2011 National Energy Code of Canada for Buildings (NECB)

2013 Revisions and Errata Package

Selected replacement pages have been produced for the NECB.

Please print and insert in your copy of the Code.

Revisions and Errata

Issued by the Canadian Commission on Building and Fire Codes

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

- Revisions are changes deemed urgent that have been approved by the Canadian Commission on Building and Fire Codes.
- Errata are corrections to existing text.
- Editorial updates are provided for information purposes only.

Code pages containing revisions and/or 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 revisions and 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	1.3.1.1.(1)	revision	2013-10-31	Date stated in Sentence was revised to read "30 June 2012"
B	Table 1.3.1.2.	erratum	2012-12-21	Document 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	Table 1.3.1.2.	revision	2013-10-31	Document references were updated as applicable to reflect more recent editions published as of June 30, 2012
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"

Change History — National Energy Code of Canada for Buildings 2011 (Continued)

Division	Code Reference	Change	Date (Y-M-D)	Description of Change
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	8.4.4.7.(3)	erratum	2013-10-31	Reference in Sentence was corrected to read "... in accordance with the requirements of Article 8.4.4.21. ..."
B	8.4.4.13.(1)	erratum	2013-10-31	Reference at beginning of Sentence was corrected to read "Where Article 5.2.2.7. applies ..."
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)
B	Table A-1.3.1.2.(1)	revision	2013-10-31	Document references were updated as applicable to reflect more recent editions published as of June 30, 2012
B	Figure A-4.2.2.9.	erratum	2013-10-31	Text in figure label was corrected to read "Obstruction is 1.5 m or higher"
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."

Part 1
General

Section 1.1. General

1.1.1. Application

1.1.1.1. Application

1) This Part applies to all *buildings* covered in this Code. (See Article 1.1.1.1. of Division A.)

1.1.2. Compliance

1.1.2.1. Prescriptive, Trade-off or Performance Compliance

(See Appendix A.)

1) *Buildings* shall comply with
a) the prescriptive or trade-off requirements stated in Parts 3 to 7, or
b) the performance requirements stated in Part 8.

1.1.3. Objective and Functional Statements

1.1.3.1. 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 Division B shall be the objective and functional statements identified in Sections 3.5., 4.5., 5.5., 6.5., 7.5. and 8.5. (See Appendix A.)

1.1.4. Basic Data and Calculation Methods

1.1.4.1. Climatic Values

1) The climatic values required for the design of *buildings* under this Code shall be in conformance with the values established by the *authority having jurisdiction* or, in the absence of such data, with the climatic values in Appendix C, Climatic and Seismic Information for Building Design in Canada, of the National Building Code of Canada for the location nearest to the *building* site. (See Appendix A.)

1.1.4.2. Calculation Procedures

1) Calculations carried out to ensure compliance with this Code and not described in the balance of this Subsection or in other Parts of the Code shall be carried out using procedures recognized for the particular purposes, such as those described in, but not limited to:
a) ASHRAE Handbooks, Standards and Guidelines,
b) HRAI Digest,
c) Hydronics Institute Manuals, and
d) ISO 13790 – Energy performance of buildings - Calculation of energy use for space heating and cooling.

Section 1.2. Terms and Abbreviations

1.2.1. Definitions of Words and Phrases

1.2.1.1. Non-defined Terms

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

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

3) Where acceptable solutions are referred to in Division B, they shall be the provisions stated in Parts 3 to 8.

1.2.1.2. Defined Terms

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

1.2.2. Symbols and Other Abbreviations

1.2.2.1. Symbols and Other Abbreviations

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

Section 1.3. Referenced Documents and Organizations

1.3.1. Referenced Documents

1.3.1.1. Effective Date

1) Unless otherwise specified herein, the documents referenced in this Code shall include all amendments, revisions, reaffirmations, reapprovals, addenda and supplements effective to 30 June 2012.

