Submit a comment

Proposed Change 1823

Code Reference(s):	**NBC20 Div.B 9.36.2.7. (first printing)** **NBC20 Div.B 9.36.5.3. (first printing)** **NBC20 Div.B 9.36.7.3. (first printing)**
Subject:	Fenestration
Title:	Thermal Characteristics of Fenestration and Doors
Description:	This proposed change places a limit on the maximum solar heat gain coefficient for fenestration and doors based on the fenestration and door area to gross wall area ratio.

This change could potentially affect the following topic areas:

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

Problem

Currently, Article 9.36.2.7. of Division B of the National Building Code of Canada (NBC) 2020 allows Code users to choose either the overall thermal transmittance (U-value) or Energy Rating (ER) path to comply with the Code requirements on the thermal characteristics of fenestration and doors.

The Code does not adequately address the risk of the overheating of buildings due to the relationship between the solar heat gain coefficient (SHGC) of glazing and the fenestration and door area to gross wall area ratio (FDWR). Buildings that have large areas of high solar heat gain from fenestration on orientations with significant solar exposure are the most susceptible to overheating. East-west orientations in particular may cause higher peak cooling loads and overheating potential. In homes using the prescriptive path for compliance that have mechanical cooling, this situation can result in higher energy use; and, in homes that do not have mechanical cooling, this situation can result in overheating, leading to a higher likelihood of homeowners installing mechanical cooling systems in future that are not included in the energy model used at the time of construction. These risks may be further amplified when solar heat gain energy is beneficial to modeling for compliance with energy-efficiency requirements.

Conversely, in the NBC 2020, Sentence 9.36.7.3.(2) requires that peak cooling in the proposed house be lower than that of the reference house. The reference house is always modeled with an SHGC of 0.26 for all fenestration, which is considered a very low solar gain coefficient. Use of this SHGC can cause non-compliance in homes that otherwise appear to meet the intent of the Code and may be overly restrictive to Code users.

Justification

An ongoing concern about the potential overheating of homes and the related impact on energy use was identified. While Sentence 9.36.8.6.(4) in the prescriptive compliance path attempts to address the potential for overheating by restricting ER compliance to orientations with less than 17% FDWR, there are no explicit limitations on high solar heat gain from fenestration, which can allow for the selection of high solar heat gain fenestration that is compliant with the current requirement. This situation can result in homes that use the prescriptive path for compliance having high energy usage for cooling, causing discomfort to occupants, and increasingly causing their owners to install mechanical cooling after occupancy that is not accounted for in the energy compliance models of the Code.

A study completed by NRC titled, "Climate Resilience Buildings: Guideline for management of overheating risk in residential buildings," [1] in 2021 (updated in 2022) in section 10.1 identifies 0.40 SHGC or lower as a notional threshold for low solar gain and shows that the selection of low solar gain fenestration correlates with a reduced risk of overheating in homes. An analysis titled, "Building Energy Simulations: Impact of SHGC on the thermal performance of detached houses in different Canadian climate zones," [2] presents additional information about the varying impact of SHGC on the increased risk of overheating by climate zone in response to the initial proposed change presented during the Fall 2023 public review.

This proposed change restricts the SHGC of fenestration depending on both the FDWR of the whole building and the climate zone of the proposed house, as specified in proposed Table 9.36.2.7.-B.

Using the performance path, NBC Sentence 9.36.7.3.(2) requires that the Code user demonstrate compliance in the proposed house by achieving a peak cooling load that is lower than that of the reference house. While this approach is intended to limit the risk of houses overheating, in application it can cause houses that appear to comply with the intent of the Code to fail the compliance metric, causing undue hardship for Code users. This situation is due in part to the use of an SHGC of 0.26 for all fenestration in the reference house (Clause 9.36.5.14.(2)(c)). Combined with the procedure for redistribution of windows in the reference house (Sentence 9.36.5.14.(5)), a peak cooling value that is unduly restrictive can be established.

Examples of types of houses that may be affected include low-load houses with small volumes, houses with overall small cooling loads, and houses with mechanical cooling installed that is already accounted for in the energy model.

It was determined that revising the SHGC used in the reference house to a higher value would trigger substantial changes to the already established tables of prescriptive points (Subsection 9.36.8.), as well as make compliance with the energy performance tiers more difficult by reducing the heating energy required by the reference house.

It was also determined that a solution would require the following two additional considerations to be incorporated into the compliance requirements to reduce the risk of overheating related to NBC Article 9.36.7.3.:

1. The introduction of a cooling intensity metric that limits the design cooling intensity of the proposed house to 10 W/m^3, based on the research presented by CanmetENERGY Ottawa to the Joint Task Group on Potential Consequences [3].
2. The installation of a mechanical cooling system in the proposed house that has the capacity to meet the peak cooling load, and that is included in the energy model calculation for compliance with NBC Article 9.36.7.2.

Taken together, the above-mentioned changes would provide relief to the owners of houses at the margins of compliance with the current requirements that meet the intent of the overheating requirements. The above-mentioned changes would also reduce the risk of overheating in houses that comply with the requirements using the prescriptive path.

The narrow scope of the work related to the above-mentioned changes limits the solutions in this proposed change to addressing concerns about overheating as they relate to energy use in houses. Overheating due to extreme climate events was deemed to be outside of scope and is not directly addressed. While this proposed change may form part of a broader solution to the overheating issue, it should not be construed as having that goal.

EXISTING PROVISION

9.36.2.7. Thermal Characteristics of Fenestration, Doors and Skylights

1) Except as provided in Sentences (2) to (8) and Article 9.36.2.11., fenestration and doors shall have an overall thermal transmittance (U-value) not greater than, or an Energy Rating not less than, the values listed in Table 9.36.2.7.-A for the applicable heating-degree day category. (See Note A-9.36.2.7.(1) and (2).)

Table 9.36.2.7.-A
Required Thermal Characteristics of Fenestration and Doors
Forming Part of Sentence 9.36.2.7.(1)

Components	Thermal Characteristics (1)	Heating Degree-Days of *Building* Location, (2) in Celsius Degree-Days					
		Zone 4 < 3000	Zone 5 3000 to 3999	Zone 6 4000 to 4999	Zone 7A 5000 to 5999	Zone 7B 6000 to 6999	Zone 8 ≥ 7000
Fenestration (3) and doors	Max. U-value, W/(m²×K)	1.84	1.84	1.61	1.61	1.44	1.44
	Min. Energy Rating	21	21	25	25	29	29

Notes to Table 9.36.2.7.-A:

(1) See Note A-Table 9.36.2.7.-A.

(2) See Article 1.1.3.1.

(3) Except skylights (see Sentence (2)) and glass block assemblies (see Sentence (4)).

2) Skylights shall have an overall thermal transmittance not greater than the values listed in Table 9.36.2.7.-B for the applicable heating-degree day category. (See Note

A-9.36.2.7.(1) and (2).)

Table 9.36.2.7.-B
Overall Thermal Transmittance of Skylights
Forming Part of Sentence 9.36.2.7.(2)

Component	Heating Degree-Days of *Building* Location, (1) in Celsius Degree-Days					
	Zone 4 < 3000	Zone 5 3000 to 3999	Zone 6 4000 to 4999	Zone 7A 5000 to 5999	Zone 7B 6000 to 6999	Zone 8 ≥ 7000
	Maximum Overall Thermal Transmittance, $W/(m^2 \times K)$					
Skylights	2.92	2.92	2.75	2.75	2.41	2.41

Note to Table 9.36.2.7.-B:

(1) See Article 1.1.3.1.

