Submit a comment

Proposed Change 1880

Code Reference(s): **NBC20 Div.A 2.1.1.2. (first printing)**

Subject: Accessibility, Visitability and Adaptability of Dwelling Units

Title: Expanding the Application of the Accessibility Objective to All Dwelling Units

Description: This proposed change removes the exemption for houses from the application of the accessibility objective.

Related Proposed Change(s): PCF 1881, PCF 1883, PCF 1957, PCF 2028

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Accessibility, Visitability and Adaptability of Dwelling Units.

Problem

The National Building Code of Canada (NBC) is an objective-based model code in which most technical requirements address at least one of five objectives: safety, health, accessibility, fire and structural protection of buildings, and environment.

The current NBC accessibility objective specifically exempts houses from its application, which prevents the addition of any accessibility requirements to the NBC for these buildings.

Exempting these dwelling units from the application of the accessibility objective means that these buildings will continue to present significant accessibility challenges for persons with disabilities. Some persons with disabilities are unable to access many homes, meaning they often cannot reside in them without costly renovations, or visit friends or family.

Limiting access to houses for persons with disabilities could be seen as discriminatory and should be corrected.

Justification

This proposed change removes the exemption for houses from the application of the accessibility objective in Division A of the NBC. This proposed change would create a framework for technical provisions related to accessibility to be considered for houses. While the NBC has accessibility requirements for many different types of buildings, it does not currently have any that apply to houses because these buildings are exempted from requirements based on the application of the accessibility objective.

This proposed change is a necessary step toward making houses accessible to a larger portion of the population in Canada, especially as population demographics shift.

Many Canadians have reported having a disability, as shown in Table 1. Furthermore, the prevalence of disabilities increases with age: over 20% of Canadians over 15 years old and nearly 40% of Canadians over 65 years old report having a disability (Statistics Canada, 2022). Where disabilities were reported, the severity (i.e., limitation on how frequently and effectively a person can perform the activities of daily living) varied; approximately 37% were reported as mild, 20% as moderate, 21% as severe, and 22% as very severe (Statistics Canada, 2017).

Table 1. Percentage of Canadian Population Aged 15 Years Old and Older, with a Disability in 2017 (adapted from Statistics Canada, 2017)

Type of Disability	Men	Women
Developmental	1.54%	0.77%
Memory	3.78%	3.63%
Dexterity	3.92%	4.95%
Learning	4.33%	3.54%
Seeing	4.91%	5.70%
Hearing	5.70%	3.92%
Mental health-related	6.01%	8.03%
Mobility	8.56%	10.12%
Flexibility	9.77%	9.90%
Pain-related	13.44%	15.00%

Strategies are needed to support aging in place and remove barriers to accessibility in houses; and this proposed change provides a framework in the NBC to address accessibility through technical requirements.

References

Statistics Canada, “A demographic, employment and income profile of Canadians with disabilities aged 15 years and over, 2017”. https://www150.statcan.gc.ca/n1/pub/89-654-x/89-654-x2018002-eng.htm

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PROPOSED CHANGE

[2.1.1.2.] 2.1.1.2. Application of Objectives
(See Note A-2.2.1.1.(1).)

[1] **1)** Except as provided in Sentences (2) to (6), the objectives described in this Part apply
  - [a] a) to all *buildings* covered in this Code (see Article 1.1.1.1.), and
  - [b] b) only to the extent that they relate to compliance with this Code as required in Article 1.2.1.1.

[2] **2)** Objective OS4, Resistance to Unwanted Entry, applies only to *dwelling units* in *buildings* covered in Part 9 of Division B. (See Article 1.3.3.3.)

[3] **3)** Objective OH3, Noise Protection, applies only to *dwelling units*.

[4] **4)** Objective OH5, Hazardous Substances Containment, applies only to the extent defined in
  - [a] a) the National Plumbing Code, and
  - [b] b) the National Fire Code.

[5] **5)** Objective OA, Accessibility (including Objectives OA1, Barrier-Free Path of Travel, and OA2, Barrier-Free Facilities), does not apply to
  - [a] a) ~~detached houses, semi-detached houses, houses with a *secondary suite*, duplexes, triplexes, townhouses, row houses and boarding houses (see Appendix , Secondary Suite),~~
  - [b] b) *buildings* of Group F, Division 1 *major occupancy*, and
  - [c] c) *buildings* that are not intended to be occupied on a daily or full-time basis, including automatic telephone exchanges, pumphouses and substations.

[6] **6)** Objective OE, Environment (including Objectives OE1, Resources, and OE1.1, Excessive Use of Energy), applies only to
  - [a] a) *buildings* of *residential occupancy* to which Part 9 of Division B applies,
  - [b] b) *buildings* containing *business and personal services*, *mercantile* or *low-hazard industrial occupancies* to which Part 9 of Division B applies whose combined total *floor area* does not exceed 300 m^2, and

[c] c) *buildings* containing a mix of the *residential* and non-*residential occupancies* described in Clauses (a) and (b).

(See Note A-2.1.1.2.(6).) (See also Article 1.3.3.3.)

Impact analysis

Financial Impact

No new costs are introduced by expanding the application of the accessibility objective to include previously exempted houses because the proposed change does not, on its own, change the current application of the accessibility requirements for buildings that were not exempted, i.e., dwelling units in Parts 3 and 9.

Part 9 directs Code users to Section 3.8. of Division B of the NBC, where houses are exempted from the application of the accessibility requirements. For example,

- Sentence 9.5.2.1.(1) explains that "Except as provided in Articles 9.5.2.3. and 3.8.2.1., every *building* shall be designed in conformance with Section 3.8."
- Sentence 3.8.2.1.(1) explains how exceptions apply to "detached houses, semi-detached houses, houses with a *secondary suite*, duplexes, triplexes, townhouses, row houses and boarding houses."

Future technical requirements related to accessibility (which are beyond the scope of this proposed change) that apply to houses may impact construction costs. Those proposed requirements will be evaluated separately and will include impact analyses specific to the proposed technical requirements in question.

Usage Impact

By expanding the application of the accessibility objective to include previously exempted houses, this proposed change provides the necessary framework for the potential addition of future accessibility-related technical requirements, which could help to achieve the intent of "limit[ing] the probability that, as a result of the design or construction of a house, a person with a physical or sensory limitation will be unacceptably impeded from accessing or using a house or its facilities."

Future accessibility requirements that apply to houses may impact the usability of these buildings; the proposed changes will be assessed accordingly.

Enforcement implications

Expanding the accessibility objective to include the application to previously exempted houses does not in itself introduce any technical requirements that would require enforcement by the authorities having jurisdiction.

Who is affected

The proposed change could affect:

- regulators and authorities having jurisdiction, who would need to be aware of the expanded scope of the accessibility objective and the potential future addition of technical requirements related to accessibility in houses,
- architects, engineers and builders, whose approach to home design and construction may be affected as future requirements for accessibility (which are beyond the scope of the objective change described in this proposed change) are developed for houses, and
- persons with disabilities and their caregivers, who may benefit from future minimum performance requirements for accessibility that apply to houses, which would be enabled by the proposed change to the NBC framework.

Submit a comment

Proposed Change 1976

Code Reference(s):	**NBC20 Div.B 1.1.3.1. (first printing)** **NBC20 Div.B Appendix C (first printing)**
Subject:	Earthquake Load and Effects — Seismicity
Title:	Update of Seismic Hazard in Northwestern Canada
Description:	This proposed change addresses a known issue in the NBC 2020 seismic hazard values for parts of northwestern Canada and updates Note A-1.1.3.1.(4) and Appendix C to reference the 2025 National Building Code of Canada Seismic Hazard Tool.

This change could potentially affect the following topic areas:

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

Problem

There is a known issue with the values of seismic hazard in parts of northwestern Canada for use with the NBC 2020. These seismic hazard values are larger than intended, and their use may unintentionally result in higher costs of construction. Seismic hazard disaggregations also produce unrealistic earthquake scenarios in the impacted regions.

Seismic hazard disaggregations are typically used in time history analysis for buildings (see the Appendix to Commentary J in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)"), geotechnical analysis, and some other infrastructure projects. Anomalies in the disaggregations in the impacted regions may lead to difficulties for engineers.

Justification

The proposed change addresses the issue of overly high seismic hazard values in parts of northwestern Canada. The adoption of updated values, which are lower than the current ones, may reduce the construction costs in these localities.

The proposed change also addresses the issue of inappropriate seismic hazard disaggregations for parts of northwestern Canada. Natural Resources Canada corrected this issue after the publication of the NBC 2020 and released an updated seismic hazard model referred to as CanadaSHM6.1. It is important to implement the updated CanadaSHM6.1 model in the NBC 2025 for consistency so that the seismic hazard model referenced in the Code is the most current model and the only model applicable in the country.

The proposed change implements this update. It also updates Note A-1.1.3.1.(4) and Appendix C to reference the 2025 National Building Code of Canada Seismic Hazard Tool.

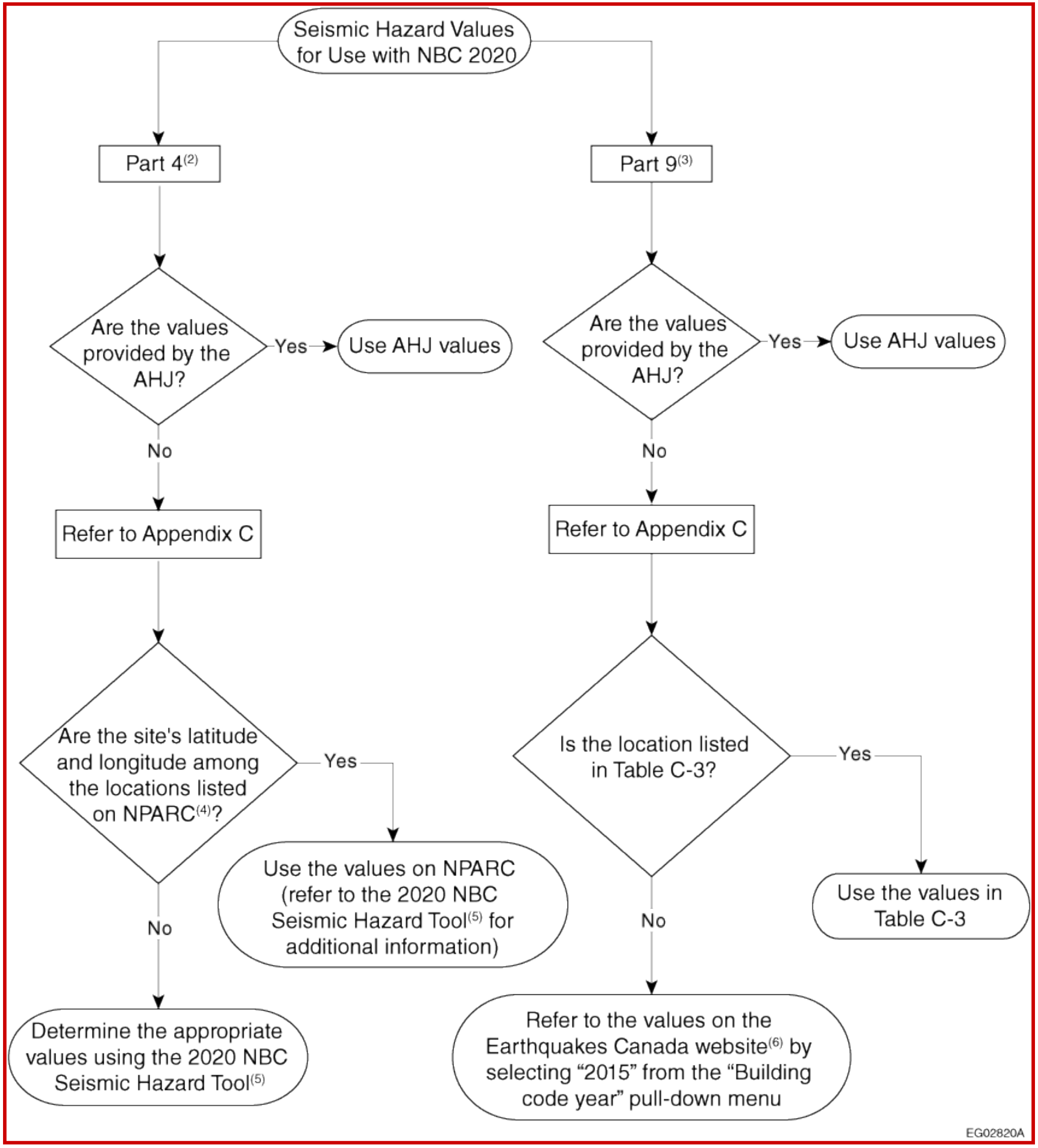
PROPOSED CHANGE

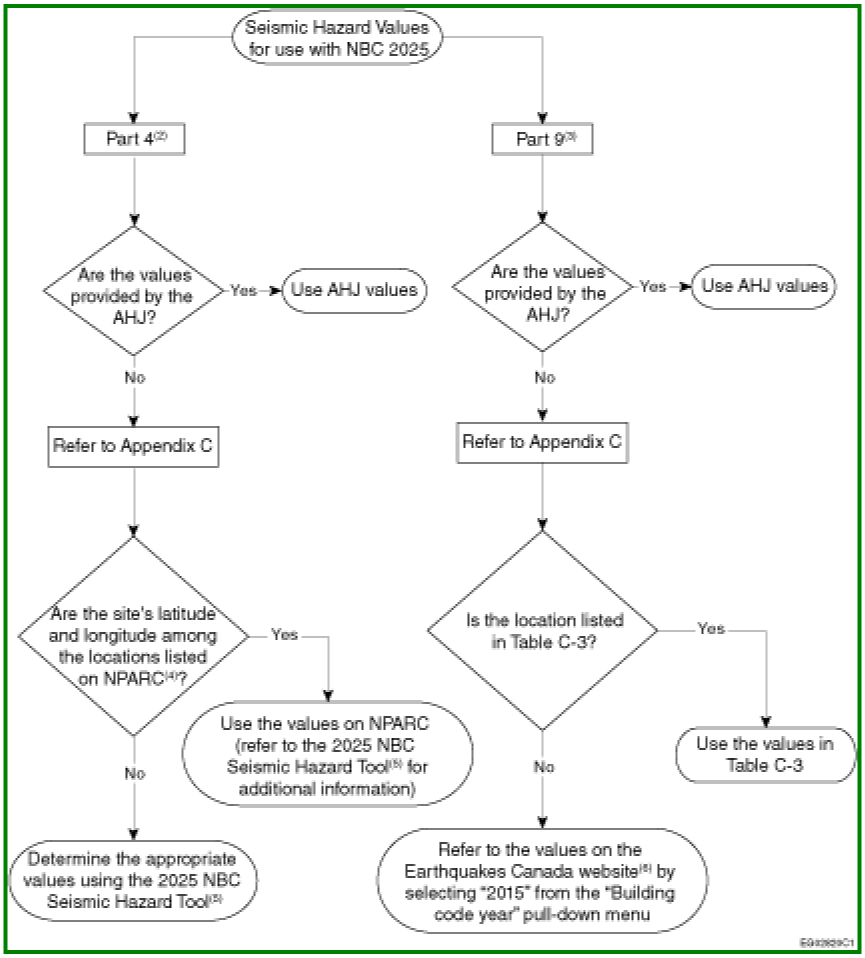
[1.1.3.1.] 1.1.3.1. Climatic and Seismic Values

Note A-1.1.3.1.(4) Seismic Values.

Figure A-1.1.3.1.(4) illustrates how to determine the seismic hazard values to be used in the application of the Part 4 and Part 9 seismic provisions.

Figure [A-1.1.3.1.(4)] A-1.1.3.1.(4)
Determining seismic hazard values for use in Part 4 and Part 9





Notes to Figure A-1.1.3.1.(4):

(1) The abbreviations used in the figure have the following meanings:
AHJ = authority having jurisdiction
NPARC = NRC Publications Archive

(2) See also the section entitled "Seismic Hazard for Part 4" in Appendix C.

(3) See also the section entitled "Seismic Hazard for Part 9" in Appendix C.

(4) The seismic hazard values available on NPARC at https://doi.org/DOI-1~~10.4224/nqzr-dz38~~ (digital object identifier (DOI) to be added when available) were generated from the ~~2020~~2025 National Building Code of Canada Seismic Hazard Tool. This subset of values on NPARC is provided as a static, archival record for Code users.

(5) The ~~2020~~2025 National Building Code of Canada Seismic Hazard Tool is available at https://doi.org/DOI-2~~10.23687/b1bd3cf0-0672-47f4-8bfa-290ae75fde9b~~ (DOI to be added when available).

(6) Refer to the "2015 – 2005 National Building Code of Canada seismic hazard values" page on NRCan's Earthquakes Canada website.

Appendix C Climatic and Seismic Information for Building Design in Canada

Footnote: This information is included for explanatory purposes only and does not form part of the requirements.

Seismic Hazard for Part 4

The seismic hazard values to be used for the design of buildings under Part 4 can be obtained from the ~~2020~~2025 National Building Code of Canada Seismic Hazard Tool (https://doi.org/DOI-2~~10.23687/b1bd3cf0-0672-47f4-8bfa-290ae75fde9b~~), which provides seismic hazard values for any site in Canada defined by latitude, longitude and site designation. The seismic hazard values used for the design of buildings under Part 4 must correspond to the applicable probability of exceedance stated in Subsection 4.1.8. The tool also provides seismic hazard values at additional probabilities and periods.

Seismic hazard values can be appreciably different for localities across a large locale. Therefore, applying the same seismic hazard value to a large geographic area could result in buildings being over-designed or under-designed. Given the large number of data points in Canada, listing every locality in a table is not practical. For archival purposes, the seismic hazard values for 679 specific latitudes and longitudes are reproduced from the ~~2020~~2025 National Building Code of Canada Seismic Hazard Tool on NPARC at https://doi.org/DOI-1~~10.4224/nqzr-dz38~~. The digital properties of the NPARC website are more suited for a static, archival data set. As such, Figure A-1.1.3.1.(4) identifies the NPARC website as the primary data set for the specified latitude and longitudes.

The parameters used to represent seismic hazard for specific geographical locations are the 5%-damped horizontal spectral acceleration for periods of 0.2 s, 0.5 s, 1.0 s, 2.0 s, 5.0 s and 10.0 s, the horizontal peak ground acceleration (PGA) and the horizontal peak ground velocity (PGV) corresponding to a 2% probability of being exceeded in 50 years. The six spectral acceleration parameters are deemed sufficient to define spectra closely matching the shape of the uniform hazard spectra (UHS) for design purposes. Spectral acceleration values for additional periods are provided for use in the selection of ground motion time histories. Spectral acceleration values for additional probabilities of exceedance are also provided.

The seismic hazard values are mean values based on a statistical analysis of the earthquakes that have been experienced in Canada and adjacent regions.(11) ~~They were updated for the 2020 edition of the Code by slightly revising the seismic source zones, adding the Leech River and Devil's Mountain fault sources near Victoria, B.C.,(12) increasing the rate of occurrence of great earthquakes on the Cascadia subduction zone to match new information, revising the ground motion models (GMMs),(13) and using a probabilistic model to combine all inputs.~~Further to the updates made to the seismic hazard model for the 2020 edition of the Code, seismic source zones in Alaska and the Beaufort Sea were revised for the 2025 edition to match the expected pattern of seismicity. This change generally resulted in a decrease in the estimated seismic hazard in northwestern Canada. The estimated seismic hazard is unchanged in all other parts of the country.

~~In addition, the method of determining seismic hazard values for different site designations has changed. For the NBC 2015, the seismic hazard values were calculated for reference Site Class C, and the values for other site designations were determined~~

~~by applying a site coefficient to the calculated values. For the NBC 2020, the seismic hazard values for each site designation were calculated directly.~~

~~For almost all locations, the revised GMMs are the most significant reason for changes in the seismic hazard values from the NBC 2015. In general, the estimated seismic hazard has increased across Canada.~~

Further details regarding the representation of seismic hazard can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)".

Impact analysis

The supporting document shows a comparison of the proposed NBC 2025 seismic design data to the NBC 2020 data for affected localities, as an example. As shown, the seismic hazard values would decrease for parts of northwestern Canada as a result of the proposed change, leading to potential savings in construction costs for this region, but would not change for the rest of Canada.

The confusion resulting from anomalous disaggregation results would also be addressed by the proposed change. In addition, the editorial changes required to update the NBC to reference the 2025 National Building Code of Canada Seismic Hazard Tool would be implemented. In summary, the proposed change would have a positive impact.

Enforcement implications

The proposed change would have a positive impact on enforcement, as it updates the seismic hazard model used for the NBC to the most current seismic hazard model available in Canada, CanadaSHM6.1. The difficulties in interpreting disaggregation results for parts of northwestern Canada would also be addressed.

As a result of this proposed change, the seismic hazard values would not change for most of Canada, but would decrease for parts of northwestern Canada. These changes to the seismic hazard values would have a positive impact on enforcement.

Who is affected

Owners, designers, contractors and enforcement professionals dealing with the earthquake design of buildings and infrastructure projects, particularly those in northwestern Canada.

Supporting Document(s)

Proposed NBC 2025 Seismic Design Data

(proposed_nbc_2025_seismic_design_data.pdf)

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

N/A

N/A

Submit a comment

Proposed Change 1967

Code Reference(s):	**NBC20 Div.B 3.1.4.2.(1) (first printing)** **NBC20 Div.B 3.1.5.15. (first printing)**
Subject:	Building Fire Safety
Title:	New Standard for Testing of Protective Coverings over Foamed Plastic Insulation
Description:	This proposed change introduces references to CAN/ULC-S145:2018, "Standard Method of Test for the Evaluation of Protective Coverings for Foamed Plastic Insulation – Full-Scale Room Test."
Related Code Change Request(s):	CCR 943, CCR 944, CCR 1071
Related Proposed Change(s):	PCF 1476, PCF 1969

This change could potentially affect the following topic areas:

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

Problem

The National Building Code of Canada (NBC) includes requirements for the protection of foamed plastics for both combustible and noncombustible construction. Depending on the application, current acceptable solutions to achieve this protection include a variety of prescriptive options (e.g., interior finishes) or use of a thermal barrier conforming to certain fire test method standards (e.g., CAN/ULC-S124:2018, "Standard Method of Test for the Evaluation of Thermal Barriers for Foamed Plastic" (PCF 1476)).

As demonstrated in CCMC Evaluation Report 14036-R[1], some products that are typically classified as “protective coverings” rather than as “thermal barriers” were found to offer an acceptable level of performance when pursued as an alternative solution to the Code requirements. Intumescent coatings are an example of these products.

As more options for protective coverings enter the market, it becomes more critical to provide manufacturers, regulators and Code users with an additional compliance path that specifies a minimum level of performance for these products to be considered acceptable solutions where incorporated in a tested assembly. Not including these specifications in the Code presents the danger of leaving the door open for the definition of the acceptable minimum level of performance by others and for protective covering products to be applied inappropriately in practice. Either scenario could result in insufficient protection that might lead to harm to building occupants and damage to the building.

Furthermore, if no additional compliance path for assemblies that incorporate protective coverings is offered, regulators and authorities having jurisdiction may continue to struggle to accept such products, which could cause economic hardship to the protective covering industry.

Justification

In the last Code cycle, the Standing Committee on Fire Protection was asked to review CCMC Evaluation Report 14036-R (the CCMC Report)[1], which introduced a new test method to assess the fire performance of a protective covering (DC 315 Intumescent Coating) over foamed plastic insulation. There was a desire to investigate, and potentially introduce in the Code, the room corner test method as an option for evaluating the performance of an entire assembly.

According to the intent statements of the NBC, the current requirements for the protection of foamed plastics aim to limit harm to persons and building damage due to early fire growth and spread.

The fire hazard of foamed plastics is their risk of contributing to the onset of flashover, after which point the chance of safe evacuation is greatly reduced, the potential for greater building damage increases, and the potential to contribute to fire growth and spread significantly increases. To mitigate this hazard, the NBC requires that foamed plastics be protected. The desired level of performance for this protection is to limit the foamed plastics from contributing to the onset of flashover, which is measured by the time to flashover.

Since the last Code cycle, and pursuant to the CCMC Report, a new standard (CAN/ULC-S145:2018, "Standard Method of Test for the Evaluation of Protective Coverings for Foamed Plastic Insulation – Full-Scale Room Test") was developed for the evaluation of protective coverings over foamed plastic insulation using a test method based on CAN/ULC-9705, "Fire Tests – Full-Scale Room Test for Surface Products." Feedback from many Canadian fire experts indicated that the proposed 10 min and 20 min classifications (representing 100kW and 300kW exposures, respectively) in CAN/ULC-S145 for protective coverings relate more directly to the hazard that the NBC intends to limit (versus existing performance tests).

Performance test options currently in the NBC (including the proposed update of CAN/ULC-S124:2018 (PCF 1476)) use a furnace test to evaluate a thermal barrier's ability to prevent the ignition of the foamed plastics by measuring the temperature transmission performance of the thermal barrier during fire growth in its early stage. The 10 min thermal barrier requirement was intended to limit the contribution of foamed plastic insulation to fire growth. CAN/ULC-S124 was deemed to be a conservative evaluation of that condition.

Alternatively, the new standard, CAN/ULC-S145, offers a room corner test method to evaluate the integrity of an assembly during fire growth and includes performance metrics associated with the onset of flashover. Because their approaches are fundamentally different, the furnace and room corner test methods are difficult to compare and cannot be equated. However, as both test methods support the overall intent of the requirement (including the mitigation of the fire hazard and establishment of a minimum level of performance with related metrics), CAN/ULC-S145 can be introduced as a suitable alternate test option for the protection of foamed plastics.

For combustible construction, an option is introduced in Sentence 3.1.4.2.(1) for assemblies incorporating protective coverings to meet the 10 min classification of CAN/ULC-S145. For noncombustible construction, the 20 min classification of CAN/ULC-S145 is introduced in Sentences 3.1.5.15.(2) and (3). This proposed change follows the hierarchical structure of the existing Code requirements, which considers a building's use, construction type, height and whether or not it is sprinklered when stipulating the level of protection needed.

Furthermore, this proposed change is consistent with the existing NBC intent statements. Performance-based room corner tests provide a clear indication of the onset of flashover, which impacts both the time available for egress and the potential contribution of a material to fire growth and spread. These tests are recognized and relied on worldwide in building code regulations to determine the contribution of room linings to the onset of flashover.

References

[1] Canadian Construction Materials Centre. "CCMC 14036-R: CCMC Canadian code compliance evaluation". National Research Council of Canada. Ottawa, Canada; June 2016.
https://nrc.canada.ca/en/certifications-evaluations-standards/canadian- construction-materials-centre/ccmc-publications/document.html?id=14036-R&type=cert (as of December 2022).