1.3.1.2. Applicable Editions

1) Where documents are referenced in this Code, they shall be the editions designated in Table 1.3.1.2. (See Appendix A.) (See also Appendix Note A-1.5.1.1.(1) of Division A.)

Table 1.3.1.2.
Documents Referenced in the National Energy Code of Canada for Buildings 2011
Forming Part of Sentence 1.3.1.2.(1)

Issuing Agency	Document Number[1]	Title of Document[2]	Code Reference
AAMA	501.5-07	Thermal Cycling of Exterior Walls	3.2.4.3.(2)
AHAM	ANSI/AHAM RAC-1-1982	Room Air Conditioners	Table 5.2.12.1.
AHRI	ANSI/AHRI 210/240-2008	Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment	Table 5.2.12.1.
AHRI	ANSI/AHRI 340/360-2007	Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment	Table 5.2.12.1.

Table 1.3.1.2. (Continued)

Issuing Agency	Document Number[1]	Title of Document[2]	Code Reference
AHRI	ANSI/AHRI 366 (SI)-2009	Performance Rating of Commercial and Industrial Unitary Air-Conditioning Condensing Units	Table 5.2.12.1.
AHRI	ANSI/AHRI 390-2003	Performance Rating of Single Package Vertical Air-Conditioners and Heat Pumps	Table 5.2.12.1.
AHRI	ANSI/AHRI 1061 (SI)-2011	Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment	5.2.10.1.(5)
AMCA	ANSI/AMCA 500-D-12	Testing Dampers for Rating	5.2.4.2.(2)
AMCA	ANSI/AMCA 500-L-12	Testing Louvers for Rating	5.2.4.2.(2)
ANSI/CSA	ANSI Z21.10.3-2011/CSA 4.3-2011	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 Z21.13-2010/CSA 4.9-2010	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 Z83.8-2009/CSA 2.6-2009	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 127-2012	Rating Computer and Data Processing Room Unitary Air-Conditioners	Table 5.2.12.1.
ASHRAE	ANSI/ASHRAE 140-2011	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 A112.18.1-2012/CSA B125.1-12[3]	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-10e1	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 1363-11	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)[4] 1.1.1.3.(1)[4] 1.1.1.3.(2)[4] 1.1.4.1.(1) 1.4.1.2.(1)[4] 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/A440-11	NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights	3.2.4.3.(3) 3.2.4.3.(4)

Table 1.3.1.2. (Continued)

Issuing Agency	Document Number[1]	Title of Document[2]	Code Reference
CSA	CAN/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	B125.3-12[3]	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.
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	CAN/CSA-C654-10	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	ANSI/AHRI 310/380-2004/CSA C744-04	Packaged Terminal Air-Conditioners and Heat Pumps	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-C860-11	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(11)	Thermal Performance Certification of Evaporative Heat Rejection Equipment	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	ANSI_ANSLG C82.11:2011	American National Standard for Lamp Ballasts–High-Frequency Fluorescent Lamp Ballasts	4.2.1.2.(2)
NFRC	100-2010	Determining Fenestration Product U-factors	3.1.1.5.(3)

Table 1.3.1.2. (Continued)

Issuing Agency	Document Number[1]	Title of Document[2]	Code Reference
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) Notwithstanding the effective date stated in Sentence 1.3.1.1.(1), the 2012 editions of ASME A112.18.1/CSA B125.1 and CSA B125.3 published on 12 December 2012 are referenced as they better meet the intent of the Code.

(4) 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 ..... CSA Group (5060 Spectrum Way, Suite 100, Mississauga, Ontario L4W 5N6; www.csagroup.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)

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

a) ANSI/AMCA 500-D-12, "Testing Dampers for Rating," and
b) ANSI/AMCA 500-L-12, "Testing Louvers for Rating."

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.)

