, Washington, D.C. 20036 U.S.A.; www.aham.org)

AHRI ..... Air-Conditioning, Heating and Refrigeration Institute (2111 Wilson Boulevard, Suite 500, Arlington, Virginia 22201 U.S.A.; www.ahrinet.org)

AMCA ..... Air Movement and Control Association (30 West University Drive, Arlington Heights, Illinois 60004 U.S.A.; www.amca.org)

ANSI ..... American National Standards Institute (25 West 43rd Street, 4th Floor, New York, New York 10036 U.S.A.; www.ansi.org)

ASHRAE ..... American Society of Heating, Refrigerating and Air-Conditioning Engineers (1791 Tullie Circle, NE, Atlanta, Georgia 30329 U.S.A.; www.ashrae.org)

ASME ..... American Society of Mechanical Engineers (Three Park Avenue, New York, New York 10016-5990 U.S.A.; www.asme.org)

ASTM ..... American Society for Testing and Materials International (100 Barr Harbor Drive, West Conshohoken, Pennsylvania 19428-2959 U.S.A.; www.astm.org)

CAN ..... National Standard of Canada designation

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

CSA ..... Canadian Standards Association (5060 Spectrum Way, Suite 100, Mississauga, Ontario L4W 5N6; www.csa.ca)

CTI ..... Cooling Technology Institute (P.O. Box 73383, Houston, Texas 77273-3383 U.S.A.; www.cti.org)

DOE ..... Department of Energy (1000 Independence Avenue, SW, Washington, D.C. 20585 U.S.A.; http://energy.gov)

HRAI ..... Heating, Refrigeration and Air Conditioning Institute of Canada (2800 Skymark Avenue, Building 1, Suite 201, Mississauga, Ontario L4W 5A6; www.hrai.ca)

HVI ..... Home Ventilating Institute (1000 N. Rand Road, Suite 214, Wauconda, Illinois 60084 U.S.A.; www.hvi.org)

IESNA ..... Illuminating Engineering Society of North America (120 Wall Street, Floor 17, New York, New York 10005-4001 U.S.A.; www.iesna.org)

ISO ..... International Organization for Standardization (Standards Council of Canada, 270 Albert Street, Suite 200, Ottawa, Ontario K1P 6N7; www.iso.org)

NBC ..... National Building Code of Canada 2010 (see CCBFC)

NECB ..... National Energy Code of Canada for Buildings 2011

NEMA ..... National Electrical Manufacturers Association (1300 North 17th Street, Suite 1752, Rosslyn, Virginia 22209 U.S.A.; www.nema.org)

NFRC ..... National Fenestration Rating Council (6305 Ivy Lane, Suite 140, Greenbelt, Maryland 20770 U.S.A.; www.nfrc.org)

NPC ..... National Plumbing Code of Canada 2010 (see CCBFC)

NRC ..... National Research Council of Canada (Ottawa, Ontario K1A 0R6; www.nrc-cnrc.gc.ca)

NRCan ..... Natural Resources Canada (www.nrcan.gc.ca)

SMACNA .... Sheet Metal and Air Conditioning Contractors' National Association (4201 Lafayette Center Drive, Chantilly, Virginia 20151-1219 U.S.A.; www.smacna.org)

TIAC ..... Thermal Insulation Association of Canada (1485 Laperrière Avenue, Ottawa, Ontario K1Z 7S8; www.tiac.ca)

U.S. Gov't .... U.S. Government Printing Office (732 North Capitol Street, NW, Washington, D.C. 20401-0001 U.S.A.; www.gpo.gov)

WDMA ..... Window & Door Manufacturers Association (401 N. Michigan Avenue, Suite 2200, Chicago, Illinois 60611 U.S.A.; www.wdma.com)

balcony slabs, beams, girders, columns, and ornamentation or appendages that must completely penetrate the *building envelope* to perform their intended function need not be taken into account, provided that the sum of the cross-sectional areas at such major structural penetrations is limited to a maximum of 2% of the above-ground *building envelope* area. (See Appendix A.)

5) Where a component of the *building envelope* is protected by an enclosed unconditioned space, such as a sun porch, enclosed veranda or vestibule, the unconditioned enclosure may be considered to have an *overall thermal transmittance* of 6.25 W/(m²·K), which is equivalent to that of one layer of glass. (See Appendix A.)

6) For the purposes of this Article, roof assemblies shall be considered to include all related structural framing.

7) For the purposes of this Article, wall assemblies inclined less than 60° from the horizontal shall be considered as roof assemblies, and roof assemblies inclined 60° or more from the horizontal shall be considered as wall assemblies.

8) For the purposes of this Article, wall assemblies shall be considered to include all related structural framing and perimeter areas of intersecting interior walls but shall not include the perimeter areas where floor or roof slabs interrupt the wall's construction. (See Appendix A.)

9) For the purposes of this Article, floor assemblies shall be considered to include all related structural framing.

Section 3.2. Prescriptive Path

3.2.1. General

3.2.1.1. Protection of Insulation Materials

1) Except as provided in Sentence (2), the *building envelope* shall be designed to avoid increasing the *overall thermal transmittance* of the insulation material due to

a) air leakage or convection,
b) wetting, or
c) moisture bypassing the plane of thermal resistance.

(See Appendix A.)

2) Where any of the conditions described in Clauses (1)(a) to (c) occur as a result of the designed *building envelope* system, their effect on the *overall thermal transmittance* of the insulation material shall be calculated in accordance with Article 3.1.1.5.

3.2.1.2. Continuity of Insulation

1) Except as provided in Sentences (2) to (6), interior *building* components that intersect with components of the *building envelope* and major structural members that partly penetrate the *building envelope* shall not break the continuity of the insulation and shall not increase the *overall thermal transmittance* at their projected area to more than that permitted in Section 3.2. (See Appendix A.)

2) Where an interior wall penetrates an exterior wall or insulated roof or ceiling and breaks the continuity of the *building envelope*, it shall be insulated

a) on both of its sides inward or outward from the *building envelope* for a distance equal to 4 times the uninsulated thickness of the penetrating wall, and
b) to an *overall thermal transmittance* no more than that required for the exterior wall.

3) Where an ornamentation or appendage other than a balcony slab or canopy slab penetrates an exterior wall and breaks the continuity of the *building envelope*, it shall be insulated

a) on both of its sides inward or outward from the *building envelope* for a distance equal to 4 times the thickness of the penetrated wall, and
b) to an *overall thermal transmittance* no more than that required for the exterior wall.

4) Where *building envelope* assemblies in the same plane intersect but their respective expanses of insulation do not, one of the two expanses of insulation shall be extended beyond the intersecting assembly for a distance equal to at least 4 times the distance separating the two expanses of insulation. (See Appendix A.)

