

Proposed Change 2057

Code Reference(s):	NBC25 Div.B 9.36.2.4. (first printing) NBC25 Div.B 9.36.6. (first printing) NBC25 Div.B 9.36.7.3.(3) (first printing)
Subject:	Performance Compliance — Energy Performance
Title:	Requirements for Energy Modeling Software
Description:	This proposed change updates ANSI/ASHRAE 140, "Method of Test for Evaluating Building Performance Simulation Software," to the 2023 edition, adds a new Article on the testing of energy modeling software, and harmonizes terminology.

This change could potentially affect the following topic areas:

- | | |
|--|--|
| ☐ Division A | ☒ Division B |
| ☐ Division C | ☐ Design and Construction |
| ☐ Building operations | ☒ Housing |
| ☒ Small Buildings | ☐ Large Buildings |
| ☐ Fire Protection | ☐ Occupant safety in use |
| ☐ Accessibility | ☐ Structural Requirements |
| ☐ Building Envelope | ☒ Energy Efficiency |
| ☐ Heating, Ventilating and Air Conditioning | ☐ Plumbing |
| | ☐ Construction and Demolition Sites |

Problem

The 2025 edition of the National Building Code of Canada (NBC) was intended to reference ANSI/ASHRAE 140-2011, "Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs," to identify acceptable software for carrying out compliance calculations for energy modeling; however, the NBC 2025 was prematurely updated to the 2023 edition of this standard for consistency with the 2025 edition of the National Energy Code of Canada for Buildings. This proposed change ensures that the public review process is still followed for this change to the NBC.

The 2011 edition of ANSI/ASHRAE 140 includes test cases for the evaluation of building performance software, but does not include information on what should be considered as acceptable software results for those test cases. The absence of mandatory pass/fail criteria means that building officials would only need to confirm that energy modeling software is capable of running the tests, but not that the results are within an

acceptable range. The 2011 edition of the standard thus presents building officials with a gap in the Code requirements when they try to determine whether the software used to demonstrate Code compliance complies with the standard.

In addition, the Code uses inconsistent terminology when referring to energy modeling software, which may cause confusion for Code users.

Justification

Referencing ANSI/ASHRAE 140-2023, "Method of Test for Evaluating Building Performance Simulation Software," would address the problem by providing pass/fail criteria by which compliance of the software with the standard may be determined.

The 2023 edition of ANSI/ASHRAE 140

- introduces normative (i.e., mandatory) acceptance criteria for determining if energy modeling software is suitable for use by the AHJ, and
- adds informative sections for AHJs on developing the acceptance criteria.

ANSI/ASHRAE 140-2023 also includes test suites that are new or have been updated since the 2011 edition in the following addenda [1]:

- ground coupled slab-on-grade analytical verification tests (ANSI/ASHRAE 140-2011, Addendum a),
- air-side HVAC equipment analytical verification tests (ANSI/ASHRAE 140-2014, Addendum a),
- building thermal envelope and fabric load tests (ANSI/ASHRAE 140-2017, Addendum a), and
- weather drivers tests (ANSI/ASHRAE 140-2020, Addendum a).

In addition, consistent use of the term "energy modeling software," would clarify the Code requirements in other provisions that reference this software.

References

[1] The listed addenda are available at <https://www.ashrae.org/technical-resources/standards-and-guidelines/standards-addenda>.

PROPOSED CHANGE

[9.36.2.4.] 9.36.2.4. Calculation of Effective Thermal Resistance of Assemblies

Note A-9.36.2.4.(4) Credit for Unheated Spaces Protecting the Building Envelope.

The reduction in RSI afforded by Sentence 9.36.2.4.(4) is intended to provide a simple credit under the prescriptive path for any unheated space that protects a component of the building envelope. The credited value is conservative because it cannot take into account the construction of the enclosure surrounding the unheated space, which may

or may not comply with the Code; as such, too many variables, such as its size or airtightness, may negate any higher credit that could be allowed.