PROPOSED CHANGE

[3.1.4.2.] 3.1.4.2. Protection of Foamed Plastics

[1] **1)** Except as permitted in Sentence (2), foamed plastics that form part of a

wall or ceiling assembly in *combustible construction* shall be protected from adjacent spaces in the *building*, other than adjacent concealed spaces within *attic or roof spaces*, crawl spaces, and wall and ceiling assemblies,

[a] a) by one of the interior finishes described in Subsections 9.29.4. to 9.29.9.,

[b] b) provided the *building* does not contain a Group A, Group B or Group C *major occupancy*, by sheet metal

  [i] i) mechanically fastened to the supporting assembly independent of the insulation,

  [ii] ii) not less than 0.38 mm thick, and

  [iii] iii) with a melting point not below 650°C, ~~or~~

[c] c) by any ~~thermal barrier~~protection method that meets the requirements of Sentence 3.1.5.15.(2) (see Note A-3.1.4.2.(1)(c))~~.~~, or

[d] --) by a protective covering, incorporated in the assembly, that meets the requirements of classification 10 min when tested in conformance with CAN/ULC-S145:2018, “Standard Method of Test for the Evaluation of Protective Coverings for Foamed Plastic Insulation – Full-Scale Room Test,” and is installed as tested (see Note A-3.1.4.2.(1)(d)).

(See Note A-3.1.4.2.(1).)

Note A-3.1.4.2.(1)(c) ~~Thermal Barrier~~Protection Method in Combustible Construction.

Any ~~thermal barrier~~protection method that is accepted under the requirements of Sentence 3.1.5.15.(2) for noncombustible construction is also acceptable for combustible construction.

Note A-3.1.4.2.(1)(d) Testing of Protective Coverings as an Assembly.

Unlike a protective covering conforming to CAN/ULC-S124:2018, “Standard Method of Test for the Evaluation of Thermal Barriers for Foamed Plastic,” a protective covering conforming to CAN/ULC-S145:2018, “Standard Method of Test for the Evaluation of Protective Coverings for Foamed Plastic Insulation – Full-Scale Room Test,” may only be used in the individual assemblies in which it was tested.

The test assembly, including the foamed plastic, the protective covering and its method of attachment, joints and adhesives, must be representative of the construction for which classification is required. Note that the protective covering may be field- or factory-applied.

If the thickness of the foamed plastic insulation within the test assembly does not exceed 100 mm, then the thickness tested is the maximum allowable thickness. If the thickness of the foamed plastic insulation within the assembly for which classification is required exceeds 100 mm, tests need not be conducted with a thickness of foamed plastic insulation that exceeds 100 mm (i.e., testing with a thickness of 100 mm is acceptable in this case).

[3.1.5.15.] 3.1.5.15. Foamed Plastic Insulation

(See Notes A-3.1.4.2. and A-3.1.4.2.(1).)

[1] **1)** Foamed plastic insulation is permitted to be installed above roof decks, outside of *foundation* walls below ground level, and beneath concrete slabs-on-ground of a *building* required to be of *noncombustible construction*.

[2] **2)** Except as provided in Sentences (3), (4) and 3.1.5.7.(1), foamed plastic insulation with a *flame-spread rating* not more than 500 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, is permitted in a *building* required to be of *noncombustible construction*, provided the insulation is protected from adjacent space in the *building*, other than adjacent concealed spaces within wall assemblies, by ~~a thermal barrier consisting of~~

[a] a) not less than 12.7 mm thick gypsum board mechanically fastened to a supporting assembly independent of the insulation,
[b] b) lath and plaster, mechanically fastened to a supporting assembly independent of the insulation,
[c] c) masonry,
[d] d) concrete, ~~or~~
[e] e) any thermal barrier that meets the requirements of classification B when tested in conformance with CAN/ULC-S124:2018, "Standard Method of Test for the Evaluation of Thermal Barriers~~Protective Coverings~~ for Foamed Plastic~~.~~," or
[f] --) a protective covering, incorporated in the assembly, that meets the requirements of classification 20 min when tested in conformance with CAN/ULC-S145:2018, “Standard Method of Test for the Evaluation of Protective Coverings for Foamed Plastic Insulation – Full-Scale Room Test,” and is installed as tested (see Note A-3.1.4.2.(1)(d)).

[3] **3)** Foamed plastic insulation with a *flame-spread rating* more than 25 but not more than 500 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, is permitted in the exterior walls of a *building* required to be of *noncombustible construction* that is not *sprinklered* and is more than 18 m high, measured from *grade* to the underside of the roof, provided the insulation is protected from adjacent space in the *building*, other than adjacent concealed spaces within wall assemblies, by ~~a thermal barrier consisting of~~

[a] a) gypsum board not less than 12.7 mm thick, mechanically fastened to a supporting assembly independent of the insulation and with all joints either backed or taped and filled,
[b] b) lath and plaster, mechanically fastened to a supporting assembly

independent of the insulation,

[c] c) masonry or concrete not less than 25 mm thick, ~~or~~

[d] d) any thermal barrier that, when tested in conformance with CAN/ULC-S101, "Standard Method of Fire Endurance Tests of Building Construction and Materials", does not develop an average temperature rise more than 140°C or a maximum temperature rise more than 180°C at any point on its unexposed face within 10 min (see Note A-3.1.5.14.(5)(d)) (see also Article 3.2.3.7.)~~.~~, or

[e] --) a protective covering, incorporated in the assembly, that meets the requirements of classification 20 min when tested in conformance with CAN/ULC-S145:2018, "Standard Method of Test for the Evaluation of Protective Coverings for Foamed Plastic Insulation – Full-Scale Room Test," and is installed as tested (see Note A-3.1.4.2.(1)(d)).

[4] 4) Foamed plastic insulation with a *flame-spread rating* more than 25 but not more than 500 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, is permitted in the interior walls, within ceilings and within roof assemblies of a *building* required to be of *noncombustible construction* that is not *sprinklered* and is more than 18 m high, measured from *grade* to the underside of the roof, provided the insulation is protected from adjacent space in the *building*, other than adjacent concealed spaces within wall assemblies, by ~~a thermal barrier consisting of~~

[a] a) Type X gypsum board not less than 15.9 mm thick, mechanically fastened to a supporting assembly independent of the insulation and with all joints either backed or taped and filled, conforming to
  [i] i) ASTM C1177/C1177M, "Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing",
  [ii] ii) ASTM C1178/C1178M, "Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel",
  [iii] iii) ASTM C1396/C1396M, "Standard Specification for Gypsum Board", or
  [iv] iv) CAN/CSA A82.27-M, "Gypsum Board",

[b] b) non-*loadbearing* masonry or concrete not less than 50 mm thick,

[c] c) *loadbearing* masonry or concrete not less than 75 mm thick, or

[d] d) any thermal barrier that, when tested in conformance with CAN/ULC-S101, "Standard Method of Fire Endurance Tests of Building Construction and Materials",
  [i] i) does not develop an average temperature rise more than 140°C or a maximum temperature rise more than 180°C at any point on its unexposed face within 20 min, and
  [ii] ii) remains in place for not less than 40 min.

Impact analysis

This proposed change provides an additional option for compliance through testing, which would allow for a broader range of material to be used for the protection of foamed plastics. This proposed change provides flexibility to designers and fosters innovation without compromising safety.

The proposed change benefits manufacturers and Code users by clarifying the minimum level of performance required for assemblies incorporating a protective covering, which facilitates enforcement for regulators and authorities having jurisdiction.

Because the introduction of CAN/ULC-S145:2018, "Standard Method of Test for the Evaluation of Protective Coverings for Foamed Plastic Insulation – Full-Scale Room Test," is not meant to replace the existing options for acceptable solutions, there are no new forced costs to builders with respect to meeting the requirements for the protection of foamed plastics.

Also, any additional costs associated with the testing of materials when using this proposed option could be offset by avoiding the time and expense of needing to pursue this option as an alternative solution.

Enforcement implications

This proposed change could be enforced by the current enforcement infrastructure for the Code.

Regulators are familiar with assessing compliance through product testing in accordance with referenced standards. Having a performance-based requirement in the Code facilitates the interpretation and enforcement of the requirement and ensures consistency of the application throughout the country.

Furthermore, in jurisdictions where alternative solutions have been sought for protective covering products, it is anticipated that there is already familiarity with these types of products.

Who is affected

This proposed change would affect:

- regulators and authorities having jurisdiction, who would need to be aware of the new standard,
- builders, architects, engineers and building owners, who would be able to consider additional products that are allowed for their projects, and
- manufacturers, who should consider further developing new and existing products to comply with the new requirements.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.1.4.2.] 3.1.4.2. ([1] 1) [F01-OS1.1] [F02-OS1.2] [F05-OS1.5]

[3.1.4.2.] 3.1.4.2. ([1] 1) [F01-OP1.1] [F02-OP1.2]

[3.1.5.15.] 3.1.5.15. ([1] 1) no attributions

[3.1.5.15.] 3.1.5.15. ([2] 2) no attributions

[3.1.5.15.] 3.1.5.15. ([2] 2) [F01-OS1.1] [F02-OS1.2] [F05-OS1.5]

[3.1.5.15.] 3.1.5.15. ([2] 2) [F01-OP1.1] [F02-OP1.2]

[3.1.5.15.] 3.1.5.15. ([3] 3) no attributions

[3.1.5.15.] 3.1.5.15. ([3] 3) [F01-OS1.1] [F02-OS1.2] [F05-OS1.5]

[3.1.5.15.] 3.1.5.15. ([3] 3) [F01-OP1.1] [F02-OP1.2]

[3.1.5.15.] 3.1.5.15. ([4] 4) no attributions

[3.1.5.15.] 3.1.5.15. ([4] 4) [F01-OS1.1] [F02-OS1.2] [F05-OS1.5]

[3.1.5.15.] 3.1.5.15. ([4] 4) [F01-OP1.1] [F02-OP1.2]

Submit a comment

Proposed Change 1922

Code Reference(s):	**NBC20 Div.B 3.1.11.5.(1) (first printing)**
Subject:	Automatic Sprinkler System
Title:	Standardization of Terminology in NBC Sprinkler Requirements
Description:	This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NBC.
Related Proposed Change(s):	PCF 1910, PCF 1912, PCF 1915, PCF 1916, PCF 1917, PCF 1920, PCF 1921, PCF 1924, PCF 1925, PCF 1926, PCF 1927, PCF 1928, PCF 1929, PCF 1930, PCF 1931, PCF 1932, PCF 1933, PCF 1934

This change could potentially affect the following topic areas:

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

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NBC by using the defined term “sprinklered” and thereby eliminates any potential confusion.

Justification

As defined in the NBC, “sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers.”

In the NBC 2020 and National Fire Code of Canada (NFC) 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term “sprinklered” could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term “sprinklered” would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… to have an automatic sprinkler system installed throughout …”	NBC	1
“… an automatic sprinkler system shall be installed in …”	NBC	1
“… sprinklers shall be installed in …”	NBC	2
“… sprinklers shall be provided for …”	NBC	1
“… sprinklers shall not be omitted in …”	NBC	1
“… in which an automatic sprinkler system is installed …”	NBC	1
“… in which a sprinkler system is installed …”	NBC	2
“… in which a sprinkler system has been installed …”	NBC	1
“… area served by the sprinkler system …”	NBC	1
“… sprinklers are installed in …”	NBC	1
“… shall be equipped throughout with a sprinkler system …”	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are not mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… do not require the installation of an automatic sprinkler system …”	NBC	1
“… in which an automatic sprinkler system is not required to be installed …”	NBC	1
“… sprinklers are not required in …”	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
"… that is not protected by an automatic sprinkler system …"	NBC	1
"… in which sprinklers are not installed …"	NBC	2
"… where a sprinkler system is not installed …"	NBC	1
"… in which an automatic sprinkler system is not installed …"	NBC	2
"… need not be equipped throughout with a sprinkler system …"	NFC	2

PROPOSED CHANGE

[3.1.11.5.] 3.1.11.5. Fire Blocks in Horizontal Concealed Spaces

[1] 1) Except for crawl spaces conforming to Sentence 3.1.11.6.(1) and as required in Sentence (3), any horizontal concealed space~~s~~ within a floor assembly or roof assembly of *combustible construction*~~,~~ ~~in which sprinklers are not installed,~~ that is not *sprinklered* shall be separated by construction conforming to Article 3.1.11.7. into compartments

[a] a) not more than 600 m^2 in area with no dimension more than 60 m if the exposed construction materials within the space have a *flame-spread rating* not more than 25, and

[b] b) not more than 300 m^2 in area with no dimension more than 20 m if the exposed construction materials within the space have a *flame-spread rating* more than 25.

(See Note A-3.1.11.5.(1).)

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.1.11.5.] 3.1.11.5. ([1] 1) [F03,F04-OS1.2]

[3.1.11.5.] 3.1.11.5. ([1] 1) [F03,F04-OP1.2]

Submit a comment

Proposed Change 1921

Code Reference(s):	**NBC20 Div.B 3.1.11.6.(1) (first printing)**
Subject:	Automatic Sprinkler System
Title:	Standardization of Terminology in NBC Sprinkler Requirements
Description:	This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NBC.
Related Proposed Change(s):	PCF 1910, PCF 1912, PCF 1915, PCF 1916, PCF 1917, PCF 1920, PCF 1922, PCF 1924, PCF 1925, PCF 1926, PCF 1927, PCF 1928, PCF 1929, PCF 1930, PCF 1931, PCF 1932, PCF 1933, PCF 1934

This change could potentially affect the following topic areas:

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

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NBC by using the defined term "sprinklered" and thereby eliminates any potential confusion.

Justification

As defined in the NBC, “sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers.”

In the NBC 2020 and National Fire Code of Canada (NFC) 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term “sprinklered” could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term “sprinklered” would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… to have an automatic sprinkler system installed throughout …”	NBC	1
“… an automatic sprinkler system shall be installed in …”	NBC	1
“… sprinklers shall be installed in …”	NBC	2
“… sprinklers shall be provided for …”	NBC	1
“… sprinklers shall not be omitted in …”	NBC	1
“… in which an automatic sprinkler system is installed …”	NBC	1
“… in which a sprinkler system is installed …”	NBC	2
“… in which a sprinkler system has been installed …”	NBC	1
“… area served by the sprinkler system …”	NBC	1
“… sprinklers are installed in …”	NBC	1
“… shall be equipped throughout with a sprinkler system …”	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are <u>not</u> mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… do not require the installation of an automatic sprinkler system …”	NBC	1
“… in which an automatic sprinkler system is not required to be installed …”	NBC	1
“… sprinklers are not required in …”	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
“… that is not protected by an automatic sprinkler system …”	NBC	1
“… in which sprinklers are not installed …”	NBC	2
“… where a sprinkler system is not installed …”	NBC	1
“… in which an automatic sprinkler system is not installed …”	NBC	2
“… need not be equipped throughout with a sprinkler system …”	NFC	2

PROPOSED CHANGE

[3.1.11.6.] 3.1.11.6. Fire Blocks in Crawl Spaces

[1] **1)** A crawl space that is not considered as a *basement* by Article 3.2.2.9. and ~~in which sprinklers are not installed~~is not *sprinklered* shall be separated by construction conforming to Article 3.1.11.7. into compartments not more than 600 m^2 in area with no dimension more than 30 m.

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.1.11.6.] 3.1.11.6. ([1] 1) [F03,F04-OS1.2]

[3.1.11.6.] 3.1.11.6. ([1] 1) [F03,F04-OP1.2]

Submit a comment

Proposed Change 1924

Code Reference(s):	**NBC20 Div.B 3.2.1.5.(1) (first printing)**
Subject:	Automatic Sprinkler System
Title:	Standardization of Terminology in NBC Sprinkler Requirements
Description:	This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NBC.
Related Proposed Change(s):	PCF 1910, PCF 1912, PCF 1915, PCF 1916, PCF 1917, PCF 1920, PCF 1921, PCF 1922, PCF 1925, PCF 1926, PCF 1927, PCF 1928, PCF 1929, PCF 1930, PCF 1931, PCF 1932, PCF 1933, PCF 1934

This change could potentially affect the following topic areas:

☐ Division A
☐ Division C
☐ Building operations
☐ Small Buildings
☑ Fire Protection
☐ Accessibility
☐ Building Envelope
☐ Heating, Ventilating and Air Conditioning

☑ Division B
☑ Design and Construction
☐ Housing
☑ Large Buildings
☐ Occupant safety in use
☐ Structural Requirements
☐ Energy Efficiency
☐ Plumbing
☐ Construction and Demolition Sites

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NBC by using the defined term “sprinklered” and thereby eliminates any potential confusion.

Justification

As defined in the NBC, “sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers.”

In the NBC 2020 and National Fire Code of Canada (NFC) 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term “sprinklered” could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term “sprinklered” would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… to have an automatic sprinkler system installed throughout …”	NBC	1
“… an automatic sprinkler system shall be installed in …”	NBC	1
“… sprinklers shall be installed in …”	NBC	2
“… sprinklers shall be provided for …”	NBC	1
“… sprinklers shall not be omitted in …”	NBC	1
“… in which an automatic sprinkler system is installed …”	NBC	1
“… in which a sprinkler system is installed …”	NBC	2
“… in which a sprinkler system has been installed …”	NBC	1
“… area served by the sprinkler system …”	NBC	1
“… sprinklers are installed in …”	NBC	1
“… shall be equipped throughout with a sprinkler system …”	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are not mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… do not require the installation of an automatic sprinkler system …”	NBC	1
“… in which an automatic sprinkler system is not required to be installed …”	NBC	1
“… sprinklers are not required in …”	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
"… that is not protected by an automatic sprinkler system …"	NBC	1
"… in which sprinklers are not installed …"	NBC	2
"… where a sprinkler system is not installed …"	NBC	1
"… in which an automatic sprinkler system is not installed …"	NBC	2
"… need not be equipped throughout with a sprinkler system …"	NFC	2

PROPOSED CHANGE

[3.2.1.5.] 3.2.1.5. Fire Containment in Basements

[1] 1) Except as permitted by Sentences (2) and 3.2.2.15.(3), in a *building* ~~in which an automatic sprinkler system is~~ not required to be ~~installed~~ *sprinklered* by Article 3.2.2.18., every *basement* shall

[a] a) be *sprinklered* ~~throughout~~, or

[b] b) be subdivided into *fire compartments* not more than 600 m^2 in area by a *fire separation* having a *fire-resistance rating* not less than that required for the floor assembly immediately above the *basement*.

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.2.1.5.] 3.2.1.5. ([1] 1) [F02-OS1.2,OS1.3]

[3.2.1.5.] 3.2.1.5. ([1] 1) [F02-OP1.2,OP1.3]

Submit a comment

Proposed Change 1931

Code Reference(s):	**NBC20 Div.B 3.2.2.15.(3) (first printing)**
Subject:	Automatic Sprinkler System
Title:	Standardization of Terminology in NBC Sprinkler Requirements
Description:	This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NBC.
Related Proposed Change(s):	PCF 1910, PCF 1912, PCF 1915, PCF 1916, PCF 1917, PCF 1920, PCF 1921, PCF 1922, PCF 1924, PCF 1925, PCF 1926, PCF 1927, PCF 1928, PCF 1929, PCF 1930, PCF 1932, PCF 1933, PCF 1934

This change could potentially affect the following topic areas:

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

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NBC by using the defined term “sprinklered” and thereby eliminates any potential confusion.

Justification

As defined in the NBC, “sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers.”

In the NBC 2020 and National Fire Code of Canada (NFC) 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term “sprinklered” could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term “sprinklered” would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… to have an automatic sprinkler system installed throughout …”	NBC	1
“… an automatic sprinkler system shall be installed in …”	NBC	1
“… sprinklers shall be installed in …”	NBC	2
“… sprinklers shall be provided for …”	NBC	1
“… sprinklers shall not be omitted in …”	NBC	1
“… in which an automatic sprinkler system is installed …”	NBC	1
“… in which a sprinkler system is installed …”	NBC	2
“… in which a sprinkler system has been installed …”	NBC	1
“… area served by the sprinkler system …”	NBC	1
“… sprinklers are installed in …”	NBC	1
“… shall be equipped throughout with a sprinkler system …”	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are not mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… do not require the installation of an automatic sprinkler system …”	NBC	1
“… in which an automatic sprinkler system is not required to be installed …”	NBC	1
“… sprinklers are not required in …”	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
"… that is not protected by an automatic sprinkler system …"	NBC	1
"… in which sprinklers are not installed …"	NBC	2
"… where a sprinkler system is not installed …"	NBC	1
"… in which an automatic sprinkler system is not installed …"	NBC	2
"… need not be equipped throughout with a sprinkler system …"	NFC	2

PROPOSED CHANGE

[3.2.2.15.] 3.2.2.15. Storeys below Ground

[1] 3) If the *first storey* of a *building* is not required to be *sprinklered*, ~~sprinklers are not required in~~ the *storey* immediately below the *first storey* need not be *sprinklered*, provided the *storey* below

- [a] a) contains only *residential occupancies*, and
- [b] b) has at least one unobstructed access opening conforming to Sentence 3.2.5.1.(2) installed on that *storey* for each 15 m of wall length in at least one wall required by this Subsection to face a *street*.

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.2.2.15.] 3.2.2.15. ([1] 3) no attributions

Submit a comment

Proposed Change 1928

Code Reference(s):	**NBC20 Div.B 3.2.2.18.(2) (first printing)**
Subject:	Automatic Sprinkler System
Title:	Standardization of Terminology in NBC Sprinkler Requirements
Description:	This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NBC.
Related Proposed Change(s):	PCF 1910, PCF 1912, PCF 1915, PCF 1916, PCF 1917, PCF 1920, PCF 1921, PCF 1922, PCF 1924, PCF 1925, PCF 1926, PCF 1927, PCF 1929, PCF 1930, PCF 1931, PCF 1932, PCF 1933, PCF 1934

This change could potentially affect the following topic areas:

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

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NBC by using the defined term “sprinklered” and thereby eliminates any potential confusion.

Justification

As defined in the NBC, “sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers.”

In the NBC 2020 and National Fire Code of Canada (NFC) 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term “sprinklered” could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term “sprinklered” would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… to have an automatic sprinkler system installed throughout …”	NBC	1
“… an automatic sprinkler system shall be installed in …”	NBC	1
“… sprinklers shall be installed in …”	NBC	2
“… sprinklers shall be provided for …”	NBC	1
“… sprinklers shall not be omitted in …”	NBC	1
“… in which an automatic sprinkler system is installed …”	NBC	1
“… in which a sprinkler system is installed …”	NBC	2
“… in which a sprinkler system has been installed …”	NBC	1
“… area served by the sprinkler system …”	NBC	1
“… sprinklers are installed in …”	NBC	1
“… shall be equipped throughout with a sprinkler system …”	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are not mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… do not require the installation of an automatic sprinkler system …”	NBC	1
“… in which an automatic sprinkler system is not required to be installed …”	NBC	1
“… sprinklers are not required in …”	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
“… that is not protected by an automatic sprinkler system …”	NBC	1
“… in which sprinklers are not installed …”	NBC	2
“… where a sprinkler system is not installed …”	NBC	1
“… in which an automatic sprinkler system is not installed …”	NBC	2
“… need not be equipped throughout with a sprinkler system …”	NFC	2

EXISTING PROVISION

3.2.2.18. Automatic Sprinkler System Required

1) Except as permitted by Sentence (2), an automatic sprinkler system conforming to the requirements of Articles 3.2.4.7., 3.2.4.8., 3.2.4.9. and 3.2.5.12. shall be installed throughout a *building* regulated by one or more of Articles 3.2.2.20., 3.2.2.21., 3.2.2.22., 3.2.2.23., 3.2.2.24., 3.2.2.26., 3.2.2.27., 3.2.2.29., 3.2.2.31., 3.2.2.33., 3.2.2.36., 3.2.2.37., 3.2.2.38., 3.2.2.39., 3.2.2.40., 3.2.2.41., 3.2.2.42., 3.2.2.43., 3.2.2.44., 3.2.2.45., 3.2.2.46., 3.2.2.47., 3.2.2.48., 3.2.2.49., 3.2.2.51., 3.2.2.52., 3.2.2.55., 3.2.2.56., 3.2.2.57., 3.2.2.59., 3.2.2.60., 3.2.2.61., 3.2.2.63., 3.2.2.65., 3.2.2.66., 3.2.2.67., 3.2.2.69., 3.2.2.71., 3.2.2.72., 3.2.2.73., 3.2.2.74., 3.2.2.76., 3.2.2.77., 3.2.2.79., 3.2.2.81., 3.2.2.82., 3.2.2.84., 3.2.2.86., 3.2.2.88. and 3.2.2.90.

2) If a *storey* in a *building* or a *floor area* is required to have an automatic sprinkler system installed throughout in accordance with one or more of Articles 3.2.2.20. to 3.2.2.92. or Section 3.3., the automatic sprinkler system shall also be installed throughout all lower *storeys* in the *building* notwithstanding permission in Articles 3.2.2.20. to 3.2.2.92. to construct one or more of those *storeys* without installing automatic sprinkler protection. (See Note A-3.2.2.18.(2).)

Note A-3.2.2.18.(2) Sprinkler Extent.

A literal interpretation of Article 3.2.2.6. and Sentences 3.2.2.4.(1) and (2) could require installation of an automatic sprinkler system throughout all storeys of a building regardless of options in Articles 3.2.2.20. to 3.2.2.92. to construct one or more storeys without installation of sprinklers. It is the intent of the Code that all storeys below a storey in which an automatic sprinkler system is installed should also be protected by an automatic sprinkler system to ensure that a fire in a lower storey does not incapacitate the automatic sprinkler system or overwhelm an automatic sprinkler system in an upper storey. Persons in an upper storey in which waivers or reductions of other fire safety systems are permitted would be exposed to an increased risk from a fire on a lower storey. This concept also applies to situations in which an automatic sprinkler system has been installed within a floor area in order to modify other safety requirements applying within the floor area. If the uppermost storey or storeys of a building can be constructed without the installation of an automatic sprinkler system it is not necessary that an automatic sprinkler system required in a lower storey be extended into the upper storey or storeys.

PROPOSED CHANGE

[3.2.2.18.] 3.2.2.18. Automatic Sprinkler System Required

[1] 2) If a *storey* in a *building* or a *floor area* is required ~~to have an automatic sprinkler system installed throughout~~to be *sprinklered* in accordance with one or more of Articles 3.2.2.20. to 3.2.2.92. or Section 3.3., ~~the automatic sprinkler system shall also be installed throughout~~ all lower *storeys* in the *building* shall also be *sprinklered*, notwithstanding permission in Articles 3.2.2.20. to 3.2.2.92. ~~to construct~~for one or more of those *storeys* ~~without~~ ~~installing automatic sprinkler protection~~to not be *sprinklered*. (See Note A-3.2.2.18.(2).)

