Information Bulletin
Building and Safety Standards Branch
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Step 1 in the BC Energy Step Code: Airtightness, Enhanced Compliance and Compliance Paths

NOTE*: This document was developed with the input of the Office of Energy Efficiency at Natural Resources Canada.*

This bulletin provides guidance on meeting the BC Energy Step Code's Step 1 requirements. It is intended for energy modellers, building officials and others interested in compliance paths of the BC Energy Step Code. It is part of a series of three bulletins about the BC Energy Step Code that includes:

- B19 – 01: Complying with Step 1 of the BC Energy Step Code for Part 9 Buildings, and
- B19 – 03: Guidelines for Energy Advisors – Setting Airtightness Values for Energy Modelling of Part 9 Buildings for Compliance with the BC Energy Step Code.

Bulletin B18 – 03 (released July 2018) is a companion bulletin that provides information on the BC Energy Compliance Reports - Performance Paths for Part 9 Buildings.

Step 1 of the BC Energy Step Code: The "Enhanced Compliance" Step

Step 1 building performance requirements are set out in Tables 9.36.6.3.-A through G of the British Columbia Building Code (BCBC). Step 1 of the BC Energy Step Code is considered to provide "enhanced compliance" to the prescriptive energy efficiency requirements of Subsections 9.36.2. through 9.36.4. of the BCBC. Enhanced compliance means a Step 1 building requires energy modelling and airtightness testing to demonstrate that the building performs as well as, or better than, a building constructed to the minimum prescriptive requirements in Subsections 9.36.2. through 9.36.4. of the BCBC.

Although Step 1 buildings must undergo airtightness testing, they are not required to meet a specific airtightness performance target. Step 1 provides an opportunity for builders to assess their ability to construct an airtight building and improve their airtightness skills without risking failure to meet the Step 1 requirements based solely on the results of the airtightness test.

Energy modelling for Step 1 may be performed using:

1. the EnerGuide Rating System compliance path, or
2. Subsection 9.36.5. of the BCBC.

Step 1 Using the EnerGuide Rating System Compliance Path

The EnerGuide Rating System (ERS) is a national system developed by Natural Resources Canada (NRCan) to rate the energy performance of Part 9 residential buildings, including multi-unit residential buildings. It is designed to achieve the following:

a) help Canadian homeowners, industry and stakeholders become "energy literate" regarding homes and the decisions related to them;
b) provide specific, readily accessible energy performance information that is widely used to support decision making in designing, constructing, purchasing… or operating a home; and

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c) facilitate energy performance advancements in new and existing low-rise housing sectors by encouraging home builders and homeowners to improve the houses[1] that they … build…[2]

To comply with the BC Energy Step Code following the ERS compliance path, an Energy Advisor[3] must model the proposed house[4] using the HOT2000 energy modelling program using the measured building airtightness, to demonstrate that the building will use no more energy than a reference house.[5] For ERS compliance, HOT2000 automatically generates a reference house to which the proposed house is compared.

The Energy Advisor creates and submits two files to NRCan:

- **The P file** - an energy model of the proposed house - is reviewed by the Energy Advisor to confirm that the proposed house could achieve the required performance based on the house plans, the proposed mechanical equipment, and the house's location, among other specifications.
- **The N file** - an energy model of the as-built house - represents the house as constructed, and must incorporate the airtightness value from an airtightness test performed in accordance with Sentence 9.36.6.5.(1) of the BCBC. The N file is submitted to NRCan for quality assurance purposes. The results are returned as an EnerGuide rating for the house and for the reference house, which can then be used to submit a BC Energy Compliance Report (see Bulletin B18 – 03) to the Authority Having Jurisdiction (AHJ) to determine Code compliance.

Step 1 Using the Subsection 9.36.5. Compliance Path

Subsection 9.36.5. is the energy performance compliance path that existed in the BCBC before the BC Energy Step Code was developed. Buildings can comply with the BCBC using Subsection 9.36.5. by demonstrating that they perform as well or better than a building that is constructed to the minimum prescriptive requirements in Subsections 9.36.2. to 9.36.4. These requirements govern the building envelope, HVAC, and service water heating. Following Subsection 9.36.5. will generate a reference house and a proposed house.

Sentences 9.36.5.10.(9) through (11) (see Appendix 1 below) specify which airtightness value to use, depending on the air barrier approach used, and require airtightness testing. However, the

[1] While "house" is not a defined term in the BCBC, Appendix Note 9.36.1.3.(3) states that "the term "houses" includes detached houses, semi-detached houses, duplexes, triplexes, townhouses, row houses and boarding houses." House and building, though not the same, are used interchangeably in this bulletin. See notes 4 and 5 for more detail.

[2] Source: "EnerGuide Rating System Standard Version 15.6", p xiii.

[3] An Energy Advisor, in the context of this bulletin, is "an individual registered with Natural Resources Canada to deliver the EnerGuide Rating System Basic Service and additional services," as per NRCan's "EnerGuide Rating System Standard Version 15.6," p. 6.

[4] The proposed house, in the context of energy modelling, is the house as designed, with standard operating conditions such as number of occupants, appliance and hot water loads, and operating schedules as defined either by HOT2000 or by Subsection 9.36.5.

[5] The ERS reference house, according to the EnerGuide Rating System's HOT2000 User Guide, is a "copy of the (proposed) house with standard operating conditions. It is then manipulated to represent the modelled house as if it were built to the National Building Code of Canada (NBC) Section 9.36 energy-efficiency requirements." However, the reference house in the ERS "is not identical to the Reference House referred to in NBC 9.36.5, although it shares many of the same properties."