5) Where mechanical ducts and chases or electrical system components, such as pipes, ducts, conduits, cabinets, panels, or recessed heaters, are placed within and parallel to the *building envelope*, the *overall thermal transmittance* of the *building envelope* at the projected area of the mechanical or electrical system components shall not be increased.

6) Except as provided in Sentence (4), joints between components of the *building envelope*, such as expansion or construction joints or joints between walls and doors or *fenestration*, shall be insulated in a manner that provides continuity across such joints. (See Appendix A.)

3.2.1.3. Spaces Heated to Different Temperatures

1) The *overall thermal transmittance*, U_1, of *building* assemblies separating *conditioned spaces* that are intended to be heated to temperatures that differ by more than 10°C shall not be greater than that obtained with the following equation:

$$U_1 = [(t_2 - t_0) / (t_2 - 0.5 \cdot t_1 - 0.5 \cdot t_0)] \cdot U$$

where

t_1 = indoor heating design temperature of the colder *conditioned space*, in °C,
t_2 = indoor heating design temperature of the warmer *conditioned space*, in °C,
t_0 = outdoor 2.5% January design temperature as specified in Article 1.1.4.1., in °C, and
U = *overall thermal transmittance* required in Sentences 3.2.2.2.(1), 3.2.2.3.(2) and 3.2.2.4.(1), in W/(m²·K).

(See Appendix A.)

3.2.1.4. Allowable Fenestration and Door Area

1) The maximum allowable total vertical *fenestration* and door area to gross wall area ratio (FDWR), determined in accordance with Article 3.1.1.6., shall be as follows:

$$\text{FDWR} = 0.40 \text{ for } \text{HDD} \leq 4000,$$
$$\text{FDWR} = (2000 - 0.2 \cdot \text{HDD}) / 3000 \text{ for } 4000 < \text{HDD} < 7000 \text{ , and}$$
$$\text{FDWR} = 0.20 \text{ for } \text{HDD} \geq 7000,$$

where

HDD = the heating degree-days of the location of the *building* determined according to Sentence 1.1.4.1.(1).

(See Appendix A.)

2) The total *skylight* area shall be less than 5% of the gross roof area as determined in Article 3.1.1.6.

illuminated shall not be greater than the individual allowance for that application taken from Table 4.2.3.1.C. for the applicable lighting zone plus any unused power applied from the basic site allowance listed in Table 4.2.3.1.B. (See Appendix A.)

Table 4.2.3.1.B.
Basic Site Allowances for Exterior Lighting
Forming Part of Sentences 4.2.3.1.(2) and (3)

Basic Site Allowance According to Lighting Zone				
Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
No allowance	500 W	600 W	750 W	1300 W

4) Except as provided in Sentence (5), the connected *exterior lighting* power for all general *building* exterior applications not listed in Table 4.2.3.1.C. that are to be illuminated shall not be greater than the sum of the individual allowances for these applications provided in Table 4.2.3.1.D. for the applicable lighting zone plus any remaining basic site allowance not used in compliance with Sentence (3). (See Appendix A.)

Table 4.2.3.1.C.
Lighting Power Allowances for Specific Building Exterior Applications
Forming Part of Sentences 4.2.3.1.(3) and (4)

Exterior Application	Lighting Power Allowances According to Lighting Zone				
	Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
Building facades (*facade lighting*)	A single luminaire of 60 W or less may be installed for each roadway or parking entry, trail head, and toilet facility, or other locations approved by the *authority having jurisdiction*	No allowance	1.1 W/m^2 for each illuminated wall or surface, or 8.2 W/m for each illuminated wall or surface length	1.6 W/m^2 for each illuminated wall or surface, or 12.3 W/m for each illuminated wall or surface length	2.2 W/m^2 for each illuminated wall or surface, or 16.4 W/m for each illuminated wall or surface length
Automated teller machines (ATM) and night depositories		270 W per location plus 90 W per additional ATM per location			
Entrances and gatehouse inspection stations at guarded facilities		8.1 W/m^2 of covered and uncovered area			
Loading areas for law enforcement, fire, ambulance and other emergency service vehicles		5.4 W/m^2 of covered and uncovered area			
Drive-up windows and doors		400 W per drive-through			
Parking near 24-hour retail entrances		800 W per main entry			

5) The following *exterior lighting* applications need not comply with Sentences (1) to (4) where the lighting is equipped with an independent control device that complies with the requirements of Subsection 4.2.4.:

a) specialized signal, directional, and marker lighting associated with transportation,
b) lighting for advertising and directional signage,
c) lighting integral to equipment or instrumentation and installed by its manufacturer,
d) lighting for theatrical purposes, including performance, stage, film and video production,

e) lighting for athletic activity areas,
f) temporary lighting,
g) lighting for industrial production, material handling, transportation sites, and associated storage areas for industrial sites,
h) lighting for theme elements in theme/amusement parks, and
i) lighting used to highlight features of art objects, public monuments and designated national or provincial historic sites.

Table 4.2.3.1.D.
Lighting Power Allowances for General Building Exterior Applications
Forming Part of Sentence 4.2.3.1.(4)

Exterior Application	Lighting Power Allowances According to Lighting Zone				
	Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
Uncovered Parking Areas					
Parking areas and drives	No allowances	0.4 W/m²	0.7 W/m²	1.1 W/m²	1.4 W/m²
Building Grounds					
Walkways less than 3 m wide		2.3 W/m	2.3 W/m	2.6 W/m	3.3 W/m
Walkways 3 m wide or greater, plaza areas, special feature areas		1.5 W/m²	1.5 W/m²	1.7 W/m²	2.2 W/m²
Stairways	No allowances	8.1 W/m²	11.0 W/m²	11.0 W/m²	11.0 W/m²
Pedestrian tunnels		1.6 W/m²	1.6 W/m²	2.2 W/m²	3.2 W/m²
Landscape lighting		0.4 W/m²	0.5 W/m²	0.5 W/m²	0.5 W/m²
Exterior Entrances and *Exterior Exits*					
Main entries		66 W/m of door width	66 W/m of door width	98 W/m of door width	98 W/m of door width
Other doors	No allowances	66 W/m of door width	66 W/m of door width	66 W/m of door width	66 W/m of door width
Entry canopies		2.7 W/m²	2.7 W/m²	4.3 W/m²	4.3 W/m²
Sales Canopies					
Free-standing and attached	No allowances	6.5 W/m²	6.5 W/m²	8.6 W/m²	11.0 W/m²
Outdoor Sales					
Open areas (including vehicle sales lots)	No allowances	2.7 W/m²	2.7 W/m²	5.4 W/m²	7.5 W/m²
Street frontage for vehicle sales lots in addition to “open area” allowance		No allowance	33 W/m	33 W/m	98 W/m

4.2.4. Exterior Lighting Controls

4.2.4.1. Requirements

1) Except as provided in Sentences (2) and (3), *exterior lighting* shall be controlled by

a) astronomical time controls,
b) photosensors,
c) a combination of photosensors and timer shut-off switch, or
d) other types of controls that perform the same function as those referred to in Clauses (a) to (c).