There may be ~~energy modeling software~~~~simulation tools~~ that can be used under the performance path to provide a better assessment of the effect of an indirectly heated space; ~~thisese softwaretools~~ may be used to calculate the credit more accurately when an unheated space is designed to provide significantly better protection than the worst-case situation assumed here. Vented spaces, such as attic and roof spaces or crawl spaces, are considered as exterior spaces; the RSI-value credit allowed in Sentence 9.36.2.4.(4) can therefore not be applied in the calculation of the effective thermal resistance of assemblies separating conditioned spaces from vented spaces.

[9.36.6.] 9.36.6. Energy Performance Compliance

[9.36.6.1.] 9.36.6.1. Scope and Application

[9.36.6.2.] 9.36.6.2. Definitions

[9.36.6.3.] 9.36.6.3. Compliance

[9.36.6.4.] 9.36.6.4. Calculation Methods

- [1] 1)** Except as provided in Sentence (2), the energy model calculations shall account for the annual energy consumption of systems and equipment required for
- [a] a) space heating,
 - [b] b) ventilation,
 - [c] c) service water heating, and
 - [d] d) where installed, space cooling.
- (See Note A-9.36.6.4.(1).)
- [2] 2)** Redundant or back-up equipment for the systems and equipment listed in Sentence (1) is permitted to be excluded from the energy model, provided it is equipped with controls and is not required to meet the space-conditioning load of the house. (See Note A-9.36.6.4.(2).)
- [3] 3)** The schedules used in the energy model shall
- [a] a) be based on a time interval not greater than one hour, where the energy model evaluates the performance of the house over hourly intervals, or
 - [b] b) be applied in an hourly-bin model then averaged, where the energy model does not evaluate the performance of the house over hourly intervals.
- [4] 4)** The energy model calculations shall account for the loads due to heat gains from occupants, lighting and miscellaneous equipment, which shall be fixed for every day of the year, by
- [a] a) following the schedule provided in Table 9.36.6.4., and

[b] b) increasing the loads for each hour by 3.58 W per square metre of *floor area* in common spaces, if applicable.

Table [9.36.6.4.] 9.36.6.4.
Default Schedule for Internal Heat Gain Loads ⁽¹⁾
Forming Part of Sentence [9.36.6.4.] 9.36.6.4.([4] 4)

Houses without a <i>Secondary Suite</i> ⁽²⁾											
Average Load, in W, Before Noon											
12 a.m.	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.
646	454	452	431	429	450	522	597	696	724	745	811
Average Load, in W, After Noon											
12 p.m.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.
815	768	738	749	760	895	1159	1305	1288	1218	981	783
Each <i>Dwelling Unit</i> in Residential <i>Buildings</i> with Two or More <i>Dwelling Units</i> ⁽²⁾											
Average Load, in W, Before Noon											
12 a.m.	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.
397	284	283	270	269	282	324	368	426	442	455	493
Average Load, in W, After Noon											
12 p.m.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.
496	468	451	457	463	543	697	783	773	732	593	477

Notes to Table [9.36.6.4.] 9.36.6.4.:

- (1) The schedule indicates at what time of day the heat gains from the metabolic activity of the occupants and occupant-dependent appliance, lighting and receptacle electrical loads are present; it does not account for heat gains from exterior lighting, lighting of unconditioned spaces, service water heating systems and HVAC equipment.
- (2) See Note A-Table 9.36.6.4.

[5] 5) The energy model calculations shall account for the following space-heating temperature set-points:

- [a] a) 20°C in all living spaces above the *basement*,
 - [b] b) 19°C in *basements* and common spaces, and
 - [c] c) 15°C in crawl spaces intended to be *conditioned spaces*.
- [6] 6)** The energy model calculations shall account for a space-cooling temperature set-point of 25°C in all *conditioned spaces* served by the cooling system.
- [7] 7)** The energy model calculations shall account for a thermostatic control that responds to fluctuations of $\pm 0.5^\circ\text{C}$ from the temperature set-point. (See Note A-9.36.6.4.(7).)
- [8] 8)** Energy modeling software that~~If a computer program~~ is used to carry out the compliance calculations,~~the calculation methods employed in the energy model~~ shall conform to
- [a] a) the testing requirements for energy modeling software stated in Article 9.36.6.17.-2030,~~or be used for both the reference and proposed houses, and~~
 - [b] b) an equivalent test method~~be tested in accordance with ANSI/ASHRAE 140, "Method of Test for Evaluating Building Performance Simulation Software", with variations in the computer program from the range recommended therein reported in accordance with Division C.~~
- [9] 9)** The proposed and reference houses shall both be modeled using the same approach and assumptions, except where *building* components or energy efficiency features are permitted by this Subsection to be different.
- [10] 10)** The energy model calculations shall account for the effect of airtightness in accordance with Sentence 9.36.6.10.(10) or Article 9.36.5.3., as applicable.
- [11] 11)** The energy model calculations shall account for heat transfer through elements separating *conditioned space* from unconditioned space, the exterior or the ground.

[9.36.6.5.] 9.36.6.5. Climatic Data

[9.36.6.6.] 9.36.6.6. Building Envelope Calculations

[9.36.6.7.] 9.36.6.7. HVAC System Calculations

[9.36.6.8.] 9.36.6.8. Service Water Heating System Calculations

[9.36.6.9.] 9.36.6.9. General Requirements for Modeling the Proposed House

[9.36.6.10.] 9.36.6.10. Modeling Building Envelope of Proposed House

[9.36.6.11.] 9.36.6.11. Modeling HVAC System of Proposed House

[9.36.6.12.] 9.36.6.12. Modeling Service Water Heating System of Proposed House

[9.36.6.13.] 9.36.6.13. General Requirements for Modeling the Reference House

[9.36.6.14.] 9.36.6.14. Modeling Building Envelope of Reference House

[9.36.6.15.] 9.36.6.15. Modeling HVAC System of Reference House

[9.36.6.16.] 9.36.6.16. Modeling Service Water Heating System of Reference House

[9.36.6.17.] --- Testing of Energy Modeling Software

- [1] --)** Energy modeling software shall be tested in accordance with the Class II, Tier 1 tests of ANSI/ASHRAE 140-2023, "Method of Test for Evaluating Building Performance Simulation Software." (See Note A-9.36.6.17.(1).)
- [2] --)** The results of the tests required by Sentence (1) shall meet the acceptance criteria established using statistical confidence interval ranges as described in Annex B22, with the range calculated at a confidence interval not greater than 93%.
- [3] --)** The same tested version of the energy modeling software shall be used to model the proposed house and the reference house.

Note A-9.36.6.3.(1) Energy Modeling.

The energy modeling of the proposed and reference houses should be performed using the same energy modeling software. An energy modeling platform other than the EnerGuide Rating System may be used to demonstrate compliance with Clause 9.36.6.3.(1)(a).

Note A-9.36.6.3.(8)(a) Peak Cooling Load.

The term “peak cooling load” refers to the highest hourly-averaged rate of mechanical cooling required to maintain the building or house at the cooling set-point temperature over the course of the year. The peak cooling load must reflect the rate at which heat is extracted from the conditioned space and not the rate of energy consumption of any cooling equipment. Some [energy](#) modeling software only reports peak cooling loads when the building or house model is configured with an air conditioner; in such cases, the model should include air-conditioning for the purpose of computing the peak cooling load. If the [energy](#) modeling software does not report peak hourly loads, the design cooling load may be used instead.

The peak cooling load criterion is intended to reduce the risk that houses will overheat in the summer as a consequence of the energy reduction measures required by the Code. To meet this goal, in houses without cooling systems, the proposed house must achieve a peak cooling load that is no more than that of the reference house or a design cooling intensity of not more than 10 W/m³. Even so, this modeling requirement does not guarantee that a house will not overheat, as a reference house complying with Subsection 9.36.6. may nevertheless be prone to overheating in some circumstances. This requirement does not prescribe the installation of cooling systems in new construction.