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.2.2.18.] 3.2.2.18. ([1] 2) [F02,F04-OS1.2,OS1.3]

[3.2.2.18.] 3.2.2.18. ([1] 2) [F02,F04-OP1.2,OP1.3]

Submit a comment

Proposed Change 1926

Code Reference(s):	**NBC20 Div.B 3.2.2.35.(4) (first printing)**
Subject:	Automatic Sprinkler System
Title:	Standardization of Terminology in NBC Sprinkler Requirements
Description:	This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NBC.
Related Proposed Change(s):	PCF 1910, PCF 1912, PCF 1915, PCF 1916, PCF 1917, PCF 1920, PCF 1921, PCF 1922, PCF 1924, PCF 1925, PCF 1927, PCF 1928, PCF 1929, PCF 1930, PCF 1931, PCF 1932, PCF 1933, PCF 1934

This change could potentially affect the following topic areas:

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

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NBC by using the defined term “sprinklered” and thereby eliminates any potential confusion.

Justification

As defined in the NBC, “sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers.”

In the NBC 2020 and National Fire Code of Canada (NFC) 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term “sprinklered” could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term “sprinklered” would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… to have an automatic sprinkler system installed throughout …”	NBC	1
“… an automatic sprinkler system shall be installed in …”	NBC	1
“… sprinklers shall be installed in …”	NBC	2
“… sprinklers shall be provided for …”	NBC	1
“… sprinklers shall not be omitted in …”	NBC	1
“… in which an automatic sprinkler system is installed …”	NBC	1
“… in which a sprinkler system is installed …”	NBC	2
“… in which a sprinkler system has been installed …”	NBC	1
“… area served by the sprinkler system …”	NBC	1
“… sprinklers are installed in …”	NBC	1
“… shall be equipped throughout with a sprinkler system …”	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are not mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… do not require the installation of an automatic sprinkler system …”	NBC	1
“… in which an automatic sprinkler system is not required to be installed …”	NBC	1
“… sprinklers are not required in …”	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
"… that is not protected by an automatic sprinkler system …"	NBC	1
"… in which sprinklers are not installed …"	NBC	2
"… where a sprinkler system is not installed …"	NBC	1
"… in which an automatic sprinkler system is not installed …"	NBC	2
"… need not be equipped throughout with a sprinkler system …"	NFC	2

PROPOSED CHANGE

[3.2.2.35.] 3.2.2.35. Group A, Division 4

[1] **4)** ~~Sprinklers shall be installed in a~~All spaces below tiers of seats in a *building* classified as Group A, Division 4 shall be *sprinklered* if those spaces are used for *occupancy*. (See Note A-3.2.2.35.(4).)

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.2.2.35.] 3.2.2.35. ([1] 4) [F02,F04-OS1.2,OS1.3]

[3.2.2.35.] 3.2.2.35. ([1] 4) [F02,F04-OP1.2,OP1.3]

Submit a comment

Proposed Change 1933

Code Reference(s): **NBC20 Div.B 3.2.3.14.(3) (first printing)**

Subject: Automatic Sprinkler System

Title: Standardization of Terminology in NBC Sprinkler Requirements

Description: This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NBC.

Related Proposed Change(s): PCF 1910, PCF 1912, PCF 1915, PCF 1916, PCF 1917, PCF 1920, PCF 1921, PCF 1922, PCF 1924, PCF 1925, PCF 1926, PCF 1927, PCF 1928, PCF 1929, PCF 1930, PCF 1931, PCF 1932, PCF 1934

This change could potentially affect the following topic areas:

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

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NBC by using the defined term “sprinklered” and thereby eliminates any potential confusion.

Justification

As defined in the NBC, “sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers.”

In the NBC 2020 and National Fire Code of Canada (NFC) 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term “sprinklered” could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term “sprinklered” would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… to have an automatic sprinkler system installed throughout …”	NBC	1
“… an automatic sprinkler system shall be installed in …”	NBC	1
“… sprinklers shall be installed in …”	NBC	2
“… sprinklers shall be provided for …”	NBC	1
“… sprinklers shall not be omitted in …”	NBC	1
“… in which an automatic sprinkler system is installed …”	NBC	1
“… in which a sprinkler system is installed …”	NBC	2
“… in which a sprinkler system has been installed …”	NBC	1
“… area served by the sprinkler system …”	NBC	1
“… sprinklers are installed in …”	NBC	1
“… shall be equipped throughout with a sprinkler system …”	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are <u>not</u> mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… do not require the installation of an automatic sprinkler system …”	NBC	1
“… in which an automatic sprinkler system is not required to be installed …”	NBC	1
“… sprinklers are not required in …”	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
"… that is not protected by an automatic sprinkler system …"	NBC	1
"… in which sprinklers are not installed …"	NBC	2
"… where a sprinkler system is not installed …"	NBC	1
"… in which an automatic sprinkler system is not installed …"	NBC	2
"… need not be equipped throughout with a sprinkler system …"	NFC	2

PROPOSED CHANGE

[3.2.3.14.] 3.2.3.14. Wall Exposed to Another Wall

[1] **3)** Sentence (1) does not apply to *unprotected openings* of *fire compartments* within a *building* that is *sprinklered* throughout, but shall apply to

[a] a) *unprotected openings* of *fire compartments* on opposite sides of a *firewall*, and

[b] b) exposure from *unprotected openings* of a *fire compartment* that is not ~~protected by an automatic sprinkler system~~*sprinklered*.

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.2.3.14.] 3.2.3.14. ([1] 3) no attributions

[3.2.3.14.] 3.2.3.14. ([1] 3) no attributions

Submit a comment

Proposed Change 1932

Code Reference(s):	**NBC20 Div.B 3.2.3.20.(1) (first printing)**
Subject:	Automatic Sprinkler System
Title:	Standardization of Terminology in NBC Sprinkler Requirements
Description:	This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NBC.
Related Proposed Change(s):	PCF 1910, PCF 1912, PCF 1915, PCF 1916, PCF 1917, PCF 1920, PCF 1921, PCF 1922, PCF 1924, PCF 1925, PCF 1926, PCF 1927, PCF 1928, PCF 1929, PCF 1930, PCF 1931, PCF 1933, PCF 1934

This change could potentially affect the following topic areas:

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

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NBC by using the defined term “sprinklered” and thereby eliminates any potential confusion.

Justification

As defined in the NBC, “sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers.”

In the NBC 2020 and National Fire Code of Canada (NFC) 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term “sprinklered” could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term “sprinklered” would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… to have an automatic sprinkler system installed throughout …”	NBC	1
“… an automatic sprinkler system shall be installed in …”	NBC	1
“… sprinklers shall be installed in …”	NBC	2
“… sprinklers shall be provided for …”	NBC	1
“… sprinklers shall not be omitted in …”	NBC	1
“… in which an automatic sprinkler system is installed …”	NBC	1
“… in which a sprinkler system is installed …”	NBC	2
“… in which a sprinkler system has been installed …”	NBC	1
“… area served by the sprinkler system …”	NBC	1
“… sprinklers are installed in …”	NBC	1
“… shall be equipped throughout with a sprinkler system …”	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are not mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… do not require the installation of an automatic sprinkler system …”	NBC	1
“… in which an automatic sprinkler system is not required to be installed …”	NBC	1
“… sprinklers are not required in …”	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
"… that is not protected by an automatic sprinkler system …"	NBC	1
"… in which sprinklers are not installed …"	NBC	2
"… where a sprinkler system is not installed …"	NBC	1
"… in which an automatic sprinkler system is not installed …"	NBC	2
"… need not be equipped throughout with a sprinkler system …"	NFC	2

PROPOSED CHANGE

[3.2.3.20.] 3.2.3.20. Underground Walkway

[1] **1)** An underground *walkway* shall not be designed or used for any purpose other than pedestrian travel unless

- [a] a) the purpose is acceptable to the *authority having jurisdiction*, and
- [b] b) ~~sprinklers are installed in~~ any space in the *walkway* containing an *occupancy* *is sprinklered*.

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.2.3.20.] 3.2.3.20. ([1] 1) [F01,F02-OP3.1]

Submit a comment

Proposed Change 1917

Code Reference(s):	**NBC20 Div.B 3.2.4.1. (first printing)**
Subject:	Automatic Sprinkler System
Title:	Standardization of Terminology in NBC Sprinkler Requirements
Description:	This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NBC.
Related Proposed Change(s):	PCF 1910, PCF 1912, PCF 1915, PCF 1916, PCF 1920, PCF 1921, PCF 1922, PCF 1924, PCF 1925, PCF 1926, PCF 1927, PCF 1928, PCF 1929, PCF 1930, PCF 1931, PCF 1932, PCF 1933, PCF 1934

This change could potentially affect the following topic areas:

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

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NBC by using the defined term “sprinklered” and thereby eliminates any potential confusion.

Justification

As defined in the NBC, “sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers.”

In the NBC 2020 and National Fire Code of Canada (NFC) 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term “sprinklered” could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term “sprinklered” would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… to have an automatic sprinkler system installed throughout …”	NBC	1
“… an automatic sprinkler system shall be installed in …”	NBC	1
“… sprinklers shall be installed in …”	NBC	2
“… sprinklers shall be provided for …”	NBC	1
“… sprinklers shall not be omitted in …”	NBC	1
“… in which an automatic sprinkler system is installed …”	NBC	1
“… in which a sprinkler system is installed …”	NBC	2
“… in which a sprinkler system has been installed …”	NBC	1
“… area served by the sprinkler system …”	NBC	1
“… sprinklers are installed in …”	NBC	1
“… shall be equipped throughout with a sprinkler system …”	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are not mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… do not require the installation of an automatic sprinkler system …”	NBC	1
“… in which an automatic sprinkler system is not required to be installed …”	NBC	1
“… sprinklers are not required in …”	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
"… that is not protected by an automatic sprinkler system …"	NBC	1
"… in which sprinklers are not installed …"	NBC	2
"… where a sprinkler system is not installed …"	NBC	1
"… in which an automatic sprinkler system is not installed …"	NBC	2
"… need not be equipped throughout with a sprinkler system …"	NFC	2

PROPOSED CHANGE

[3.2.4.1.] 3.2.4.1. Determination of Requirement for a Fire Alarm System

[1] **1)** Except as permitted in Sentences (2) and (3), a fire alarm system shall be installed in *buildings* ~~in which an automatic sprinkler system is installed~~that are *sprinklered*.

[2] **2)** *Buildings* ~~in which a sprinkler system is installed~~that are *sprinklered* in accordance with NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes", need not comply with Sentence (1).

[3] **3)** *Buildings* that contain fewer than 9 sprinklers conforming to Sentence 3.2.5.12.(4) need not comply with Sentence (1).

[4] **4)** Except as permitted by Sentences (5), (6) and 3.2.4.2.(4), a fire alarm system shall be installed in a *building* that is not *sprinklered* throughout and that contains

[a] a) a *contained use area*,

[b] b) an *impeded egress zone*,

[c] c) more than 3 *storeys*, including the *storeys* below the *first storey*,

[d] d) a total *occupant load* more than 300, other than in open air seating areas,

[e] e) an *occupant load* more than 150 above or below the *first storey*, other than in open air seating areas,

[f] f) a school, college, or child care facility, including a daycare facility, with an *occupant load* more than 40,

[g] g) a licensed beverage establishment or a licensed restaurant, with an *occupant load* more than 150,

[h] h) a *low-hazard industrial occupancy* with an *occupant load* more than 75 above or below the *first storey*,

[i] i) a *medium-hazard industrial occupancy* with an *occupant load* more than 75 above or below the *first storey*,

[j] j) a *residential occupancy* with sleeping accommodation for more than

10 persons,

[k] k) a *high-hazard industrial occupancy* with an *occupant load* more than 25, or

[l] l) an *occupant load* more than 300 below an open air seating area.

[5] **5)** A fire alarm system is not required in a *residential occupancy* that is not *sprinklered*, where

[a] a) not more than 4 *suites* share a common *means of egress*, or

[b] b) each *suite* has direct access to an exterior *exit* facility leading to ground level.

[6] **6)** A fire alarm system is not required in a *storage garage* conforming to Article 3.2.2.92. that is contained in a *building* that is not *sprinklered* provided there are no other *occupancies* in the *building*.

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.2.4.1.] 3.2.4.1. ([1] 1) [F11-OS1.5] [F13-OS1.5,OS1.2]

[3.2.4.1.] 3.2.4.1. ([1] 1) [F13-OP1.2]

[3.2.4.1.] 3.2.4.1. ([2] 2) no attributions

[3.2.4.1.] 3.2.4.1. ([3] 3) no attributions

[3.2.4.1.] 3.2.4.1. ([4] 4) [F11-OS1.5]

[3.2.4.1.] 3.2.4.1. ([5] 5) no attributions

[3.2.4.1.] 3.2.4.1. ([6] 6) no attributions

Submit a comment

Proposed Change 1910

Code Reference(s):	**NBC20 Div.B 3.2.4.8.(5) (first printing)**
Subject:	Automatic Sprinkler System
Title:	Standardization of Terminology in NBC Sprinkler Requirements
Description:	This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NBC.
Related Proposed Change(s):	PCF 1912, PCF 1915, PCF 1916, PCF 1917, PCF 1920, PCF 1921, PCF 1922, PCF 1924, PCF 1925, PCF 1926, PCF 1927, PCF 1928, PCF 1929, PCF 1930, PCF 1931, PCF 1932, PCF 1933, PCF 1934

This change could potentially affect the following topic areas:

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

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NBC by using the defined term “sprinklered” and thereby eliminates any potential confusion.

Justification

As defined in the NBC, “sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers.”

In the NBC 2020 and National Fire Code of Canada (NFC) 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term “sprinklered” could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term “sprinklered” would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… to have an automatic sprinkler system installed throughout …”	NBC	1
“… an automatic sprinkler system shall be installed in …”	NBC	1
“… sprinklers shall be installed in …”	NBC	2
“… sprinklers shall be provided for …”	NBC	1
“… sprinklers shall not be omitted in …”	NBC	1
“… in which an automatic sprinkler system is installed …”	NBC	1
“… in which a sprinkler system is installed …”	NBC	2
“… in which a sprinkler system has been installed …”	NBC	1
“… area served by the sprinkler system …”	NBC	1
“… sprinklers are installed in …”	NBC	1
“… shall be equipped throughout with a sprinkler system …”	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are not mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… do not require the installation of an automatic sprinkler system …”	NBC	1
“… in which an automatic sprinkler system is not required to be installed …”	NBC	1
“… sprinklers are not required in …”	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
"… that is not protected by an automatic sprinkler system …"	NBC	1
"… in which sprinklers are not installed …"	NBC	2
"… where a sprinkler system is not installed …"	NBC	1
"… in which an automatic sprinkler system is not installed …"	NBC	2
"… need not be equipped throughout with a sprinkler system …"	NFC	2

PROPOSED CHANGE

[3.2.4.8.] 3.2.4.8. Annunciator and Zone Indication

[1] **5)** The requirements of Sentence (1) are waived in a *building* that

[a] a) ~~in which an automatic sprinkler system is not installed~~is not *sprinklered*,

[b] b) ~~that~~ has an aggregate area for all *storeys* of not more than 2 000 m^2, and

[c] c) ~~that~~ is not more than 3 *storeys* in *building height*.

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.2.4.8.] 3.2.4.8. ([1] 5) no attributions

Submit a comment

Proposed Change 1925

Code Reference(s):	**NBC20 Div.B 3.2.4.10.(4) (first printing)**
Subject:	Automatic Sprinkler System
Title:	Standardization of Terminology in NBC Sprinkler Requirements
Description:	This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NBC.
Related Proposed Change(s):	PCF 1910, PCF 1912, PCF 1915, PCF 1916, PCF 1917, PCF 1920, PCF 1921, PCF 1922, PCF 1924, PCF 1926, PCF 1927, PCF 1928, PCF 1929, PCF 1930, PCF 1931, PCF 1932, PCF 1933, PCF 1934

This change could potentially affect the following topic areas:

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

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NBC by using the defined term “sprinklered” and thereby eliminates any potential confusion.

Justification

As defined in the NBC, "sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers."

In the NBC 2020 and National Fire Code of Canada (NFC) 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term "sprinklered" could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term "sprinklered" would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
"… to have an automatic sprinkler system installed throughout …"	NBC	1
"… an automatic sprinkler system shall be installed in …"	NBC	1
"… sprinklers shall be installed in …"	NBC	2
"… sprinklers shall be provided for …"	NBC	1
"… sprinklers shall not be omitted in …"	NBC	1
"… in which an automatic sprinkler system is installed …"	NBC	1
"… in which a sprinkler system is installed …"	NBC	2
"… in which a sprinkler system has been installed …"	NBC	1
"… area served by the sprinkler system …"	NBC	1
"… sprinklers are installed in …"	NBC	1
"… shall be equipped throughout with a sprinkler system …"	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are not mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
"… do not require the installation of an automatic sprinkler system …"	NBC	1
"… in which an automatic sprinkler system is not required to be installed …"	NBC	1
"… sprinklers are not required in …"	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
"… that is not protected by an automatic sprinkler system …"	NBC	1
"… in which sprinklers are not installed …"	NBC	2
"… where a sprinkler system is not installed …"	NBC	1
"… in which an automatic sprinkler system is not installed …"	NBC	2
"… need not be equipped throughout with a sprinkler system …"	NFC	2

PROPOSED CHANGE

[3.2.4.10.] 3.2.4.10. Fire Detectors

[1] **4)** *Fire detectors* required by Sentence (2) shall be installed in elevator hoistways and dumbwaiter shafts ~~where a sprinkler system is not installed within the hoistway or shaft~~that are not *sprinklered*.

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.2.4.10.] 3.2.4.10. ([1] 4) [F11-OS1.5]

Submit a comment

Proposed Change 1927

Code Reference(s):	**NBC20 Div.B 3.2.5.10.(5) (first printing)**
Subject:	Automatic Sprinkler System
Title:	Standardization of Terminology in NBC Sprinkler Requirements
Description:	This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NBC.
Related Proposed Change(s):	PCF 1910, PCF 1912, PCF 1915, PCF 1916, PCF 1917, PCF 1920, PCF 1921, PCF 1922, PCF 1924, PCF 1925, PCF 1926, PCF 1928, PCF 1929, PCF 1930, PCF 1931, PCF 1932, PCF 1933, PCF 1934

This change could potentially affect the following topic areas:

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

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NBC by using the defined term “sprinklered” and thereby eliminates any potential confusion.

Justification

As defined in the NBC, “sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers.”

In the NBC 2020 and National Fire Code of Canada (NFC) 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term “sprinklered” could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term “sprinklered” would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… to have an automatic sprinkler system installed throughout …”	NBC	1
“… an automatic sprinkler system shall be installed in …”	NBC	1
“… sprinklers shall be installed in …”	NBC	2
“… sprinklers shall be provided for …”	NBC	1
“… sprinklers shall not be omitted in …”	NBC	1
“… in which an automatic sprinkler system is installed …”	NBC	1
“… in which a sprinkler system is installed …”	NBC	2
“… in which a sprinkler system has been installed …”	NBC	1
“… area served by the sprinkler system …”	NBC	1
“… sprinklers are installed in …”	NBC	1
“… shall be equipped throughout with a sprinkler system …”	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are not mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… do not require the installation of an automatic sprinkler system …”	NBC	1
“… in which an automatic sprinkler system is not required to be installed …”	NBC	1
“… sprinklers are not required in …”	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
"… that is not protected by an automatic sprinkler system …"	NBC	1
"… in which sprinklers are not installed …"	NBC	2
"… where a sprinkler system is not installed …"	NBC	1
"… in which an automatic sprinkler system is not installed …"	NBC	2
"… need not be equipped throughout with a sprinkler system …"	NFC	2

PROPOSED CHANGE

[3.2.5.10.] 3.2.5.10. Hose Connections

[1] **5)** Hose connections for 64 mm diam hose are not required in a *building* that is not *sprinklered* and that is not more than 25 m high, measured between *grade* and the ceiling level of the top *storey* ~~and in which an automatic sprinkler system is not installed~~.

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.2.5.10.] 3.2.5.10. ([1] 5) no attributions

Submit a comment

Proposed Change 1912

Code Reference(s): **NBC20 Div.B 3.2.5.12. (first printing)**

Subject: Automatic Sprinkler System

Title: Standardization of Terminology in NBC Sprinkler Requirements

Description: This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NBC.

Related Proposed Change(s): PCF 1910, PCF 1915, PCF 1916, PCF 1917, PCF 1920, PCF 1921, PCF 1922, PCF 1924, PCF 1925, PCF 1926, PCF 1927, PCF 1928, PCF 1929, PCF 1930, PCF 1931, PCF 1932, PCF 1933, PCF 1934

This change could potentially affect the following topic areas:

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

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NBC by using the defined term “sprinklered” and thereby eliminates any potential confusion.

Justification

As defined in the NBC, “sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers.”

In the NBC 2020 and National Fire Code of Canada (NFC) 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term “sprinklered” could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term “sprinklered” would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… to have an automatic sprinkler system installed throughout …”	NBC	1
“… an automatic sprinkler system shall be installed in …”	NBC	1
“… sprinklers shall be installed in …”	NBC	2
“… sprinklers shall be provided for …”	NBC	1
“… sprinklers shall not be omitted in …”	NBC	1
“… in which an automatic sprinkler system is installed …”	NBC	1
“… in which a sprinkler system is installed …”	NBC	2
“… in which a sprinkler system has been installed …”	NBC	1
“… area served by the sprinkler system …”	NBC	1
“… sprinklers are installed in …”	NBC	1
“… shall be equipped throughout with a sprinkler system …”	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are not mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… do not require the installation of an automatic sprinkler system …”	NBC	1
“… in which an automatic sprinkler system is not required to be installed …”	NBC	1
“… sprinklers are not required in …”	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
“… that is not protected by an automatic sprinkler system …”	NBC	1
“… in which sprinklers are not installed …”	NBC	2
“… where a sprinkler system is not installed …”	NBC	1
“… in which an automatic sprinkler system is not installed …”	NBC	2
“… need not be equipped throughout with a sprinkler system …”	NFC	2

PROPOSED CHANGE

[3.2.5.12.] 3.2.5.12. Automatic Sprinkler Systems

[1] 1) Except as permitted by Sentences (2) to (4) and (9), an automatic sprinkler system shall be designed, constructed, installed and tested in conformance with NFPA 13, "Standard for the Installation of Sprinkler Systems". (See Note A-3.2.5.12.(1).)

[2] 2) Instead of the requirements of Sentence (1), NFPA 13R, "Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies", is permitted to be used for the design, construction and installation of an automatic sprinkler system installed

- [a] a) in a *building* of *residential occupancy* throughout that
  - [i] i) is not more than 4 *storeys* in *building height* and conforms to Article 3.2.2.47., 3.2.2.49., 3.2.2.51., 3.2.2.52. or or 3.2.2.55., or
  - [ii] ii) is not more than 3 *storeys* in *building height* and conforms to Article 9.10.1.3., or
- [b] b) in a *building* of *care occupancy* with not more than 10 occupants that is not more than 3 *storeys* in *building height* and conforms to one of Articles 3.2.2.42. to 3.2.2.46.

(See Note A-3.2.5.12.(2).)

[3] 3) Instead of the requirements of Sentence (1), NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes", is permitted to be used for the design, construction and installation of an automatic sprinkler system installed

- [a] a) in a *building* of *residential occupancy* throughout that contains not more than two *dwelling units*,
- [b] b) in a *building* of *care occupancy*, provided
  - [i] i) it contains not more than two *suites* of *care occupancy*,
  - [ii] ii) it has not more than five residents throughout, and
  - [iii] iii) a 30-minute water supply demand can be met, and

[c] c) in a *building* of *residential occupancy* throughout that contains more than two *dwelling units*, provided
  [i] i) except for a *secondary suite*, no *dwelling unit* is located above another *dwelling unit*,
  [ii] ii) all *suites* are separated by a vertical *fire separation* having a *fire-resistance rating* of not less than 1 h that provides continuous protection from the top of the footing to the underside of the roof deck, with any space between the top of the wall and the roof deck tightly filled with mineral wool or *noncombustible* material,
  [iii] iii) each *dwelling unit* has its own sprinkler water supply provided in accordance with NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes",
  [iv] iv) a passive purge sprinkler system design is used as described in NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes", and
  [v] v) where the sprinkler system is taken into consideration for the reduction of *limiting distance*, all rooms, including closets, bathrooms and attached garages, that adjoin an *exposing building face* are sprinklered, notwithstanding any exemption stated in NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes".

(See Note A-3.2.5.12.(2).)

[4] **4)** If a *building* contains fewer than 9 sprinklers, the water supply for these sprinklers is permitted to be supplied from the domestic water system for the *building* provided the required flow for the sprinklers can be met by the domestic system.

[5] **5)** If a water supply serves both an automatic sprinkler system and a system serving other equipment, control valves shall be provided so that either system can be shut off independently.

[6] **6)** Notwithstanding the requirements of the standards referenced in Sentences (1) and (2) regarding the installation of automatic sprinkler systems, ~~sprinklers shall not be omitted in~~ any room or closet in the *storey* immediately below a roof assembly shall be *sprinklered*. (See Note A-3.2.5.12.(6).)

[7] **7)** Notwithstanding the requirements of the standards referenced in Sentences (1) and (2) regarding the installation of automatic sprinkler systems, in *buildings* conforming to Article 3.2.2.48., 3.2.2.51., 3.2.2.57. or 3.2.2.60., ~~sprinklers shall be provided for~~ balconies and decks exceeding 610 mm in depth measured perpendicular to the exterior wall shall be *sprinklered*. (See Note A-3.2.5.12.(7).)

[8] **8)** Sprinklers in elevator machine rooms shall have a temperature rating not

less than that required for an intermediate temperature classification and shall be protected against physical damage. (See Note A-3.2.5.12.(8).)

[9] **9)** Except as provided in Subsection 3.2.8., closely spaced sprinklers and associated draft stops need not be installed around floor openings in conformance with NFPA 13, "Standard for the Installation of Sprinkler Systems".