5.2.3.2. Constant-Volume Fan Systems

1) Where fans produce a constant airflow rate whenever the system is operating, the power demand required by the motors for the combined supply and return fan system at design conditions shall not exceed 1.6 W per L/s of supply air delivered to the *conditioned space*, calculated using the following equation:

$$W = 0.001 \cdot F \cdot SP/\eta$$

where

W = power demand, in watts,
F = design flow rate, in L/s,
SP = design static pressure across the fan, in Pa, and
η = combined fan-drive-motor efficiency, expressed as a decimal fraction.

(See Appendix A.)

5.2.3.3. Variable-Air-Volume Fan Systems

1) For fan systems through which airflow varies automatically as a function of load, the power demand required by the motors for the combined supply and return fan system, as calculated using the equation in Sentence 5.2.3.2.(1), shall not exceed 2.65 W per L/s of supply air delivered to the *conditioned space* at design conditions. (See Appendix A.)

2) In variable-air-volume systems, any individual supply, relief or return fan with a power demand greater than 7.5 kW and less than 25 kW, as calculated using the equation in Sentence 5.2.3.2.(1), shall incorporate controls and devices such that, if air delivery volume is reduced to 50% of design air volume, the corresponding fan power demand will be no more than 55% of design wattage, based on the manufacturer's test data.

3) In variable-air-volume systems, any individual supply, relief or return fan with a power demand equal to or greater than 25 kW, as calculated using the equation in Sentence 5.2.3.2.(1), shall incorporate controls and devices necessary to prevent the fan motor from demanding more than 30% of design wattage at 50% of design air volume, based on the manufacturer's test data.

5.2.4. Air Intake and Outlet Dampers

5.2.4.1. Required Dampers

1) Except as provided in Sentences (2) to (4), every duct or opening intended to discharge air from a *conditioned space* to the outdoors or to unconditioned space, and every outdoor air intake duct or opening shall be equipped with a motorized damper.

2) Where dampers are not permitted by other regulations, air intakes and outlets need not comply with Sentence (1).

3) Air intakes and outlets serving HVAC systems required to operate continuously need not comply with Sentence (1).

4) Where the duct or opening does not exceed 0.08 m^2 in cross-sectional area, air intake dampers required by Sentence (1) are permitted to be manually operated and air outlet dampers required by Sentence (1) are permitted to consist of gravity or spring-operated backflow dampers.

5.2.4.2. Type and Location of Dampers

1) Except as provided in Sentences (3) and (4), dampers required by Article 5.2.4.1. shall be

a) located as near as possible to the plane of the *building envelope*, and
b) designed to close automatically when the HVAC system is not in operation.

2) Motorized dampers required in Sentence 5.2.4.1.(1) shall be designed so that, when the damper is in the closed position, airflow does not exceed 15 L/s per m^2 of

cross-sectional area at a pressure differential of 250 Pa, when tested in accordance with AMCA 500, "Louvers, Dampers and Shutters."

3) Dampers required in Article 5.2.4.1. are permitted to be located inboard of the *building envelope*, provided the portion of the duct between the damper and the *building envelope* is insulated in conformance with Sentence 5.2.2.5.(4) for ducts located outdoors.

4) Dampers in air intakes and outlets serving air-heating or -cooling equipment located outside of the *building envelope* are permitted to be located within the equipment.

5.2.5. Piping for Heating, Ventilating and Air-conditioning Systems

5.2.5.1. Design and Installation of Piping

1) HVAC piping shall be designed and installed in accordance with the NBC.

5.2.5.2. Provision for Balancing

1) All hydronic systems shall be designed so that they can be balanced. (See Appendix A.)

5.2.5.3. Piping Insulation

1) Except as provided in Sentences (2) to (5), piping forming part of an HVAC system shall be thermally insulated in accordance with Table 5.2.5.3.

2) Except for suction-line piping of direct expansion systems, piping located within *conditioned space* in a *dwelling unit* and serving only that *dwelling unit* need not comply with Sentence (1).

3) HVAC piping located outside the *building envelope* shall be insulated to the level specified in Table 5.2.5.3. for heating system piping conveying fluid with design operating temperatures above 177°C.

4) HVAC piping that conveys fluids with design operating temperatures greater than 13°C and less than 41°C need not comply with Table 5.2.5.3.

5) Where piping insulation has a thermal conductivity that is greater than the ranges given in Table 5.2.5.3., the insulation thickness given in the Table shall be increased by the ratio u2/u1, where u1 is the value at the higher end of the conductivity range for the operating temperature and u2 is the measured thermal conductivity of the insulation at the mean rating temperature.

6) Where piping insulation has a thermal conductivity that is lower than the ranges given in Table 5.2.5.3., the insulation thickness given in the Table may be decreased by the ratio u2/u1, where u1 is the value at lower end of the conductivity range for the operating temperature and u2 is the measured thermal conductivity of the insulation at the mean rating temperature.

7) The thermal conductivity of piping insulation at a mean rating temperature shall be determined in conformance with ASTM C 335/C 335M, "Steady-State Heat Transfer Properties of Pipe Insulation."

8) Insulation material required in Sentence (1) shall be installed in accordance with good practice. (See A-5.2.2.5.(6) and 5.2.5.3.(8) in Appendix A.)

5) Vestibules between *conditioned spaces* and the outdoors shall have a temperature-control device that limits the maximum heating temperature in the vestibule to 15°C.

5.2.8.6. Ice- and Snow-Melting Heater Controls

1) Ice- and snow-melting heaters shall be provided with automatic controls or readily accessible manual controls that allow them to be shut down when not required.

5.2.8.7. Control of Temperature of Air Leaving the Supply Air Handler

1) Except as provided in Sentences (2) and (3), a *supply air handler* shall be designed and equipped with controls to achieve the design supply air temperature without

a) heating previously cooled air,
b) cooling previously heated air, or
c) heating outdoor air, separately from the return air or mixed with it, in excess of the minimum required for ventilation.

2) Reheating supply air for humidity control is permitted where specified humidity levels are required. (See Appendix A.)

3) Reheating supply air is permitted where such reheating will not cause an increase in energy consumption.

5.2.8.8. Control of Space Temperature by Reheating or Recooling

1) Except as provided in Sentence (4), HVAC systems that control the temperature of a space by reheating previously cooled air shall be equipped with controls that automatically adjust the temperature of the cool air supply to the highest temperature that will satisfy the *temperature-control zone* requiring the coolest air.

2) Except as provided in Sentence (4), HVAC systems that control the temperature of a space by recooling previously heated air shall be equipped with controls that automatically adjust the temperature of the warm air supply to the lowest temperature that will satisfy the *temperature-control zone* requiring the warmest air.