8.4.4.6. Lighting

1) Except as provided in Sentences (2) and (3), the *installed interior lighting power* of the reference *building* shall be set at the *interior lighting power allowance* determined in Article 4.2.1.5. or 4.2.1.6., as applicable.

2) *Dwelling units* shall be modeled with an installed lighting power density of 5 W/m^2.

3) Where *occupant sensors* are required by Subsection 4.2.2., the *installed interior lighting power* shall be multiplied by an adjustment factor of 0.9.

4) The proportions of radiant and convective heat and the percentage of heat gain from lighting going directly to return air shall be modeled as being identical to those determined for the proposed *building* in Article 8.4.2.7.

8.4.4.7. Purchased Energy

1) Where a primary heating system of the proposed *building* uses purchased energy, the reference *building*'s corresponding system shall be modeled in accordance with the requirements of Article 8.4.4.10. adjusted as follows:

a) the energy type of each *boiler* shall be electricity,
b) each *boiler* shall have 100% efficiency, independent of load, and
c) the total capacity of the *boilers*, relative to the reference *building*'s total heating capacity, shall correspond to the ratio of the proposed *building*'s purchased energy capacity divided by its total heating capacity.

2) Where a primary cooling system of the proposed *building* uses purchased energy, the reference *building*'s corresponding system shall be modeled in accordance with the requirements of Article 8.4.4.11. adjusted as follows:

a) the energy type of each chiller shall be electricity,
b) each chiller shall have a COP of 1.0, independent of load, and
c) the total capacity of the chillers, relative to the reference *building*'s total cooling capacity, shall correspond to the ratio of the proposed *building*'s purchased energy capacity divided by its total cooling capacity.

3) Where a primary *service water* heating system of the proposed *building* uses purchased energy, the reference *building*'s corresponding system shall be modeled in accordance with the requirements of Article 8.4.4.21. adjusted as follows:

a) the energy type of each *service water* heater shall be electricity,
b) each *service water* heater shall have 100% efficiency, independent of load, and
c) the total capacity of the *service water* heaters, relative to the reference *building*'s total *service water* heating capacity, shall correspond to the ratio of the proposed *building*'s purchased energy capacity divided by its total heating capacity.

4) The operating schedule, priority of use and other operational characteristics of the proposed *building*'s use of purchased energy shall apply to the equipment representing the purchased energy in Sentences (1) to (3).

8.4.4.8. HVAC System Selection

1) Except as provided in Sentences (3) and (4), the type of HVAC system assigned to each *thermal block* of the reference *building* shall be determined based on each *thermal block*'s *building* or space type using Table 8.4.4.8.A. with the corresponding descriptions in Table 8.4.4.8.B.

Table 8.4.4.8.A.
HVAC System Selection for the Reference Building
Forming Part of Sentences 8.4.4.8.(1), 8.4.4.11.(1) and (7), 8.4.4.14.(1) and 8.4.4.19.(6)