3) Except for site-assembled or site-glazed factory-made fenestration products, curtain wall construction, and site-built windows and glazed doors that are tested in accordance with Sentence 9.36.2.2.(3), site-built windows and glazed doors need not comply with Sentence (1), provided they are constructed in accordance with one of the options presented in Table 9.36.2.7.-C for the applicable climate zone. (See Note A-9.36.2.7.(3).)

Table 9.36.2.7.-C
Compliance Options for Site-built Windows and Glazed Portion of Doors
Forming Part of Sentence 9.36.2.7.(3)

Component	Description of Component	Compliance Options							
		Climate Zones 4 and 5			Climate Zones 6 and 7A			Climate Zones 7B and 8	
		≤ 3999 HDD			4000 to 5999 HDD			≥ 6000 HDD	
		1	2	3	1	2	3	1	2
Frame	non-metallic	✓	✓	—	✓	✓	—	✓	✓
	thermally broken metallic	—	—	✓	—	—	✓	—	—
Glazing	double	—	✓	—	—	—	—	—	—
	triple	✓	—	✓	✓	✓	✓	✓	✓
	argon-filled	—	✓	—	✓	—	✓	—	✓
Low-e coating	none	✓	—	—	—	—	—	—	—
	number of panes with ≤ 0.10	—	≥ 1	—	—	—	—	≥ 2	—

Component	Description of Component	Compliance Options							
		Climate Zones 4 and 5			Climate Zones 6 and 7A			Climate Zones 7B and 8	
		≤ 3999 HDD			4000 to 5999 HDD			≥ 6000 HDD	
		1	2	3	1	2	3	1	2
	number of panes with ≤ 0.20	—	—	2	≥ 1	2	≥ 2	—	≥ 2
Spacer	size, mm	12.7	—	12.7	≥ 12.7	12.7	≥ 12.7	≥ 12.7	≥ 12.7
	non-metallic	—	✓	—	—	—	—	—	—

4) Glass block assemblies separating *conditioned space* from unconditioned space or the exterior shall have
- a) an overall thermal transmittance of not more than 2.9 W/(m^2×K), and
- b) a total aggregate area of not more than 1.85 m^2.

5) One door separating a *conditioned space* from an unconditioned space or the exterior is permitted to have an overall thermal transmittance up to 2.6 W/(m^2×K).

6) Storm windows and doors need not comply with Sentence (1).

7) Vehicular access doors separating a *conditioned space* from an unconditioned space or the exterior shall have a nominal thermal resistance of not less than 1.1 (m^2×K)/W.

8) Access hatches separating a *conditioned space* from an unconditioned space shall be insulated to a nominal thermal resistance of not less than 2.6 (m^2×K)/W.

Note A-9.36.2.7.(1) and (2) Design of Windows, Glazed Doors and Skylights.

The design of windows, glazed doors and skylights involves many variables that impact their energy performance and their compliance with the Code's energy efficiency requirements, such as the type of framing material, number of glass layers, type and position of low-emissivity (low-e) coating, type and size of spacer between glass layers, type of gas used to fill the glass unit, and additionally for glazed doors, type of materials used to construct the door slab.

Here are a few examples of common window and glazed door constructions:
- a U-value of about 1.8 is typically achieved using argon-filled glazing units with a low-e coating and energy-efficient spacer materials installed in a frame chosen mostly for aesthetic reasons;
- a U-value of about 1.6 is typically achieved using triple glazing but may be achieved using double glazing with an optimized gas, spacer and coating configuration installed in an insulated frame;
- a U-value of about 1.4 is typically achieved using triple glazing and multiple low-e coatings.

U-values and Energy Ratings (ER) for manufactured windows, glazed doors and skylights are obtained through testing in accordance with the standards referenced in Sentence 9.36.2.2.(3). The U-value and/or ER number for a proprietary product that has been tested can be found in the manufacturer's literature or on a label affixed to the product.

Note A-Table 9.36.2.7.-A Thermal Characteristics of Windows and Doors.

Energy Ratings, also known as ER numbers, are based on CSA A440.2/A440.3, "Fenestration energy performance/User guide to CSA A440.2:19, Fenestration energy performance".

They are derived from a formula that measures the overall performance of windows or doors based on solar heat gain, heat loss and air leakage through frames, spacers and glass. The ER formula produces a single unitless ER number between 0 and 50 for each of the specified sample sizes found in CSA A440.2/A440.3 (the number only applies to the product at the sample size and not to a particular proprietary window or door). The higher the ER number, the more energy-efficient the product. Note that the ER formula does not apply to sloped glazing so skylights do not have an ER value.

The maximum U-values specified in Table 9.36.2.7.-A are based on the following assumptions:

- that of moderate solar gain for each window and glazed door,
- that houses have a mix of picture and sash windows, each of which performs differently from an energy-efficiency perspective, and
- that fenestration area to gross wall area ratios typically vary between 8% and 25%.

Note A-9.36.2.7.(3) Site-built Windows.

Site-built windows are often installed in custom-built homes or in unique configurations for which manufactured units are not available. The airtightness requirements in Section 9.7. also apply to site-built windows.

9.36.5.3. Compliance

(See Note A-9.36.5.3.)

1) The performance compliance calculations shall determine the annual energy consumption of the proposed house and the house energy target of a reference house in accordance with

a) this Subsection, or

b) the EnerGuide Rating System, version 15, and Sentence (2).

(See Note A-9.36.5.3.(1).)

2) The annual energy consumption of the proposed house shall not exceed the house energy target of the reference house. (See Note A-9.36.5.3.(2).)

3) In establishing the house energy target, *building* components, systems and assemblies shall be accounted for in accordance with the prescriptive requirements of Subsections 9.36.2. to 9.36.4. for the climate zone under consideration.

4) In establishing the annual energy consumption, *building* components, systems and assemblies that are addressed in the scope of the prescriptive requirements of Subsections 9.36.2. to 9.36.4. shall be accounted for for the climate zone under consideration.

5) Where the construction techniques or *building* components, systems or assemblies used are more energy-efficient than those prescribed by the prescriptive requirements, the performance compliance calculations are permitted to take this increased performance level into account in the determination of the annual energy consumption, provided it can be quantified and is not dependent on occupant interaction.

6) Both the proposed and reference houses shall be modeled using the same climatic data, *soil* conditions, operating schedules in Article 9.36.5.4. and temperature set-points.

Note A-9.36.5.3. Compliance.

Where a Part 9 building contains more than one dwelling unit, compliance with Section 9.36. can be demonstrated on a per-unit basis. For dwelling units that are house-like in form, such as single detached houses, semi-detached houses, row houses and townhouses, this approach is commonly used as it can simplify airtightness testing. For dwelling units that are apartment-like in form, airtightness testing can be simplified by subdividing buildings into zones containing one or more dwelling units that are connected by a common space.