3) Except as provided in Sentence (4), HVAC systems that control the temperature of a space by mixing heated supply air and cooled supply air shall be equipped with controls that

a) automatically adjust the temperature of the warm supply air to the lowest temperature that will satisfy the *temperature-control zone* requiring the warmest air, and
b) automatically adjust the temperature of the cool supply air to the highest temperature that will satisfy the *temperature-control zone* requiring the coolest air.

4) HVAC systems that are designed to reduce the air supplied to each *temperature-control zone* to no more than 2 L/s per m^2 of *floor surface area* of the *temperature-control zone* before reheating, recooling or mixing of supply air takes place need not comply with Sentences (1) to (3).

5.2.9. Humidification

5.2.9.1. Humidification Controls

1) If an HVAC system is equipped with a means for adding or removing moisture to maintain specific humidity levels in a space, an automatic humidity control device shall be provided.

5.2.10. Heat Recovery

5.2.10.1. Heat-Recovery Systems

1) Except as provided in Sentence (3), when the sensible heat content of an exhaust air system as calculated in accordance with Sentence (4) exceeds 150 kW, the system

shall be equipped with a heat-recovery apparatus capable of recovering sensible heat with a minimum 50% efficiency. (See Appendix A.)

2) Heat recovered in accordance with Sentence (1) shall be used in *building* systems.

3) Specialized exhaust systems, such as those used to exhaust smoke, grease-laden vapours, or toxic, flammable, paint, or corrosive fumes or dust, need not comply with Sentence (1).

4) The sensible heat, in kW, referred to in Sentence (1), which is the sensible heat content of the total quantity of exhaust, shall be calculated as follows:

$$\text{Sensible Heat} = 0.00123 \cdot Q \cdot (T_e - T_o)$$

where

Q = rated capacity of exhaust system at normal exhaust air temperature, in L/s,
T_e = temperature of exhaust air before heat recovery, in °C, and
T_o = outdoor 2.5% January design temperature, in °C (see Appendix A).

5) At airflow rates not less than the system design capacity, the sensible-heat-recovery efficiency of a heat-recovery apparatus referred to in Sentence (1) shall be determined in conformance with

a) the test method described in ANSI/AHRI 1060, "Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation," or
b) another acceptable test method.

5.2.10.2. Heat Recovery from Dehumidification in Swimming Pools

1) Except for pools with a water surface area of less than 10 m² and except as provided in Sentence (2), systems that exhaust air from swimming pools within *conditioned spaces* shall be capable of recovering at least 40% of the sensible heat from exhaust air at design conditions, as calculated in accordance with Sentence 5.2.10.1.(4). (See Appendix A.)

2) Indoor swimming pools need not comply with Sentence (1), provided a stationary mechanical or desiccant dehumidification system is installed that provides at least 80% of the dehumidification that would result from compliance with Sentence (1).

5.2.10.3. Heat Recovery from Ice-making Machines in Ice Arenas and Curling Rinks

1) Where an ice arena or a curling rink has a heating requirement, the refrigeration system shall incorporate a means of recovering the heat rejected by the system to satisfy some or all of the *building*'s space-heating or *service water* heating requirements. (See Appendix A.)

5.2.10.4. Heat Recovery in Dwelling Units

1) Except for climate zones 4, 5 and 6, where a self-contained mechanical ventilation system serves a single *dwelling unit*, the principal exhaust component of the ventilation system shall be equipped with heat-recovery capability. (See Appendix A.)

2) Heat-recovery ventilators used to meet the requirements of Sentence (1) shall have a sensible-heat-recovery efficiency, when tested in conformance with the low-temperature thermal and ventilation test methods described in CAN/CSA-C439, "Rating the Performance of Heat/Energy-Recovery Ventilators," of

a) at least 65% at an outside air test temperature of 0°C, and
b) not less than that required by Table 5.2.10.4. for the 2.5% January design temperature for the *building*'s location, as listed in Appendix C of Division B of the NBC.

(See Appendix A.)

Table 5.2.12.1. (Continued)

Computer Room Air Conditioners				
Component or Equipment	Cooling or Heating Capacity, kW (Btu/h)	Standard	Rating Conditions[1]	Minimum Performance[2]
Air conditioners, air-cooled	< 19 (65 000)	ANSI/ASHRAE 127	—	SCOP = 2.20 / 2.09
	≥ 19 (65 000) and < 70 (240 000)			SCOP = 2.10 / 1.99
	≥ 70 (240 000)			SCOP = 1.90 / 1.79
Air conditioners, water-cooled	< 19 (65 000)			SCOP = 2.60 / 2.49
	≥ 19 (65 000) and < 70 (240 000)			SCOP = 2.50 / 2.39
	≥ 70 (240 000)			SCOP = 2.40 / 2.29
Air conditioners, water-cooled with fluid economizer	< 19 (65 000)			SCOP = 2.55 / 2.44
	≥ 19 (65 000) and < 70 (240 000)			SCOP = 2.45 / 2.34
	≥ 70 (240 000)			SCOP = 2.35 / 2.24
Air conditioners, glycol-cooled	< 19 (65 000)		rated at 40% propylene glycol	SCOP = 2.50 / 2.39
	≥ 19 (65 000) and < 70 (240 000)			SCOP = 2.15 / 2.04
	≥ 70 (240 000)			SCOP = 2.10 / 1.99
Air conditioners, glycol-cooled with fluid economizer	< 19 (65 000)			SCOP = 2.45 / 2.34
	≥ 19 (65 000) and < 70 (240 000)			SCOP = 2.10 / 1.99
	≥ 70 (240 000)			SCOP = 2.05 / 1.94
Chilled water air handler	< 19 (65 000)		—	SCOP = 8.00 / 6.06
	≥ 19 (65 000) and < 70 (240 000)			SCOP = 9.00 / 7.06
	≥ 70 (240 000)			SCOP = 11.00 / 9.06
Packaged Water Chillers				
Component or Equipment	Cooling or Heating Capacity, kW (Btu/h)	Standard	Rating Conditions[1]	Minimum Performance[2]
Vapour compression, air- or water-cooled, electrically operated	< 5 600 (19 000 000)	CAN/CSA-C743	—	See standard
Absorption, single- or double-effect, indirect- or direct-fired				

Table 5.2.12.1. (Continued)