Building or Space Type of the Proposed *Building*	Size of *Building* or Space[1][2]	Type of HVAC System Required[3]
Assembly Area: exhibit space, conference/meeting/multi-purpose room, performing arts/motion picture *theatre*, courtroom, classroom/lecture/training room, place of worship, fellowship hall, sports centre, arena and swimming pool seating area, waiting room	Maximum 4 *storeys*	System - 3
	More than 4 *storeys*	System - 6
Automotive Area: *repair garage* or parking garage, fire engine room, indoor truck dock, indoor bus or train platform	All sizes	System - 4
Data Processing Area: control room, data centre	All sizes	Where the proposed *building* or space has a cooling capacity exceeding 20 kW, the reference *building* or space shall use System - 2; otherwise, the reference *building* or space shall use System - 1.
General Area: office, banking, health care clinic, library, retail/mall concourse, gymnasium, athletic play area, swimming pool, exercise centre, dressing room, lighting control room, atrium	Maximum 2 *storeys*	System - 3
	More than 2 *storeys*	System - 6
Historical Collections Area: archival library, museum and gallery archives	All sizes	System - 2
Hospital Area: operating theatre, emergency room, patient/recovery room, clean room, hospital laboratories, forensics laboratory	All sizes	System - 3
Indoor Arena: ice rinks, curling rinks	All sizes	System - 7
Industrial Area: industrial manufacturing and workshop without dust exhausting hood	All sizes	System - 3 Where the reference *building* or space is a single zone, it can be divided into multiple units as long as it matches the proposed *building* or space's units.
Residential/Accommodation Area: multi-unit residential, hotel/motel guest room	All sizes	Where the proposed *building* or space is heated only, the reference *building* or space shall use System - 1.
		Where the proposed *building* or space is heated as well as being cooled with an air-cooled unitary, packaged terminal or room air-conditioner (or heat pumps), or fan coils, the reference *building* or space's HVAC system shall be modeled as being identical to that of the proposed *building* or space; otherwise, the reference *building* or space shall use through-the-wall systems.
Sleeping Area: dormitory, detention cell, sleeping quarters	All sizes	System - 3
Supermarket/Food Service Area:		
grocery store, bar lounge/leisure, cafeteria, fast food, family dining, food preparation without kitchen hood or vented appliance[4]	All sizes	System - 3
food preparation with kitchen hood or vented appliance[4]	All sizes	System - 4
Warehouse Area: fine, medium and bulky material storage, self-storage, material handling/sorting/baggage areas	All sizes of non-refrigerated space	System - 4
	All sizes of refrigerated space	System - 5

Notes to Table 8.4.4.8.A.:

(1) Spaces generally located in the same vicinity shall be grouped together for the purpose of selecting the reference *building*'s type of HVAC system.

(2) Small individual spaces in the proposed *building* that are located among larger spaces of another space type shall be considered ancillary to that larger space: for example, a conference room serving office spaces would be grouped with the office spaces as one space type. The HVAC system serving that space in the reference *building* shall be the same as the one for the larger space type.

(3) See Table 8.4.4.8.B. for descriptions of HVAC Systems 1 - 7.

(4) Vented appliances include, for example, steam dishwashers.

8.4.4.11. Cooling Systems

1) Except as provided in Sentence (2), the cooling system serving each *thermal block* of the reference *building* shall be determined in accordance with Table 8.4.4.8.A. and this Article.

2) Where the proposed *building* uses purchased energy, Article 8.4.4.7. shall apply to the reference *building*.

3) Except as provided in Sentence (4), the energy type of the reference *building*'s cooling system shall be modeled as being identical to that of the proposed *building*'s cooling system.

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

a) the cooling capacities of the reference *building*'s cooling equipment shall match the ratio of the proposed *building*'s cooling 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) Cooling equipment performance characteristics as a function of part-load shall be modeled in accordance with the part-load performance curves found in Tables 8.4.4.22.C. to 8.4.4.22.F.

6) Where a hydronic system is installed, the cooling plant shall be modeled as follows:

a) the cooling capacity of the cooling plant shall be the sum of the cooling capacities of the systems served by the plant, multiplied by the applicable oversize factor,
b) where the cooling capacity is not greater than 2 100 kW, the cooling plant shall be modeled with one water chiller,
c) where the cooling capacity is greater than 2 100 kW, the cooling plant shall be modeled with two water chillers, each having half the capacity of the cooling plant's capacity,
d) the water chiller's pumping system shall be modeled as a *primary system* with constant speed operation,
e) the water chiller's pumping flow rate shall be set considering
    i) the cooling plant's capacity,
    ii) use of pure water, and
    iii) a 6°C temperature rise,
f) the types of water chillers shall be modeled as being identical to those of the proposed *building*,
g) the chilled water supply temperature shall be set at 7°C, and
h) each water chiller shall be fully modulating down to 25% of its capacity.