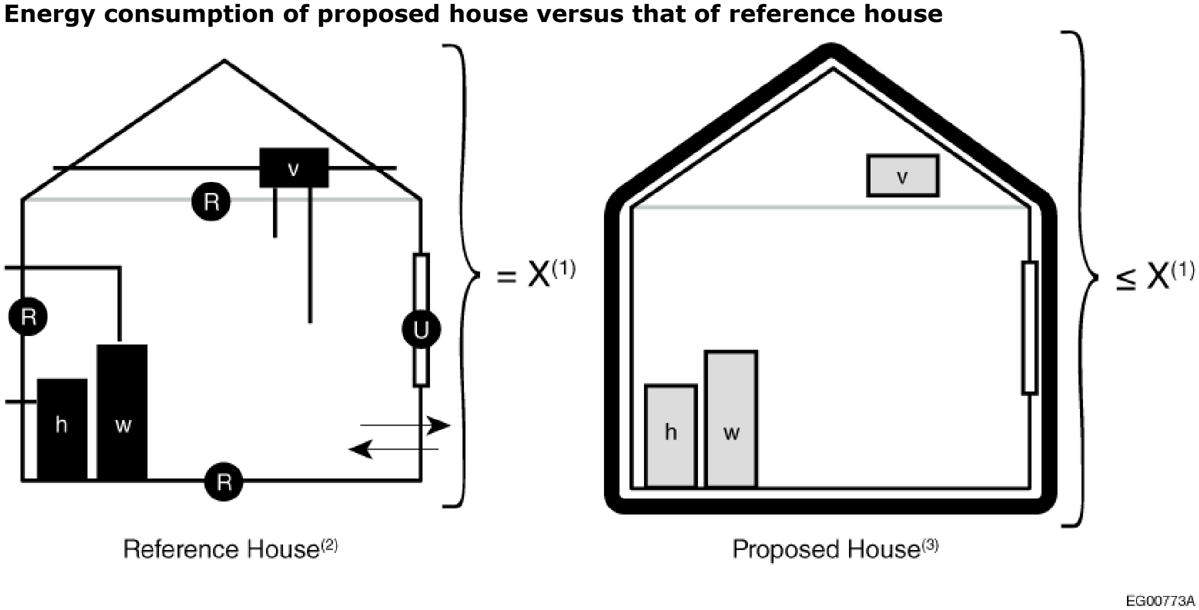
Note A-9.36.5.3.(1) Energy Modeling.

The energy modeling of the proposed and reference houses should be performed using the same software. An energy modeling platform other than the EnerGuide Rating System may be used to demonstrate compliance with Clause 9.36.5.3.(1)(a).

Note A-9.36.5.3.(2) Concept of Comparing Performance.

Comparing the performance of a reference house to that of a proposed house is one way to benchmark the performance of a proposed house in relation to Code requirements. There are other ways to benchmark energy consumption models: for example, by setting a quantitative energy target or using a benchmark design. In the performance compliance option presented in Subsection 9.36.5., the user must demonstrate that their design results in a similar level of performance to that of the prescriptive requirements— an approach that is consistent with the concept of objective-based codes.

Figure A-9.36.5.3.(2)
Energy consumption of proposed house versus that of reference house



Notes to Figure A-9.36.5.3.(2):

(1) X = calculated house energy target of reference house
(2) Complies with prescriptive requirements in Subsections 9.36.2. to 9.36.4.
(3) Complies with objectives of Subsections 9.36.2. to 9.36.4. using performance compliance option

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9.36.7.3. Energy Performance Improvement Compliance Calculations

1) Except where otherwise stated in this Article, the proposed and reference houses shall be modeled in accordance with Subsection 9.36.5. to determine

a) the annual energy consumption of the proposed house and the house energy target of the reference house,

b) the annual gross space heat loss of the proposed and reference houses calculated in accordance with Sentence (5), and

c) the peak cooling load of the proposed and reference houses (see Sentence (4)).

(See Note A-9.36.7.3.(1).)

2) The peak cooling load for the proposed house shall not be greater than the peak cooling load for the reference house. (See Sentence (4).)

3) Except for energy performance tier 1, where space heating is provided by a heat pump in the proposed house, the reference house shall be modeled using

a) equipment of the same type as the secondary or back-up system in the proposed house, but made to comply with the energy efficiency requirements of Article 9.36.3.10., or

b) electric resistance heaters, where no back-up is provided in the proposed house.

4) Where cooling systems are not installed in the proposed house, both the proposed and reference houses shall have additional models using appropriately sized space-cooling equipment serving all *conditioned spaces* to determine the peak cooling load. (See Note A-9.36.7.3.(4).)

5) The annual gross space heat loss shall be calculated as the sum of the cumulative heat loss from

a) conduction across opaque and transparent elements of the *building* envelope,

b) air infiltration and exfiltration, and

c) mechanical ventilation.

(See Note A-9.36.7.3.(5).)

6) The percent heat loss reduction shall be calculated by subtracting the annual gross space heat loss of the proposed house from the annual gross space heat loss of the reference house and dividing the result by the annual gross space heat loss of the reference house.

7) The percent improvement shall be calculated by subtracting the annual energy consumption of the proposed house from the house energy target of the reference house and dividing the result by the house energy target of the reference house.

8) The percent house energy target shall be calculated by dividing the annual energy consumption of the proposed house by the house energy target of the reference house.

9) The airtightness value used in the energy model for the proposed house shall be

a) the airtightness value set out in Clause 9.36.5.10.(9)(a), or

b) where an airtightness test is to be conducted, a design airtightness, until the airtightness has been measured in accordance with Sentence 9.36.6.3.(1) and the appropriate airtightness value set out in Sentence 9.36.5.10.(9) can be selected.

(See Note A-9.36.7.3.(9).)

Note A-9.36.7.3.(1) Reference House and Proposed House.

The terms “reference house” and “proposed house” have the same meanings as in Subsection 9.36.5. and they apply to energy models for both houses and multi-unit residential buildings. The term “house” is used for consistency and is intended to be applied to both houses and buildings within the scope of Subsection 9.36.7.

Note A-9.36.7.3.(4) 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 modeling software only report 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 modeling software does not report peak hourly loads, the design cooling load may be used instead.

The peak cooling load criteria is intended to reduce the risk that houses built under the tiered energy performance compliance path will overheat in the summer. To meet this goal, the proposed house must achieve a peak cooling load that is no more than that of the reference house. Even so, this modeling requirement does not guarantee that a house will not overheat, as a reference house complying with Subsection 9.36.5. may nevertheless be prone to overheating in some circumstances. Instead, houses complying with this modeling requirement should be no more prone to overheating than houses constructed under other energy efficiency compliance paths in the Code. This requirement does not prescribe the installation of cooling systems in new construction nor can the installation of air-conditioning be used as an alternative compliance path for houses not meeting this requirement.