Note A-9.36.6.15.(6) Default Settings.

The default settings in energy [performance](#) modeling software for houses are an appropriate source of part-load performance values of equipment.

Note A-9.36.6.17.(1) Testing of Energy Modeling Software.

The Class II, Tier 1 tests in ANSI/ASHRAE 140-2023, “Method of Test for Evaluating Building Performance Simulation Software,” are applicable to software that models low-rise wood-frame construction, which dominates the residential construction industry in Canada. Designers who model high thermal mass and passive solar designs should consider using software that has also been verified using Tier 2 Tests.

Note that Code users are not expected to perform this testing themselves; instead, Code users should refer to the reports typically produced by reputable vendors of energy modeling software on the compliance of their products with ANSI/ASHRAE 140.

[9.36.7.3.] 9.36.7.3. Energy Performance Improvement Compliance Calculations

- [1] 3)** The annual gross space heat loss shall be calculated as the sum of the cumulative heat loss from
- [a] a) conduction across opaque and transparent elements of the *building* envelope,
 - [b] b) air infiltration and exfiltration, and
 - [c] c) mechanical ventilation.
- (See Note A-9.36.7.3.(3).)

Note A-9.36.7.3.(3) Annual Gross Space Heat Loss.

The annual gross space heat loss has been selected as a good proxy for heat loss due to building envelope performance. It is readily extracted from [energy modeling software](#)~~building simulation models~~ and correlates well with the combined conductive (through both fenestration and opaque elements) and air leakage losses, while excluding solar and internal gains. The inclusion of ventilation losses is not strictly relevant to building envelope performance, but their contribution to the annual gross space heat loss is generally small and, given that unbalanced ventilation is permitted by the Code and thus may be modeled, disaggregating energy losses due to unintentional air leakage from those due to intentional ventilation can be difficult ~~for in~~ most [energy modeling software](#)~~simulation models~~.

Impact analysis

This proposed change is expected to be cost neutral for energy modelers. The NBC already requires that software used for energy modeling be tested in accordance with ANSI/ASHRAE 140. The additional burden of testing software to the 2023 edition of the standard rests with the vendors of energy modeling software, many of whom already incurred much of this cost when they submitted results during the development of the acceptance criteria.

Overall, this approach would encourage greater accuracy and consistency in building performance simulation software. No comments were provided during the public review of the new acceptance criteria in ANSI/ASHRAE 140-2023, which reflects the consensus reached within the software and modeling community.

Enforcement implications

Currently, building officials need to confirm that energy modeling software complies with ANSI/ASHRAE 140 by visiting the website of the energy modeling software vendor. Energy modeling software vendors should provide enough information to allow users to verify that the results meet the criteria set in the standard; it is not expected that building officials would perform this testing themselves.

Who is affected

Energy modelers, energy modeling software vendors, and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

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- [\[9.36.2.4.\]](#) 9.36.2.4. ([\[2\]](#) 2) no attributions
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[\[9.36.6.11.\]](#) 9.36.6.11. ([\[19\]](#) 19) [F95,F99-OE1.1]
[\[9.36.6.11.\]](#) 9.36.6.11. ([\[20\]](#) 20) [F95,F99-OE1.1]
[\[9.36.6.12.\]](#) 9.36.6.12. ([\[1\]](#) 1) [F96,F99-OE1.1]