7) Where Table 8.4.4.8.A. indicates that a cooling system is required in the *secondary system* as well as in a terminal device, the cooling capacity of each type of equipment shall be set as follows:

a) the cooling capacity of the terminal device shall meet the *thermal block*'s cooling load due to the transfer of energy through the *building envelope* and internal loads only,
b) the combined cooling capacities of the cooling systems in the terminal device and *secondary system* shall meet the peak cooling load of the *thermal blocks* served by the system, and
c) the applicable oversize factor shall apply on each type of equipment.

8) Where a direct-expansion system is modeled in the reference *building*, that system shall be modeled as follows:

a) the cooling capacity of the system shall be the sum of the cooling loads of the *thermal blocks* served by the system, multiplied by the applicable oversize factor,

b) where the cooling capacity of the system is not greater than 66 kW, the system shall be modeled with two stages of equal capacity, and
c) where the cooling capacity is greater than 66 kW, the system shall be modeled with a number of stages equal to its capacity divided by 66 kW and rounded up to the nearest integer.

9) For water-cooled systems, heat rejection to the atmosphere shall be modeled in accordance with Article 8.4.4.12.

8.4.4.12. Cooling Tower Systems

1) Where applicable, water-cooled systems shall be paired to a direct-contact cooling tower that has
a) a capacity equal to the nominal heat rejection rate of the equipment,
b) inlet and outlet water temperatures of 35°C and 29°C, respectively, and
c) an inlet outside air wet bulb temperature of 24°C.

2) A cooling tower with a capacity not greater than 1 750 kW shall be modeled with one cell.

3) A cooling tower with a capacity greater than 1 750 kW shall be modeled with a number of cells equal to its capacity divided by 1 750 and rounded up to the nearest integer.

4) The pumping system shall be modeled as constant speed operation.

5) The pumping flow rate shall be set considering
a) the cooling tower's capacity,
b) use of pure water, and
c) a 6°C temperature drop.

6) The fan of each cooling tower cell shall be modeled
a) as constant speed operation,
b) with a fan power equal to 0.015 multiplied by the cell's capacity in kW, and
c) with cycling control to maintain an outlet water temperature of 29°C.

8.4.4.13. Cooling with Outside Air

1) Where Article 5.2.2.7. applies to a proposed *building*'s HVAC system, the HVAC systems of the corresponding *thermal blocks* in the reference *building* shall be modeled in accordance with that Article and Table 8.4.4.13.

Table 8.4.4.13.
Applicable Requirements for Cooling with Outside Air According to Type of HVAC System
Forming Part of Sentence 8.4.4.13.(1)

Type of System	Applicable Article for Cooling with Outside Air
HVAC systems – 1, 3, 4 and 6(1)	5.2.2.8.
HVAC systems – 2, 5 and 7(1)	5.2.2.9.
All types of heat pump systems(2)	5.2.2.8.

Notes to Table 8.4.4.13.:
(1) See Table 8.4.4.8.B.
(2) See Table 8.4.4.14.

8.4.4.14. Heat Pumps

(See Appendix A.)

1) Except as provided in Sentence (2), where the proposed *building*'s HVAC system includes a water loop heat pump that supplies conditioned air to a *thermal block* or conditioned water to a hydronic loop, the reference *building*'s HVAC system for that *thermal block* shall be selected using Table 8.4.4.8.A. (See Appendix A.)