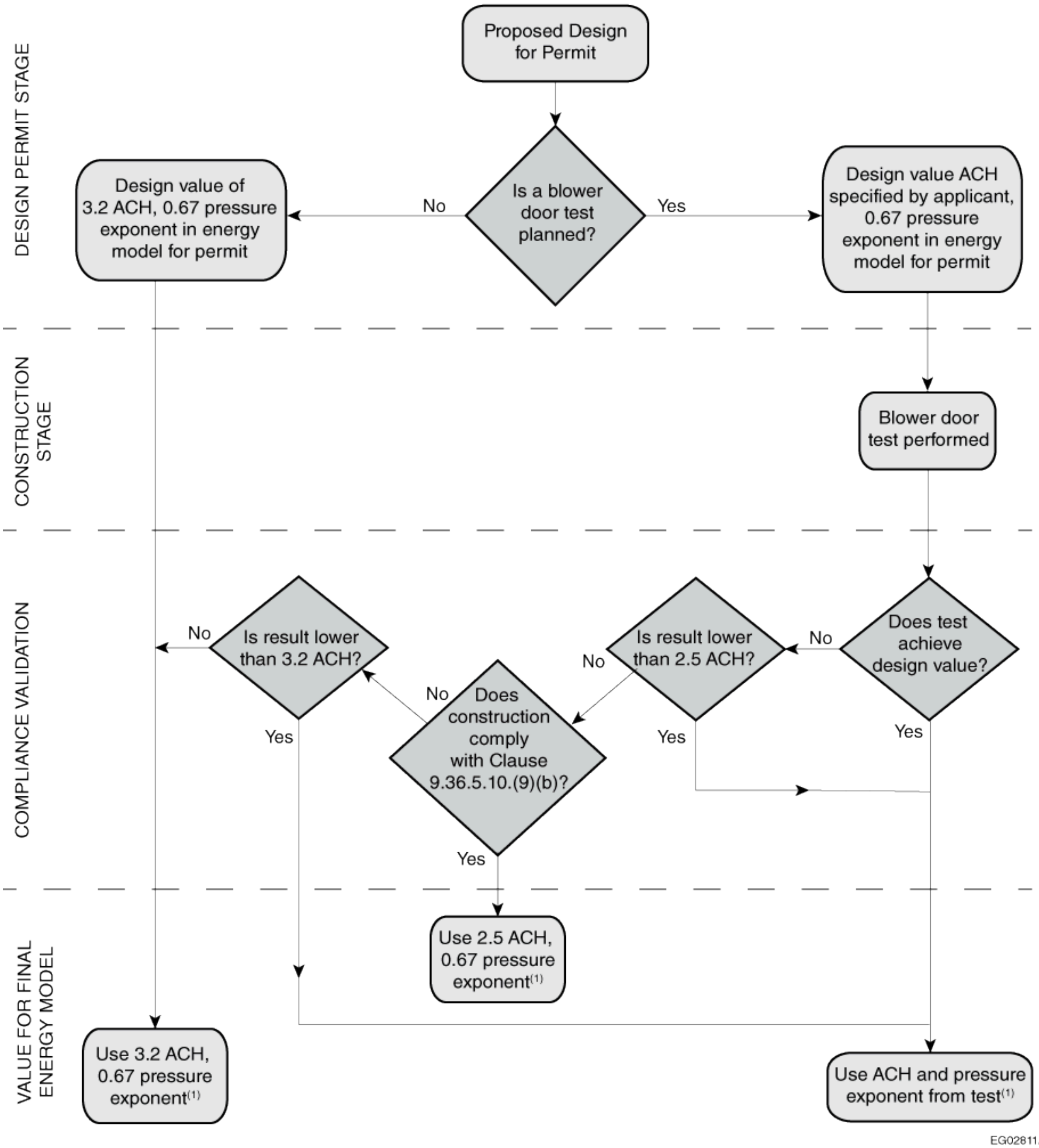
Note A-9.36.7.3.(5) Annual Gross Space Heat Loss.

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 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 in most simulation models.

Note A-9.36.7.3.(9) Airtightness Testing.

The flow chart in Figure A-9.36.7.3.(9) outlines the intended interpretation of Sentence 9.36.7.3.(9). Airtightness testing is voluntary, however, not testing will result in the proposed house model using a default airtightness of 3.2 air changes per hour (ACH) at 50 Pa pressure difference and a pressure exponent of 0.67.

Figure A-9.36.7.3.(9)
Determining the appropriate airtightness value to use in the energy model calculations in the tiered energy performance compliance path



Note to Figure A-9.36.7.3.(9):

(1) Airtightness value and pressure exponent of reference house shall be as per Sentence 9.36.5.14.(2).

Where testing is to be carried out, Code users may use a design value for ACH at 50 Pa pressure difference in the proposed house that they expect to achieve upon testing. Good airtightness is a significant contributor to energy-efficient performance and is likely to be needed to achieve the higher energy performance tiers, however, it requires careful detailing and planning. Caution is advised when choosing a design airtightness value, especially for Code users who are not used to delivering highly airtight buildings. Industry resources are available to assist with selecting and achieving a design airtightness.

Once an airtightness test has been performed, Code users may choose whether to use the test result, the default value of 3.2 ACH at 50 Pa pressure difference or, where the requirements of Clause 9.36.5.10.(9)(b) have been met, 2.5 ACH at 50 Pa pressure difference. It is important to note that a tested pressure exponent may only be used in cases where the tested ACH is used.

PROPOSED CHANGE AS SUBMITTED TO FALL 2023 PUBLIC REVIEW

[9.36.2.7.] 9.36.2.7. Thermal Characteristics of Fenestration, Doors and Skylights

[1] **1)** Except as provided in ~~Sentences (2) to (8)~~Sentences (3)-2025 to (9)-2025 and Article 9.36.2.11., fenestration and doors shall have an overall thermal transmittance (U-value) not greater than, or an Energy Rating not less than, the values listed in Table 9.36.2.7.-A for the applicable heating-degree day category. (See Note A-9.36.2.7.(1) and (3)~~Note A-9.36.2.7.(1) and (2)~~.)

Table [9.36.2.7.-A] 9.36.2.7.-A
Required Thermal Characteristics of Fenestration and Doors
Forming Part of Sentence [9.36.2.7.] 9.36.2.7.([1] 1)

Components	Thermal Characteristics (1)	Heating Degree-Days of *Building* Location, (2) in Celsius Degree-Days					
		Zone 4 < 3000	Zone 5 3000 to 3999	Zone 6 4000 to 4999	Zone 7A 5000 to 5999	Zone 7B 6000 to 6999	Zone 8 ≥ 7000
Fenestration (3) and doors	Max. U-value, W/(m^2×K)	1.84	1.84	1.61	1.61	1.44	1.44
	Min. Energy Rating	21	21	25	25	29	29

Notes to Table [9.36.2.7.-A] 9.36.2.7.-A:

(1) See Note A-Table 9.36.2.7.-A.

(2) See Article 1.1.3.1.

(3) Except skylights (see Sentence (3)-2025~~Sentence (2)~~) and glass block assemblies (see Sentence (5)-2025~~Sentence (4)~~).

[2] --) The solar heat gain coefficient of fenestration and doors in a given orientation shall not be greater than the value listed in Table 9.36.2.7.-B-2025 for the fenestration and door area to gross wall area ratio (FDWR) in that orientation.

Table [9.36.2.7.-B]
Solar Heat Gain Coefficient of Fenestration and Doors
Forming Part of Sentence [9.36.2.7.] 9.36.2.7.([3] 2)

Fenestration and door area to gross wall area ratio (FDWR)	Maximum solar heat gain coefficient of fenestration and doors
FDWR < 17%	0.45
17% < FDWR < 22%	0.40
FDWR > 22%	0.26

[3] 2) Skylights shall have an overall thermal transmittance not greater than the values listed in ~~Table 9.36.2.7.-B~~Table 9.36.2.7-C-2025 for the applicable heating-degree day category. (See Note A-9.36.2.7.(1) and (3)~~Note A-9.36.2.7.(1) and (2)~~.)

Table [9.36.2.7.-C] 9.36.2.7.-B
Overall Thermal Transmittance of Skylights
Forming Part of Sentence [9.36.2.7.] 9.36.2.7.([3] 2)

	Heating Degree-Days of *Building* Location,(1) in Celsius Degree-Days					
	Zone 4 < 3000	Zone 5 3000 to 3999	Zone 6 4000 to 4999	Zone 7A 5000 to 5999	Zone 7B 6000 to 6999	Zone 8 ≥ 7000
Component	Maximum Overall Thermal Transmittance, $W/(m^2 \times K)$					
Skylights	2.92	2.92	2.75	2.75	2.41	2.41

Note to Table [9.36.2.7.-C] 9.36.2.7.-B:

(1) See Article 1.1.3.1.