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.2.5.12.] **3.2.5.12. ([1] 1) [F02,F81,F82-OS1.2]**

[3.2.5.12.] **3.2.5.12. ([1] 1) [F02,F81,F82-OP1.2]**

[3.2.5.12.] **3.2.5.12. ([2] 2) [F02,F81-OS1.2]**

[3.2.5.12.] **3.2.5.12. ([2] 2) [F02,F81-OP1.2]**

[3.2.5.12.] **3.2.5.12. ([3] 3) [F02,F81-OS1.2]**

[3.2.5.12.] **3.2.5.12. ([3] 3) [F02,F81-OP1.2]**

[3.2.5.12.] **3.2.5.12. ([4] 4) [F02-OS1.2]**

[3.2.5.12.] **3.2.5.12. ([4] 4) [F02-OP1.2]**

[3.2.5.12.] 3.2.5.12. ([5] 5) [F81-OS1.2]

[3.2.5.12.] 3.2.5.12. ([5] 5) [F81-OP1.2]

[3.2.5.12.] 3.2.5.12. ([6] 6) [F02-OS1.2]

[3.2.5.12.] 3.2.5.12. ([6] 6) [F02-OP1.2]

[3.2.5.12.] 3.2.5.12. ([7] 7) [F03-OS1.2]

[3.2.5.12.] 3.2.5.12. ([7] 7) [F03-OP1.2]

[3.2.5.12.] 3.2.5.12. ([7] 7) [F03-OP3.1]

[3.2.5.12.] 3.2.5.12. ([8] 8) [F81-OS3.3,OS3.6]

[3.2.5.12.] 3.2.5.12. ([9] 9) no attributions

Submit a comment

Proposed Change 1915

Code Reference(s):	**NBC20 Div.B 3.2.5.13.(3) (first printing)**
Subject:	Automatic Sprinkler System
Title:	Standardization of Terminology in NBC Sprinkler Requirements
Description:	This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NBC.
Related Proposed Change(s):	PCF 1910, PCF 1912, PCF 1916, PCF 1917, PCF 1920, PCF 1921, PCF 1922, PCF 1924, PCF 1925, PCF 1926, PCF 1927, PCF 1928, PCF 1929, PCF 1930, PCF 1931, PCF 1932, PCF 1933, PCF 1934

This change could potentially affect the following topic areas:

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

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NBC by using the defined term “sprinklered” and thereby eliminates any potential confusion.

Justification

As defined in the NBC, “sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers.”

In the NBC 2020 and National Fire Code of Canada (NFC) 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term “sprinklered” could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term “sprinklered” would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… to have an automatic sprinkler system installed throughout …”	NBC	1
“… an automatic sprinkler system shall be installed in …”	NBC	1
“… sprinklers shall be installed in …”	NBC	2
“… sprinklers shall be provided for …”	NBC	1
“… sprinklers shall not be omitted in …”	NBC	1
“… in which an automatic sprinkler system is installed …”	NBC	1
“… in which a sprinkler system is installed …”	NBC	2
“… in which a sprinkler system has been installed …”	NBC	1
“… area served by the sprinkler system …”	NBC	1
“… sprinklers are installed in …”	NBC	1
“… shall be equipped throughout with a sprinkler system …”	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are not mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… do not require the installation of an automatic sprinkler system …”	NBC	1
“… in which an automatic sprinkler system is not required to be installed …”	NBC	1
“… sprinklers are not required in …”	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
"… that is not protected by an automatic sprinkler system …"	NBC	1
"… in which sprinklers are not installed …"	NBC	2
"… where a sprinkler system is not installed …"	NBC	1
"… in which an automatic sprinkler system is not installed …"	NBC	2
"… need not be equipped throughout with a sprinkler system …"	NFC	2

PROPOSED CHANGE

[3.2.5.13.] 3.2.5.13. Combustible Sprinkler Piping

[1] **3)** Except as permitted by Sentence (5), *combustible* sprinkler piping shall be separated from the *sprinklered* area ~~served by the sprinkler system,~~ and from any other *fire compartment*, by ceilings, walls, or soffits consisting of, as a minimum,

[a] a) lath and plaster,

[b] b) gypsum board not less than 9.5 mm thick,

[c] c) plywood not less than 13 mm thick, or

[d] d) a suspended membrane ceiling with

  [i] i) steel suspension grids, and

  [ii] ii) lay-in panels or tiles having a mass not less than 1.7 kg/m^2.

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.2.5.13.] 3.2.5.13. ([1] 3) [F06-OS1.2]

[3.2.5.13.] 3.2.5.13. ([1] 3) [F06-OP1.2]

Submit a comment

Proposed Change 1929

Code Reference(s):	**NBC20 Div.B 3.2.5.14.(1) (first printing)**
Subject:	Automatic Sprinkler System
Title:	Standardization of Terminology in NBC Sprinkler Requirements
Description:	This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NBC.
Related Proposed Change(s):	PCF 1910, PCF 1912, PCF 1915, PCF 1916, PCF 1917, PCF 1920, PCF 1921, PCF 1922, PCF 1924, PCF 1925, PCF 1926, PCF 1927, PCF 1928, PCF 1930, PCF 1931, PCF 1932, PCF 1933, PCF 1934

This change could potentially affect the following topic areas:

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

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NBC by using the defined term “sprinklered” and thereby eliminates any potential confusion.

Justification

As defined in the NBC, “sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers.”

In the NBC 2020 and National Fire Code of Canada (NFC) 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term “sprinklered” could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term “sprinklered” would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… to have an automatic sprinkler system installed throughout …”	NBC	1
“… an automatic sprinkler system shall be installed in …”	NBC	1
“… sprinklers shall be installed in …”	NBC	2
“… sprinklers shall be provided for …”	NBC	1
“… sprinklers shall not be omitted in …”	NBC	1
“… in which an automatic sprinkler system is installed …”	NBC	1
“… in which a sprinkler system is installed …”	NBC	2
“… in which a sprinkler system has been installed …”	NBC	1
“… area served by the sprinkler system …”	NBC	1
“… sprinklers are installed in …”	NBC	1
“… shall be equipped throughout with a sprinkler system …”	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are not mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… do not require the installation of an automatic sprinkler system …”	NBC	1
“… in which an automatic sprinkler system is not required to be installed …”	NBC	1
“… sprinklers are not required in …”	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
"… that is not protected by an automatic sprinkler system …"	NBC	1
"… in which sprinklers are not installed …"	NBC	2
"… where a sprinkler system is not installed …"	NBC	1
"… in which an automatic sprinkler system is not installed …"	NBC	2
"… need not be equipped throughout with a sprinkler system …"	NFC	2

PROPOSED CHANGE

[3.2.5.14.] 3.2.5.14. Sprinklered Service Space

[1] **1)** ~~An automatic sprinkler system shall be installed in a~~A *service space* referred to in Sentence 3.2.1.1.(8) shall be *sprinklered* if flooring for access within the *service space* is other than catwalks.

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.2.5.14.] 3.2.5.14. ([1] 1) [F02-OS1.2]

[3.2.5.14.] 3.2.5.14. ([1] 1) [F02-OP1.2]

Submit a comment

Proposed Change 1916

Code Reference(s):	**NBC20 Div.B 3.3.3.7.(4) (first printing)**
Subject:	Automatic Sprinkler System
Title:	Standardization of Terminology in NBC Sprinkler Requirements
Description:	This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NBC.
Related Proposed Change(s):	PCF 1910, PCF 1912, PCF 1915, PCF 1917, PCF 1920, PCF 1921, PCF 1922, PCF 1924, PCF 1925, PCF 1926, PCF 1927, PCF 1928, PCF 1929, PCF 1930, PCF 1931, PCF 1932, PCF 1933, PCF 1934

This change could potentially affect the following topic areas:

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

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NBC by using the defined term “sprinklered” and thereby eliminates any potential confusion.

Justification

As defined in the NBC, "sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers."

In the NBC 2020 and National Fire Code of Canada (NFC) 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term "sprinklered" could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term "sprinklered" would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
"… to have an automatic sprinkler system installed throughout …"	NBC	1
"… an automatic sprinkler system shall be installed in …"	NBC	1
"… sprinklers shall be installed in …"	NBC	2
"… sprinklers shall be provided for …"	NBC	1
"… sprinklers shall not be omitted in …"	NBC	1
"… in which an automatic sprinkler system is installed …"	NBC	1
"… in which a sprinkler system is installed …"	NBC	2
"… in which a sprinkler system has been installed …"	NBC	1
"… area served by the sprinkler system …"	NBC	1
"… sprinklers are installed in …"	NBC	1
"… shall be equipped throughout with a sprinkler system …"	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are not mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
"… do not require the installation of an automatic sprinkler system …"	NBC	1
"… in which an automatic sprinkler system is not required to be installed …"	NBC	1
"… sprinklers are not required in …"	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
"… that is not protected by an automatic sprinkler system …"	NBC	1
"… in which sprinklers are not installed …"	NBC	2
"… where a sprinkler system is not installed …"	NBC	1
"… in which an automatic sprinkler system is not installed …"	NBC	2
"… need not be equipped throughout with a sprinkler system …"	NFC	2

PROPOSED CHANGE

[3.3.3.7.] 3.3.3.7. Contained Use Areas

[1] **4)** A *contained use area*, in a *building* ~~for which~~not required to be *sprinklered* in conformance with Articles 3.2.2.20. to 3.2.2.92. ~~do not require the installation of an automatic sprinkler system~~, is not required to be *sprinklered* in conformance with~~as required by~~ Sentence (3) provided

[a] a) the *building* is designed so that during a period of 2 h after the start of a fire in the *contained use area* other *fire compartments* will not contain more than 1% by volume of contaminated air from the *contained use area*,

[b] b) the *building* is designed so that during a period of 2 h after the start of a fire in another part of the *building* the *contained use area* will not contain more than 1% by volume of contaminated air from the other part of the *building*,

[c] c) all doors are designed to be remotely released in conformance with Sentence 3.3.1.13.(6), and

[d] d) the *contained use area* does not contain any rooms lined with *combustible* padding.

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.3.3.7.] 3.3.3.7. ([1] 4) [F02-OS1.2] [F06-OS1.5,OS1.2]

[3.3.3.7.] 3.3.3.7. ([1] 4) [F02,F06-OP1.2]

Submit a comment

Proposed Change 1930

Code Reference(s):	**NBC20 Div.B 3.3.4.3.(1) (first printing)**
Subject:	Automatic Sprinkler System
Title:	Standardization of Terminology in NBC Sprinkler Requirements
Description:	This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NBC.
Related Proposed Change(s):	PCF 1910, PCF 1912, PCF 1915, PCF 1916, PCF 1917, PCF 1920, PCF 1921, PCF 1922, PCF 1924, PCF 1925, PCF 1926, PCF 1927, PCF 1928, PCF 1929, PCF 1931, PCF 1932, PCF 1933, PCF 1934

This change could potentially affect the following topic areas:

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

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NBC by using the defined term “sprinklered” and thereby eliminates any potential confusion.

Justification

As defined in the NBC, “sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers.”

In the NBC 2020 and National Fire Code of Canada (NFC) 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term “sprinklered” could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term “sprinklered” would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… to have an automatic sprinkler system installed throughout …”	NBC	1
“… an automatic sprinkler system shall be installed in …”	NBC	1
“… sprinklers shall be installed in …”	NBC	2
“… sprinklers shall be provided for …”	NBC	1
“… sprinklers shall not be omitted in …”	NBC	1
“… in which an automatic sprinkler system is installed …”	NBC	1
“… in which a sprinkler system is installed …”	NBC	2
“… in which a sprinkler system has been installed …”	NBC	1
“… area served by the sprinkler system …”	NBC	1
“… sprinklers are installed in …”	NBC	1
“… shall be equipped throughout with a sprinkler system …”	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are not mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… do not require the installation of an automatic sprinkler system …”	NBC	1
“… in which an automatic sprinkler system is not required to be installed …”	NBC	1
“… sprinklers are not required in …”	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
"… that is not protected by an automatic sprinkler system …"	NBC	1
"… in which sprinklers are not installed …"	NBC	2
"… where a sprinkler system is not installed …"	NBC	1
"… in which an automatic sprinkler system is not installed …"	NBC	2
"… need not be equipped throughout with a sprinkler system …"	NFC	2

PROPOSED CHANGE

[3.3.4.3.] 3.3.4.3. Storage Rooms

[1] **1)** ~~Sprinklers shall be installed in a~~A storage room provided for the use of tenants in a *residential occupancy* within a *floor area* but not contained within a *suite* shall be *sprinklered*.

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.3.4.3.] 3.3.4.3. ([1] 1) [F02-OS1.2]

[3.3.4.3.] 3.3.4.3. ([1] 1) [F02-OP1.2]

Submit a comment

Proposed Change 1772

Code Reference(s):	**NBC20 Div.B 3.4.6.5. (first printing)**
Subject:	Other — Use and Egress
Title:	Minimum Width of Stairs or Ramps Between Handrails
Description:	This proposed change clarifies the minimum width of stairs or ramps where an intermediate handrail is required.
Related Code Change Request(s):	CCR 1546

This change could potentially affect the following topic areas:

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

Problem

Sentence 3.4.6.5.(3) of Division B of the NBC provides requirements for intermediate handrails where stairs or ramps are too wide to readily reach one of the handrails on the outer edges of the stair or ramp.

Clause 3.4.6.5.(3)(b) is worded such that for stairs or ramps that require an intermediate handrail, one portion of the stair or ramp must have the minimum width required. As it is written, this provision could be interpreted to mean that the dimension (1 100 mm in many cases) must be the exact minimum width. The 1 100 mm width allows for two people to use the stairs or ramp side by side. Clause 3.4.6.5.(3)(c) indicates that other portions of stairs or ramps must have a clear width of at least 510 mm between handrails, leaving room for wider portions of stair or ramp, if desired. These portions are intended to be wide enough to allow at least one person to use the stairs. The intent for both requirements is to provide minimum dimensions to serve in emergency situations where people are likely to circulate only in one direction.

It is intended that the portion of stair or ramp having the minimum width required also be “at least” this wide, while also having handrails within reach as required by Clause 3.4.6.5.(3)(a). However, the Code language does not currently reflect this intent.

Additionally, there is confusion where the Code uses different terms such as “minimum width” and “clear width”, especially in the same Sentence. Some Code users may interpret these terms as having the same meaning, while others do not. This could lead to different levels of performance in exit facility design, which may not be sufficient to facilitate a timely evacuation as originally intended by the Code. For clarity and ease of design and enforcement, this proposed change clarifies the terms used in this Sentence by introducing an explanatory Note and related figures.

Justification

The dimensions of portions of stairs or ramps were previously reviewed and given due consideration. It is acknowledged that some stair or ramp widths might not comply with the existing requirements (for example, for stairs that are 1 400 mm wide, a portion of 1 100 mm plus a minimum of 510 mm for the other portion is not possible). However, this would be the case regardless of the minimum dimension (510 mm or another number).

This proposed change revises Clause 3.4.6.5.(3)(b) to reflect the Code intent to require a portion of stairs or a ramp to be “at least” the minimum width required and clarify how the width should be measured.

This proposed change also introduces explanatory Note A-3.4.6.5.(3) to clarify where the intermediate handrail is required by Sentence 3.4.6.5.(3) and how to measure the relevant dimensions. Additionally, two figures are provided to illustrate where an intermediate handrail is not required and where a handrail is required.

The proposed change clarifies the existing provisions to avoid misinterpretation and for consistent application by designers, builders and building officials.

PROPOSED CHANGE

[3.4.6.5.] 3.4.6.5. Handrails

[1] **1)** One handrail shall be provided on stairs that are less than 1 100 mm in width.

[2] **2)** One handrail shall be provided on each side of

[a] a) stairs that are 1 100 mm or more in width,

[b] b) curved *flights* of any width, and

[c] c) *ramps*.

[3] **3)** In addition to Sentence (2), intermediate handrails shall be provided so that

[a] a) a handrail is reachable within 750 mm of all portions of the required *exit* width,

[b] b) at least one portion of the stair or *ramp* ~~between two handrails is~~ has at least the minimum width required for stairways or *ramps* (see Sentences 3.4.3.2.(8) and 3.4.3.3.(4)), and

[c] c) all other portions of the stair or *ramp* between two handrails have a clear width of at least 510 mm ~~or more~~.

(See Note A-3.4.6.5.(3).)

[4] 4) Where a stair or *ramp* is wider than its required *exit* width, handrails shall be located along the most direct path of travel. (See Note A-3.4.6.5.(4).)

[5] 5) Handrails shall be continuously graspable along their entire length, be free of any sharp or abrasive elements, and have

[a] a) a circular cross-section with an outside diameter not less than 30 mm and not more than 50 mm, or

[b] b) a non-circular cross-section with a perimeter not less than 100 mm and not more than 160 mm and whose largest cross-sectional dimension is not more than 57 mm.

[6] 6) The height of handrails on stairs, on aisles with steps and on *ramps* shall be measured vertically from the top of the handrail to

[a] a) a straight line drawn tangent to the tread nosings of the stair or aisle step served by the handrail (see Note A-9.8.7.4.), or

[b] b) the surface of the *ramp*, floor or landing served by the handrail.

[7] 7) Except as provided in Sentence (8) and Clause 3.8.3.5.(1)(e), the height of handrails on stairs, on aisles with steps and on *ramps* shall be

[a] a) not less than 865 mm, and

[b] b) not more than 1 070 mm.

[8] 8) Handrails installed in addition to required handrails need not comply with Sentence (7).

[9] 9) Required handrails shall be continuously graspable throughout the length of

[a] a) a *ramp*, and

[b] b) a *flight* of stairs, from the bottom riser to the top riser.

(See Note A-9.8.7.2.)

[10] 10) Except where interrupted by doorways, at least one handrail shall be continuous throughout the length of a stairway or *ramp*, including at landings.

[11] 11) Handrails shall be terminated in a manner that will not obstruct pedestrian travel or create a hazard. (See Note A-3.4.6.5.(11)).

[12] 12) At least one handrail at the side of a stairway or *ramp* shall extend horizontally not less than 300 mm beyond the top and bottom of the stairway or *ramp*.

[13] 13) The clearance between a handrail and any surface behind it shall be not less than

[a] a) 50 mm, or
[b] b) 60 mm if the surface behind the handrail is rough or abrasive.

[14] 14) Handrails and their supports shall be designed and constructed to withstand the loading values specified in Sentence 4.1.5.14.(7).

[15] 15) A *ramp* shall have handrails on both sides.

Note A-3.4.6.5.(3) Intermediate Handrails.

Clause 3.4.6.5.(3)(a) establishes that a handrail must be provided within arm's reach (750 mm) of any location in the portion of a stair or ramp that contains the required exit width, in order to mitigate the risk of injury due to missteps and falls. This 750 mm distance should be measured to the nearest edge of the handrail.

Where a stair or ramp is too wide for this reaching distance to be satisfied with handrails at the sides of the stair or ramp, an intermediate handrail is required. Clause 3.4.6.5.(3)(b) establishes that an intermediate handrail must be provided so that at least one portion of the stair or ramp has at least the minimum width required for stairs and ramps (often 1 100 mm) in order to accommodate the flow of two lines of occupants in an emergency.

Clause 3.4.6.5.(3)(c) establishes that all other portions of a stair or ramp must have a clear width between handrails of at least 510 mm.

Designers should consider the function served by a stair or ramp in the building's design. Where a stair or ramp is intended to serve people travelling in both directions in normal building use, widths larger than those prescribed by Sentence 3.4.6.5.(3) should be considered.

Figure [A-3.4.6.5.(3)-A]
Stair where an intermediate handrail is not required by Clause 3.4.6.5.(3)(a)

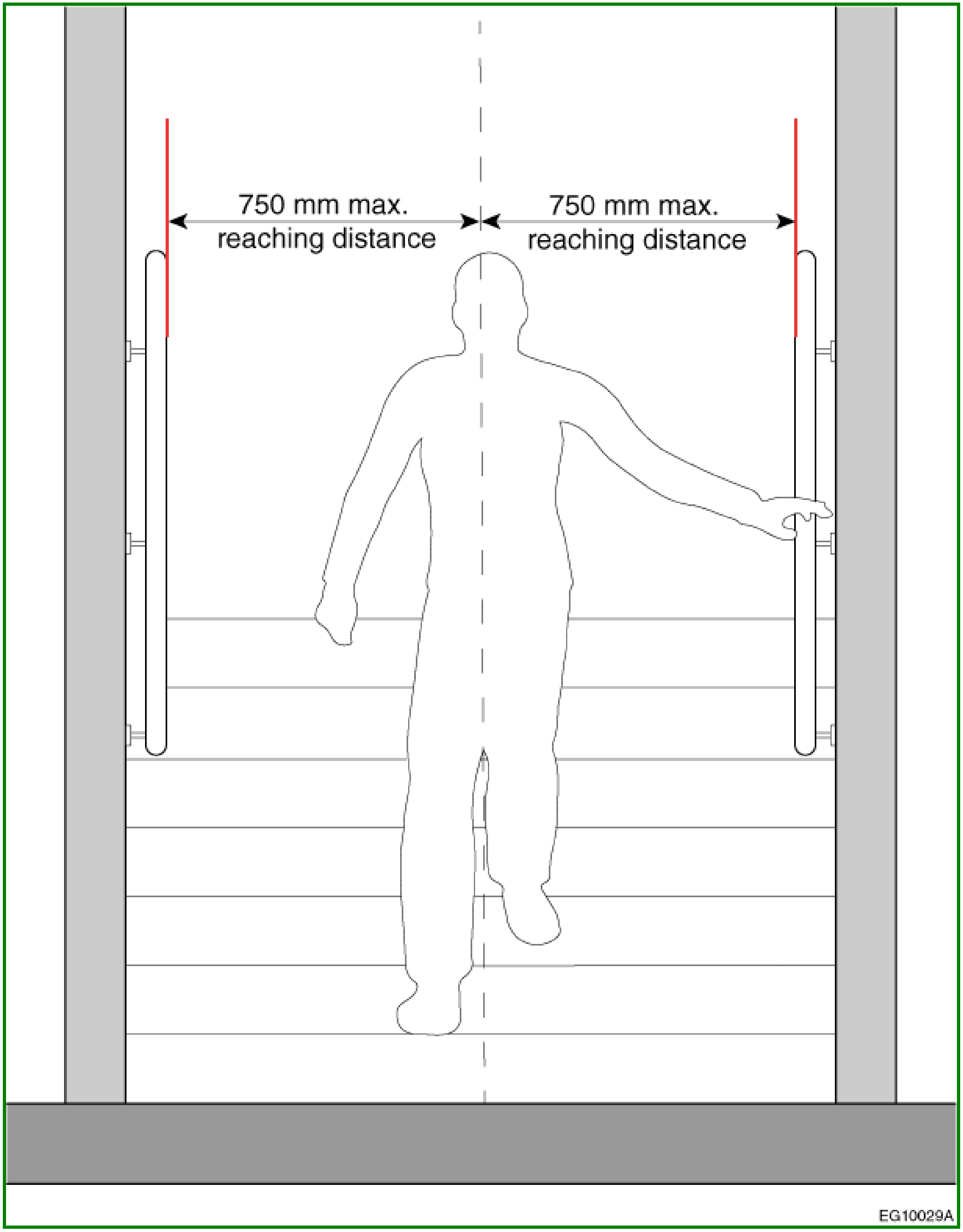
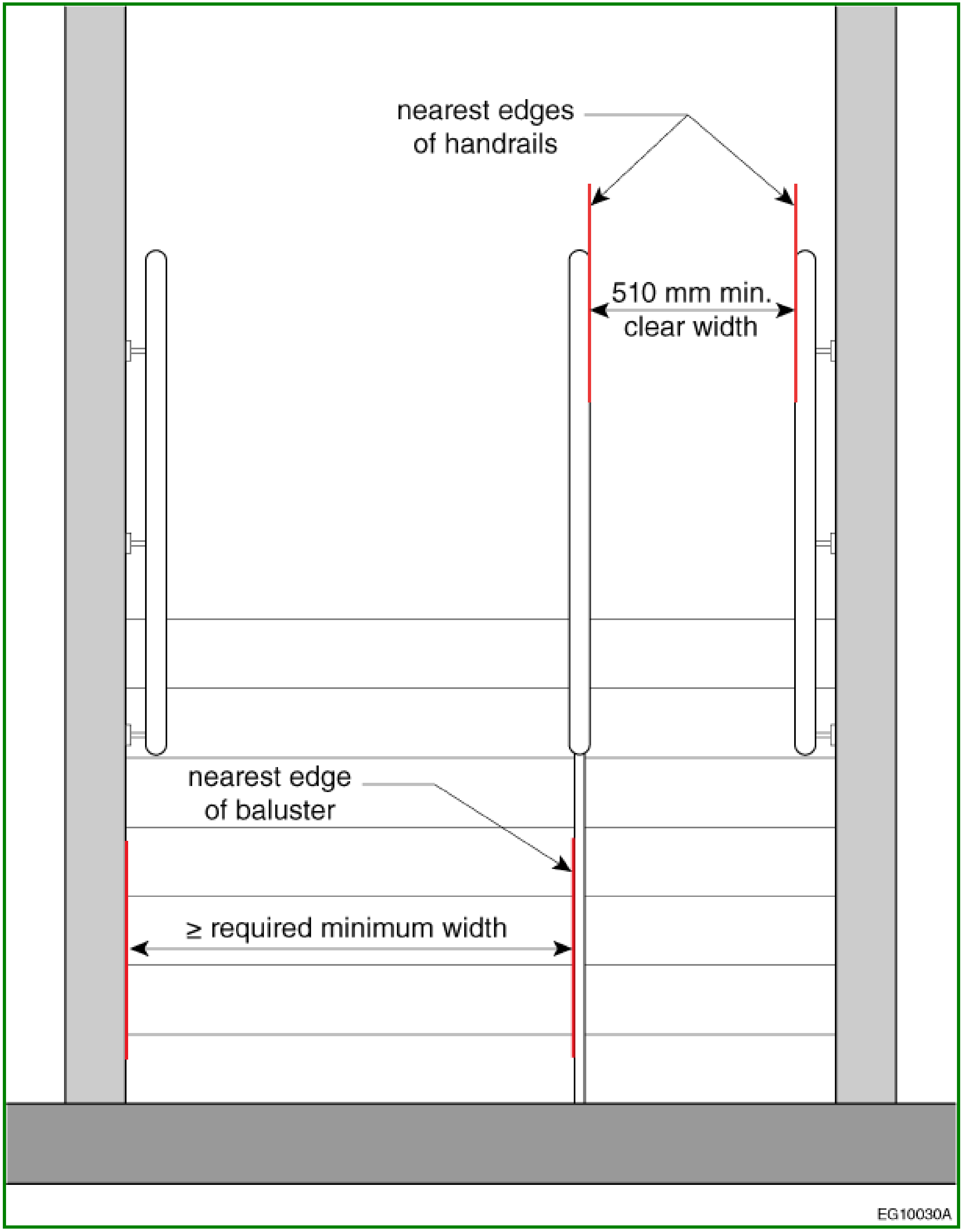


Figure [A-3.4.6.5.(3)-B]
Stair where an intermediate handrail is provided in accordance with Clauses 3.4.6.5.(3)(b) and (c)



Impact analysis

As the proposed change clarifies the existing provisions, no increased cost is associated with it. Unnecessary costs associated with redesign or rework can be minimized by clarifying the current Code provisions. The clarification would provide guidance for designers and building officials so that the design of stairs and ramps can permit the efficient evacuation of people, as well as consider normal daily traffic on the stairs and ramps.