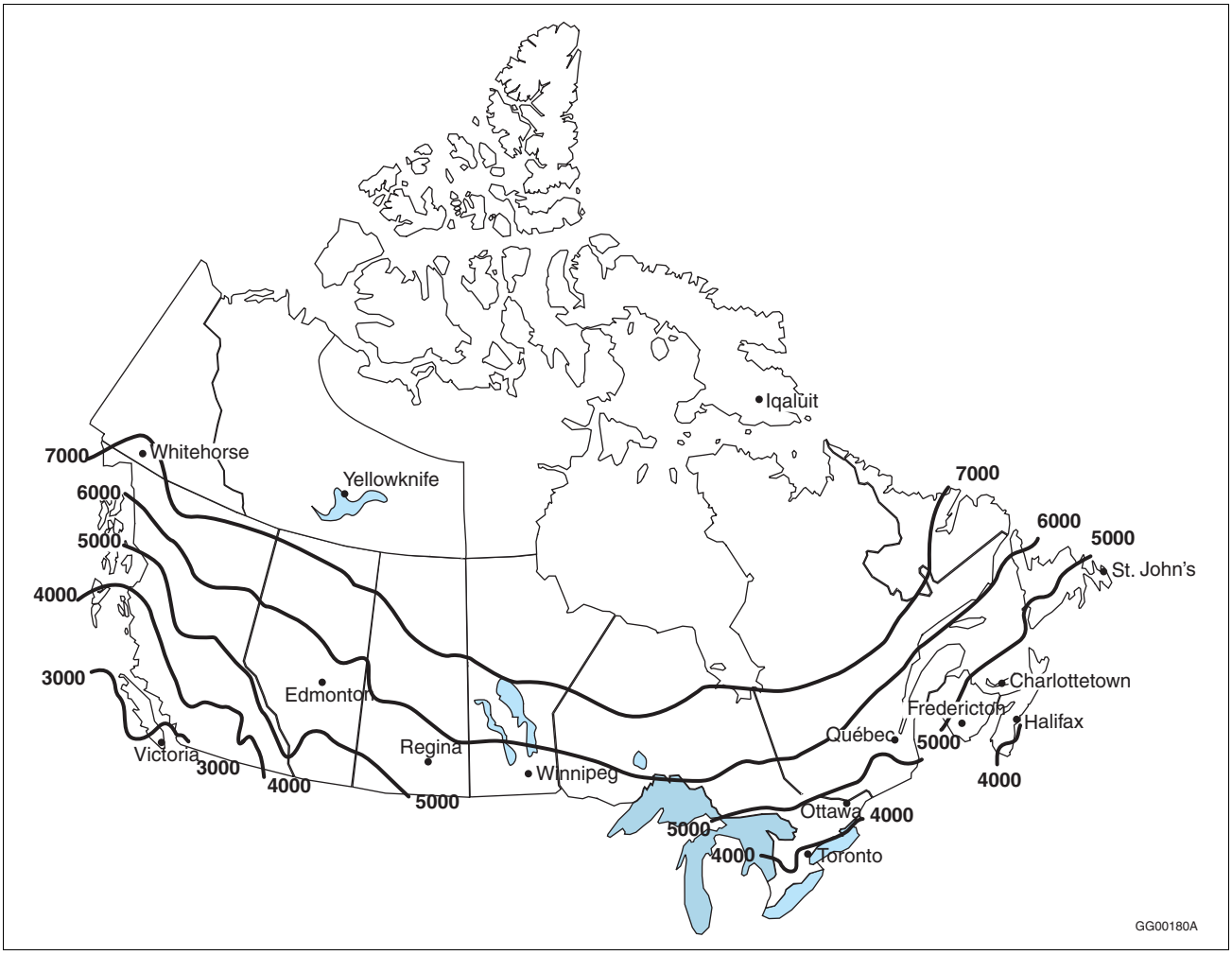

Figure A-1.1.4.1.(1)
Average annual heating degree-days (C-degrees)

A-1.3.1.2.(1) Applicable Editions. Where documents are referenced in the Appendices of this Code, they shall be the editions designated in Table A-1.3.1.2.(1).