[4] 3) Except for site-assembled or site-glazed factory-made fenestration products, curtain wall construction, and site-built windows and glazed doors that are tested in accordance with Sentence 9.36.2.2.(3), site-built windows and glazed doors need not comply with Sentence (1), provided they are constructed in accordance with one of the options presented in ~~Table 9.36.2.7.-C~~Table 9.36.2.7.-D for the applicable climate zone. (See Note A-9.36.2.7.(4)~~Note A-9.36.2.7.(3)~~.)

Table [9.36.2.7.-D] 9.36.2.7.-C
Compliance Options for Site-built Windows and Glazed Portion of Doors
Forming Part of Sentence [9.36.2.7.] 9.36.2.7.([4] 3)

Component	Description of Component	Compliance Options							
		Climate Zones 4 and 5			Climate Zones 6 and 7A			Climate Zones 7B and 8	
		≤ 3999 HDD			4000 to 5999 HDD			≥ 6000 HDD	
		1	2	3	1	2	3	1	2
Frame	non-metallic	✓	✓	—	✓	✓	—	✓	✓
	thermally broken metallic	—	—	✓	—	—	✓	—	—
Glazing	double	—	✓	—	—	—	—	—	—
	triple	✓	—	✓	✓	✓	✓	✓	✓
	argon-filled	—	✓	—	✓	—	✓	—	✓
Low-e coating	none	✓	—	—	—	—	—	—	—
	number of panes with ≤ 0.10	—	≥ 1	—	—	—	—	≥ 2	—
	number of panes with ≤ 0.20	—	—	2	≥ 1	2	≥ 2	—	≥ 2
Spacer	size, mm	12.7	—	12.7	≥ 12.7	12.7	≥ 12.7	≥ 12.7	≥ 12.7
	non-metallic	—	✓	—	—	—	—	—	—

[5] **4)** Glass block assemblies separating *conditioned space* from unconditioned space or the exterior shall have
  [a] a) an overall thermal transmittance of not more than 2.9 W/(m^2×K), and
  [b] b) a total aggregate area of not more than 1.85 m^2.

[6] **5)** One door separating a *conditioned space* from an unconditioned space or the exterior is permitted to have an overall thermal transmittance up to 2.6 W/(m^2×K).

[7] **6)** Storm windows and doors need not comply with Sentence (1).

[8] **7)** Vehicular access doors separating a *conditioned space* from an unconditioned space or the exterior shall have a nominal thermal resistance of not less than 1.1 (m^2×K)/W.

[9] **8)** Access hatches separating a *conditioned space* from an unconditioned space shall be insulated to a nominal thermal resistance of not less than 2.6 (m^2×K)/W.

[9.36.5.3.] 9.36.5.3. Compliance
(See Note A-9.36.5.3.)

[1] **1)** The performance compliance calculations shall determine the annual energy consumption of the proposed house and the house energy target of a reference house

in accordance with

[a] a) this Subsection, or

[b] b) the EnerGuide Rating System, version 15, and Sentence (2).

(See Note A-9.36.5.3.(1).)

[2] **2)** The annual energy consumption of the proposed house shall not exceed the house energy target of the reference house. (See Note A-9.36.5.3.(2).)

[3] **3)** In establishing the house energy target, *building* components, systems and assemblies shall be accounted for in accordance with the prescriptive requirements of Subsections 9.36.2. to 9.36.4. for the climate zone under consideration.

[4] **4)** In establishing the annual energy consumption, *building* components, systems and assemblies that are addressed in the scope of the prescriptive requirements of Subsections 9.36.2. to 9.36.4. shall be accounted for for the climate zone under consideration.

[5] **5)** Where the construction techniques or *building* components, systems or assemblies used are more energy-efficient than those prescribed by the prescriptive requirements, the performance compliance calculations are permitted to take this increased performance level into account in the determination of the annual energy consumption, provided it can be quantified and is not dependent on occupant interaction.

[6] **6)** Both the proposed and reference houses shall be modeled using the same climatic data, *soil* conditions, operating schedules in Article 9.36.5.4. and temperature set-points.

[7] --) Where a cooling system is not installed in the proposed house, the peak cooling load shall be modeled for both the proposed and reference houses by using additional models with appropriately sized space-cooling equipment serving all *conditioned spaces*. (See Note A-9.36.5.3.(7).)

[8] --) The proposed house described in Sentence (7) shall have

[a] --) a peak cooling load not greater than 110% of the peak cooling load for the reference house, or

[b] --) a design cooling intensity not greater than 4.5 W/m^3.

Note A-9.36.5.3.(7). 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 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 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 110% that of the reference house or a design cooling intensity of not more than 4.5 W/m^3. Even so, this modeling requirement does not guarantee that a house will not overheat, as a reference house complying with Subsection 9.36.5. may nevertheless be prone to overheating in some circumstances. This requirement does not prescribe the installation of cooling systems in new construction.

[9.36.7.3.] 9.36.7.3. Energy Performance Improvement Compliance Calculations

[1] **1)** Except where otherwise stated in this Article, the proposed and reference houses shall be modeled in accordance with Subsection 9.36.5. to determine

[a] a) the annual energy consumption of the proposed house and the house energy target of the reference house,

[b] b) the annual gross space heat loss of the proposed and reference houses calculated in accordance with Sentence (5), and

[c] c) the peak cooling load of the proposed and reference houses ~~(see Sentence (4))~~.

(See Note A-9.36.7.3.(1).)

~~[2] 2) The peak cooling load for the proposed house shall not be greater than the peak cooling load for the reference house. (See Sentence (4).)~~

[3] **3)** Except for energy performance tier 1, where space heating is provided by a heat pump in the proposed house, the reference house shall be modeled using

[a] a) equipment of the same type as the secondary or back-up system in the proposed house, but made to comply with the energy efficiency requirements of Article 9.36.3.10., or

[b] b) electric resistance heaters, where no back-up is provided in the proposed house.

~~[4] 4) Where cooling systems are not installed in the proposed house, both the proposed and reference houses shall have additional models using appropriately sized space-cooling equipment serving all *conditioned spaces* to determine the peak cooling load. (See Note A-9.36.7.3.(4).)~~

[5] **5)** 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.(5).)

[6] **6)** The percent heat loss reduction shall be calculated by subtracting the annual gross space heat loss of the proposed house from the annual gross space heat loss of the reference house and dividing the result by the annual gross space heat loss of the reference house.

[7] **7)** The percent improvement shall be calculated by subtracting the annual energy consumption of the proposed house from the house energy target of the reference house and dividing the result by the house energy target of the reference house.

[8] **8)** The percent house energy target shall be calculated by dividing the annual energy consumption of the proposed house by the house energy target of the reference house.

[9] **9)** The airtightness value used in the energy model for the proposed house shall be

[a] a) the airtightness value set out in Clause 9.36.5.10.(9)(a), or

[b] b) where an airtightness test is to be conducted, a design airtightness, until the airtightness has been measured in accordance with Sentence 9.36.6.3.(1) and the appropriate airtightness value set out in Sentence 9.36.5.10.(9) can be selected.

(See Note A-9.36.7.3.(9).)