Boilers				
Component or Equipment	Cooling or Heating Capacity, kW (Btu/h)	Standard	Rating Conditions[1]	Minimum Performance[2]
Electric *boilers*	—	—	—	[3]
Gas-fired *boilers*[4]	< 88 (300 000)	ANSI Z21.13/CSA 4.9	—	AFUE = 85%
	≥ 88 (300 000) and < 733 (2 500 000)	ANSI Z21.13/CSA 4.9 or ASME PTC 4	—	$E_c \geq 82.5\%$ $E_t \geq 83.0\%$
	≥ 733 (2 500 000)		—	$E_c \geq 83.3\%$
Oil-fired *boilers*	< 88 (300 000)	CSA B212 or ASME PTC 4	—	AFUE ≥ 84.7%
	≥ 88 (300 000) and < 733 (2 500 000)			$E_t \geq 83.4\%$
	≥ 733 (2 500 000)			$E_c \geq 85.8\%$
Oil-fired *boilers*, residual (No. 5 or No. 6 oil) and other	< 88 (300 000)	CSA B212	—	AFUE ≥ 84.7%
	≥ 88 (300 000) and < 733 (2 500 000)	ASME PTC 4		$E_t \geq 83.4\%$
	≥ 733 (2 500 000)			$E_c \geq 85.8\%$
Warm-Air Furnaces, Combination Warm-Air Furnace/Air-conditioning Units, Duct Furnaces and Unit Heaters				
Component or Equipment	Cooling or Heating Capacity, kW (Btu/h)	Standard	Rating Conditions[1]	Minimum Performance[2]
Gas-fired warm-air *furnaces*[4][5]	≤ 117.23 (400 000)	ANSI Z21.47/CSA 2.3	—	AFUE ≥ 92.4%
	> 117.23 (400 000)		Maximum rated capacity, steady-state	$E_t \geq 81\%$
			Minimum rated capacity, steady-state	$E_t \geq 81\%$
Gas-fired duct *furnaces*[4][5]	≤ 117.23 (400 000)	ANSI Z83.8/CSA 2.6	—	$E_t \geq 81\%$
Gas-fired *unit heaters*[4]				$E_t \geq 82\%$
Oil-fired warm-air *furnaces*[5]	≤ 66 (225 000)	CSA B212		$E_t \geq 84.5\%$
	> 66 (225 000)	CAN/CSA-B140.4		$E_t \geq 81.3\%$
Oil-fired duct *furnaces*[5] and *unit heaters*	—			$E_t \geq 81\%$

Notes to Table 5.2.12.1.:

(1) The abbreviations that appear in this column have the following meanings:

db = dry bulb outdoor air temperature
wb = wet bulb outdoor air temperature

(2) The symbols and abbreviations that appear in this column have the following meanings:

AFUE = annual fuel utilization efficiency, in %
Cap_c = rated cooling capacity, in W(Btu/h)
COP = *coefficient of performance*, in W/W
E_c = *combustion efficiency*, in %
EER = *energy efficiency ratio*, in (Btu/h)/W
E_t = *thermal efficiency*, in %
ICOP = integrated *coefficient of performance*, in W/W
IPLV = *integrated part-load value* (no units)
SCOP = sensible *coefficient of performance*, in downflow units/upflow units (first value is downflow; second value is upflow). The SCOP is a ratio that is calculated by dividing the net sensible cooling capacity, in W, by the total power input, in W (excluding re-heaters and humidifiers).
SEER = *seasonal energy efficiency ratio*, in (Btu/h)/W (no metric equivalent)

(3) No standards address the performance efficiency of electric *boilers*; however, their efficiency typically approaches 100%.

(4) Includes propane.

(5) Excludes packaged rooftop units.

Part 6
Service Water Heating Systems

Section 6.1. General

6.1.1. General

6.1.1.1. Scope

1) This Part is concerned with the systems used to heat *service water*.

6.1.1.2. Application

1) This Part applies to *service water* heating systems.

6.1.1.3. Compliance

1) Except as provided in Sentence (2), compliance with this Part shall be achieved by following

a) the prescriptive path described in Section 6.2.,
b) the trade-off path described in Section 6.3., or
c) the performance path described in Section 6.4. (see A-3.1.1.3.(1)(c) in Appendix A).

(See Appendix A.)

2) Back-up systems shall comply with the prescriptive requirements stated in Section 6.2.

6.1.1.4. Definitions

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

Section 6.2. Prescriptive Path

6.2.1. System Design

6.2.1.1. Regulations

1) *Service water* heating systems shall be designed in accordance with the relevant provincial, territorial or municipal *building* regulations or, in the absence of such regulations, or where *service water* heating systems are not covered by such regulations, with the National Plumbing Code of Canada 2010.

6.2.2. Water Heating Equipment and Storage Vessels

6.2.2.1. Equipment Efficiency

1) Storage-type and non-storage-type *service water* heaters and pool heaters shall comply with the performance requirements stated in Table 6.2.2.1. (See Appendix A.)

Table 6.2.2.1.
Service Water Heating Equipment Performance Standards
Forming Part of Sentences 5.2.12.3.(1), 6.2.2.1.(1), 6.2.2.4.(2), 6.2.2.5.(1), 6.3.2.5.(1) and 6.3.2.6.(1)

Storage-Type and Non-Storage-Type (Instantaneous) Service Water Heaters							
Component	Input	Capacity, L	V_t, L (US gal.)	Input/V_t, W/L (Btu/h/US gal.)	Standard	Rating Conditions	Performance Requirement(1)
Electric	≤ 12 kW	50 – 270	—	—	CAN/CSA-C191	See standard	SL ≤ 35 + 0.20V (top inlet) SL ≤ 40 + 0.20V (bottom inlet)
	—	> 270 and ≤ 454					SL ≤ (0.472V) – 38.5 (top inlet) SL ≤ (0.472V) – 33.5 (bottom inlet)
	> 12 kW	> 454			ANSI Z21.10.3/CSA 4.3(2)	Δt = 44.4°C (80°F)	E_t ≥ 98% EF ≥ 0.98
Heat pump water heaters	≤ 24 A and ≤ 250 V	—	—	—	CAN/CSA-C745	—	EF ≥ 2.1
Gas-fired	< 22 kW	—	—	—	CAN/CSA-P.3	—	EF ≥ 0.67 – 0.0005V
	> 117 kW		—	< 310 (4000)	ANSI Z21.10.3/CSA 4.3	Δt = 50°C (90°F)	E_t ≥ 80%
			< 37.8 (10)	≥ 310 (4000)			E_t ≥ 80%(3)
			≥ 37.8 (10)			Δt = 50°C (90°F)	E_t ≥ 77%(3)
Oil-fired, instantaneous	≤ 61.5 kW(4)	—	—	—	DOE 10 CFR, Part 430, Subpart B, Appendix E	—	EF ≥ 0.59 – 0.0019 V
	Others	—	—	< 310 (4000)	ANSI Z21.10.3/CSA 4.3	Δt = 50°C (90°F)	E_t ≥ 78%(3) SL ≤ 1.3 + 95/V_t(2)
			< 37.8 (10)	≥ 310 (4000)		—	E_t ≥ 80%(3)
			≥ 37.8 (10)			Δt = 50°C (90°F)	E_t ≥ 77% SL ≤ 2.3 + 67/V_t(2)
Oil-fired, storage-type	≤ 30.5 kW	≤ 190	—	—	CAN/CSA-B211	—	EF ≥ 0.55
		> 190			DOE 10 CFR, Part 430, Subpart B, Appendix E		
	> 30.5 kW	> 190	—	< 310 (4000)	ANSI Z21.10.3/CSA 4.3	Δt = 50°C (90°F)	EF ≥ 0.55
			< 37.8 (10)	≥ 310 (4000)		—	EF ≥ 0.55
			≥ 37.8 (10)			Δt = 50°C (90°F)	EF ≥ 0.55 SL ≤ 2.3 + 67/V_t(2)
Pool Heaters							
Component	Input	Capacity, L	V_t, L (US gal.)	Input/V_t, W/L (Btu/h/US gal.)	Standard	Rating Conditions	Performance Requirement(1)
Gas-fired(2)	< 117.2 kW	—	—	—	ANSI Z21.56/CSA 4.7	—	E_t ≥ 78%
Oil-fired	—						E_t ≥ 78%(3)