Depending on how the Clause 3.4.6.5.3.(b) was previously interpreted, the addition of “at least” would not have a particular impact. However, where it was interpreted to mean that a portion of stairs or ramps was required to match the exact exit width (for example, exactly 1 100 mm), the proposed change would provide additional flexibility in stair or ramp design, while still maintaining the level of safety (handrails within reach from any location in that portion of stair or ramp).

Enforcement implications

The proposed change makes consistent use of the term “minimum width”, which would allow ease of design and enforcement in the field. The width at shoulder height of the average person is considered to be the more critical measure for egress purposes than “clear width” between handrails.

The clarification provided in the proposed change should facilitate the more consistent application of the requirements. Stair and ramp widths can be measured using existing methods and basic measurement tools.

Who is affected

The proposed change clarifies the existing provisions for building designers and authorities having jurisdiction so that the provisions can be interpreted consistently.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.4.6.5.] 3.4.6.5. ([1] 1) [F10-OS3.7] [F30-OS3.1]

[3.4.6.5.] 3.4.6.5. ([2] 2) [F10-OS3.7] [F30-OS3.1]

[3.4.6.5.] 3.4.6.5. ([3] 3) [F10-OS3.7] [F30-OS3.1]

[3.4.6.5.] 3.4.6.5. ([4] 4) [F10-OS3.7] [F30-OS3.1]

[3.4.6.5.] 3.4.6.5. ([5] 5) [F30-OS3.1] [F10-OS3.7]

[3.4.6.5.] 3.4.6.5. ([6] 6) no attributions

[3.4.6.5.] 3.4.6.5. ([7] 7) [F30-OS3.1] [F10-OS3.7]

[3.4.6.5.] 3.4.6.5. ([8] 8) no attributions

[3.4.6.5.] 3.4.6.5. ([9] 9) [F10-OS3.7] [F30-OS3.1]

[3.4.6.5.] 3.4.6.5. ([10] 10) [F30-OS3.1] [F10-OS3.7]

[3.4.6.5.] 3.4.6.5. ([10] 10) [F73-OA1]

[3.4.6.5.] 3.4.6.5. ([11] 11) [F30-OS3.1] [F10-OS3.7]

[3.4.6.5.] 3.4.6.5. ([12] 12) [F30-OS3.1] [F10-OS3.7]

[3.4.6.5.] 3.4.6.5. ([12] 12) [F73-OA1]

[3.4.6.5.] 3.4.6.5. ([13] 13) [F30-OS3.1] [F10-OS3.7]

[3.4.6.5.] 3.4.6.5. ([14] 14) no attributions

[3.4.6.5.] 3.4.6.5. ([15] 15) [F30-OS3.1] [F10-OS3.7]

Submit a comment

Proposed Change 2005

Code Reference(s):	**NBC20 Div.B 3.5.4.1. (first printing)**
Subject:	Building Fire Safety
Title:	Rooftop Enclosures as a Storey for Determining Elevator Car Dimensions
Description:	This proposed change clarifies whether a rooftop enclosure provided for elevator machinery, a stairway or a service room is intended to be considered as a storey for the purposes of Article 3.5.4.1.
Related Code Change Request(s):	CCR 1567
Related Proposed Change(s):	PCF 1854

This change could potentially affect the following topic areas:

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

Problem

The term "storey" is defined in the National Building Code of Canada (NBC) as meaning: "that portion of a building that is situated between the top of any floor and the top of the floor next above it, and if there is no floor above it, that portion between the top of such floor and the ceiling above it.” As such, a rooftop enclosure is a storey. However, there are several applications in the Code where a rooftop enclosure is exempted from being considered a storey, such as when determining the building height in Sentence 3.2.1.1.(1) of Division B of the NBC.

Sentence 3.5.4.1.(1) stipulates that if one or more elevators are provided in a building, at least one elevator on each storey with access to an elevator is required to have inside dimensions capable of accommodating a patient stretcher (excluding limited-use/limited application elevators).

Sentence 3.5.4.1.(1) means that if a storey is served by an elevator, such elevator should comply with the requirement to accommodate the specified stretcher size. If more than one elevator serves a storey, at least one elevator should meet that specification.

The 2015 edition of the NBC required that all storeys be served by at least one elevator that met the stretcher size specification. The intent statement for Sentence 3.5.4.1.(1) is the following:

> To limit the probability that an elevator will not be of sufficient size to accommodate a person in a stretcher in a prone position, which could lead to delays in providing medical services to the person, which could lead to harm to the person.

This provision was never intended to require an elevator to serve certain rooftop enclosures, nor to require such elevator to meet the car dimension requirements stated in Sentence 3.5.4.1.(1) on the basis that such rooftop enclosure was solely provided for elevator machinery, a stairway or a service room used for no purpose other than for service to the building and would not be occupied on a regular basis. As such, the specified rooftop enclosure should not be considered a storey for the application of Sentence 3.5.4.1.(1). Misinterpretation of the requirements has led to confusion in enforcement and resulted in an inconsistent level of performance across different regions.

To ensure designers and authorities having jurisdiction apply the requirements as intended and to avoid further confusion between this provision in different editions of the NBC, this proposed change exempts such rooftop enclosures from being considered a storey for the application of Sentence 3.5.4.1.(1). Misinterpretation of the requirement could also result in overdesigned building elements, which could lead to increased building costs.

Justification

This proposed change clarifies whether or not rooftop enclosures are intended to be considered as a storey in the application of Sentence 3.1.5.4.(1). This proposed change would eliminate confusion among Code users and ensure that the requirements are applied and enforced as intended. As well, this proposed change mitigates the risk of inconsistent levels of performance occurring across different regions.

The introduction of Sentence 3.5.4.1.(4) provides an exemption to Sentence (1) that clarifies when rooftop enclosures are not required to be considered as a storey when applying the requirements for elevator car dimensions. The proposed exemption has the same justification as the existing exemption provided in Sentence 3.2.1.1.(1). That is to say, it is provided because certain rooftop enclosures are normally only briefly and intermittently occupied by persons and thus do not pose an undue safety risk to persons.

PROPOSED CHANGE

[3.5.4.1.] 3.5.4.1. Elevator Car Dimensions

[1] **1)** Except as provided in Sentences (2) and (4), if one or more elevators are provided in a *building*, at least one elevator on each *storey* with access to an elevator shall have inside dimensions that will accommodate and provide adequate access for a patient stretcher 2 010 mm long and 610 mm wide in the prone position. (See Note A-3.5.4.1.(1).)

[2] **2)** The inside dimensions stipulated in Sentence (1) do not apply to limited-use/limited-application elevators designed and installed in accordance with ASME A17.1/CSA B44, "Safety Code for Elevators and Escalators".

[3] **3)** An elevator satisfying the requirements of Sentence (1) shall be clearly identified on the main entrance level of the *building*.

[4] --) A rooftop enclosure for elevator machinery, a stairway or a *service room* used only for service to the *building* need not be considered as a *storey* for the purpose of Sentence (1).

Impact analysis

This proposed change clarifies Sentence 3.5.4.1.(1) by introducing an exemption that does not change the intent of the existing Code requirements. As such, no cost increases are anticipated. There may be cost savings for Code users in jurisdictions that interpreted the application of Sentence 3.5.4.1.(1) more conservatively than intended.

Code users (including designers and regulators) would need to consider whether their previous interpretation of Sentence 3.5.4.1.(1) was aligned with the intended Code interpretation, as this could affect their subsequent design work and expectations. This proposed change could result in potential cost savings by requiring a less stringent application of the dimension requirements for elevators serving certain rooftop enclosures and whether or not an elevator is required to service certain rooftop enclosures.

The proposed change enables consistent enforcement of Code requirements, which contributes to improving harmonization and consistent levels of performance across regions.

Enforcement implications

This proposed change clarifies for regulators and designers whether rooftop enclosures should be considered as a storey when applying the requirements of the NBC. As a result, this proposed change would facilitate the enforcement of Code requirements.

Who is affected

Regulators, builders, consumers, manufacturers and designers.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.5.4.1.] 3.5.4.1. ([1] 1) [F12-OS3.7]

[3.5.4.1.] 3.5.4.1. ([2] 2) no attributions

[3.5.4.1.] 3.5.4.1. ([3] 3) [F12-OS3.7]

[3.5.4.1.] -- ([4] --)

Submit a comment

Proposed Change 1881

Code Reference(s):	**NBC20 Div.B 3.8. (first printing)**
Subject:	Accessibility, Visitability and Adaptability of Dwelling Units
Title:	Application of Accessibility Requirements
Description:	This proposed change revises the application of Section 3.8. that exempts dwelling units from the accessibility requirements.
Related Proposed Change(s):	PCF 1880, PCF 1883, PCF 1957, PCF 2028

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Accessibility, Visitability and Adaptability of Dwelling Units.

Problem

The National Building Code of Canada (NBC) consolidates technical requirements for accessibility in Section 3.8. of Division B. While placing accessibility requirements in one section helps Code users to locate these requirements in the Code, the current structure and application of Section 3.8. creates the following two problems for identifying and applying the technical requirements that address various levels of accessibility of dwelling units:

1. Clause 3.8.2.1.(1)(a) exempts from the Section 3.8. accessibility requirements several types of dwelling units, including detached houses, semi-detached houses, houses with a secondary suite, duplexes, triplexes, townhouses, row houses and boarding houses. This is a problem because persons with disabilities may not be able to access or use the facilities of many houses, thereby making it difficult for these persons to:
    - remain in their own dwelling unit without requiring costly alterations, and
    - visit the dwelling units of friends or family.
2. Section 3.8. was written in consideration of the exemption in Clause 3.8.2.1.(1)(a).

New technical requirements would need to be consolidated to address the need to:

- reduce the cost of renovating the dwelling units to address a person's changing needs or progressing disability, and
- facilitate access to the dwelling units of friends or family during visits (i.e., visitability).

As a result, new Subsections in the NBC are needed.

Justification

The proposed change modifies the framework in Section 3.8. to:

1. alter the exemption in Clause 3.8.2.1.(1)(a) to allow Section 3.8. to apply to all types of dwelling units,
2. create new Subsections that consolidate technical requirements for the adaptability and visitability of dwelling units (Subsections 3.8.4. and 3.8.5., respectively), and
3. define the application of new Subsections 3.8.4. and 3.8.5.

This proposed structure is supported through the following related PCFs:

- PCF 1880 proposes to expand the accessibility objectives in the NBC to include all types of dwelling units,
- PCF 2028 proposes to revise the scope of Section 3.8. to include new Subsections 3.8.4. and 3.8.5.,
- PCFs 1883 and 1957 propose technical requirements that apply broadly to dwelling units and that address low-cost elements of adaptable housing, forming the basis of proposed Subsection 3.8.4. Other PCFs (PCFs 1882 and 2031) related to technical requirements for adaptable housing are tentatively planned to be included in the Spring 2024 public review, and
- Additional PCFs (1884 and 1958) propose technical requirements for visitability that form the basis of proposed Subsection 3.8.5. and are tentatively scheduled for the Spring 2024 public review. These requirements focus on ensuring that visitable dwelling units are designed with adequate space for a person using a wheelchair to access and use the living spaces on the entrance level of the dwelling unit, including the living room, dining room and washroom.

During the current public review, PCF 1881 should be read with the assumption that the technical requirements in proposed Subsection 3.8.5. would also be included in the NBC 2025; thus, the reader should focus on the proposed framework that would introduce visitability requirements to multi-unit residential buildings as required by the authority having jurisdiction.

By deleting the exempted houses in Clause 3.8.2.1.(1)(a), this proposed change creates a framework for applying technical requirements that apply the accessibility objective to a larger range of dwelling units. This is a critical step toward introducing minimum requirements in the NBC that address the accessibility of dwelling units for persons with disabilities, including the 10% of Canadians with disabilities related to mobility, the 5% of Canadians with disabilities related to dexterity, and the many Canadians with other types of disabilities that limit their access to facilities in the home[1].

By creating new Subsections 3.8.4. and 3.8.5. to address the basic adaptability and visitability of dwelling units, the new structure makes it easy for Code users to locate these requirements in the Code.

By defining the application of Subsections 3.8.4. and 3.8.5. in Article 3.8.2.1., Code users can quickly see where these requirements do and do not apply. In this Code cycle, adaptability is intended to focus on low-cost technical requirements that reduce or eliminate the expense and inconvenience of alterations for accessibility and is intended to be applied broadly (i.e., to all houses and some units in multi-unit residential buildings (MURBs), as required by the authority having jurisdiction). Visitability focuses on dwelling units where a barrier-free path of travel is already required to access the entrance to the unit (e.g., most units in MURBs) and as required by the authority having jurisdiction.

Several frameworks that delineate levels of accessibility in housing position adaptability ahead of visitability (i.e., requirements for adaptability are more stringent than those for visitability and include features such as height-adjustable counters), for example, in Manitoba[2]. Other frameworks address adaptability through mandatory requirements but do not address visitability (for example, Nova Scotia), implying that visitability is more stringent because it is not mandated in the Code. In the context of the NBC, the broader application of proposed adaptability requirements, combined with the focus on low-cost provisions to reduce the expense of alterations, resulted in technical requirements that were less stringent than those proposed under visitability.

To reduce confusion for Code users and simplify integration with provincial and territorial codes, proposed Subsection 3.8.4. uses the term "dwelling units" without specifying “adaptability,” since the application is intended to be broad. Proposed Subsection 3.8.5. refers to visitability through use of the term "visitable dwelling units."

Finally, many provinces (including Quebec, Alberta and Nova Scotia) have adopted a structure similar to that of this proposed change, where most or all of the accessibility requirements related to dwelling units are addressed in stand-alone Subsections within Section 3.8. As such, the proposed change is expected to advance harmonization goals by simplifying the integration of accessibility requirements related to dwelling units in the provincial and territorial codes as they are currently structured.

References

(1) Statistics Canada (2017), “New data on disability in Canada 2017”. Retrieved 12 May 2023 from:
https://www150.statcan.gc.ca/n1/en/pub/11-627-m/11-627-m2018035-eng.pdf?st=v5UqujRh

(2) Manitoba Housing and Renewal Corporation, "Visitable Housing: Community Building Through Visitable and Adaptable Housing", 2006. Retrieved Oct. 31, 2023 from:
https://www.gov.mb.ca/housing/progs/pdf/visitable-housing-visitable-housing-community-building.pdf

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PROPOSED CHANGE

[3.8.] 3.8. Accessibility

(See Note A-3.8.)

[3.8.1.] 3.8.1. Scope

[3.8.1.1.] 3.8.1.1. Scope

[3.8.2.] 3.8.2. Application

[3.8.2.1.] 3.8.2.1. Exceptions

(See Note A-3.8.2.1.)

[1] 1) Except as provided in Sentences (2) to (4), ~~T~~the requirements of this Section apply to all *buildings*. ~~except~~

- [a] a) ~~detached houses, semi-detached houses, houses with a *secondary suite*, duplexes, triplexes, townhouses, row houses and boarding houses (see Appendix of Division A, Secondary Suite),~~
- [b] b) ~~*buildings* of Group F, Division 1 *major occupancy*, and~~
- [c] c) ~~*buildings* that are not intended to be occupied on a daily or full-time basis, including automatic telephone exchanges, pumphouses and substations.~~

[2] --) The requirements of this Section do not apply to

- [a] --) *buildings* of Group F, Division 1 *major occupancy*, and
- [b] --) *buildings* that are not intended to be occupied on a daily or full-time basis, including automatic telephone exchanges, pumphouses and substations.

[3] --) The requirements of Subsection 3.8.4. (PCFs 1883 and 1957 of the current public review; and PCFs 1882 and 2031, tentatively planned for the Spring 2024 public review) apply to

- [a] --) detached houses, semi-detached houses, houses with a *secondary suite*, duplexes, triplexes, townhouses, row houses and boarding houses, and
- [b] --) other *dwelling units* where required by federal, provincial or territorial regulations or municipal bylaws. (See Note 3.8.2.1.(3) and (4).)

[4] --) The requirements of Subsections 3.8.4. (PCFs 1883 and 1957, and PCFs 1882 and 2031) and 3.8.5. (PCFs 1884 and 1958, tentatively planned for the Spring 2024 public review) apply to *dwelling units* required to be visitable by federal, provincial or territorial regulations or municipal bylaws.
(See Note 3.8.2.1.(3) and (4).)

[3.8.3.15.] 3.8.3.15. Water-Closet Stalls and Urinals for Persons with Limited Mobility

[3.8.3.16.] 3.8.3.16. Lavatories and Mirrors

[3.8.3.17.] 3.8.3.17. Showers

[3.8.3.18.] 3.8.3.18. Accessible Bathtubs

[3.8.3.19.] 3.8.3.19. Assistive Listening Systems

[3.8.3.20.] 3.8.3.20. Counters

[3.8.3.21.] 3.8.3.21. Telephones

[3.8.3.22.] 3.8.3.22. Spaces in Seating Area

[3.8.4.] -- Dwelling Units

[3.8.5.] -- Visitable Dwelling Units

Note A-3.8.2.1.(3) and (4) Application to Dwelling Units.

Subsection 3.8.4. (PCFs 1883 and 1957 of the current public review; and PCFs 1882 and 2031, tentatively planned for the Spring 2024 public review) focuses on technical requirements that eliminate the need for, or reduce the cost and difficulty of, common modifications to a dwelling unit for accessibility, thereby making the dwelling unit more easily adaptable to a person's needs.

Subsection 3.8.5. (PCFs 1884 and 1958, tentatively planned for the Spring 2024 public review) is founded on the principle of visitability, i.e., providing basic accessibility features to allow persons with disabilities related to mobility to visit others in their dwellings. These features include barrier-free paths of travel in the main living spaces of a dwelling unit and washrooms that are large enough for a person using a wheelchair to maneuver in that space.

Impact analysis

The proposed changes to the structure of Section 3.8. and the removal of the exemptions for most types of dwelling units does not in itself introduce new costs because the proposed change does not introduce new technical requirements, nor does it expand the application of existing technical requirements for accessibility. Technical requirements that fit within the proposed structure may have different impacts on dwelling units in terms of cost, space demand, accessibility and safety. These requirements and their impact would be evaluated outside the scope of this proposed change under regular procedures for Code development, including coordination with relevant technical committees and public reviews.

This proposed change provides the necessary framework for future technical requirements related to accessibility to apply to detached houses, semi-detached houses, houses with a secondary suite, duplexes, triplexes, townhouses, row houses and boarding houses. It is also expected to simplify the application of adaptability and visitability requirements by consolidating those related to dwelling units into distinct subsections.

Finally, this proposed change preserves critical flexibility for uptake into provincial and territorial codes with different frameworks and applications of adaptability requirements by using the generic term "dwelling units" in Subsection 3.8.4. to address basic requirements that meet the goals of adaptability for this Code cycle.

Enforcement implications

Expanding the accessibility framework to all types of dwelling unit does not introduce new technical requirements. As such, the proposed change can be enforced with the existing Code enforcement infrastructure.

By consolidating the requirements for adaptability and visitability into distinct Subsections with clear application statements, this proposed change is expected to simplify the enforcement of the technical requirements within these Subsections.

Authorities having jurisdiction would need to be aware that the language used to describe adaptability and visitability in their jurisdiction may differ from that of the NBC.

Who is affected

The proposed change could affect:

- regulators and authorities having jurisdiction, who would need to be aware of the change to the application of Section 3.8. and the new requirements for adaptability and visitability for dwelling units,
- architects, engineers and builders, whose approach to design and construction may be affected as future requirements for the adaptability and visitability of dwelling units (which are beyond the scope of the change to NBC framework described in this proposed change) are developed for housing, and
- persons with disabilities and their caregivers, who may benefit from future minimum performance requirements for the adaptability and visitability of dwelling units, which would be enabled by the proposed change to the NBC framework.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.8.1.1.] 3.8.1.1. ([1] 1) no attributions

[3.8.1.1.] 3.8.1.1. ([2] 2) no attributions

[3.8.2.1.] 3.8.2.1. ([1] 1) no attributions

[3.8.2.1.] -- ([2] --) no attributions

[3.8.2.1.] -- ([3] --) no attributions

[3.8.2.1.] -- ([4] --) no attributions

[3.8.2.2.] 3.8.2.2. ([1] 1) [F73-OA1]

[3.8.2.2.] 3.8.2.2. ([2] 2) no attributions

[3.8.2.2.] 3.8.2.2. ([3] 3) no attributions

[3.8.2.2.] 3.8.2.2. ([4] 4) [F73-OA1]

[3.8.2.3.] 3.8.2.3. ([1] 1) [F73-OA1]

[3.8.2.3.] 3.8.2.3. ([2] 2) no attributions

[3.8.2.3.] 3.8.2.3. ([3] 3) [F74-OA2]

[3.8.2.3.] 3.8.2.3. ([4] 4) [F74-OA2]

[3.8.2.3.] 3.8.2.3. ([5] 5) [F74-OA2]

[3.8.2.3.] 3.8.2.3. ([5] 5) [F10-OS3.7]

[3.8.2.3.] 3.8.2.3. ([6] 6) [F74-OA2]

[3.8.2.4.] 3.8.2.4. ([1] 1) [F73-OA1]

[3.8.2.4.] 3.8.2.4. ([2] 2) [F73-OA1]

[3.8.2.5.] 3.8.2.5. ([1] 1) [F73-OA1]

[3.8.2.5.] 3.8.2.5. ([2] 2) [F73-OA1]

[3.8.2.5.] 3.8.2.5. ([3] 3) no attributions

[3.8.2.6.] 3.8.2.6. ([1] 1) no attributions

[3.8.2.7.] 3.8.2.7. ([1] 1) [F73-OA1]

[3.8.2.7.] 3.8.2.7. ([2] 2) no attributions

[3.8.2.7.] 3.8.2.7. ([3] 3) no attributions

[3.8.2.8.] 3.8.2.8. ([1] 1) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([1] 1) [F72-OH2.1] [F71-OH2.3]

[3.8.2.8.] 3.8.2.8. ([2] 2) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([2] 2) [F72-OH2.1] [F71-OH2.3]

[3.8.2.8.] 3.8.2.8. ([2] 2) no attributions

[3.8.2.8.] 3.8.2.8. ([3] 3) no attributions

[3.8.2.8.] 3.8.2.8. ([4] 4) [F72-OH2.1]

[3.8.2.8.] 3.8.2.8. ([4] 4) [F73-OA1]

[3.8.2.8.] 3.8.2.8. ([5] 5) no attributions

[3.8.2.8.] 3.8.2.8. ([6] 6) no attributions

[3.8.2.8.] 3.8.2.8. ([7] 7) no attributions

[3.8.2.8.] 3.8.2.8. ([8] 8) no attributions

[3.8.2.8.] 3.8.2.8. ([9] 9) no attributions

[3.8.2.8.] 3.8.2.8. ([10] 10) no attributions

[3.8.2.8.] 3.8.2.8. ([11] 11) no attributions

[3.8.2.8.] 3.8.2.8. ([12] 12) no attributions

[3.8.2.8.] 3.8.2.8. ([13] 13) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([13] 13) no attributions

[3.8.2.8.] 3.8.2.8. ([14] 14) no attributions

[3.8.2.8.] 3.8.2.8. ([15] 15) no attributions

[3.8.2.8.] 3.8.2.8. ([15] 15) [F74-OA2]

[3.8.2.9.] 3.8.2.9. ([1] 1) no attributions

[3.8.2.9.] 3.8.2.9. ([2] 2) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([1] 1) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([1] 1) no attributions

[3.8.2.10.] 3.8.2.10. ([2] 2) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([3] 3) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([3] 3) no attributions

[3.8.2.10.] 3.8.2.10. ([4] 4) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([4] 4) no attributions

[3.8.2.11.] 3.8.2.11. ([1] 1) [F74-OA2]

[3.8.2.11.] 3.8.2.11. ([1] 1) no attributions

[3.8.2.12.] 3.8.2.12. ([1] 1) [F74-OA2]

[3.8.2.12.] 3.8.2.12. ([1] 1) no attributions

[3.8.3.1.] 3.8.3.1. ([1] 1) no attributions

[3.8.3.2.] 3.8.3.2. ([1] 1) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([2] 2) no attributions

[3.8.3.2.] 3.8.3.2. ([3] 3) ([a] a),([b] b) [F30-OS3.1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([a] a),([b] b) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([c] c),([d] d) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([e] e),([f] f) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([e] e),([f] f) [F30-OS3.1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([c] c),([d] d) [F30-OS3.1]

[3.8.3.2.] 3.8.3.2. ([4] 4) no attributions

[3.8.3.2.] 3.8.3.2. ([5] 5) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([6] 6) [F73-OA1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([a] a) [F73-OA1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([a] a) [F30-OS3.1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([b] b) [F73-OA1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([c] c)

[3.8.3.3.] 3.8.3.3. ([1] 1) ([d] d) [F30-OS3.1]

[3.8.3.4.] 3.8.3.4. ([1] 1) ([a] a) [F74-OA2]

[3.8.3.4.] 3.8.3.4. ([1] 1) ([b] b) [F73-OA1]

[3.8.3.4.] 3.8.3.4. ([1] 1) ([c] c) [F74-OA2]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([b] b),([e] e) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([d] d) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([c] c) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([d] d) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([e] e),([f] f)

[3.8.3.5.] 3.8.3.5. ([1] 1) ([b] b),([e] e) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([a] a)

[3.8.3.5.] 3.8.3.5. ([1] 1) ([c] c) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([2] 2) no attributions

[3.8.3.5.] 3.8.3.5. ([3] 3) no attributions

[3.8.3.5.] 3.8.3.5. ([4] 4) ([a] a) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([4] 4) ([b] b),([c] c) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([5] 5) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([1] 1) no attributions

[3.8.3.6.] 3.8.3.6. ([2] 2) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([3] 3) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([3] 3) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([4] 4) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([4] 4) [F10-OS3.7]

[3.8.3.6.] 3.8.3.6. ([5] 5) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([5] 5) [F10-OS3.7]

[3.8.3.6.] 3.8.3.6. ([6] 6) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([7] 7) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([8] 8) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([9] 9) no attributions

[3.8.3.6.] 3.8.3.6. ([10] 10) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([10] 10) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([10] 10) no attributions

[3.8.3.6.] 3.8.3.6. ([11] 11) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([12] 12) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([12] 12) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([13] 13) no attributions

[3.8.3.6.] 3.8.3.6. ([14] 14) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([15] 15) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([16] 16) no attributions

[3.8.3.6.] 3.8.3.6. ([17] 17) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([17] 17) [F10-OS3.7]

[3.8.3.7.] 3.8.3.7. ([1] 1) [F73-OA1]

[3.8.3.7.] 3.8.3.7. ([1] 1) [F74-OA2]

