Ontario Association of Architects

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ANSI/ASHRAE/IES 90.1–2013 – An Overview

Summary

This Practice Tip provides Architects with an overview of "ANSI/ASHRAE/IES 90.1-2013 Energy Standard for Buildings except Low-Rise Residential Buildings" (ASHRAE 90.1) and how it is used in conjunction with the "2012 Ontario Building Code" (OBC) and in particular "Supplementary Standard SB-10 Energy Efficiency Requirements" (SB-10).

Compliance with requirements in the OBC for energy efficiency of buildings within the scope of Part 3 and buildings of non-residential occupancy within the scope of Part 9 can be achieved through adherence to requirements set out in:

- ANSI/ASHRAE/IES Standard 90.1-2013 + SB-10 Division 3 Chapter 2 Prescriptive Path
- CCBFC NRCC 56191, 2015 National Energy Code of Canada for Buildings + SB-10, Division 3, Chapter 3 Prescriptive + Performance Paths
- ANSI/ASHRAE/USGBC/IES Standard 189.1-2014, "Standard for the Design of High-Performance Green Buildings

Except for Low-Rise Residential Buildings" Performance Path – Modelling Required

- ASHRAE 90.1-2010 + SB-10 Chapter 2 + 13% Performance Path – Modelling Required.
- National Energy Code for Buildings 2011 (NECB) + SB-10 Chapter 3 + 13% Performance Path – Modelling Required
- ASHRAE 90.1-2010 + 5% + 13% Performance Path - Modelling Required

A version of ASHRAE 90.1 is required in 3 of the 6 paths.

Sections 1–4 of the standard include important general information.

Section 5, Building Envelope, contains the requirements for envelope compliance including the mandatory provisions referenced in SB-10.

Sections 6-10 deal with Mechanical/Electrical systems and equipment.

Section 11 details a performance methodology.

Section 12 describes the normative references that are part of the standard.

Appendixes A through G provide supplementary information and necessary tools for applying the standard to specific projects.

Content

ASHRAE 90.1 sets the mandatory minimum requirements for the energy efficient design of new buildings and additions to existing buildings other than low rise residential buildings. It also covers the use of on-site renewable energy resources.

The OBC modifies and augments ASHRAE 90.1 with SB-10 to ensure compatibility with Ontario climatic conditions, energy availability and construction practices. Comments and interpretations are provided for sections of the standard where appropriate.

ASHRAE 90.1 is divided into 12 Sections and includes 7 Appendices:

Section 1 **Purpose:** Broad scope description of raison d'être for the standard and what aspects of the design of buildings are covered.

Section 2 **Scope:** Provides a detailed description of what is and what is not covered by the standard.

Section 3 **Definitions, Abbreviations, and Acronyms:** SB-10 relies on the definitions in ASHRAE 90.1 in addition to those in the OBC. Definitions for U, C and F Factors are included.

Section 4 **Administration and Enforcement:** Important information on what is covered by ASHRAE 90.1. It should be read in conjunction with the OBC, Division A Part 1 and SB-10 Division 1.

Section 5 **Building Envelope:** The requirements for energy efficiency in envelope design including the mandatory provisions referenced in SB-10 are included.

Section 6 **Heating, Ventilating and Air Conditioning:** Provides a simplified approach and detailed procedures for energy efficiency in the design of space conditioning systems. The requirements of hydronic systems, radiant heating, heat recovery, heat pumps and some heating boilers are included.

Section 7 **Service Water Heating:** Provides a simplified approach and detailed procedures for energy efficiency in the design of space and water heating equipment and systems. Water boiler requirements except those in Section 6 are covered.

Section 8 **Power:** Provides the requirements for energy efficiency in the design of all power distribution systems. Some equipment is covered.

Section 9 **Lighting:** Includes the requirements for energy efficiency in the design of interior and exterior lighting if attached to or fed by the building's electrical service. It does not include lighting within dwelling units or emergency lighting.

Section 10 **Other Equipment:** The energy efficiency design requirements for electric motors, booster pumps and elevators are included.

Section 11 **Energy Cost Budget Method (ECBM):** The ECBM is an alternative to the prescriptive provisions of the standard and may be used to evaluate compliance of proposed designs. The requirements for energy modelling are stipulated in this Section and it is useful for understanding the terms and assumptions used in energy modeling software.

The ECBM may be used when more innovative design concepts are being considered or when the proposed design fails to meet either prescriptive or simple trade off methods of compliance.

Section 12 **Normative References:** References within this Section are necessary parts of the standard not unlike OBC Division B, Part 3, Section 1.3. Referenced Documents and Organizations.

Normative Appendices are considered integral parts of the mandatory requirements of the Standard.

Normative Appendix A: **Rated R-Value of Insulation and Assembly Factor U-Factor, C-Factor, and F-Factor Determinations:** The Appendix has useful tables for converting assembly component insulation thermal resistance RSI(R)-values to overall assembly thermal transmittance U-values which take into account parallel path losses.

Normative Appendix B: **Building Envelope Climate Criteria**: Climate Zone and Data for some Canadian cities are included in Table B-2 but should be used with caution especially when using energy modelling software. Toronto, for instance, is listed by ASHRAE as Zone 6. In Supplementary Standard SB-1 Climatic & Seismic Data (for Ontario) (SB-1), with Heating Degree Days below 18ºC (HDD18) 3500 – 3800, it would be in ASHRAE Zone 5.