Notes to Table 6.2.2.1.:

(1) The symbols and abbreviations used in this column have the following meanings:

V_t = tank storage volume, in L, as measured according to the referenced standard
SL = *standby losses,* in %/h or in W, depending on standard
E_t = *thermal efficiency* with 38.9°C (70°F) water temperature difference
EF = *energy factor*, in %/h
V = storage volume, in L, as specified by the manufacturer

Table 6.2.2.1. (Continued)

(2) When testing an electric *storage-type service water heater* for *standby losses* using the test procedure described in Section 2.9. of the referenced standard, the electrical supply voltage shall be maintained within ±1% of the centre of the voltage range specified on the water heater nameplate. Also, when needed for calculations, the *thermal efficiency* (E_t) shall be 98%.

(3) Includes propane.

(4) Consistent with the US National Appliance Energy Conservation Act of 1987.

6.2.2.2. Equipment Insulation

1) Except for tanks covered by Article 6.2.2.1., hot *service water* storage tanks shall be covered with insulation having a maximum U-value of 0.45 W/(m²·K).

2) Tank insulation referred to in Sentence (1) that is installed in areas where it may be subject to mechanical damage shall be protected.

6.2.2.3. Solar Thermal Service Water Heating Equipment

1) *Service water* heating equipment using solar thermal technology shall be designed and installed in accordance with

a) the manufacturer's procedures, or
b) CAN/CSA-F379 SERIES, "Packaged Solar Domestic Hot Water Systems (Liquid-to-Liquid Heat Transfer)."

6.2.2.4. Combination Service Water Heating and Space-Heating Equipment

1) Combination *service water* heating and space-heating equipment is only permitted to be used where input to the combination equipment is

a) less than 22 kW, or
b) less than twice the design *service water* heating load.

2) Where combination equipment referred to in Sentence (1) is used, its performance shall meet the greater of the minimum energy efficiency ratings for *service water* heating equipment and space-heating equipment required in the applicable standards listed in Table 5.2.12.1. or 6.2.2.1. or, where such equipment is not covered in these Tables, with the Energy Efficiency Act and its Regulations.

6.2.2.5. Space-Heating Equipment Used for Indirect Service Water Heating

1) Space-heating equipment used solely to provide indirect *service water* heating or used to provide a combination of space heating and indirect *service water* heating shall meet the greater of the minimum energy efficiency ratings for *service water* heating equipment and space-heating equipment required in the applicable standards listed in Table 5.2.12.1. or 6.2.2.1. or, where such equipment is not covered in these Tables, with the Energy Efficiency Act and its Regulations.

6.2.3. Piping

6.2.3.1. Insulation

1) All piping conveying hot *service water* in circulating systems, non-circulating systems without *heat traps* and non-circulating systems with electric heating elements along the pipes to maintain temperature shall be insulated in accordance with Table 6.2.3.1. and Sentences (2) to (4). (See Appendix A.)

2) Where piping insulation has a thermal conductivity, as determined in accordance with Sentence (4), that is greater than the range given in Table 6.2.3.1., the thickness given in the Table shall be increased by the ratio u2/u1, where u1 is the value at the higher end of the conductivity range for the operating temperature and u2 is the measured thermal conductivity of the insulation at the mean rating temperature.

3) Where piping insulation has a thermal conductivity, as determined in accordance with Sentence (4), that is lower than the range given in Table 6.2.3.1., the thickness given in the Table may be decreased by the ratio u2/u1, where u1 is the value

at the lower end of the conductivity range for the operating temperature and u2 is the measured thermal conductivity of the insulation at the mean rating temperature.

4) The thermal conductivity of piping insulation at the mean rating temperature shall be determined in conformance with ASTM C 335/C 335M, "Steady-State Heat Transfer Properties of Pipe Insulation."

5) On non-circulating systems with *heat traps*, the inlet and outlet piping between the storage or heating vessel and the *heat traps* as well as the first 2.4 m of outlet piping downstream of the *heat trap*, shall be insulated in accordance with Table 6.2.3.1. and Sentences 5.2.5.3.(5) to (7).

Table 6.2.3.1.
Minimum Thickness of Piping Insulation for Service Water Heating Systems
Forming Part of Sentences 6.2.3.1.(1), (2), (3) and (5)

Location of Piping	Thermal Conductivity of Insulation		Nominal Pipe Diameter, in. (mm)	Minimum Thickness of Piping Insulation,(1) mm
	Conductivity Range, W/m·°C	Mean Rating Temperature, °C		
Conditioned space	0.035-0.040	38	Runouts(1) ≤ 2 (51)	25.4
			≤ 1 (25.4)	
			1¼ to 2 (32 to 51)	
			2½ to 4 (64 to 102)	38.1
			≥ 5 (127)	
Unconditioned space or outside	0.046-0.049	38	Runouts(1) ≤ 2 (51)	38.1
			≤ 1 (25.4)	63.5
			1¼ to 2 (32 to 51)	
			2½ to 4 (64 to 102)	76.2
			≥ 5 (127)	88.9

Notes to Table 6.2.3.1.:
(1) Applies to recirculating sections of *service water* heating systems and to the first 2.4 m from storage tanks for non-recirculating systems.

6.2.4. Controls

6.2.4.1. Temperature Controls

1) *Service water* heating systems with storage tanks shall be equipped with automatic temperature controls capable of adjustment between the lowest and the highest acceptable temperature settings for the intended use. (See Appendix A.)

6.2.4.2. Shutdown

1) Except for systems whose storage capacity is less than 100 L, each *service water* heating system shall be equipped with a readily accessible and clearly labeled shut-off device that allows the system, including any heating elements installed along the pipes to maintain temperature, to be shut-off. (See Appendix A.)