[3.8.3.7.] 3.8.3.7. ([1] 1) [F30-OS3.1] [F10-OS3.7]

[3.8.3.8.] 3.8.3.8. ([1] 1) [F74-OA2]

[3.8.3.8.] 3.8.3.8. ([1] 1) [F10-OS3.7]

[3.8.3.9.] 3.8.3.9. ([1] 1) no attributions

[3.8.3.9.] 3.8.3.9. ([1] 1) [F74-OA2]

[3.8.3.9.] 3.8.3.9. ([1] 1) [F73-OA1]

[3.8.3.9.] 3.8.3.9. ([2] 2) [F74-OA2]

[3.8.3.9.] 3.8.3.9. ([2] 2) [F73-OA1]

[3.8.3.9.] 3.8.3.9. ([3] 3) [F74-OA2]

[3.8.3.9.] 3.8.3.9. ([3] 3) [F73-OA1]

[3.8.3.10.] 3.8.3.10. ([1] 1) [F74-OA2]

[3.8.3.10.] 3.8.3.10. ([2] 2) [F74-OA2]

[3.8.3.11.] 3.8.3.11. ([1] 1) [F74-OA2]

[3.8.3.11.] 3.8.3.11. ([2] 2) [F74-OA2]

[3.8.3.12.] 3.8.3.12. ([1] 1) [F74-OA2]

[3.8.3.12.] 3.8.3.12. ([1] 1) [F72-OH2.1]

[3.8.3.12.] 3.8.3.12. ([1] 1) ([d] d)([i] i) [F74-OA2]

[3.8.3.12.] 3.8.3.12. ([1] 1) ([f] f),([g] g) [F30,F20-OS3.1]

[3.8.3.12.] 3.8.3.12. ([1] 1) ([f] f) and ([g] g)

[3.8.3.12.] 3.8.3.12. ([1] 1) ([h] h) [F30-OS3.1]

[3.8.3.12.] 3.8.3.12. ([1] 1) no attributions

[3.8.3.13.] 3.8.3.13. ([1] 1) [F74-OA2]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([b] b) [F10-OS3.7]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([c] c)

[3.8.3.13.] 3.8.3.13. ([1] 1) ([d] d)

[3.8.3.13.] 3.8.3.13. ([1] 1) ([f] f)

[3.8.3.13.] 3.8.3.13. ([1] 1) ([g] g) [F30-OS3.1]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([i] i) [F74-OA2]

[3.8.3.13.] 3.8.3.13. ([1] 1) [F72-OH2.1] [F71-OH2.3]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([b] b) [F74-OA2]

[3.8.3.13.] 3.8.3.13. ([2] 2) [F72-OH2.1] [F71-OH2.3]

[3.8.3.14.] 3.8.3.14. ([1] 1) [F74-OA2]

[3.8.3.14.] 3.8.3.14. ([1] 1) [F72-OH2.1]

[3.8.3.15.] 3.8.3.15. ([1] 1) [F74-OA2]

[3.8.3.15.] 3.8.3.15. ([1] 1) ([d] d) [F30-OS3.1]

[3.8.3.15.] 3.8.3.15. ([1] 1) ([a] a)

[3.8.3.15.] 3.8.3.15. ([2] 2) [F74-OA2]

[3.8.3.15.] 3.8.3.15. ([2] 2) ([f] f) [F30-OS3.1]

[3.8.3.15.] 3.8.3.15. ([2] 2) ([c] c)

[3.8.3.16.] 3.8.3.16. ([1] 1) [F74-OA2]

[3.8.3.16.] 3.8.3.16. ([1] 1) [F71-OH2.3]

[3.8.3.16.] 3.8.3.16. ([1] 1) ([f] f) [F31-OS3.2]

[3.8.3.16.] 3.8.3.16. ([2] 2) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([1] 1) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([1] 1) ([d] d),([e] e) [F30-OS3.1]

[3.8.3.17.] 3.8.3.17. ([1] 1) ([f] f) [F30-OS3.1]

[3.8.3.17.] 3.8.3.17. ([1] 1) ([h] h) [F31-OS3.2]

[3.8.3.17.] 3.8.3.17. ([2] 2) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([2] 2) [F71-OH2.3]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([a] a) [F73-OA1]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([b] b) [F10-OS3.7]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([b] b) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([g] g) [F74-OA2]

[3.8.3.18.] 3.8.3.18. ([1] 1) [F74-OA2]

[3.8.3.19.] 3.8.3.19. ([1] 1) [F74-OA2]

[3.8.3.19.] 3.8.3.19. ([1] 1) [F11-OS3.7]

[3.8.3.19.] 3.8.3.19. ([2] 2) [F74-OA2]

[3.8.3.20.] 3.8.3.20. ([1] 1) [F74-OA2]

[3.8.3.21.] 3.8.3.21. ([1] 1) [F74-OA2]

[3.8.3.21.] 3.8.3.21. ([2] 2) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([1] 1) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([1] 1) [F30-OS3.1]

[3.8.3.22.] 3.8.3.22. ([1] 1) ([d] d) [F10-OS3.7]

[3.8.3.22.] 3.8.3.22. ([2] 2) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([2] 2) [F30-OS3.1]

[3.8.3.22.] 3.8.3.22. ([3] 3) ([a] a) [F10-OS3.7]

[3.8.3.22.] 3.8.3.22. ([3] 3) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([4] 4) [F10-OS3.7]

Submit a comment

Proposed Change 1883

Code Reference(s): **NBC20 Div.B 3.8. (first printing)**

Subject: Accessibility, Visitability and Adaptability of Dwelling Units

Title: Adaptable Dwelling Entrance

Description: This proposed change increases the clear width of an entrance to a dwelling unit to accommodate the use of mobility devices.

Related Proposed Change(s): PCF 1880, PCF 1881, PCF 1957, PCF 2028

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Accessibility, Visitability and Adaptability of Dwelling Units.

Problem

Being able to enter and exit one’s dwelling unit is fundamental to participating in several activities of daily living. However, for Canadians who regularly use wheeled mobility aids (e.g., wheelchairs), the NBC minimum width requirements for door entrances to dwelling units are not wide enough to accommodate most devices: approximately 10% of modern wheelchairs cannot fit through a doorway width that complies with the current NBC requirements (i.e., clear width of 745 mm, corresponding to a door width of 810 mm)(1).

As a result, some dwelling units are challenging to enter and exit, and some others are entirely inaccessible. Additionally, where a person using a mobility aid can, with difficulty, enter a dwelling unit, the level of impedance presents a concern during emergency egress. This level of impedance is unacceptable and needs to be addressed by the NBC.

Because the mobility needs of people evolve over time, the entrance of a dwelling unit that was once suitable for the occupant's level of mobility may become inaccessible or present unnecessary hardship as the occupant ages. As a result, occupants may be required to alter their dwelling units to accommodate their changing level of mobility or, if the scope of the alteration is too large, or if the dwelling unit is rented, occupants may need to move to a more suitable dwelling unit, engaging costs and associated stress. Both of these issues can be addressed by introducing NBC requirements for a wider entrance to dwelling units to reduce the need for and costs of alterations for accessibility.

Justification

This proposed change introduces a new requirement that every dwelling unit have at least one entrance with a minimum clear width of 850 mm when the door is in the open position. By requiring at least one entrance that provides a clear width of 850 mm (achievable using a standard 915 mm door opened to approximately 100 to 110 degrees), this proposed change would permit approximately 99% of modern wheelchairs to pass through(1). This proposed change would help to limit the probability that a person who uses a wheeled mobility aid would be unable to enter or exit the dwelling unit and use its facilities.

Introducing requirements for larger entrances for dwelling units would also reduce the costs of alteration to owners should they need to modify their dwelling unit for accessibility as their needs evolve.

Approximately 10% of Canadians have a disability related to mobility(2), while 1% of Canadians in the community regularly use wheelchairs or scooters(3). However, the prevalence of disabilities related to mobility and the associated use of assistive aids increases with age, with over 18% of community-dwelling Canadians over the age of 75 regularly using canes or walking sticks, 14% regularly using walkers and rollators, and 4% regularly using wheelchairs or scooters(3,4). As such, many Canadians will use assistive aids for mobility at some point in their lives and will require larger entrances to access their home.

While the proposed change does not address every aspect of the alteration of dwelling units for accessibility, this change is expected to contribute to reducing the costs of alterations to persons who require larger entrances for accessing their home.

References:

(1) Steinfeld, E., Maisel, J., Feathers, D., and D'Souza, C. (2010). Anthropometry and standards for wheeled mobility: an international comparison. *Assistive Technology*, *22*(1), 51-67.

(2) Statistics Canada. (2020). Canadians with a mobility disability. https://www150.statcan.gc.ca/n1/pub/11-627-m/11-627-m2020085-eng.htm

(3) Smith, E. M., Giesbrecht, E. M., Mortenson, W. B., and Miller, W. C. (2016). Prevalence of wheelchair and scooter use among community-dwelling Canadians. *Physical Therapy*, *96*(8), 1135-1142.

(4) Charette, C., Best, K. L., Smith, E. M., Miller, W. C., and Routhier, F. (2018). Walking aid use in Canada: prevalence and demographic characteristics among community-dwelling users. *Physical Therapy*, *98*(7), 571-577.

PROPOSED CHANGE

[3.8.] 3.8. Accessibility

(See Note A-3.8.)

[3.8.1.] 3.8.1. Scope

[3.8.1.1.] 3.8.1.1. Scope

[3.8.2.] 3.8.2. Application

[3.8.2.1.] 3.8.2.1. Exceptions

[3.8.2.2.] 3.8.2.2. Entrances

[3.8.2.3.] 3.8.2.3. Areas Requiring a Barrier-Free Path of Travel

[3.8.2.4.] 3.8.2.4. Access to Storeys Served by Escalators and Moving Walks

[3.8.2.5.] 3.8.2.5. Exterior Barrier-Free Paths of Travel to Building Entrances and Exterior Passenger-Loading Zones

[3.8.2.6.] 3.8.2.6. Controls

[3.8.2.7.] 3.8.2.7. Power Door Operators

[3.8.2.8.] 3.8.2.8. Plumbing Facilities

[3.8.2.9.] 3.8.2.9. Assistive Listening Systems

[3.8.2.10.] 3.8.2.10. Signs and Indicators

[3.8.2.11.] 3.8.2.11. Counters

[3.8.2.12.] 3.8.2.12. Telephones

[3.8.3.] 3.8.3. Design

[3.8.3.1.] 3.8.3.1. Design Standards

[3.8.3.2.] 3.8.3.2. Barrier-Free Path of Travel

[3.8.3.3.] 3.8.3.3. Exterior Walks

[3.8.3.4.] 3.8.3.4. Exterior Passenger-Loading Zones

[3.8.3.5.] 3.8.3.5. Ramps

[3.8.3.6.] 3.8.3.6. Doorways and Doors

[3.8.3.7.] 3.8.3.7. Passenger-Elevating Devices

[3.8.3.8.] 3.8.3.8. Controls

[3.8.3.9.] 3.8.3.9. Accessible Signs

[3.8.3.10.] 3.8.3.10. Drinking Fountains

[3.8.3.11.] 3.8.3.11. Water-Bottle Filling Stations

[3.8.3.12.] 3.8.3.12. Accessible Water-Closet Stalls

[3.8.3.13.] 3.8.3.13. Universal Washrooms

[3.8.3.14.] 3.8.3.14. Water Closets

[3.8.3.15.] 3.8.3.15. Water-Closet Stalls and Urinals for Persons with Limited Mobility

[3.8.3.16.] 3.8.3.16. Lavatories and Mirrors

[3.8.3.17.] 3.8.3.17. Showers

[3.8.3.18.] 3.8.3.18. Accessible Bathtubs

[3.8.3.19.] 3.8.3.19. Assistive Listening Systems

[3.8.3.20.] 3.8.3.20. Counters

[3.8.3.21.] 3.8.3.21. Telephones

[3.8.3.22.] 3.8.3.22. Spaces in Seating Area

[3.8.4.] -- Dwelling Units

[3.8.4.1.] --- Entrance Doorway Width

[1] --) The minimum clear width of at least one entrance doorway of a *dwelling unit* shall be 850 mm when the entrance door is in the open position. (See Note A-3.8.4.1.)

Note A-3.8.4.1. Location of Entrance Required by Article 3.8.4.1.

For dwelling units having multiple entrances, care should be exercised when selecting an appropriate location for the doorway that is wide enough for use with common mobility aids. Relevant factors include, but are not limited to, proximity to parking, ease of access from the outside and from the main living space inside, and adequate clearance available to open the entrance door after installation.

Impact analysis

Cost Impact

The overall cost impact of this proposed change considers the following factors:

1. The new clear width requirement would require wider entrance doors that may have a different price than doors compliant with the NBC 2020.
2. The wider entrance doors would reduce the amount of exterior wall that needs to be constructed.

1. Cost Increase of Wider Entrance Doors

Tables 1 to 3 present regional retail cost comparisons of entrance doors that comply with NBC 2020 (810 mm) and entrance doors that comply with this proposed change (850 mm clear width ≈ 915 mm door width), for select door material types.

Table 1. Exterior Door Width and Cost Comparison: Fibreglass

Location	Cost of 810 mm Door(1)(2)	Cost of 915 mm Door(1)(2)	Max. Difference(3)
Saskatoon	$759	$759	–
Calgary	$759	$759	–
Nanaimo	$759	$759	–
Toronto	$759	$759	–
Moncton	$766	$767	$1
Montréal	$766	$767	$1
Halifax	$766	$767	$1
Winnipeg	$759	$759	–

Notes to Table 1

(1) Source of price information for Saskatoon, Calgary and Nanaimo: https://www.homedepot.ca/product/masonite-36-inch-x-80-inch-craftsman-6-lite-primed-fibreglass-smooth-prehung-front-door/1000784545

(2) Source of price information for Toronto, Moncton, Montréal, Halifax and Winnipeg: https://www.homedepot.ca/product/masonite-32-inch-x-80-inch-craftsman-6-lite-primed-fibreglass-smooth-prehung-front-door/1000784539

(3) For the selected fibreglass options, only a few locations priced the wider selection $1 higher, which is insignificant.

Table 2. Exterior Door Width and Cost Comparison: Steel

Location	Cost of 810 mm Door(1)	Cost of 915 mm Door(1)	Max. Difference(2)
Saskatoon	$698	$798	$100
Calgary	$698	$798	$100
Nanaimo	$698	$798	$100
Toronto	$698	$798	$100
Moncton	$698	$798	$100
Montréal	$698	$798	$100
Halifax	$698	$798	$100
Winnipeg	$698	$798	$100

Notes to Table 2

(1) Source of price information: https://www.homedepot.ca/product/masonite-36-inch-x-80-inch-x-4-9-16-inch-full-lite-clear-single-primed-steel-prehung-front-door-rh/1001057069?rrec=true

(2) For the selected steel options, the wider door was consistently retail priced $100 more.

Table 3. Exterior Door Width and Cost Comparison: Wood

Location	Cost of 810 mm Door(1)(2)	Cost of 915 mm Door(1)(2)	Max. Difference(3)
Saskatoon	$2,595	$2,595	–
Calgary	$2,595	$2,595	–
Nanaimo	$2,595	$2,595	–
Toronto	$2,595	$2,595	–
Moncton	$2,595	$2,595	–
Montréal	$2,595	$2,595	–
Halifax	$2,595	$2,595	–
Winnipeg	$2,595	$2,595	–

Notes to Table 3

(1) Source of price information for Saskatoon, Nanaimo, Moncton, Halifax and Winnipeg: https://www.homedepot.ca/product/krosswood-doors-36-in-x-80-in-right-hand-modern-hemlock-black-stain-solid-wood-single-prehung-front-door/1001749971

(2) Source of price information for Calgary, Toronto and Montréal: https://www.homedepot.ca/product/krosswood-doors-32-in-x-80-in-right-hand-modern-hemlock-black-stain-solid-wood-single-prehung-front-door/1001751924

(3) For the selected wood options, the retail price was unchanged between the two door widths.

Given the information in Tables 1 to 3, a $100 difference will be assumed between the entrance doors that comply with the NBC 2020 and those that comply with this proposed change because this represents the worst-case scenario, even though Tables 1 to 3 show that many of these products do not vary in price for different width options.

2. Cost Decrease Related to Construction of Reduced Exterior Wall

Table 4 presents costing data (from RSMeans) per linear metre of typical exterior wall assembly, which is used to determine the cost savings from installing a wider doorway that reduces the amount of exterior wall to be built.

Table 4. Cost of Typical Exterior Wall per Linear Metre

Component	Quantity	Unit Cost	Total Cost, ≈ $/m
11 mm OSB sheathing	2.44 m^2	$12.59/$m^2$	30.70
38 × 140 mm @ 400 mm stud wall			
38 x 140 mm plates (2 top, 1 btm)	3.00 m	$7.05/m	21.16
38 x 140 mm studs	6.10 m	$6.17/m	37.63
Fibreglass batt insulation (R21)	2.21 m^2	$13.13/$m^2$	28.99
12.7 mm gypsum wall board	2.44 m^2	$14.31/$m^2$	34.92
Total			153.39

As shown in Table 4, the cost per linear metre of a typical exterior wall is $153.39.

Cost decrease from constructing less exterior wall = (Typical exterior wall cost per linear metre) × (proposed change compliant door width − NBC 2020 compliant door width) = (153.39 $/m) × (0.915 − 0.810) m

Cost decrease from constructing less exterior wall = $16.11

3. Overall Cost

Cost of this proposed change = (cost increase of a wider entrance door) − (cost decrease from constructing less exterior wall) = ($100.00) − ($16.11)

Cost of this proposed change = $83.89

Therefore, based on the regional retail costing data for entrance doors that comply with NBC 2020 and this proposed change, it is expected that this change could present an increase in cost of $83.89 per applicable dwelling unit.

Limitations of the Cost Analysis

1. To comply with the proposed change, a standard 915 mm door would need to be open to approximately 100 to 105 degrees, corresponding to approximately 15 cm to 20 cm of additional clearance relative to opening the same door to 90 degrees. This may affect the layout of certain types of entrances (along with other parts of the dwelling unit), particularly for townhouses with narrow entrances.
2. The proposed change may result in the need for greater production of 915 mm doors, at the possible expense of smaller doors. It is noted that the proposed change applies to a minimum of one entrance, meaning that smaller exterior doors could still be used for other entrances where included in the design of the dwelling unit.
3. Door costs are based on retail prices, but may be priced differently if procured at a large scale.

Benefit Impact

Based on the NBC minimum width requirement of 810 mm for the entrance door of a dwelling unit, this requirement estimates the clear width of the doorway by subtracting 65 mm (i.e., 45 mm door thickness + 20 mm exterior door jamb stop width = 65 mm reduction of doorway width by obstruction). Table 5 compares the reported percentages of wheelchairs that would not be able to fit through doorways of NBC 2020-compliant entrance doors having a clear width of 745 mm, and those compliant with this proposed change having a clear width of 850 mm.

Table 5. Percentages of Wheelchairs that Cannot Be Accommodated by Various Clear Widths of Doorways and Impact of the Proposed Change

Wheelchairs not accommodated by listed clear width, %			Wheelchairs not accommodated by the NBC 2020 clear width, but accommodated by the proposed change in PCF 1883, %	
Source	745 mm (NBC 2020)	850 mm (PCF 1883)	Source	850 mm
Seeger et al., AUS	4.1	0.9	Seeger et al., AUS	77.8

UDI, Canada	2.9	0.0	UDI, Canada	100.0
DfT, UK	4.1	2.4	DfT, UK	42.5
IDEA Center, USA	5.1	1.0	IDEA Center, USA	80.1

According to the information in Table 5, this proposed change would allow 42.5% to 100% of wheelchairs to enter a dwelling unit of those that cannot currently pass through a minimum NBC 2020-compliant entrance door.

Limitations of the Benefit Analysis

While this proposed change addresses the width of an entrance door, it does not include any requirements for the threshold of the doorway, which could still present an obstacle for mobility devices, though there are some products available on the market that can help address this.

Enforcement implications

The proposed change is expected to be enforceable using a combination of a measuring tape and visual inspection. Authorities having jurisdiction would need to become familiar with the proposed change. Suites in Part 3 buildings (including dwelling units) require entrance doors with a clear width of 850 mm (Clause 3.3.1.13.(1)(b)), and similar methods could be used to enforce the proposed change in houses and other types of dwelling units.

Who is affected

Builders and designers would need to be aware of the proposed change and potentially modify the layout of the dwelling unit to accommodate the need for increased space by the affected door.

Occupants (including owners) may gain a larger entrance and avoid the need to increase the doorway width should their mobility needs change.

Regulators and authorities having jurisdiction would need to be aware of and enforce the proposed change.

Door manufacturers and distributors might need to plan for changes to the production of exterior doors that comply with the proposed change.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.8.1.1.] 3.8.1.1. ([1] 1) no attributions

[3.8.1.1.] 3.8.1.1. ([2] 2) no attributions

[3.8.2.1.] 3.8.2.1. ([1] 1) no attributions

[3.8.2.2.] 3.8.2.2. ([1] 1) [F73-OA1]

[3.8.2.2.] 3.8.2.2. ([2] 2) no attributions

[3.8.2.2.] 3.8.2.2. ([3] 3) no attributions

[3.8.2.2.] 3.8.2.2. ([4] 4) [F73-OA1]

[3.8.2.3.] 3.8.2.3. ([1] 1) [F73-OA1]

[3.8.2.3.] 3.8.2.3. ([2] 2) no attributions

[3.8.2.3.] 3.8.2.3. ([3] 3) [F74-OA2]

[3.8.2.3.] 3.8.2.3. ([4] 4) [F74-OA2]

[3.8.2.3.] 3.8.2.3. ([5] 5) [F74-OA2]

[3.8.2.3.] 3.8.2.3. ([5] 5) [F10-OS3.7]

[3.8.2.3.] 3.8.2.3. ([6] 6) [F74-OA2]

[3.8.2.4.] 3.8.2.4. ([1] 1) [F73-OA1]

[3.8.2.4.] 3.8.2.4. ([2] 2) [F73-OA1]

[3.8.2.5.] 3.8.2.5. ([1] 1) [F73-OA1]

[3.8.2.5.] 3.8.2.5. ([2] 2) [F73-OA1]

[3.8.2.5.] 3.8.2.5. ([3] 3) no attributions

[3.8.2.6.] 3.8.2.6. ([1] 1) no attributions

[3.8.2.7.] 3.8.2.7. ([1] 1) [F73-OA1]

[3.8.2.7.] 3.8.2.7. ([2] 2) no attributions

[3.8.2.7.] 3.8.2.7. ([3] 3) no attributions

[3.8.2.8.] 3.8.2.8. ([1] 1) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([1] 1) [F72-OH2.1] [F71-OH2.3]

[3.8.2.8.] 3.8.2.8. ([2] 2) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([2] 2) [F72-OH2.1] [F71-OH2.3]

[3.8.2.8.] 3.8.2.8. ([2] 2) no attributions

[3.8.2.8.] 3.8.2.8. ([3] 3) no attributions

[3.8.2.8.] 3.8.2.8. ([4] 4) [F72-OH2.1]

[3.8.2.8.] 3.8.2.8. ([4] 4) [F73-OA1]

[3.8.2.8.] 3.8.2.8. ([5] 5) no attributions

[3.8.2.8.] 3.8.2.8. ([6] 6) no attributions

[3.8.2.8.] 3.8.2.8. ([7] 7) no attributions

[3.8.2.8.] 3.8.2.8. ([8] 8) no attributions

[3.8.2.8.] 3.8.2.8. ([9] 9) no attributions

[3.8.2.8.] 3.8.2.8. ([10] 10) no attributions

[3.8.2.8.] 3.8.2.8. ([11] 11) no attributions

[3.8.2.8.] 3.8.2.8. ([12] 12) no attributions

[3.8.2.8.] 3.8.2.8. ([13] 13) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([13] 13) no attributions

[3.8.2.8.] 3.8.2.8. ([14] 14) no attributions

[3.8.2.8.] 3.8.2.8. ([15] 15) no attributions

[3.8.2.8.] 3.8.2.8. ([15] 15) [F74-OA2]

[3.8.2.9.] 3.8.2.9. ([1] 1) no attributions

[3.8.2.9.] 3.8.2.9. ([2] 2) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([1] 1) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([1] 1) no attributions

[3.8.2.10.] 3.8.2.10. ([2] 2) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([3] 3) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([3] 3) no attributions

[3.8.2.10.] 3.8.2.10. ([4] 4) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([4] 4) no attributions

[3.8.2.11.] 3.8.2.11. ([1] 1) [F74-OA2]

[3.8.2.11.] 3.8.2.11. ([1] 1) no attributions

[3.8.2.12.] 3.8.2.12. ([1] 1) [F74-OA2]

[3.8.2.12.] 3.8.2.12. ([1] 1) no attributions

[3.8.3.1.] 3.8.3.1. ([1] 1) no attributions

[3.8.3.2.] 3.8.3.2. ([1] 1) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([2] 2) no attributions

[3.8.3.2.] 3.8.3.2. ([3] 3) ([a] a),([b] b) [F30-OS3.1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([a] a),([b] b) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([c] c),([d] d) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([e] e),([f] f) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([e] e),([f] f) [F30-OS3.1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([c] c),([d] d) [F30-OS3.1]

[3.8.3.2.] 3.8.3.2. ([4] 4) no attributions

[3.8.3.2.] 3.8.3.2. ([5] 5) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([6] 6) [F73-OA1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([a] a) [F73-OA1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([a] a) [F30-OS3.1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([b] b) [F73-OA1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([c] c)

[3.8.3.3.] 3.8.3.3. ([1] 1) ([d] d) [F30-OS3.1]

[3.8.3.4.] 3.8.3.4. ([1] 1) ([a] a) [F74-OA2]

[3.8.3.4.] 3.8.3.4. ([1] 1) ([b] b) [F73-OA1]

[3.8.3.4.] 3.8.3.4. ([1] 1) ([c] c) [F74-OA2]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([b] b),([e] e) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([d] d) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([c] c) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([d] d) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([e] e),([f] f)

[3.8.3.5.] 3.8.3.5. ([1] 1) ([b] b),([e] e) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([a] a)

[3.8.3.5.] 3.8.3.5. ([1] 1) ([c] c) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([2] 2) no attributions

[3.8.3.5.] 3.8.3.5. ([3] 3) no attributions

[3.8.3.5.] 3.8.3.5. ([4] 4) ([a] a) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([4] 4) ([b] b),([c] c) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([5] 5) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([1] 1) no attributions

[3.8.3.6.] 3.8.3.6. ([2] 2) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([3] 3) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([3] 3) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([4] 4) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([4] 4) [F10-OS3.7]