Table A-1.3.1.2.(1)
Documents Referenced in the Appendices of the National Energy Code of Canada for Buildings 2011

Issuing Agency	Document Number(1)	Title of Document(2)	Code Reference
ASHRAE	2009	ASHRAE Handbook – Fundamentals	A-8.4.4.5.(1)
ASHRAE	2011	ASHRAE Handbook – HVAC Applications	A-6.2.4.1.(1)
ASHRAE	ANSI/ASHRAE/IES 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings	A-Table 3.2.2.2. A-5.2.10.1.(1)
ASHRAE	ASHRAE/IES 90.1-2010	User's Manual	A-5.2.10.4.(5) A-6.2.3.1.(1)
ASHRAE	ANSI/ASHRAE 111-2008	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems	A-5.2.5.2.(1)

Table A-1.3.1.2.(1) (Continued)

Issuing Agency	Document Number[1]	Title of Document[2]	Code Reference
CCBFC	NRCC 53301	National Building Code of Canada 2010	A-1.1.1.1.(1)[3] A-1.1.4.1.(1) A-3.2.1.1.(1)[3] A-3.2.1.2.(4) A-3.2.3.1.(3) A-5.2.2.8.(2) A-5.2.8.3.(1) A-5.2.10.1.(4) A-5.2.10.4.(1) A-5.2.10.4.(5) A-8.4.2.3. A-8.4.3.7.(1)
CCBFC	NRCC 53302	National Plumbing Code of Canada 2010	A-3.2.1.1.(1)[3] A-5.2.10.4.(1) A-8.4.4.21.(6) A-8.4.4.21.(7)
CCBFC	NRCC 53303	National Fire Code of Canada 2010	A-3.2.1.1.(1)[3]
CSA	CAN/CSA-A440.2-09/A440.3-09	Fenestration Energy Performance/User Guide to CSA A440.2-09, Fenestration Energy Performance	A-3.1.1.6.(1)
CSA	C22.1-12	Canadian Electrical Code, Part I	A-7.2.1.1.
CSA	CAN/CSA-C439-09	Rating the Performance of Heat/Energy-Recovery Ventilators	A-5.2.10.4.(2)
HRAI	SAR-G1	HRAI Digest 2005	A-5.2.1.1.(1)
HVI	HVI Publication 911-2012	Certified Home Ventilating Products Directory	A-5.2.10.4.(2)
IES	2011	The Lighting Handbook	A-Table 4.3.2.8.
SMACNA	ANSI/SMACNA 006-2006	HVAC Duct Construction Standards – Metal and Flexible	A-5.2.2.1.(1)
SMACNA	1985	HVAC Air Duct Leakage Test Manual	A-5.2.2.1.(1)
SMACNA	2003	Fibrous Glass Duct Construction Standards	A-5.2.2.1.(1)
SMACNA	2006	HVAC Systems – Duct Design	A-5.2.2.1.(1)
TIAC	2010	Mechanical Insulation Best Practices Guide	A-5.2.2.5.(6) and 5.2.5.3.(8)

Notes to Table A-1.3.1.2.(1):

(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.

A-3.1.1.2.(1)(a) Space-conditioning Systems. A cooking stove, pot heater or window air conditioner should not be considered a system in the context of Clause 3.1.1.2.(1)(a), but electric baseboard heaters, for example, in the principal rooms should.

A-3.1.1.3.(1) Compliance. The flow chart in Figure A-3.1.1.3.(1) illustrates the process for all three paths of compliance applicable to Part 3.

A-4.2.2.7. Skylight Effective Aperture. The effective aperture of a skylight approximates the percentage of available daylight that will reach the floor or task area in a space with skylights. It is used to determine whether a daylighted space has enough daylight to justify the use of automatic daylighting controls.

A-4.2.2.8. Primary Sidelighted Area. The floor area affected by sidelighting can extend beyond the primary sidelighted area.

A-4.2.2.9. Primary Sidelighted Areas. Figure A-4.2.2.9. illustrates how to determine primary sidelighted areas.