Section 6.4. Performance Path

(See A-1.1.2.1. in Appendix A.)

6.4.1. General

6.4.1.1. Scope

1) Subject to the limitations stated in Article 6.4.1.2., where the *service water* heating system does not comply with the requirements of Section 6.2. or 6.3., it shall comply with Part 8.

6.4.1.2. Limitations

1) Notwithstanding use of the performance path, all *service water* heating appliances and equipment shall comply with the applicable appliance or equipment energy efficiency act or, in the absence of such an act or where the appliance or equipment is not covered by such an act, with the applicable performance standard.

2) This Section does not apply to back-up SWH systems, which shall comply with Sentence 6.1.1.3.(2).

Section 6.5. Objective and Functional Statements

6.5.1. Objective and Functional Statements

6.5.1.1. Attributions to Acceptable Solutions

1) For the purpose of compliance with this Code as required in Clause 1.2.1.1.(1)(b) of Division A, the objective and functional statements attributed to the acceptable solutions in this Part shall be the objective and functional statements listed in Table 6.5.1.1. (See A-1.1.3.1.(1) in Appendix A.)

Table 6.5.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 6
Forming Part of Sentence 6.5.1.1.(1)

Functional Statements and Objectives[1]	
6.2.1.1. Regulations	
(1)	[F96,F98-OE1.1]
6.2.2.1. Equipment Efficiency	
(1)	[F96,F98-OE1.1]
6.2.2.2. Equipment Insulation	
(1)	[F93,F96-OE1.1]
(2)	[F93,F96-OE1.1]
6.2.2.3. Solar Thermal Service Water Heating Equipment	
(1)	[F96,F98,F99-OE1.1]
6.2.2.4. Combination Service Water Heating and Space-Heating Equipment	
(1)	[F95,F96,F98,F99-OE1.1]
(2)	[F95,F96,F98,F99-OE1.1]
6.2.2.5. Space-Heating Equipment Used for Indirect Service Water Heating	
(1)	[F95,F96,F98,F99-OE1.1]

Table 6.5.1.1. (Continued)

Functional Statements and Objectives[1]	
6.2.3.1. Insulation	
(1)	[F92,F93-OE1.1]
(2)	[F92,F93-OE1.1]
(4)	[F92,F93-OE1.1]
(5)	[F92,F93-OE1.1]
6.2.4.1. Temperature Controls	
(1)	[F96-OE1.1]
6.2.4.2. Shutdown	
(1)	[F96-OE1.1]
6.2.4.3. Maintaining Temperature of Hot Service Water	
(1)	[F96-OE1.1]
6.2.5.1. Remote or Booster Heaters	
(1)	[F96-OE1.1]
6.2.6.1. Showers	
(1)	[F96-OE1.1]
(2)	[F96-OE1.1]
6.2.6.2. Lavatories	
(1)	[F96-OE1.1]

Table 6.5.1.1. (Continued)

Functional Statements and Objectives[1]	
(2)	[F96-OE1.1]
6.2.7.1. Controls	
(1)	[F95,F96,F99-OE1.1]
(2)	[F95,F96,F99-OE1.1]
6.2.7.2. Pool and Hot Tub Covers	
(1)	[F95-OE1.1]
(2)	[F95-OE1.1]
6.3.1.1. Application	
(1)	[F96,F99-OE1.1]
6.3.1.3. Compliance	
(1)	[F96,F99-OE1.1]
6.3.2.1. SWH Trade-off Index	
(1)	[F96,F99-OE1.1]
(2)	[F96,F99-OE1.1]
(3)	[F96,F99-OE1.1]
6.3.2.2. Determination of Peak Daily Flow Ratio	
(1)	[F96,F99-OE1.1]
6.3.2.3. Determination of Normalized Tank Area	
(1)	[F96,F99-OE1.1]
6.3.2.4. Determination of Normalized Tank Diameter	
(1)	[F96,F99-OE1.1]
6.3.2.5. Determination of Trade-off Values of Components, ToV_i	
(1)	[F96,F99-OE1.1]
6.3.2.6. Determination of Reference Heat Generator Efficiency, η_{ref}	
(1)	[F96,F99-OE1.1]
6.4.1.2. Limitations	
(1)	[F98,F99-OE1.1]

Notes to Table 6.5.1.1.:

(1) See Parts 2 and 3 of Division A.

Part 7
Electrical Power Systems and Motors

Section 7.1. General

7.1.1. General

7.1.1.1. Scope

1) This Part is concerned with electrical power systems and motors for the application listed in Article 7.1.1.2.

7.1.1.2. Application

1) This Part applies to the electrical power systems and motors that are connected to the *building*'s electrical service. (See Appendix A.)

7.1.1.3. Compliance

1) Compliance with this Part shall be achieved by following
a) the prescriptive path described in Section 7.2., or
b) the performance path described in Section 7.4. (see A-3.1.1.3.(1)(c) in Appendix A).

(See Appendix A.)

7.1.1.4. Definitions

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

Section 7.2. Prescriptive Path

7.2.1. Electrical Distribution System

7.2.1.1. Monitoring

(See Appendix A.)

1) Electrical distribution systems whose load-carrying capacity is greater than 250 kVA shall be designed to facilitate the installation of a means to monitor the electrical energy consumption of
a) HVAC systems,
b) *interior lighting*, and
c) *exterior lighting*.

2) The electrical distribution systems of *buildings* with tenants or *dwelling units* shall have a means to separately monitor the electrical energy consumption of the total *building* and of each individual tenant or *dwelling unit*, excluding shared systems.

7.2.2. Voltage Drop

7.2.2.1. Feeders

1) Feeder conductors shall be sized for a maximum voltage drop of 2% at design load.

7.2.2.2. Branch Circuits

1) Branch circuit conductors shall be sized for a maximum voltage drop of 3% at design load.

7.2.3. Transformers

7.2.3.1. Transformer Selection

1) Transformers shall conform to
a) CAN/CSA-C802.1, "Minimum Efficiency Values for Liquid-Filled Distribution Transformers,"
b) CAN/CSA-C802.2, "Minimum Efficiency Values for Dry-Type Transformers,"or
c) CAN/CSA-C802.3, "Maximum Losses for Power Transformers."

7.2.4. Electrical Motors

7.2.4.1. Efficiency

1) Except for elevator motors and motors that are components of rated equipment, permanently wired polyphase motors serving the *building* shall have a nominal full-load motor efficiency not less than the minimum specified in Tables 3 and 5 of CSA C390, "Test Methods, Marking Requirements, and Energy Efficiency Levels for Three-Phase Induction Motors."

Section 7.3. Trade-off Path (Reserved)

Section 7.4. Performance Path

(See A-1.1.2.1. in Appendix A.)