[3.8.3.6.] 3.8.3.6. ([5] 5) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([5] 5) [F10-OS3.7]

[3.8.3.6.] 3.8.3.6. ([6] 6) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([7] 7) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([8] 8) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([9] 9) no attributions

[3.8.3.6.] 3.8.3.6. ([10] 10) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([10] 10) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([10] 10) no attributions

[3.8.3.6.] 3.8.3.6. ([11] 11) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([12] 12) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([12] 12) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([13] 13) no attributions

[3.8.3.6.] 3.8.3.6. ([14] 14) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([15] 15) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([16] 16) no attributions

[3.8.3.6.] 3.8.3.6. ([17] 17) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([17] 17) [F10-OS3.7]

[3.8.3.7.] 3.8.3.7. ([1] 1) [F73-OA1]

[3.8.3.7.] 3.8.3.7. ([1] 1) [F74-OA2]

[3.8.3.7.] 3.8.3.7. ([1] 1) [F30-OS3.1] [F10-OS3.7]

[3.8.3.8.] 3.8.3.8. ([1] 1) [F74-OA2]

[3.8.3.8.] 3.8.3.8. ([1] 1) [F10-OS3.7]

[3.8.3.9.] 3.8.3.9. ([1] 1) no attributions

[3.8.3.9.] 3.8.3.9. ([1] 1) [F74-OA2]

[3.8.3.9.] 3.8.3.9. ([1] 1) [F73-OA1]

[3.8.3.9.] 3.8.3.9. ([2] 2) [F74-OA2]

[3.8.3.9.] 3.8.3.9. ([2] 2) [F73-OA1]

[3.8.3.9.] 3.8.3.9. ([3] 3) [F74-OA2]

[3.8.3.9.] 3.8.3.9. ([3] 3) [F73-OA1]

[3.8.3.10.] 3.8.3.10. ([1] 1) [F74-OA2]

[3.8.3.10.] 3.8.3.10. ([2] 2) [F74-OA2]

[3.8.3.11.] 3.8.3.11. ([1] 1) [F74-OA2]

[3.8.3.11.] 3.8.3.11. ([2] 2) [F74-OA2]

[3.8.3.12.] 3.8.3.12. ([1] 1) [F74-OA2]

[3.8.3.12.] 3.8.3.12. ([1] 1) [F72-OH2.1]

[3.8.3.12.] 3.8.3.12. ([1] 1) ([d] d)([i] i) [F74-OA2]

[3.8.3.12.] 3.8.3.12. ([1] 1) ([f] f),([g] g) [F30,F20-OS3.1]

[3.8.3.12.] 3.8.3.12. ([1] 1) ([f] f) and ([g] g)

[3.8.3.12.] 3.8.3.12. ([1] 1) ([h] h) [F30-OS3.1]

[3.8.3.12.] 3.8.3.12. ([1] 1) no attributions

[3.8.3.13.] 3.8.3.13. ([1] 1) [F74-OA2]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([b] b) [F10-OS3.7]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([c] c)

[3.8.3.13.] 3.8.3.13. ([1] 1) ([d] d)

[3.8.3.13.] 3.8.3.13. ([1] 1) ([f] f)

[3.8.3.13.] 3.8.3.13. ([1] 1) ([g] g) [F30-OS3.1]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([i] i) [F74-OA2]

[3.8.3.13.] 3.8.3.13. ([1] 1) [F72-OH2.1] [F71-OH2.3]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([b] b) [F74-OA2]

[3.8.3.13.] 3.8.3.13. ([2] 2) [F72-OH2.1] [F71-OH2.3]

[3.8.3.14.] 3.8.3.14. ([1] 1) [F74-OA2]

[3.8.3.14.] 3.8.3.14. ([1] 1) [F72-OH2.1]

[3.8.3.15.] 3.8.3.15. ([1] 1) [F74-OA2]

[3.8.3.15.] 3.8.3.15. ([1] 1) ([d] d) [F30-OS3.1]

[3.8.3.15.] 3.8.3.15. ([1] 1) ([a] a)

[3.8.3.15.] 3.8.3.15. ([2] 2) [F74-OA2]

[3.8.3.15.] 3.8.3.15. ([2] 2) ([f] f) [F30-OS3.1]

[3.8.3.15.] 3.8.3.15. ([2] 2) ([c] c)

[3.8.3.16.] 3.8.3.16. ([1] 1) [F74-OA2]

[3.8.3.16.] 3.8.3.16. ([1] 1) [F71-OH2.3]

[3.8.3.16.] 3.8.3.16. ([1] 1) ([f] f) [F31-OS3.2]

[3.8.3.16.] 3.8.3.16. ([2] 2) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([1] 1) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([1] 1) ([d] d),([e] e) [F30-OS3.1]

[3.8.3.17.] 3.8.3.17. ([1] 1) ([f] f) [F30-OS3.1]

[3.8.3.17.] 3.8.3.17. ([1] 1) ([h] h) [F31-OS3.2]

[3.8.3.17.] 3.8.3.17. ([2] 2) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([2] 2) [F71-OH2.3]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([a] a) [F73-OA1]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([b] b) [F10-OS3.7]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([b] b) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([g] g) [F74-OA2]

[3.8.3.18.] 3.8.3.18. ([1] 1) [F74-OA2]

[3.8.3.19.] 3.8.3.19. ([1] 1) [F74-OA2]

[3.8.3.19.] 3.8.3.19. ([1] 1) [F11-OS3.7]

[3.8.3.19.] 3.8.3.19. ([2] 2) [F74-OA2]

[3.8.3.20.] 3.8.3.20. ([1] 1) [F74-OA2]

[3.8.3.21.] 3.8.3.21. ([1] 1) [F74-OA2]

[3.8.3.21.] 3.8.3.21. ([2] 2) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([1] 1) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([1] 1) [F30-OS3.1]

[3.8.3.22.] 3.8.3.22. ([1] 1) ([d] d) [F10-OS3.7]

[3.8.3.22.] 3.8.3.22. ([2] 2) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([2] 2) [F30-OS3.1]

[3.8.3.22.] 3.8.3.22. ([3] 3) ([a] a) [F10-OS3.7]

[3.8.3.22.] 3.8.3.22. ([3] 3) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([4] 4) [F10-OS3.7]

[3.8.4.1.] -- ([1] --) [F73-OA1]

Submit a comment

Proposed Change 1957

Code Reference(s):	**NBC20 Div.B 3.8. (first printing)**
Subject:	Accessibility, Visitability and Adaptability of Dwelling Units
Title:	Reachable Controls in Dwelling Units
Description:	This proposed change introduces new requirements for controls in dwelling units to make them reachable from a seated or standing position.
Related Proposed Change(s):	PCF 1880, PCF 1881, PCF 1883, PCF 2028

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Accessibility, Visitability and Adaptability of Dwelling Units.

Problem

The ability to access controls and receptacles (e.g., light switches) in the dwelling is essential for people to live independently. However, as people age, disabilities become more common, and Canadians over the age of 65 are nearly twice as likely to be disabled compared to those who are 20–64 years old [1].

Consequently, controls that were once accessible when a person moved into a dwelling may no longer be accessible as the person's health status evolves. This situation can create problems for persons with disabilities related to balance and mobility (particularly those who use wheelchairs or scooters while seated, as well as those at a higher risk of falls while reaching up or bending down) as they may not be able to reach controls in the dwelling that have been installed too high or too low. Persons who use mobility aids (including walkers and rollators) also experience difficulty in reaching controls when the controls are located in the inside corners of a room and the mobility aid is blocked by the adjacent wall.

When renovating a dwelling unit, repositioning certain controls for accessibility is possible. However, repositioning hard-wired controls, such as light switches, is expensive and labour intensive relative to installing the controls in accessible locations when the dwelling is first built.

Justification

This proposed change introduces new requirements for the design and installation of controls in dwelling units so that they can be more easily reached by persons with disabilities related to balance and mobility. Specifically, this proposed change constrains the installation location of certain types of controls (e.g., light switches, electrical outlets and regularly operated components of security systems) in a dwelling unit to be within a height range of 400 mm to 1 200 mm above the finished floor or ground surface. Moreover, where controls are to be installed in inside corners of a room, this proposed change would require them to be located at least 300 mm from the inside corner.

Approximately 10% of Canadians report having a disability related to mobility [1], while 1% of Canadians who live in the community regularly use wheelchairs or scooters [2]. Restricting the height range of the installation location of certain types of controls would also benefit many older adults and persons with disabilities related to balance who do not use wheelchairs or scooters by reducing the need to reach extensively to access controls located in high positions or to squat, stoop or crouch to access controls located in low positions. These are activities that increase the risk of balance loss and subsequent fall or injury in older adults and persons with disabilities related to balance [3–6]. Similarly, placing restrictions on the location of controls in the inside corners of the room would make it easier for persons who use mobility aids, such as walkers or rollators (in addition to wheelchairs or scooters), to reach the controls while also using their mobility aid. By constraining the installation location of controls in dwelling units, this proposed change would limit the probability that persons with disabilities related to balance and mobility cannot safely access the building's facilities.

This proposed change complements the existing requirements in the National Building Code of Canada (NBC) for the accessible design of controls in most units in multi-unit residential buildings, as outlined in Section 3.8. of Division B. The current requirements in the NBC differ from this proposed change in that they address dexterity and focus on all controls, whereas this proposed change strictly addresses height and proximity to an inside corner for a limited range of controls. As such, this proposed change would generally affect houses and other dwelling units that do not need to comply with Section 3.8.

By focusing on specific controls that are frequently used by occupants and are expensive to relocate once installed relative to the initial installation cost, this proposed change is expected to address critical controls used in a dwelling unit while simplifying enforcement and Code compliance. This proposed change also maintains flexibility in the design of controls that are typically installed in an accessible location (e.g., door hardware and faucets) unless occupants choose to install them elsewhere.

PROPOSED CHANGE

[3.8.] 3.8. Accessibility

(See Note A-3.8.)

[3.8.1.] 3.8.1. Scope

[3.8.1.1.] 3.8.1.1. Scope

[3.8.2.] 3.8.2. Application

[3.8.2.1.] 3.8.2.1. Exceptions

[3.8.2.2.] 3.8.2.2. Entrances

[3.8.2.3.] 3.8.2.3. Areas Requiring a Barrier-Free Path of Travel

[3.8.2.4.] 3.8.2.4. Access to Storeys Served by Escalators and Moving Walks

[3.8.2.5.] 3.8.2.5. Exterior Barrier-Free Paths of Travel to Building Entrances and Exterior Passenger-Loading Zones

[3.8.2.6.] 3.8.2.6. Controls

[3.8.2.7.] 3.8.2.7. Power Door Operators

[3.8.2.8.] 3.8.2.8. Plumbing Facilities

[3.8.2.9.] 3.8.2.9. Assistive Listening Systems

[3.8.2.10.] 3.8.2.10. Signs and Indicators

[3.8.2.11.] 3.8.2.11. Counters

[3.8.2.12.] 3.8.2.12. Telephones

[3.8.3.] 3.8.3. Design

[3.8.3.1.] 3.8.3.1. Design Standards

[3.8.3.2.] 3.8.3.2. Barrier-Free Path of Travel

[3.8.3.3.] 3.8.3.3. Exterior Walks

[3.8.3.4.] 3.8.3.4. Exterior Passenger-Loading Zones

[3.8.3.5.] 3.8.3.5. Ramps

[3.8.3.6.] 3.8.3.6. Doorways and Doors

[3.8.3.7.] 3.8.3.7. Passenger-Elevating Devices

[3.8.3.8.] 3.8.3.8. Controls

[3.8.3.9.] 3.8.3.9. Accessible Signs

[3.8.3.10.] 3.8.3.10. Drinking Fountains

[3.8.3.11.] 3.8.3.11. Water-Bottle Filling Stations

[3.8.3.12.] 3.8.3.12. Accessible Water-Closet Stalls

[3.8.3.13.] 3.8.3.13. Universal Washrooms

[3.8.3.14.] 3.8.3.14. Water Closets

[3.8.3.15.] 3.8.3.15. Water-Closet Stalls and Urinals for Persons with Limited Mobility

[3.8.3.16.] 3.8.3.16. Lavatories and Mirrors

[3.8.3.17.] 3.8.3.17. Showers

[3.8.3.18.] 3.8.3.18. Accessible Bathtubs

[3.8.3.19.] 3.8.3.19. Assistive Listening Systems

[3.8.3.20.] 3.8.3.20. Counters

[3.8.3.21.] 3.8.3.21. Telephones

[3.8.3.22.] 3.8.3.22. Spaces in Seating Area

[3.8.4.] -- Dwelling Units

[3.8.4.2.] --- Operating Controls and Electrical Receptacles

[1] --) Where they are mounted on a wall and intended for regular use by the occupant, switches, electrical receptacles and security controls shall be located with their centre lines

- [a] --) between 400 mm and 1 200 mm above the finished floor or ground surface, and
- [b] --) at least 300 mm from the inside wall corner.

(See Note A-3.8.4.2.-2025.)

Note A-3.8.4.2.-2025 Operating Controls and Electrical Receptacles.

Sentence 3.8.4.2.(1) is not intended to apply where the operating controls and electrical receptacles are not for regular use or are installed outside of the prescribed distance ranges for use with dedicated equipment or appliances.

Impact analysis

Impact on accessibility

Being able to access controls (e.g., light switches and electrical outlets) profoundly affects one's independence while living in a dwelling unit.

This proposed change is expected to improve accessibility by facilitating the reaching of controls from a seated or standing position. Approximately 10% of Canadians over 15 years old have a disability related to mobility [1], with 1% of community-dwelling Canadians being regular users of wheelchairs and scooters [2]. While the proposed height range was originally established to facilitate persons reaching from a seated position, the proposed change would also improve the safety of persons accessing controls while standing and reduce the need for stooping, squatting or crouching to reach low positions—all of which are activities that are associated with balance loss and potential falls, even in older adults without disabilities related to balance [3–6]. Similarly, the proposed requirements for the location of controls in inside corners (i.e., at least 300 mm from the inside corner) are expected to improve the safety of persons accessing controls while using a mobility aid (e.g., walkers, rollators, wheelchairs, scooters). By requiring that controls be installed in an accessible location irrespective of wheelchair or scooter use, this proposed change would make it easier for occupants to access these controls throughout the dwelling.

Impact on financial costs

This proposed change is not expected to increase the costs of building new dwelling units, as the change would only affect the mounting location of the controls. However, implementing the proposed change to the installation height and location ranges of controls is expected to reduce the need for individuals to modify the location of controls to make them more reachable from a wheelchair or a standing position after the dwelling unit has been built. This proposed change should result in cost and time savings related to complex adjustments, such as changing the location of hard-wired electrical outlets and light switches. Designers and builders would need to be aware of the change and apply it in practice.

Impact on the provinces and territories

The impact of this proposed change would differ across provinces and territories based on (a) the type of dwelling unit, where existing requirements for the accessible design of controls in dwelling units currently apply; and (b) the specific technical components of these requirements.

This proposed change is mostly a relaxation of the adaptability requirements for controls in the Nova Scotia Building Code, Article 3.8.4.6., which apply to the design and construction of all dwelling units, including houses. Specifically, the Nova Scotia Building Code already addresses dexterity requirements (which impact the geometry and operating force of controls) and defines "controls" much more broadly. On the other hand, the Nova Scotia Building Code does not address the position of controls with respect to inside corners, whereas this proposed change does.

In the Quebec Construction Code, all dwelling units not exempt from the accessibility requirements in Section 3.8. (i.e., dwelling units in multi-unit residential buildings [MURBs]) would have to comply with this proposed change. The one key difference is that this proposed change would apply throughout the dwelling unit, whereas the current requirements in Quebec only apply to controls that are within or are adjacent to the barrier-free path of travel. The NBC proposes a broader application to address the needs of persons with mobility disabilities who do not use wheelchairs in the home, in addition to those who do.

Other provinces and territories have similar requirements for the location of controls in their provisions for accessible dwelling units, which typically apply to a percentage of units in MURBs but do not apply to houses.

Finally, the NBC 2020 requires that all buildings (including dwelling units) that are not subject to the exemptions outlined in Section 3.8. (e.g., houses) comply with the requirements for controls stated in Article 3.8.3.8. (which prescribes a height range for installation, clearance requirements around the controls to allow a wheelchair to approach and turn, and requirements to allow a person with a disability related to dexterity to operate the controls using low force and a closed fist). Thus, this proposed change would mostly affect houses; however, the requirements are relaxed compared to those for MURBs.

References

[1] Statistics Canada. (2017). "New data on disability in Canada 2017." https://www150.statcan.gc.ca/n1/en/pub/11-627-m/11-627-m2018035-eng.pdf?st=v5UqujRh

[2] Smith, E., Giesbrecht, E., Mortenson, W., and Miller, W. (2016). Prevalence of wheelchair and scooter use among community-dwelling Canadians. *Physical Therapy*, *96*, 1135–1142.

[3] Glinka, M. N., Weaver, T. B., and Laing, A. C. (2015). Age-related differences in movement strategies and postural control during stooping and crouching tasks. *Human Movement Science*, *44*, 246–257.

[4] Hernandez, M. E., Ashton-Miller, J. A., and Alexander, N. B. (2013). Age-related differences in maintenance of balance during forward reach to the floor. *Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences*, *68*(8), 960–967.

[5] Huang, M. H., and Brown, S. H. (2013). Age differences in the control of postural stability during reaching tasks. *Gait & Posture*, *38*(4), 837–842.

[6] Nasarwanji, M. F., Paquet, V. L., and Steinfeld, E. (2012). Age differences in postural strategies for low forward reach. In M. M. Soares and F. Rebelo (Eds.), *Advances in Usability Evaluation–Part I*: pp. 97–118. CRC Press, Boca Raton, FL.

Enforcement implications

This proposed change could be enforced using existing Code enforcement methods for accessible controls in Part 3 buildings, including the use of a measuring tape to measure installation height.

Authorities having jurisdiction would need to be made aware of this proposed change and its distinction from existing requirements for accessible controls in Article 3.8.3.8. (which apply to a broader range of controls and also address dexterity).

Who is affected

Designers, builders, engineers and homeowners would need to be aware of this proposed change and select controls to comply with the proposed requirements.

Manufacturers would need to be aware of the expanded requirements for accessible controls in Canada.

Authorities having jurisdiction would need to be aware of this proposed change when evaluating building compliance.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.8.1.1.] 3.8.1.1. ([1] 1) no attributions

[3.8.1.1.] 3.8.1.1. ([2] 2) no attributions

[3.8.2.1.] 3.8.2.1. ([1] 1) no attributions

[3.8.2.2.] 3.8.2.2. ([1] 1) [F73-OA1]

[3.8.2.2.] 3.8.2.2. ([2] 2) no attributions

[3.8.2.2.] 3.8.2.2. ([3] 3) no attributions

[3.8.2.2.] 3.8.2.2. ([4] 4) [F73-OA1]

[3.8.2.3.] 3.8.2.3. ([1] 1) [F73-OA1]

[3.8.2.3.] 3.8.2.3. ([2] 2) no attributions

[3.8.2.3.] 3.8.2.3. ([3] 3) [F74-OA2]

[3.8.2.3.] 3.8.2.3. ([4] 4) [F74-OA2]

[3.8.2.3.] 3.8.2.3. ([5] 5) [F74-OA2]

[3.8.2.3.] 3.8.2.3. ([5] 5) [F10-OS3.7]

[3.8.2.3.] 3.8.2.3. ([6] 6) [F74-OA2]

[3.8.2.4.] 3.8.2.4. ([1] 1) [F73-OA1]

[3.8.2.4.] 3.8.2.4. ([2] 2) [F73-OA1]

[3.8.2.5.] 3.8.2.5. ([1] 1) [F73-OA1]

[3.8.2.5.] 3.8.2.5. ([2] 2) [F73-OA1]

[3.8.2.5.] 3.8.2.5. ([3] 3) no attributions

[3.8.2.6.] 3.8.2.6. ([1] 1) no attributions

[3.8.2.7.] 3.8.2.7. ([1] 1) [F73-OA1]

[3.8.2.7.] 3.8.2.7. ([2] 2) no attributions

[3.8.2.7.] 3.8.2.7. ([3] 3) no attributions

[3.8.2.8.] 3.8.2.8. ([1] 1) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([1] 1) [F72-OH2.1] [F71-OH2.3]

[3.8.2.8.] 3.8.2.8. ([2] 2) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([2] 2) [F72-OH2.1] [F71-OH2.3]

[3.8.2.8.] 3.8.2.8. ([2] 2) no attributions

[3.8.2.8.] 3.8.2.8. ([3] 3) no attributions

[3.8.2.8.] 3.8.2.8. ([4] 4) [F72-OH2.1]

[3.8.2.8.] 3.8.2.8. ([4] 4) [F73-OA1]

[3.8.2.8.] 3.8.2.8. ([5] 5) no attributions

[3.8.2.8.] 3.8.2.8. ([6] 6) no attributions

[3.8.2.8.] 3.8.2.8. ([7] 7) no attributions

[3.8.2.8.] 3.8.2.8. ([8] 8) no attributions

[3.8.2.8.] 3.8.2.8. ([9] 9) no attributions

[3.8.2.8.] 3.8.2.8. ([10] 10) no attributions

[3.8.2.8.] 3.8.2.8. ([11] 11) no attributions

[3.8.2.8.] 3.8.2.8. ([12] 12) no attributions

[3.8.2.8.] 3.8.2.8. ([13] 13) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([13] 13) no attributions

[3.8.2.8.] 3.8.2.8. ([14] 14) no attributions

[3.8.2.8.] 3.8.2.8. ([15] 15) no attributions

[3.8.2.8.] 3.8.2.8. ([15] 15) [F74-OA2]

[3.8.2.9.] 3.8.2.9. ([1] 1) no attributions

[3.8.2.9.] 3.8.2.9. ([2] 2) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([1] 1) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([1] 1) no attributions

[3.8.2.10.] 3.8.2.10. ([2] 2) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([3] 3) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([3] 3) no attributions

[3.8.2.10.] 3.8.2.10. ([4] 4) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([4] 4) no attributions

[3.8.2.11.] 3.8.2.11. ([1] 1) [F74-OA2]

[3.8.2.11.] 3.8.2.11. ([1] 1) no attributions

[3.8.2.12.] 3.8.2.12. ([1] 1) [F74-OA2]

[3.8.2.12.] 3.8.2.12. ([1] 1) no attributions

[3.8.3.1.] 3.8.3.1. ([1] 1) no attributions

[3.8.3.2.] 3.8.3.2. ([1] 1) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([2] 2) no attributions

[3.8.3.2.] 3.8.3.2. ([3] 3) ([a] a),([b] b) [F30-OS3.1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([a] a),([b] b) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([c] c),([d] d) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([e] e),([f] f) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([e] e),([f] f) [F30-OS3.1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([c] c),([d] d) [F30-OS3.1]

[3.8.3.2.] 3.8.3.2. ([4] 4) no attributions

[3.8.3.2.] 3.8.3.2. ([5] 5) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([6] 6) [F73-OA1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([a] a) [F73-OA1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([a] a) [F30-OS3.1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([b] b) [F73-OA1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([c] c)

[3.8.3.3.] 3.8.3.3. ([1] 1) ([d] d) [F30-OS3.1]

[3.8.3.4.] 3.8.3.4. ([1] 1) ([a] a) [F74-OA2]

[3.8.3.4.] 3.8.3.4. ([1] 1) ([b] b) [F73-OA1]

[3.8.3.4.] 3.8.3.4. ([1] 1) ([c] c) [F74-OA2]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([b] b),([e] e) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([d] d) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([c] c) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([d] d) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([e] e),([f] f)

[3.8.3.5.] 3.8.3.5. ([1] 1) ([b] b),([e] e) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([a] a)

[3.8.3.5.] 3.8.3.5. ([1] 1) ([c] c) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([2] 2) no attributions

[3.8.3.5.] 3.8.3.5. ([3] 3) no attributions

[3.8.3.5.] 3.8.3.5. ([4] 4) ([a] a) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([4] 4) ([b] b),([c] c) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([5] 5) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([1] 1) no attributions

[3.8.3.6.] 3.8.3.6. ([2] 2) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([3] 3) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([3] 3) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([4] 4) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([4] 4) [F10-OS3.7]

[3.8.3.6.] 3.8.3.6. ([5] 5) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([5] 5) [F10-OS3.7]

[3.8.3.6.] 3.8.3.6. ([6] 6) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([7] 7) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([8] 8) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([9] 9) no attributions

[3.8.3.6.] 3.8.3.6. ([10] 10) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([10] 10) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([10] 10) no attributions

[3.8.3.6.] 3.8.3.6. ([11] 11) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([12] 12) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([12] 12) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([13] 13) no attributions

[3.8.3.6.] 3.8.3.6. ([14] 14) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([15] 15) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([16] 16) no attributions

[3.8.3.6.] 3.8.3.6. ([17] 17) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([17] 17) [F10-OS3.7]

[3.8.3.7.] 3.8.3.7. ([1] 1) [F73-OA1]

[3.8.3.7.] 3.8.3.7. ([1] 1) [F74-OA2]

[3.8.3.7.] 3.8.3.7. ([1] 1) [F30-OS3.1] [F10-OS3.7]

[3.8.3.8.] 3.8.3.8. ([1] 1) [F74-OA2]

[3.8.3.8.] 3.8.3.8. ([1] 1) [F10-OS3.7]

[3.8.3.9.] 3.8.3.9. ([1] 1) no attributions

[3.8.3.9.] 3.8.3.9. ([1] 1) [F74-OA2]

[3.8.3.9.] 3.8.3.9. ([1] 1) [F73-OA1]

[3.8.3.9.] 3.8.3.9. ([2] 2) [F74-OA2]

[3.8.3.9.] 3.8.3.9. ([2] 2) [F73-OA1]

[3.8.3.9.] 3.8.3.9. ([3] 3) [F74-OA2]

[3.8.3.9.] 3.8.3.9. ([3] 3) [F73-OA1]

[3.8.3.10.] 3.8.3.10. ([1] 1) [F74-OA2]

[3.8.3.10.] 3.8.3.10. ([2] 2) [F74-OA2]

[3.8.3.11.] 3.8.3.11. ([1] 1) [F74-OA2]

[3.8.3.11.] 3.8.3.11. ([2] 2) [F74-OA2]

[3.8.3.12.] 3.8.3.12. ([1] 1) [F74-OA2]

[3.8.3.12.] 3.8.3.12. ([1] 1) [F72-OH2.1]

[3.8.3.12.] 3.8.3.12. ([1] 1) ([d] d)([i] i) [F74-OA2]

[3.8.3.12.] 3.8.3.12. ([1] 1) ([f] f),([g] g) [F30,F20-OS3.1]

[3.8.3.12.] 3.8.3.12. ([1] 1) ([f] f) and ([g] g)