Normative Appendix C: **Methodology for Building Envelope Trade-Off Option in Subsection 5.6**. Appendix C details the procedures for the building envelope trade-off option. The method permits trade-offs between building elements but is very complicated. Software such as COMcheck offers an easier way to do trade-offs.

Normative Appendix D: **Climatic Data:** Climate Data for some Canadian cities is included in Table D-2 but should be used with caution. The value in Appendix D for Toronto is 4059 HDD18 whereas in SB-1 the value is 3500 – 3800 HDD18. According to ASHRAE Timmins is a frigid 6319 HDD18. SB-1 is considerably kinder and puts the City with a Heart of Gold at 5940 HDD18. In both cases the SB-1 values are one climate zone lower. If you are using American or international energy modelling software which include Ontario cities, check the assumed values and if necessary use a different City with values closer to those in SB-1.

Informative Appendixes contain additional information and are not mandatory or part of the Standard.

Informative Appendix E: **Informative References:** This appendix contains informative references for the convenience of users of ASHRAE 90.1 and to acknowledge source documents when appropriate. They are generally not necessary parts of the Standard although some Section 12 Nominative References are included here as well.

Informative Appendix F: **Addenda Description Information:** The more than 100 addenda to 90.1 are summarized.

Informative Appendix G: **Performance Rating Method:** The building performance rating method is a modification of the ECBM in Section 11 and is intended for use in rating the energy efficiency of building designs that exceed the minimum requirements of the standard. The appendix is not an alternative compliance path for the minimum compliance requirements when using Section 11, ECBM. This appendix is provided for those wishing to use the methodology developed for ASHRAE 90.1 to quantify performance that substantially exceeds the requirements of ASHRAE 90.1.

Suggested Procedure

To follow either of the 2 compliance paths, prescriptive or performance, requiring ASHRAE 90.1, review the standard, paying particular attention to the mandatory requirements in sub-section 5.4.

Coordinate with the other disciplines in the design team and select the compliance path appropriate for the project. Analysis and co-ordination among the consultants is critical to selecting the compliance method appropriate for the project.

Refer to the Supplementary Standard SB–10 Energy Efficiency Requirements, PT.36.2 OBC SB-10 Energy Efficiency Requirements – Prescriptive Compliance and PT.36.1 Energy Modelling for details on how to apply ASHRAE 90.1 prescriptive or performance compliance to the design.

Abbrevations

ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
CCBFC	Canadian Commission on Building & Fire Codes
IES	Illuminating Engineering Society
IRC	Institute for Research in Construction

MNECB	Model National Energy Code for Buildings
MMAH	Ministry of Municipal Affairs & Housing
NECB	National Energy Code for Buildings
NRC	National Research Council.

Definitions

C–Factor (Thermal Conductance): A measure of the heat flow through a building construction (e.g. a wall or window) or a given thickness of material (e.g. insulation). Lower numbers indicate better insulating properties. C–Factor does not include the boundary air or soil films. The units for C–Factor are W/m²•º K (Btu/hr•ft²•ºF).

F–Factor: A measure of the heat loss along the perimeter of a slab-on-grade. Lower numbers indicate better insulating properties. The units for F–Factor are W/m•ºK (Btu/hr•ft•ºF).

HDD18: Heating degree days 18 is a measure of how much (in degrees), and for how long (in days), the outside air temperature was below 18 C in a year. The imperial equivalent is HDD65, the number of Heating Degree Days where the exterior temperature is below 65ºF. The conversion factor is HDD18 = 5/9•HDD65.

Parallel path losses: The effective thermal resistance of an assembly with framing members and insulation of different thermal conductivity in the same plane. Insulation is used to fill the cavities created by the framing. Parallel path losses take into account the effect of thermal bridging of the framing members and can be significant. The effective RSI value of a steel stud wall with only mineral fibre insulation between the studs is approximately 60% of the RSI of the insulation.

U-Factor (Thermal Transmittance): A measure of the heat flow through a building construction (e.g. a wall or window) including the boundary air films or a given thickness of material (e.g. insulation). Lower numbers indicate better insulating properties. The units for U–Factor are W/m²•º K (Btu/hr•ft²•ºF). U–Factor is the inverse of R–Value.

References

Codes, Standards and Guides

1. ASHRAE 90.1-2013 (Imperial Edition Read Only)
2. ASHRAE 90.1-2013 (SI Edition for purchase)
3. OBC, Volume 1 Division B, Part 12 Resource Conservation and Environmental Integrity, MMAH
4. OBC, Volume 2 Supplementary Standard SB-1 Climate and Seismic Data, MMAH
5. OBC, Volume 2 Supplementary Standard SB-10 Energy Efficiency Requirements, MMAH

Software

1. Natural Resources: CAN-QUEST
2. US Department of Energy: COMcheck, Version 4.1.2
3. Natural Resources Canada: EE4

Other Useful Information

1. Graham Finch, MASc, P.Eng :Adoption and Compliance with Energy Codes: ASHRAE 90.1 and NECB.
2. MMAH: ASHRAE 90.1 + SB-10, Energy Efficiency Design Summary, Compliance Forms,
3. Sophie Mercier: Envelope Compliance ASHRAE 90.1 and NECB 2011
4. MMAH: NECB 2015 + SB-10 Compliance Forms
5. OAA: PT-36.1 Energy Modelling

6. OAA: PT-36.2 SB-10 Energy Efficiency Requirements – Prescriptive Compliance

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The OAA does not provide legal, insurance or accounting advice. Readers are advised to consult their own legal, accounting or insurance representatives to obtain suitable professional advice in those regards.