7.4.1. General

7.4.1.1. Scope

1) Where electrical power systems and motors do not comply with the requirements of Section 7.2., they shall comply with Part 8.

Section 7.5. Objective and Functional Statements

7.5.1. Objective and Functional Statements

7.5.1.1. Attributions to Acceptable Solutions

1) For the purpose of compliance with this Code as required in Clause 1.2.1.1.(1)(b) of Division A, the objective and functional statements attributed to the acceptable solutions in this Part shall be the objective and functional statements listed in Table 7.5.1.1. (See A-1.1.3.1.(1) in Appendix A.)

Table 7.5.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 7
Forming Part of Sentence 7.5.1.1.(1)

Functional Statements and Objectives[1]	
7.2.2.1. Feeders	
(1)	[F99-OE1.1]

4) Where more than one energy type is used by the proposed *building*'s *service water* heating system,

a) the heating capacities of the reference *building*'s *service water* heating equipment shall match the ratio of the proposed *building*'s *service water* heating equipment capacity allocation, and
b) the operating schedule, priority of use and other operational characteristics of the proposed *building*'s use of energy types shall apply.

5) *Service water* heating equipment performance characteristics as a function of part-load shall be modeled in accordance with the part-load performance curves found in Table 8.4.4.22.G.

6) The *service water* heating system's supply temperature shall be modeled as being identical to that of the proposed *building*. (See Appendix A.)

7) Where a storage tank is to be modeled, the *service water* heating system's storage temperature shall be modeled as being identical to that of the proposed *building*. (See Appendix A.)

8) Where the proposed *building*'s *service water* heating system comprises multiple water heaters, the reference *building*'s *service water* heating system shall be modeled with the same number of water heaters.

9) Where the proposed *building*'s *service water* heating system is a recirculation system, the circulation pumps shall be modeled as

a) constant speed operation, and
b) having a flow rate that is identical to that of the proposed *building*'s circulation pumps.

8.4.4.22. Part-Load Performance Curves

1) Part-load performance curves for the reference *building*'s systems shall be calculated in accordance with Tables 8.4.4.22.A. to 8.4.4.22.G., as applicable.

Table 8.4.4.22.A.
Heating Equipment Part-Load Performance Characteristics
Forming Part of Sentences 8.4.4.10.(8) and 8.4.4.22.(1)

Boiler Part-Load Performance Curve(s)	The fuel consumption at part-load conditions, derived by applying an adjustment factor to the fuel consumption at design conditions, shall be calculated using the following equation. Condensing and non-condensing *boiler* curves fit the quadratic equation of FHeatPLC defined therein. For modulating *boilers*, values for $Q_{partload}/Q_{design}$ and corresponding values for FHeatPLC shall be those listed in the last row of this Table.

$$\mathrm{Fuel_{partload}} = \mathrm{Fuel_{design}} \cdot \mathrm{FHeatPLC} \quad (1)$$

where
$Fuel_{partload}$ = fuel consumption at part-load conditions, in Btu/h,
$Fuel_{design}$ = fuel consumption at design conditions, in Btu/h, and
FHeatPLC = fuel heating part-load efficiency curve determined using Equation (2) or values from the last row of this Table, as applicable.

$$\mathrm{FHeatPLC} = \left(\mathrm{a} + \mathrm{b} \cdot \frac{\mathrm{Q_{partload}}}{\mathrm{Q_{design}}} + \mathrm{c} \cdot \left(\frac{\mathrm{Q_{partload}}}{\mathrm{Q_{design}}}\right)^2\right) \quad (2)$$

where
$Q_{partload}$ = *boiler* capacity at part-load conditions, in Btu/h, or values from the last row of this Table, as applicable,
Q_{design} = *boiler* capacity at design conditions, in Btu/h, or values from the last row of this Table, as applicable, and
a, b, c = applicable values as follows:

Variable	Condensing *Boiler*	Non-condensing *Boiler*
a	0.00533	0.082597
b	0.904	0.996764
c	0.09066	–0.079361

Table 8.4.4.22.A. (Continued)

<table>
<tr><td>*Furnace* Part-Load Performance Curve(s)</td><td>The fuel consumption at part-load conditions, derived by applying an adjustment factor to the fuel consumption at rated conditions, shall be calculated using the following equation. Condensing and atmospheric *furnace* curves fit the quadratic equation of FHeatPLC defined therein. For modulating *furnaces*, values for $Q_{partload}/Q_{rated}$ and corresponding values for FHeatPLC shall be those listed in the last row of this Table.

$$\mathrm{Fuel_{partload}} = \mathrm{Fuel_{rated}} \cdot \mathrm{FHeatPLC} \quad (3)$$
where
$Fuel_{partload}$ = fuel consumption at part-load conditions, in Btu/h,
$Fuel_{rated}$ = fuel consumption at rated conditions, in Btu/h, and
FHeatPLC = fuel heating part-load efficiency curve determined using Equation (4) or values from the last row of this Table, as applicable.

$$\mathrm{FHeatPLC} = \left(\mathrm{a} + \mathrm{b} \cdot \frac{\mathrm{Q_{partload}}}{\mathrm{Q_{rated}}} + \mathrm{c} \cdot \left(\frac{\mathrm{Q_{partload}}}{\mathrm{Q_{rated}}}\right)^2\right) \quad (4)$$
where
$Q_{partload}$ = *furnace* capacity at part-load conditions, in Btu/h, or values from the last row of this Table, as applicable,
Q_{rated} = *furnace* capacity at rated conditions, in Btu/h, or values from the last row of this Table, as applicable, and
a, b, c = applicable values as follows:

<table>
<tr><th>Variable</th><th>Condensing *Furnace*</th><th>Atmospheric *Furnace*</th></tr>
<tr><td>a</td><td>0.00533</td><td>0.0186100</td></tr>
<tr><td>b</td><td>0.904</td><td>1.0942090</td></tr>
<tr><td>c</td><td>0.09066</td><td>–0.1128190</td></tr>
</table></td></tr>
<tr><td>Modulating *Boilers* and *Furnaces*</td><td>
<table>
<tr><th>$Q_{partload}$, Q_{rated} and Q_{design} (Part-Load Ratio)</th><th>FHeatPLC</th></tr>
<tr><td>0.1</td><td>0.118</td></tr>
<tr><td>0.2</td><td>0.209</td></tr>
<tr><td>0.3</td><td>0.308</td></tr>
<tr><td>0.4</td><td>0.407</td></tr>
<tr><td>0.5</td><td>0.506</td></tr>
<tr><td>0.6</td><td>0.605</td></tr>
<tr><td>0.7</td><td>0.704</td></tr>
<tr><td>0.8</td><td>0.802</td></tr>
<tr><td>0.9</td><td>0.901</td></tr>
<tr><td>1</td><td>1</td></tr>
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