~~**Note A-9.36.7.3.(4) 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 modeling software only report 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 modeling software does not report peak hourly loads, the design cooling load may be used instead.~~

~~The peak cooling load criteria is intended to reduce the risk that houses built under the tiered energy performance compliance path will overheat in the summer. To meet this goal, the proposed house must achieve a peak cooling load that is no more than that of the reference house. Even so, this modeling requirement does not guarantee that a house will not overheat, as a reference house complying with Subsection 9.36.5. may nevertheless be prone to overheating in some circumstances. Instead, houses complying with this modeling requirement should be no more prone to overheating than houses constructed under other energy efficiency compliance paths in the Code. This requirement does not prescribe the installation of cooling systems in new construction nor can the installation of air-conditioning be used as an alternative compliance path for houses not meeting this requirement.~~

REVISED PROPOSED CHANGE FOLLOWING FALL 2023 PUBLIC REVIEW

[9.36.2.7.] 9.36.2.7. Thermal Characteristics of Fenestration, Doors and Skylights

[1] **1)** Except as provided in Sentences (3)-2025 to (9)-2025 and Article 9.36.2.11., fenestration and doors shall have an overall thermal transmittance (U-value) not greater than, or an Energy Rating not less than, the values listed in Table 9.36.2.7.-A for the applicable heating-degree day category. (See Note A-9.36.2.7.(1) and (3).)

Table [9.36.2.7.-A] 9.36.2.7.-A
Required Thermal Characteristics of Fenestration and Doors
Forming Part of Sentence [9.36.2.7.] 9.36.2.7.([1] 1)

Components	Thermal Characteristics (1)	Heating Degree-Days of *Building* Location, (2) in Celsius Degree-Days					
		Zone 4 < 3000	Zone 5 3000 to 3999	Zone 6 4000 to 4999	Zone 7A 5000 to 5999	Zone 7B 6000 to 6999	Zone 8 ≥ 7000
Fenestration (3) and doors	Max. U-value, W/(m^2×K)	1.84	1.84	1.61	1.61	1.44	1.44
	Min. Energy Rating	21	21	25	25	29	29

Notes to Table [9.36.2.7.-A] 9.36.2.7.-A:

(1) See Note A-Table 9.36.2.7.-A.

(2) See Article 1.1.3.1.

(3) Except skylights (see Sentence (3)-2025) and glass block assemblies (see Sentence (5)-2025).

[2] --) The solar heat gain coefficient of fenestration and doors ~~in a given orientation~~ shall not be greater than the value listed in Table 9.36.2.7.-B-2025 for the fenestration and door area to gross wall area ratio (FDWR) ~~in that orientation~~.

Table [9.36.2.7.-B]
Solar Heat Gain Coefficient of Fenestration and Doors
Forming Part of Sentence [9.36.2.7.] 9.36.2.7.([3] 2)

Fenestration and Door Area to Gross Wall Area Ratio (FDWR)	Heating Degree-Days of Building Location (1) in Celsius Degree-Days					
	Maximum Solar Heat Gain Coefficient ~~of fenestration and doors~~					
	Zone 4 < 3000	Zone 5 3000 to 3999	Zone 6 4000 to 4999	Zone 7A 5000 to 5999	Zone 7B 6000 to 6999	Zone 8 > 7000
FDWR ~~<~~≤ 17%	0.35	0.40	0.45	0.50	0.55	0.60
17% < FDWR ~~<~~≤ 22%	0.30	0.35	0.40	0.45	0.50	0.55
22% < FDWR ~~>~~≤ ~~22~~30%	0.26	0.30	0.35	0.40	0.45	0.50
FDWR > 30%	0.26					

Note to Table [9.36.2.7.-B] :

(1) See Article 1.1.3.1.

[3] 2) Skylights shall have an overall thermal transmittance not greater than the values listed in Table 9.36.2.7-C-2025 for the applicable heating-degree day category. (See Note A-9.36.2.7.(1) and (3).)

Table [9.36.2.7.-C] 9.36.2.7.-B
Overall Thermal Transmittance of Skylights
Forming Part of Sentence [9.36.2.7.] 9.36.2.7.([3] 2)

Component	Heating Degree-Days of *Building* Location, (1) in Celsius Degree-Days					
	Zone 4 < 3000	Zone 5 3000 to 3999	Zone 6 4000 to 4999	Zone 7A 5000 to 5999	Zone 7B 6000 to 6999	Zone 8 ≥ 7000
	Maximum Overall Thermal Transmittance, W/(m²×K)					
Skylights	2.92	2.92	2.75	2.75	2.41	2.41

Note to Table [9.36.2.7.-C] 9.36.2.7.-B:

(1) See Article 1.1.3.1.

[4] **3)** Except for site-assembled or site-glazed factory-made fenestration products, curtain wall construction, and site-built windows and glazed doors that are tested in accordance with Sentence 9.36.2.2.(3), site-built windows and glazed doors need not comply with Sentence (1), provided they are constructed in accordance with one of the options presented in Table 9.36.2.7.-D for the applicable climate zone. (See Note A-9.36.2.7.(4).)

Table [9.36.2.7.-D] 9.36.2.7.-C
Compliance Options for Site-built Windows and Glazed Portion of Doors
Forming Part of Sentence [9.36.2.7.] 9.36.2.7.([4] 3)

Component	Description of Component	Compliance Options							
		Climate Zones 4 and 5			Climate Zones 6 and 7A			Climate Zones 7B and 8	
		≤ 3999 HDD			4000 to 5999 HDD			≥ 6000 HDD	
		1	2	3	1	2	3	1	2
Frame	non-metallic	✓	✓	—	✓	✓	—	✓	✓
	thermally broken metallic	—	—	✓	—	—	✓	—	—
Glazing	double	—	✓	—	—	—	—	—	—
	triple	✓	—	✓	✓	✓	✓	✓	✓
	argon-filled	—	✓	—	✓	—	✓	—	✓
Low-e coating	none	✓	—	—	—	—	—	—	—
	number of panes with ≤ 0.10	—	≥ 1	—	—	—	—	≥ 2	—
	number of panes with ≤ 0.20	—	—	2	≥ 1	2	≥ 2	—	≥ 2
Spacer	size, mm	12.7	—	12.7	≥ 12.7	12.7	≥ 12.7	≥ 12.7	≥ 12.7
	non-metallic	—	✓	—	—	—	—	—	—

[5] **4)** Glass block assemblies separating *conditioned space* from unconditioned space or the exterior shall have
[a] a) an overall thermal transmittance of not more than 2.9 W/(m^2×K), and
[b] b) a total aggregate area of not more than 1.85 m^2.

[6] **5)** One door separating a *conditioned space* from an unconditioned space or the exterior is permitted to have an overall thermal transmittance up to 2.6 W/(m^2×K).

[7] **6)** Storm windows and doors need not comply with Sentence (1).

[8] **7)** Vehicular access doors separating a *conditioned space* from an unconditioned space

or the exterior shall have a nominal thermal resistance of not less than 1.1 (m^2×K)/W.

[9] **8)** Access hatches separating a *conditioned space* from an unconditioned space shall be insulated to a nominal thermal resistance of not less than 2.6 (m^2×K)/W.

[9.36.5.3.] 9.36.5.3. Compliance

(See Note A-9.36.5.3.)

[1] **1)** The performance compliance calculations shall determine the annual energy consumption of the proposed house and the house energy target of a reference house in accordance with

[a] a) this Subsection, or

[b] b) the EnerGuide Rating System, version 15, and Sentence (2).

(See Note A-9.36.5.3.(1).)

[2] **2)** The annual energy consumption of the proposed house shall not exceed the house energy target of the reference house. (See Note A-9.36.5.3.(2).)

[3] **3)** In establishing the house energy target, *building* components, systems and assemblies shall be accounted for in accordance with the prescriptive requirements of Subsections 9.36.2. to 9.36.4. for the climate zone under consideration.