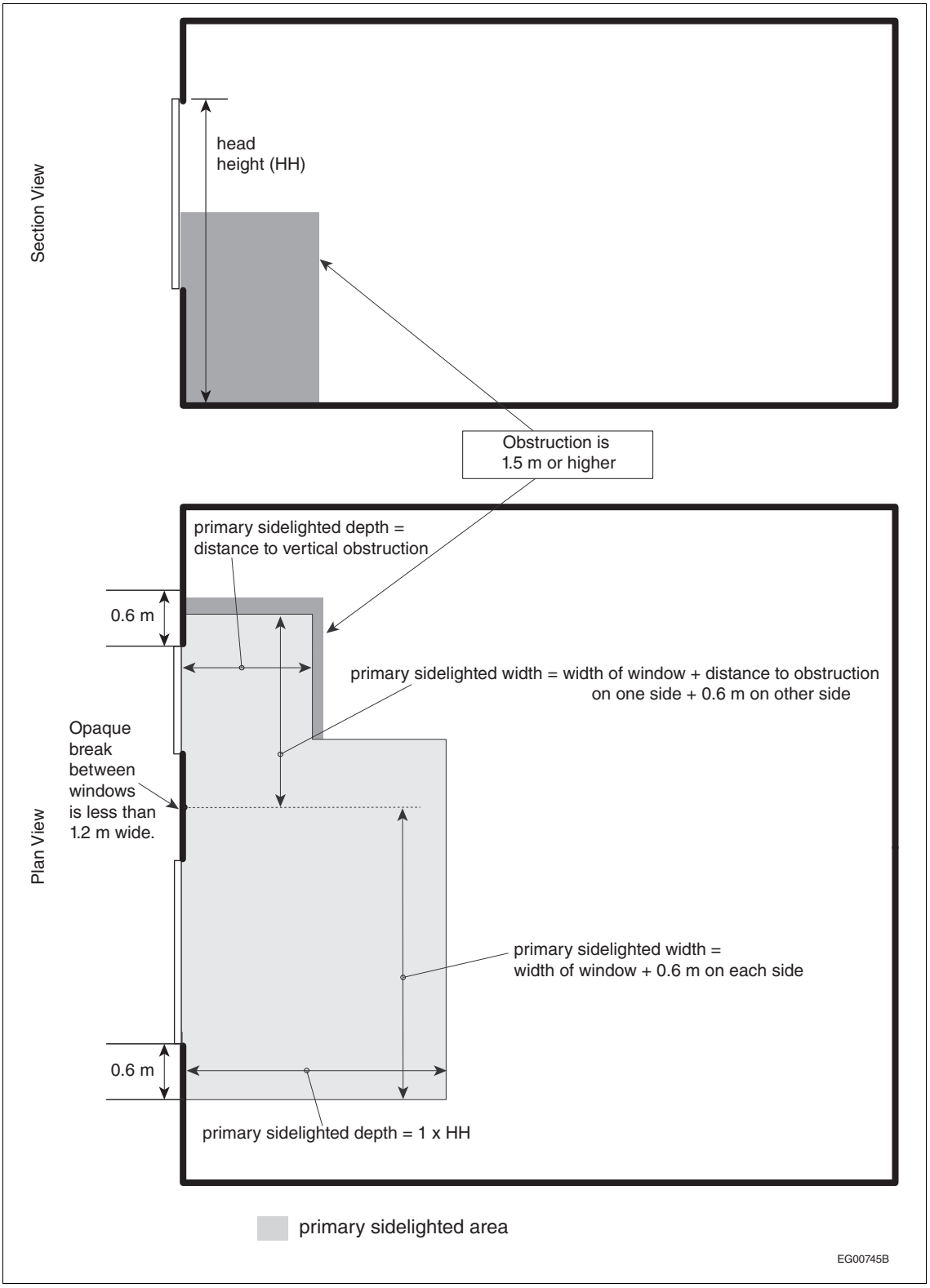

Figure A-4.2.2.9.
Determining primary sidelighted areas