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airtightness test results do not necessarily need to be incorporated into the final Subsection 9.36.5. energy compliance model. An airtightness value of either 3.5 or 4.5. air changes per hour at 50 Pascals pressure differential (ACH_{50}) must be used in the proposed house energy model, as per Sentence 9.36.5.10.(9). The value is determined as follows:

- If the builder chooses to comply with BCBC Section 9.25., "Heat Transfer, Air Leakage and Condensation Control," the energy model must use an airtightness value of 4.5 ACH_{50}.
- If the builder chooses to comply with BCBC Subsection 9.25.3., "Air Barrier Systems" and Articles 9.36.2.9., "Airtightness," and 9.36.2.10., "Construction of Air Barrier Details," they may use 3.5 ACH_{50}.

Notable differences between the two options:

- Section 9.25. states that, where a flexible sheet material is used as an air barrier, the joints shall be sealed or lapped not less than 100 mm and clamped between framing members. In contrast, the Article 9.36.2.10. requirement for the flexible sheet materials' joints are that they must be lapped not less than 50 mm, sealed, and structurally supported;
- Article 9.36.2.9. contains more information on air leakage requirements and standards to be met for windows, and a requirement to restrict air movement through chimneys from fireplaces; and
- Article 9.36.2.10. contains more clarity on sealant materials and on sealing around penetrations in the air barrier, joints, chimneys, and where interior and exterior surfaces meet, among other items.

The Subsection 9.36.5. path provides builders with a compliance path for Step 1 of the BC Energy Step Code while they develop their ability to construct more airtight buildings. Upon completion, builders and energy modellers may choose to use the actual airtightness value of their building as constructed, or they may choose to use 3.5 or 4.5 ACH_{50}, depending on their chosen compliance path.

Because the proposed house airtightness value must be 3.5 or 4.5 ACH_{50} (which is less airtight than the reference house airtightness value of 2.5 ACH_{50}), builders will likely need to implement energy efficiency measures that are above the BCBC minimum prescriptive requirements to offset this increased air leakage. The need for this will depend on the differences between the proposed house and the Subsection 9.36.5. reference house. Bulletin B19 – 03 provides guidance to Energy Advisors and energy modellers on setting an airtightness target for the proposed house.

Any software that has been tested to ANSI/ASHRAE 140-2011, "Evaluation of Building Energy Analysis Computer Programs," including HOT2000, can be used to model the Subsection 9.36.5. compliance path. However, the Subsection 9.36.5. path files cannot be submitted to NRCan for quality assurance. Only files generated using the ERS compliance path (described previously) can be submitted to NRCan for quality assurance and receive an EnerGuide rating.

Results can be submitted to the AHJ using the BC Energy Compliance Report to determine Code compliance. Builders and energy modellers should consult the AHJ regarding their processes and administrative requirements, particularly when following the 9.36.5. path.

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What are the differences between the reference house and the proposed house?

Both the ERS and the Subsection 9.36.5. compliance paths assume that a minimally BCBC compliant building achieves an airtightness of 2.5 ACH_{50}.

For this reason, a Step 1 building may need to incorporate at least one building characteristic that exceeds the minimum energy performance requirements of the BCBC prescriptive requirements, such as improved insulation and better performing windows. This is especially the case when following the Subsection 9.36.5. compliance path, where the proposed building airtightness value is greater than 2.5 $ACH_{50.}$

Several characteristics of the reference house are set by both ERS and Subsection 9.36.5. and cannot be changed:

- the fenestration and door area to gross wall area (FDW) ratio must be between 17 and 22%; for example, a proposed house with less than a 17% FDW ratio will have a corresponding reference house with 17% FDW ratio;
- the fenestration in the reference house is assumed to be equally distributed amongst all sides (north, south, east, and west) of the building;
- the solar heat gain coefficient of windows in the reference house is set to 0.26; and
- it is assumed there is no heat recovery ventilator (HRV) in the reference house.

Four additional scenarios apply only to ERS reference houses:

- if a heat pump is the primary heating system in the proposed house, the baseline is electric baseboard heating in the reference house;
- if a heat pump is combined with another heating system, the baseline in the reference house is the other heating system;
- if the heat pump is providing cooling, the baseline in the reference house will include air conditioning; and
- the insulation requirements in the reference house are those for houses that do not have an HRV.

The proposed house orientation and features may influence its energy performance such that there is either minimal or notable change to the proposed house's design, compared to a prescriptive Code-compliant reference house.

More Information

Please visit www.gov.bc.ca/buildingcodes or www.energystepcode.ca.

Questions related to this bulletin can be directed to CodeQuestion@gov.bc.ca.

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Appendix 1 - Subsection 9.36.5. Requirements for Airtightness

Sentences (9) through (11) of Article 9.36.5.10. state:

9) The airtightness value used in the energy model calculations for the proposed house shall be
   a) 4.5 air changes per hour at 50 Pa pressure differential, where the construction complies with Section 9.25.,
   b) 3.5 air changes per hour at 50 Pa pressure differential, where it can be shown that the *air barrier system* is constructed in accordance with Subsection 9.25.3. and Articles 9.36.2.9. and 9.36.2.10., or
   c) tested in accordance with Sentence (11), and shall be,
      i) the number of air changes per hour at 50 Pa pressure differential, and
      ii) the equivalent leakage area (see Appendix A).
10) Where airtightness is measured in accordance with Clause 9.36.5.10.(9)(c), the applicable airtightness value in Clause 9.36.5.10.(9)(a) or (b) shall be assigned for use in the energy model calculations until the actual airtightness has been measured in accordance with Sentence (11).
11) Where measured airtightness is used in the energy model calculations, it shall be determined in accordance with CAN/CGSB-149.10, “Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method”
   a) as written, or
   b) excluding Clause 6.1.6, which allows intentional openings for mechanical equipment to be left unsealed.