[4] **4)** In establishing the annual energy consumption, *building* components, systems and assemblies that are addressed in the scope of the prescriptive requirements of Subsections 9.36.2. to 9.36.4. shall be accounted for for the climate zone under consideration.

[5] **5)** Where the construction techniques or *building* components, systems or assemblies used are more energy-efficient than those prescribed by the prescriptive requirements, the performance compliance calculations are permitted to take this increased performance level into account in the determination of the annual energy consumption, provided it can be quantified and is not dependent on occupant interaction.

[6] **6)** Both the proposed and reference houses shall be modeled using the same climatic data, *soil* conditions, operating schedules in Article 9.36.5.4. and temperature set-points.

[7] **--)** Where a cooling system is not installed in the proposed house, or the cooling loads are not determined in accordance with CSA F280-12, “Determining the required capacity of residential space heating and cooling appliances,” the peak cooling load shall be modeled for both the proposed and reference houses by using additional models with appropriately sized space-cooling equipment serving all *conditioned spaces*. (See Note A-9.36.5.3.(7).)

[8] **--)** The proposed house described in Sentence (7) shall have

[a] --) a peak cooling load not greater than ~~110~~100% of the peak cooling load for the reference house, or

[b] --) a design cooling intensity not greater than ~~4.5~~10 W/m^3.

Note A-9.36.5.3.(7). 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 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 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 ~~110~~100% that of the reference house or a design cooling intensity of not more than ~~4.5~~10 W/m^3. Even so, this modeling requirement does not guarantee that a house will not overheat, as a reference house complying with Subsection 9.36.5. may nevertheless be prone to overheating in some circumstances. This requirement does not prescribe the installation of cooling systems in new construction.

[9.36.7.3.] 9.36.7.3. Energy Performance Improvement Compliance Calculations

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Impact analysis

This proposed change would restrict the use of windows with a high solar heat gain coefficient (SHGC) to varying degrees in certain climate zones, which may initially result in higher construction costs for some builders. High solar heat gain windows (under the Energy Rating path) generally cost less than the equivalent low SHGC windows. However, it is noted that mid- and low-SHGC glazing options are becoming increasingly available and cost-competitive as demand for this product type increases. As of June 2023, the difference in manufacturer's suggested retail unit price is $100 between low- and high-SHGC windows that are 48 in. × 48 in. in a double pane vinyl casement.

This proposed change would result in a lower operational cost to homeowners by reducing the cost of air-conditioning where cooling systems are installed and by limiting the discomfort of overheating where they are not. This proposed change has the additional benefit of reducing the likelihood of low SEER air conditioners being added or retrofitted by homeowners after closing that would not have been considered in the energy calculation at the time of construction. This situation would represent an increase in energy use in the house as a consequence of the requirements related to glazing selection, which are intended to reduce energy use, and would result in the additional energy use being omitted from the calculations. The National Research Council of Canada (NRC), Natural Resources Canada (NRCan) and Canada Mortgage and Housing Corporation (CMHC), with contributions from 37 companies, studied the impact of using glazing systems with high versus low solar heat gain in the webpage titled, "Low-Solar and High-Solar Gain Glazings" [4]. The results compiled throughout North America and the results for 10 Canadian locations indicated the following:

- High solar heat gain glazing systems offered 13% to 17% energy cost savings compared to conventional windows and offered annual energy cost savings of $117 to $354.
- Low solar heat gain glazing systems offered 8% to 10% energy cost savings compared to conventional windows and offered annual energy cost savings from $71 to $203.

Another study conducted by CanmetENERGY-Ottawa (NRCan) observed that, for a typical window-to-wall ratio, low-SHGC windows reduce the peak cooling load by 0.4 ton to 1 ton depending on the orientation. This translates into a savings of $6 to $15 for each heating period of 24 hours.

As a benefit to builders, this proposed change would help reduce customer discomfort and costly retrofits as a result of customer call-backs. Further, the additional compliance options introduced in the performance path in Article 9.36.5.3. would increase flexibility in compliance for builders by providing three options instead of only one. Anecdotal feedback indicated that the use of the performance path for compliance often results in net-cost reductions for builders, where the costs of energy modeling are offset by trade-offs in specifications that may not be available under the prescriptive path method.

References

[1] Laouadi A., Bartko M., Gaur A., Lacasse M.A., “Climate Resilience Buildings: Guideline for management of overheating risk in residential buildings,” National Research Council, CRBCPI-Y4-10, April 1, 2021, including revisions released on January 10, 2022 and February 16, 2022: nrc-publications.canada.ca/eng/view/ft/?id=9c60dc19-ca18-4f4c-871f-2633f002b95c&dp=2&dsl=en

[2] Association de vitrerie et fenestration du Québec (AVFQ), Building Energy Simulations: Impact of SHGC on the thermal performance of detached houses in different Canadian climate zones, December 2023.

[3] CanmetENERGY Buildings & Renewables Group, Adjusted cooling load requirements, May 2024.

[4] Natural Resources Canada, Low-Solar and High-Solar Gain Glazings, website: https://natural-resources.canada.ca/energy/efficiency/data-research-and-insights-energy-efficiency/housing-innovation/low-solar-and-high-solar-gain-glazings/5139

Enforcement implications

This proposed change can be enforced by the existing Code enforcement infrastructure without additional resources. There are no enforcement implications beyond the practices required to enforce the existing Code provisions.

Who is affected

Designers, engineers, architects, manufacturers, builders, specification writers and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.36.2.7.] 9.36.2.7. ([1] 1) [F92-OE1.1]

Intent 1:

To limit the probability that the overall thermal transmittance of fenestration and doors other than skylights and glass block masonry units will be unacceptably high or their energy rating will be unacceptably low, which could lead to excessive thermal transfer through the building envelope, which could lead to excessive use of energy for heating and cooling, which could lead to an unacceptable effect on the environment.

[9.36.2.7.] -- ([2] --) [F95-OE1.1]

Intent 1:

To limit the probability that the maximum solar heat gain coefficient of fenestration and doors will be unacceptably high, which could lead to excessive use of energy for cooling, which could lead to an unacceptable effect on the environment.

[9.36.2.7.] 9.36.2.7. ([3] 2) [F92-OE1.1]

Intent 1:

To limit the probability that the overall thermal transmittance of skylights will be unacceptably high, which could lead to excessive thermal transfer through the building envelope, which could lead to excessive use of energy for heating and cooling, which could lead to an unacceptable effect on the environment.

[9.36.2.7.] 9.36.2.7. ([4] 3) no attributions

Intent 1:

To exempt site-built windows and site-built glazed doors from the requirements stated in Sentence 9.36.2.7.(1), on the basis that constructing them according to the options presented in Table 9.36.2.7.-C will achieve an acceptable energy performance.

[9.36.2.7.] 9.36.2.7. ([4] 3) [F92-OE1.1]

Intent 1:

To limit the probability that the construction of site-built windows and site-built glazed doors will be inadequate to achieve an acceptable energy performance, which could lead to such windows and doors having an unacceptably high overall thermal transmittance, which could lead to excessive thermal transfer through the building envelope, which could lead to excessive use of energy for heating and cooling, which could lead to an unacceptable effect on the environment.

[9.36.2.7.] 9.36.2.7. ([5] 4) [F92-OE1.1]

Intent 1:

To limit the probability that glass block assemblies separating conditioned space from unconditioned space or the exterior will have an unacceptably high overall thermal transmittance or make up too great an area of the separating assembly, which could lead to excessive thermal transfer through the building envelope, which could lead to excessive use of energy for heating and cooling, which could lead to an unacceptable effect on the environment.