- [\[9.36.6.12.\]](#) 9.36.6.12. ([\[2\]](#) 2) no attributions
- [\[9.36.6.13.\]](#) 9.36.6.13. ([\[1\]](#) 1) [F99-OE1.1]
- [\[9.36.6.13.\]](#) 9.36.6.13. ([\[2\]](#) 2) [F99-OE1.1]
- [\[9.36.6.14.\]](#) 9.36.6.14. ([\[1\]](#) 1) [F92,F95,F99-OE1.1]
- [\[9.36.6.14.\]](#) 9.36.6.14. ([\[2\]](#) 2) [F90,F91,F92,F95,F99-OE1.1]
- [\[9.36.6.14.\]](#) 9.36.6.14. ([\[3\]](#) 3) [F92,F95,F99-OE1.1]
- [\[9.36.6.14.\]](#) 9.36.6.14. ([\[4\]](#) 4) [F92,F95,F99-OE1.1]
- [\[9.36.6.14.\]](#) 9.36.6.14. ([\[5\]](#) 5) [F92,F99-OE1.1]
- [\[9.36.6.14.\]](#) 9.36.6.14. ([\[6\]](#) 6) [F92,F95,F99-OE1.1]
- [\[9.36.6.14.\]](#) 9.36.6.14. ([\[7\]](#) 7) [F92,F99-OE1.1]
- [\[9.36.6.14.\]](#) 9.36.6.14. ([\[8\]](#) 8) [F92,F99-OE1.1]
- [\[9.36.6.14.\]](#) 9.36.6.14. ([\[9\]](#) 9) [F92,F99,F95-OE1.1]
- [\[9.36.6.14.\]](#) 9.36.6.14. ([\[10\]](#) 10) [F92,F99-OE1.1]
- [\[9.36.6.15.\]](#) 9.36.6.15. ([\[1\]](#) 1) [F95,F99-OE1.1]
- [\[9.36.6.15.\]](#) 9.36.6.15. ([\[2\]](#) 2) [F95,F99-OE1.1]
- [\[9.36.6.15.\]](#) 9.36.6.15. ([\[3\]](#) 3) [F95,F99,F100-OE1.1]
- [\[9.36.6.15.\]](#) 9.36.6.15. ([\[4\]](#) 4) [F95,F99-OE1.1]
- [\[9.36.6.15.\]](#) 9.36.6.15. ([\[5\]](#) 5) [F95,F99-OE1.1]
- [\[9.36.6.15.\]](#) 9.36.6.15. ([\[6\]](#) 6) [F95,F99-OE1.1]
- [\[9.36.6.15.\]](#) 9.36.6.15. ([\[7\]](#) 7) [F95,F99-OE1.1]
- [\[9.36.6.15.\]](#) 9.36.6.15. ([\[8\]](#) 8) [F95,F99,F100-OE1.1]
- [\[9.36.6.15.\]](#) 9.36.6.15. ([\[9\]](#) 9) [F95,F99-OE1.1]
- [\[9.36.6.15.\]](#) 9.36.6.15. ([\[10\]](#) 10) [F95,F99-OE1.1]
- [\[9.36.6.15.\]](#) 9.36.6.15. ([\[11\]](#) 11) [F95,F99-OE1.1]
- [\[9.36.6.15.\]](#) 9.36.6.15. ([\[12\]](#) 12) [F95,F99,F100-OE1.1]
- [\[9.36.6.15.\]](#) 9.36.6.15. ([\[13\]](#) 13) [F95,F99,F100-OE1.1]
- [\[9.36.6.15.\]](#) 9.36.6.15. ([\[14\]](#) 14) [F95,F99-OE1.1]
- [\[9.36.6.15.\]](#) 9.36.6.15. ([\[15\]](#) 15) [F95,F99-OE1.1]
- [\[9.36.6.15.\]](#) 9.36.6.15. ([\[16\]](#) 16) [F95,F99-OE1.1]
- [\[9.36.6.16.\]](#) 9.36.6.16. ([\[1\]](#) 1) [F95,F99-OE1.1]
- [\[9.36.6.16.\]](#) 9.36.6.16. ([\[2\]](#) 2) [F95,F99-OE1.1]

[9.36.6.16.] 9.36.6.16. ([3] 3) [F95,F99-OE1.1]

[9.36.6.17.] -- ([1] --) [F99-OE1.1]

[9.36.6.17.] -- ([2] --) [F99-OE1.1]

[9.36.6.17.] -- ([3] --) [F99-OE1.1]

[9.36.7.3.] 9.36.7.3. ([1] 3) [F90,F91,F92,F93,F95,F100-OE1.1]