[9.36.2.7.] 9.36.2.7. ([6] 5) [F92-OE1.1]

Intent 1:

To allow one exterior door in a dwelling unit to have a higher overall thermal transmittance than permitted by Sentence 9.36.2.7.(1), which would otherwise require all doors to conform to the same maximum overall thermal transmittance requirements, on the basis that some doors, due to their function, cannot easily meet these requirements and some flexibility is needed.

[9.36.2.7.] 9.36.2.7. ([7] 6) no attributions

Intent 1:

To exempt storm windows and doors from the thermal characteristic requirements stated in Sentence 9.36.2.7.(1), on the basis that these types of windows and doors typically cannot achieve the performance levels of other doors due to their function and properties.

[9.36.2.7.] 9.36.2.7. ([8] 7) [F92-OE1.1]

Intent 1:

To allow vehicular access doors to have a higher overall thermal transmittance than permitted in the thermal characteristic requirements of Sentence 9.36.2.7.(1), which would otherwise require all doors to conform to the same maximum overall thermal transmittance requirements, on the basis that some doors, due to their function, cannot easily meet these requirements and some flexibility is needed.

[9.36.2.7.] 9.36.2.7. ([9] 8) [F92-OE1.1]

Intent 1:

To limit the probability that the effective thermal resistance of access hatches will be unacceptably low, which could lead to excessive thermal transfer through the building envelope, which could lead to excessive use of energy for heating and cooling, which could lead to an unacceptable effect on the environment.

[9.36.5.3.] 9.36.5.3. ([1] 1) no attributions

Intent 1:

To explain the aim of the performance compliance calculations.

Intent 2:

To enable compliance with the EnerGuide Rating System as an acceptable alternative to the requirements of Subsection 9.36.5. This is to limit the probability that minor differences between Subsection 9.36.5. and the EnerGuide Rating System will lead to a requirement to prepare two energy models for compliance with Subsection 9.36.5. and the EnerGuide Rating System.

Intent 3:

To permit the use of the automatically generated reference house for compliance with Subsection 9.36.5. when complying with the EnerGuide Rating System, rather than manually modelling the reference building as required in Subsection 9.36.5.

[9.36.5.3.] 9.36.5.3. ([2] 2) [F92,F93,F95,F96,F98,F99,F100-OE1.1]

Intent 1:

To limit the probability that the energy consumption of the proposed building will exceed the energy consumption of the reference building, which could lead to excessive use of energy, which could lead to an unacceptable effect on the environment.

[9.36.5.3.] 9.36.5.3. ([3] 3) [F92,F93,F95,F96,F98,F99,F100-OE1.1]

Intent 1:

To limit the probability that the house energy target of the reference building will not account for energy uses covered by the prescriptive requirements, which could lead to overestimation of the energy used by the reference building, which could lead to excessive use of energy, which could lead to an unacceptable effect on the environment.

[9.36.5.3.] 9.36.5.3. ([4] 4) [F92,F93,F95,F96,F98,F99,F100-OE1.1]

Intent 1:

To limit the probability that the annual energy consumption of the proposed building will not account for energy uses covered by the prescriptive requirements, which could lead to overestimation of the energy used by the reference building or underestimation of the energy used by the proposed building, which could lead to excessive use of energy, which could lead to an unacceptable effect on the environment.

[9.36.5.3.] 9.36.5.3. ([5] 5) [F92,F93,F95,F96,F98,F99,F100-OE1.1]

Intent 1:

To limit the probability that the annual energy consumption of the proposed building will include a credit for construction techniques or building components whose better-than-prescriptive performance cannot be quantified or is dependent on occupant interaction, which could lead to underestimation of the annual energy consumption, which could lead to excessive use of energy, which could lead to an unacceptable effect on the environment.

[9.36.5.3.] 9.36.5.3. ([6] 6) [F99-OE1.1]

Intent 1:

To limit the probability that different climatic data, soil conditions, schedules and temperature set-points will be used in modeling the proposed and reference houses, which could lead to inaccuracy of the model, which could lead to overestimation of the energy used by the reference building or underestimation of the energy used by the proposed building, which could lead to excessive use of energy, which could lead to an unacceptable effect on the environment.

[9.36.5.3.] -- ([7] --) [F95,F99-OE1.1]

Intent 1:

To limit the probability that the energy model calculation will not model the energy required for cooling, which could lead to inaccuracy of the model, which could lead to overestimation of the energy used by the reference building or underestimation of the energy used by the proposed building, which could lead to excessive use of energy, which could lead to an unacceptable effect on the environment.

[9.36.5.3.] -- ([8] --) [F95,F99-OE1.1]

Intent 1:

To limit the probability that the design and construction of the proposed house will lead to a decrease in the rate at which heat is extracted from the conditioned space, which could lead to overheating in the summer, which could lead to excessive use of energy for cooling, which could lead to an unacceptable effect on the environment.

[9.36.7.3.] 9.36.7.3. ([1] 1) no attributions

Intent 1:

To direct Code users to Subsection 9.36.5. for the determination of the envelope performance improvement and overall performance improvements.

[9.36.7.3.] 9.36.7.3. ([2] 3) no attributions

Intent 1:

To permit a reduction in the overall energy performance, building envelope performance and airtightness level requirements of building or dwelling units with a conditioned space equal to or less than 230 m^3 on the basis that they consume less energy.

[9.36.7.3.] 9.36.7.3. ([2] 3) [F90,F91,F92,F93,F95,F96,F98,F99,F100-OE1.1]

Intent 1:

To limit the probability that the overall energy performance, building envelope performance and airtightness level of building or dwelling units containing not more than 230 m^3 of conditioned space will be unacceptably low for each tier, which could lead to excessive use of energy for heating and cooling, which could lead to an unacceptable effect on the environment.

[9.36.7.3.] 9.36.7.3. ([3] 5) [F90,F91,F92,F93,F95,F100-OE1.1]

Intent 1:

To limit the probability that the annual gross space heat loss will not be properly calculated, which could lead to excessive use of energy for heating and cooling, which could lead to an unacceptable effect on the environment.

[9.36.7.3.] 9.36.7.3. ([4] 6) no attributions

Intent 1:

To direct Code users to Article 9.36.5.2. for the determination of the house energy target and the annual energy consumption.

[9.36.7.3.] 9.36.7.3. ([4] 6) [F99-OE1.1]

Intent 1:

To limit the probability that the overall performance improvement is inaccurately determined, which could lead to excessive use of energy, which could lead to an unacceptable effect on the environment.

[9.36.7.3.] 9.36.7.3. ([5] 7) [F99-OE1.1]

Intent 1:

To limit the probability that the envelope performance improvement is inaccurately determined, which could lead to excessive use of energy, which could lead to an unacceptable effect on the environment.

[9.36.7.3.] 9.36.7.3. ([6] 8) [F90,F91,F92,F93,F95,F96,F98,F99,F100-OE1.1]

Intent 1:

To limit the probability that the percent house energy target will not be properly calculated, which could lead to overestimation of the percent house energy target, which could lead to excessive use of energy for heating and cooling, which could lead to an unacceptable effect on the environment.

[9.36.7.3.] 9.36.7.3. ([7] 9) [F90,F91,F92,F93,F95,F100-OE1.1]

Intent 1:

To limit the probability that the energy model calculation will not account for air leakage through the building envelope, which could lead to inaccuracy of the model, which could lead to overestimation of the energy used by the reference building or underestimation of the energy used by the proposed building, which could lead to excessive use of energy, which could lead to an unacceptable effect on the environment.