[3.8.3.12.] 3.8.3.12. ([1] 1) ([h] h) [F30-OS3.1]

[3.8.3.12.] 3.8.3.12. ([1] 1) no attributions

[3.8.3.13.] 3.8.3.13. ([1] 1) [F74-OA2]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([b] b) [F10-OS3.7]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([c] c)

[3.8.3.13.] 3.8.3.13. ([1] 1) ([d] d)

[3.8.3.13.] 3.8.3.13. ([1] 1) ([f] f)

[3.8.3.13.] 3.8.3.13. ([1] 1) ([g] g) [F30-OS3.1]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([i] i) [F74-OA2]

[3.8.3.13.] 3.8.3.13. ([1] 1) [F72-OH2.1] [F71-OH2.3]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([b] b) [F74-OA2]

[3.8.3.13.] 3.8.3.13. ([2] 2) [F72-OH2.1] [F71-OH2.3]

[3.8.3.14.] 3.8.3.14. ([1] 1) [F74-OA2]

[3.8.3.14.] 3.8.3.14. ([1] 1) [F72-OH2.1]

[3.8.3.15.] 3.8.3.15. ([1] 1) [F74-OA2]

[3.8.3.15.] 3.8.3.15. ([1] 1) ([d] d) [F30-OS3.1]

[3.8.3.15.] 3.8.3.15. ([1] 1) ([a] a)

[3.8.3.15.] 3.8.3.15. ([2] 2) [F74-OA2]

[3.8.3.15.] 3.8.3.15. ([2] 2) ([f] f) [F30-OS3.1]

[3.8.3.15.] 3.8.3.15. ([2] 2) ([c] c)

[3.8.3.16.] 3.8.3.16. ([1] 1) [F74-OA2]

[3.8.3.16.] 3.8.3.16. ([1] 1) [F71-OH2.3]

[3.8.3.16.] 3.8.3.16. ([1] 1) ([f] f) [F31-OS3.2]

[3.8.3.16.] 3.8.3.16. ([2] 2) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([1] 1) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([1] 1) ([d] d),([e] e) [F30-OS3.1]

[3.8.3.17.] 3.8.3.17. ([1] 1) ([f] f) [F30-OS3.1]

[3.8.3.17.] 3.8.3.17. ([1] 1) ([h] h) [F31-OS3.2]

[3.8.3.17.] 3.8.3.17. ([2] 2) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([2] 2) [F71-OH2.3]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([a] a) [F73-OA1]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([b] b) [F10-OS3.7]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([b] b) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([g] g) [F74-OA2]

[3.8.3.18.] 3.8.3.18. ([1] 1) [F74-OA2]

[3.8.3.19.] 3.8.3.19. ([1] 1) [F74-OA2]

[3.8.3.19.] 3.8.3.19. ([1] 1) [F11-OS3.7]

[3.8.3.19.] 3.8.3.19. ([2] 2) [F74-OA2]

[3.8.3.20.] 3.8.3.20. ([1] 1) [F74-OA2]

[3.8.3.21.] 3.8.3.21. ([1] 1) [F74-OA2]

[3.8.3.21.] 3.8.3.21. ([2] 2) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([1] 1) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([1] 1) [F30-OS3.1]

[3.8.3.22.] 3.8.3.22. ([1] 1) ([d] d) [F10-OS3.7]

[3.8.3.22.] 3.8.3.22. ([2] 2) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([2] 2) [F30-OS3.1]

[3.8.3.22.] 3.8.3.22. ([3] 3) ([a] a) [F10-OS3.7]

[3.8.3.22.] 3.8.3.22. ([3] 3) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([4] 4) [F10-OS3.7]

[3.8.4.2.] -- ([1] --) [F30-OS3.1]

[3.8.4.2.] -- ([1] --) [F74-OA2]

Submit a comment

Proposed Change 2028

Code Reference(s):	**NBC20 Div.B 3.8.1. (first printing)**
Subject:	Accessibility, Visitability and Adaptability of Dwelling Units
Title:	Expanding the Scope of the Accessibility Requirements
Description:	This proposed change expands the scope of the accessibility requirements in Section 3.8. to include proposed Subsections 3.8.4. and 3.8.5.
Related Proposed Change(s):	PCF 1880, PCF 1881, PCF 1883, PCF 1957

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Accessibility, Visitability and Adaptability of Dwelling Units.

Problem

Technical requirements in the general area of the adaptability and visitability of dwelling units have been developed for consideration in the 2025 edition of the National Building Code of Canada (NBC). A complementary proposed change, PCF 1881, proposes to include these technical requirements in new Subsections 3.8.4. and 3.8.5.

However, the scope of Section 3.8. (as stated in Article 3.8.1.1.) is currently limited to Subsections 3.8.2. and 3.8.3. The scope of Section 3.8. needs to be expanded to include proposed Subsections 3.8.4. and 3.8.5. that address the design of dwelling units with respect to adaptability and visitability.

Justification

This proposed change expands the scope of Section 3.8. (as stated in Article 3.8.1.1.) to include proposed Subsections 3.8.4. and 3.8.5.

This proposed change would allow different levels of technical requirements related to the adaptability and visitability of dwelling units to explicitly fall within the scope of Section 3.8.

PROPOSED CHANGE

NBC20 Div.B 3.8.1. (first printing)

[3.8.1.] 3.8.1. Scope

[3.8.1.1.] 3.8.1.1. Scope

[1] 1) This Section is concerned with the *barrier-free* design of *buildings*.

[2] 2) Except as provided in Sentence (3), ~~B~~*buildings* and their facilities required to be *barrier-free* in accordance with Subsection 3.8.2. shall be designed in accordance with Subsection 3.8.3.

[3] --) *Dwelling units* required to comply with Sentences 3.8.2.1.(3) and (4) (PCF 1881) shall be designed in accordance with Subsections 3.8.4. and 3.8.5.

Impact analysis

This proposed change does not, on its own, introduce any new costs because it simply expands the NBC framework to explicitly include proposed Subsections 3.8.4. and 3.8.5. within the scope of Section 3.8. These proposed Subsections are necessary to position new technical requirements for the adaptability and visitability of dwelling units. However, the future introduction of specific technical requirements that are related to accessibility, but are beyond the scope of this proposed change, may introduce costs. These future technical requirements would be developed through separate proposed changes (with stand-alone impact analyses) that would undergo typical cross-committee coordination and public review procedures so that the members of Code committees and Code users can make informed recommendations on the progression of such proposed changes.

This proposed change is necessary to explicitly include new Subsections 3.8.4. and 3.8.5. within the scope of Section 3.8. Enabling the NBC framework to include these proposed Subsections, which are related to the adaptable and visitable design of dwelling units, would simplify use of the NBC for Code users.

Enforcement implications

No enforcement implications are expected as a result of this proposed change, as it simply expands the scope of NBC Section 3.8. to include proposed Subsections 3.8.4. and 3.8.5.

Who is affected

This proposed change does not directly affect Code users because expanding the scope of NBC Section 3.8. does not present new technical requirements.

However, the expanded framework to consolidate the proposed requirements for the adaptable and visitable design of dwelling units (facilitated by this proposed change to the scope of Section 3.8.) should simplify use of the NBC for Code users by allowing them to find relevant accessibility requirements in stand-alone Subsections 3.8.4 and 3.8.5.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

NBC20 Div.B 3.8.1. (first printing)

[3.8.1.1.] 3.8.1.1. ([1] 1) no attributions

[3.8.1.1.] 3.8.1.1. ([2] 2) no attributions

[3.8.1.1.] 3.8.1.1. ([2] 2) no attributions

Submit a comment

Proposed Change 1771

Code Reference(s):	**NBC20 Div.B 3.8.2.8. (first printing)** **NBC20 Div.B 3.8.3.16. (first printing)**
Subject:	Accessibility
Title:	Installation Height of Accessible Menstrual Product Dispensers
Description:	This proposed change requires that menstrual product dispensers, where provided, be mounted in an accessible location so that they may be reached from a seated posture.
Related Code Change Request(s):	CCR 1441
Related Proposed Change(s):	PCF 2029

This change could potentially affect the following topic areas:

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

Problem

Lack of access to menstrual products can lead to persons having to miss work, school or social events, and can lead to health consequences. In some buildings and facilities, menstrual products dispensers are installed in washrooms alongside dispensers for soap, towels and other products. However, unlike soap dispensers and other equipment, the NBC does not regulate the design and installation of menstrual product dispensers (where they are provided) with respect to accessibility. This lack of accessibility requirements can cause problems for persons with limited mobility who menstruate, especially those who use wheeled mobility aids, because they may not be able to reach menstrual product dispensers if they are mounted too low or too high.

Justification

This proposed change would introduce new requirements for the installation location of wall-mounted menstrual product dispensers where they are provided in barrier-free washrooms so that they can be reached by people seated in wheeled mobility aids.

By introducing accessibility requirements for the installation position of menstrual product dispensers, the proposed change would help to limit the probability that people who are seated in wheeled mobility aids will be unable to access menstrual products.

Similar to accessibility requirements for toilet paper and soap dispensers, the proposed change addresses the installation location of menstrual product dispensers where they are provided but does not address operational issues related to the provision or stocking of dispensers.

PROPOSED CHANGE

[3.8.2.8.] 3.8.2.8. Plumbing Facilities

[1] **1)** Except as permitted by Sentence (3), at each location where washrooms are provided in a *storey* to which a *barrier-free* path of travel is required in accordance with Article 3.8.2.3., at least one universal washroom complying with Subsection 3.8.3. shall be provided. (See Note A-3.8.2.8.(1) to (4).)

[2] **2)** Except as permitted by Sentence (3), where more than two water closets or a combination of more than one water closet and one urinal are provided in a washroom located in a *storey* to which a *barrier-free* path of travel is required in accordance with Article 3.8.2.3., at least one water-closet stall shall be *barrier-free* in accordance with Subsection 3.8.3. (See Note A-3.8.2.8.(1) to (4).)

[3] **3)** Washrooms located within a *suite* of *residential occupancy* or a *suite* of *care occupancy* need not conform to the requirements of Sentence (1) or (2). (See Note A-3.8.2.8.(1) to (4).)

[4] **4)** In a *building* in which water closets are required in accordance with Subsection 3.7.2., at least one *barrier-free* water closet shall be provided in the entrance *storey*, unless

[a] a) a *barrier-free* path of travel is provided to *barrier-free* water closets elsewhere in the *building*, or

[b] b) the water closets required by Subsection 3.7.2. are for *dwelling units* only.

(See Note A-3.8.2.8.(1) to (4).)

[5] **5)** At least one water-closet stall or enclosure in a washroom required to be *barrier-free* shall comply with Subsection 3.8.3.

[6] **6)** Where urinals are provided in a *barrier-free* washroom, at least one urinal for persons with limited mobility conforming to Subsection 3.8.3. shall be provided for every 10 urinals.

[7] **7)** Where water-closet stalls are provided in a *barrier-free* washroom, at least one stall for persons with limited mobility conforming to Subsection 3.8.3. shall be provided for every 10 stalls.

[8] **8)** A *barrier-free* washroom shall be provided with a lavatory that complies with Subsection 3.8.3.

[9] **9)** Where mirrors are provided in a *barrier-free* washroom, at least one mirror shall comply with Subsection 3.8.3.

[10] --) Where a menstrual product dispenser is provided in a *barrier-free* washroom, it shall comply with Subsection 3.8.3.

[11] 10) At each location where one or more drinking fountains are provided, at least one of them shall comply with Subsection 3.8.3.

[12] 11) At each location where one or more water-bottle filling stations are provided, at least one of them shall comply with Subsection 3.8.3.

[13] 12) Except within a *suite* of *care occupancy* or a *suite* of *residential occupancy*, where showers are provided in a *building*, at least one shower stall in each group of showers shall comply with Subsection 3.8.3.

[14] 13) At each location where a showering facility is provided for use by the general public or customers, or as part of a common-use area for employees, at least one universal dressing and shower room conforming to Subsection 3.8.3. shall be provided. (See Note A-3.8.2.8.(13).)

[15] 14) Where a bathtub is installed in a *suite* of *residential occupancy* required to be *barrier-free*, it shall comply with Subsection 3.8.3.

[16] 15) In *buildings* containing Group A, Group B, Division 2 or Group E *major occupancies* where at least one of these *major occupancies* has an *occupant load* of more than 500, at least one universal washroom on the *storey* on which the main *barrier-free* entrance to the *building* is located shall incorporate an accessible change space conforming to Subsection 3.8.3. (See Note A-3.8.2.8.(15).)

[3.8.3.16.] 3.8.3.16. Lavatories, ~~and~~ Mirrors and Other Washroom Amenities

[1] 1) Lavatories required by Sentence 3.8.2.8.(8) shall

- [a] a) be equipped with faucets complying with Sentence 3.7.2.3.(4),
- [b] b) be located so that the distance between the centre line of the lavatory and any side wall is not less than 460 mm,
- [c] c) have a clear floor space in front of the lavatory that is at least
  - [i] i) 800 mm wide, centred on the lavatory, and
  - [ii] ii) 1 350 mm long, of which no more than 430 mm is beneath the lavatory,
- [d] d) have a rim height not more than 865 mm above the floor,
- [e] e) have a clearance beneath the lavatory not less than
  - [i] i) 800 mm wide, centred on the lavatory,
  - [ii] ii) 735 mm high at the front edge,
  - [iii] iii) 685 mm high at a point 200 mm back from the front edge, and
  - [iv] iv) 230 mm high over the distance from a point 280 mm to a point 430 mm back from the front edge,(see Note A-3.8.3.16.(1)(e))
- [f] f) have insulated water supply and drain pipes where these pipes are exposed (see Note A-3.8.3.16.(1)(f)),
- [g] g) have a soap dispenser that
  - [i] i) is automatic, or
  - [ii] ii) complies with Clause 3.8.3.8.(1)(b) and is located not more than 1 100 mm above the floor, within 500 mm from the front of the lavatory (see Note A-3.8.3.16.(1)(g)), and
- [h] h) have a towel dispenser or other hand-drying equipment located close to the lavatory, not more than 1 200 mm above the floor in an area that is accessible to persons in wheelchairs.

[2] 2) Mirrors required by Sentence 3.8.2.8.(9) shall be

[a] a) mounted with their bottom edge not more than 1 000 mm above the floor, or

[b] b) fixed in an inclined position so as to be usable by a person in a wheelchair.

[3] --) The menstrual product dispenser referred to in Sentence 3.8.2.8.(10)-2025 shall be mounted such that its controls and dispensing components are located

[a] --) in accordance with Clause 3.8.3.8.(1)(a), except that the dispenser shall not be mounted less than 600 mm above the floor, or

[b] --) on the side wall closest to the *barrier-free* water closet, in accordance with Subclauses 3.8.3.12.(1)(i)(i) and (i)(ii).

Impact analysis

Financial Impact

The impact of the proposed change would vary for different buildings, because the change does not mandate that menstrual product dispensers be provided. Rather, it specifies that if these dispensers are provided, they must be installed such that they can be used equally by all people who may need them. Some building owners or operators may decide to provide alternatives to commercial dispensers, depending on their needs (e.g., a basket of products on the lavatory counter); in these cases, the proposed change would have no cost implications.

The installation location requirements are not expected to affect the cost of procuring dispensers. Designers would need to consider the location of menstrual product dispensers in relation to other equipment.

The proposed restrictions on the installation location of menstrual product dispensers are not expected to impact manufacturers, because they do not introduce new requirements for product design.

Accessible Usage Impact

The proposed change is expected to improve the accessibility of menstrual product dispensers for persons with mobility disabilities. Approximately 1% of Canadian adults regularly use wheeled mobility aids (Smith et al., 2016). While data on the distribution of disability by sex are not available from the most recent Canadian Survey on Disability, earlier surveys indicate that female adults are 25% more likely than male adults to have disabilities related to mobility (Statistics Canada, 2012). While disabilities are less common among people of menstruating age (12 to 56 years[1]) than among people over 65 (Statistics Canada, 2017), they affect people of all ages, and anyone who may need menstrual products should be able to access them when they are provided in a building. The consequences of being unable to do so can include missing school, work or other activities.

[1] In Canada, the median age of onset of menstruation is approximately 12 years (Al-Sahab et al., 2010), while the median age of menopause is approximately 50 years (Costanian et al., 2018). However, menstruation is common up to approximately 56 years, the age at which approximately 90% of females in Canada have experienced menopause (Costanian et al., 2018).

References

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2012. https://www150.statcan.gc.ca/n1/pub/89-503-x/2015001/article/14695/tbl/tbl06-eng.htm

Enforcement implications

The proposed change could be enforced in the same way as accessibility requirements for other washroom features such as soap dispensers and lavatory controls, i.e., through visual inspection and basic measurement tools.

Who is affected

Building occupants, particularly those who use wheeled mobility aids, would be able to access menstrual product dispensers.

Building owners would need to decide if the building's washrooms should be equipped with menstrual product dispensers.

Designers would need to ensure dispensers are mounted in appropriate locations.

Authorities having jurisdiction would need to ensure that dispensers comply with the mounting requirements.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.8.2.8.] **3.8.2.8. ([1] 1) [F74-OA2]**

[3.8.2.8.] **3.8.2.8. ([1] 1) [F72-OH2.1] [F71-OH2.3]**

[3.8.2.8.] **3.8.2.8. ([2] 2) [F74-OA2]**

[3.8.2.8.] **3.8.2.8. ([2] 2) [F72-OH2.1] [F71-OH2.3]**

[3.8.2.8.] **3.8.2.8. ([2] 2) no attributions**

[3.8.2.8.] **3.8.2.8. ([3] 3) no attributions**

[3.8.2.8.] **3.8.2.8. ([4] 4) [F72-OH2.1]**

[3.8.2.8.] **3.8.2.8. ([4] 4) [F73-OA1]**

[3.8.2.8.] **3.8.2.8. ([5] 5) no attributions**

[3.8.2.8.] **3.8.2.8. ([6] 6) no attributions**

[3.8.2.8.] **3.8.2.8. ([7] 7) no attributions**

[3.8.2.8.] 3.8.2.8. ([8] 8) no attributions

[3.8.2.8.] 3.8.2.8. ([9] 9) no attributions

[3.8.2.8.] -- ([10] --) no attributions

[3.8.2.8.] 3.8.2.8. ([11] 10) no attributions

[3.8.2.8.] 3.8.2.8. ([12] 11) no attributions

[3.8.2.8.] 3.8.2.8. ([13] 12) no attributions

[3.8.2.8.] 3.8.2.8. ([14] 13) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([14] 13) no attributions

[3.8.2.8.] 3.8.2.8. ([15] 14) no attributions

[3.8.2.8.] 3.8.2.8. ([16] 15) no attributions

[3.8.2.8.] 3.8.2.8. ([16] 15) [F74-OA2]

[3.8.3.16.] 3.8.3.16. ([1] 1) [F74-OA2]

[3.8.3.16.] 3.8.3.16. ([1] 1) [F71-OH2.3]

[3.8.3.16.] 3.8.3.16. ([1] 1) ([f] f) [F31-OS3.2]

[3.8.3.16.] 3.8.3.16. ([2] 2) [F74-OA2]

[3.8.3.16.] -- ([3] --) [F74-OA2]

Submit a comment

Proposed Change 1895

Code Reference(s):	**NBC20 Div.B 4.1.8.1. (first printing)**
Subject:	Earthquake Design — Site Properties
Title:	Datum for the Determination of $\overline{N}_{60}$ and $\bar{s}_u$ in Article 4.1.8.1.
Description:	The proposed change revises the datum used for the determination of $\overline{N}_{60}$ and $\bar{s}_u$ in Article 4.1.8.1. to make it consistent with that used in the rest of Subsection 4.1.8.

This change could potentially affect the following topic areas:

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

Problem

Currently, the specified datum for the determination of $\overline{N}_{60}$ and $\bar{s}_u$ is described differently in Clause 4.1.8.1.(2)(b) and in other parts of Subsection 4.1.8. of Division B of the NBC.

This inconsistency is a source of confusion and could lead to the incorrect and inadequate design of buildings, which could increase the risk to life safety and the risk of injury beyond the risk levels that are currently acceptable in the NBC for a design-level earthquake event.

Justification

The inconsistency in the specified datum to be used for the determination of $\overline{N}_{60}$ and $\overline{s}_u$ in Article 4.1.8.1. and in the rest of Subsection 4.1.8. must be addressed to ensure the consistent and correct application of the NBC requirements for earthquake design. The proposed change removes the inconsistency and harmonizes the specified datum throughout Subsection 4.1.8.

This proposed change would eliminate confusion and prevent errors in the application of the Code requirements, thus, preventing any increase in the risk to life safety and the risk of injury beyond the risk levels currently acceptable in the NBC.

PROPOSED CHANGE

[4.1.8.1.] 4.1.8.1. Analysis

[1] **1)** Except as permitted in Sentence (2), the deflections and specified loading due to earthquake motions shall be determined according to the requirements of Articles 4.1.8.2. to 4.1.8.23.

[2] **2)** Where $I_E F_s S_a(0.2,X_{450})$ and $I_E F_s S_a(2.0,X_{450})$ are less than 0.16 and 0.03 respectively, the deflections and specified loading due to earthquake motions are permitted to be determined in accordance with Sentences (3) to (15), where

- [a] a) I_E is the earthquake importance factor and has a value of 0.8, 1.0, 1.3 and 1.5 for *buildings* in the Low, Normal, High and Post-disaster Importance Categories respectively,
- [b] b) F_s is the site coefficient based on the average $\overline{N}_{60}$ or $\overline{s}_u$, as defined in Article 4.1.8.2., for the top 30 m of *soil* ~~below the footings, *pile* caps, or mat *foundations*~~ and has a value of
  - [i] i) 1.0 for *rock* sites or when $\overline{N}_{60} > 50$ or $\overline{s}_u > 100$ kPa,
  - [ii] ii) 1.6 when $15 \leq \overline{N}_{60} \leq 50$ or 50 kPa $\leq \overline{s}_u \leq$ 100 kPa, and
  - [iii] iii) 2.8 for all other cases, and
- [c] c) $S_a(T,X_{450})$ is the 5%-damped spectral acceleration value at period T for site designation X_{450}, as defined in Article 4.1.8.2., determined in accordance with Subsection 1.1.3. and corresponding to a 2% probability of exceedance in 50 years.

[3] **3)** The structure shall have a clearly defined

- [a] a) seismic force resisting system (SFRS) to resist the earthquake loads and their effects, and
- [b] b) load path (or paths) that will transfer the inertial forces generated in an earthquake to the supporting ground.

[4] **4)** An unreinforced masonry SFRS shall not be permitted where

- [a] a) I_E is greater than 1.0, or

[b] b) the height above *grade* is greater than or equal to 30 m.

[5] **5)** The height above *grade* of an SFRS designed in accordance with CSA S136, "North American Specification for the Design of Cold-Formed Steel Structural Members (using the Appendix B provisions applicable to Canada)", shall be less than 15 m.

[6] **6)** Earthquake forces shall be assumed to act horizontally and independently about any two orthogonal axes.

[7] **7)** The specified lateral earthquake force, V_s, at the base of the structure in the direction under consideration shall be calculated as follows:

$$V_s = S_a\left(T_s, X_s\right) I_E W \Big/ R_S$$

where

$S_a(T_s,X_{450})$ = value of $S_a(T_s,X_{450})$ determined by linear interpolation between the values of $S_a(0.2,X_{450})$, $S_a(0.5,X_{450})$ and $S_a(1.0,X_{450})$,
= $S_a(0.2,X_{450})$ for $T_s \leq 0.2$ s, and
= $S_a(1.0,X_{450})$ for $T_s \geq 1.0$ s,

W = sum of W_i over the height of the *building*, where W_i is defined in Article 4.1.8.2., and

R_s = 1.5, except $R_s = 1.0$ for structures where the *storey* strength is less than that in the *storey* above and for an unreinforced masonry SFRS,

where

T_s = fundamental lateral period of vibration of the *building*, as defined in Article 4.1.8.2.,
= $0.085(h_n)^{3/4}$ for steel moment frames,
= $0.075(h_n)^{3/4}$ for concrete moment frames,
= 0.1N for other moment frames,
= $0.025h_n$ for braced frames, and
= $0.05(h_n)^{3/4}$ for shear walls and other structures,

where

h_n = height, in m, above the base to level n, as defined in Article 4.1.8.2., and

N = total number of *storeys* above exterior *grade* to level n, as defined in Article 4.1.8.2.,

except that, in cases where $R_s = 1.5$, V_s need not be greater than $F_sS_a(0.5,X_{450})I_EW/R_s$.

[8] **8)** The specified lateral earthquake force, V_s, shall be distributed over the height of the *building* in accordance with the following formula:

$$F_x = \frac{V_s W_x h_x}{\sum_{i=1}^{n} W_i h_i}$$

where

F_x = force applied through the centre of mass at level x,

W_x, W_i = portion of W that is located at or is assigned to level x or i respectively, and

h_x, h_i = height, in m, above the base to level x or i respectively, as defined in Article 4.1.8.2.

[9] **9)** Accidental torsional effects applied concurrently with F_x shall be considered by applying torsional moments about the vertical axis at each level for each of the following cases considered separately:

[a] a) $+0.1D_{nx}F_x$, and

[b] b) $-0.1D_{nx}F_x$.

[10] **10)** Deflections obtained from a linear analysis shall include the effects of torsion and be multiplied by R_s/I_E to get realistic values of expected deflections.

[11] **11)** The deflections referred to in Sentence (10) shall be used to calculate the largest inter*storey* deflection, which shall not exceed

[a] a) $0.01h_s$ for *post-disaster buildings*,

[b] b) $0.02h_s$ for High Importance Category *buildings*, and

[c] c) $0.025h_s$ for all other *buildings*,

where h_s is the inter*storey* height as defined in Article 4.1.8.2.

[12] **12)** When earthquake forces are calculated using $R_s = 1.5$, the following elements in the SFRS shall have their design forces due to earthquake effects increased by 33%:

[a] a) diaphragms and their chords, connections, struts and collectors,

[b] b) tie downs in wood or drywall shear walls,

[c] c) connections and anchor bolts in steel- and wood-braced frames,

[d] d) connections in precast concrete, and

[e] e) connections in steel moment frames.

[13] **13)** Except as provided in Sentence (14), where cantilever parapet walls, other cantilever walls, exterior ornamentation and appendages, towers, chimneys or penthouses are connected to or form part of a *building*, they shall be designed, along with their connections, for a lateral force, V_{sp}, distributed according to the distribution of mass of the element and acting in the lateral direction that results in the most critical loading for design using the following equation:

$$V_{\mathrm{sp}} = 0.9S_a\left(0.2, X_{450}\right)F_s I_E W_p$$

where

W_p = weight of a portion of a structure as defined in Article 4.1.8.2.

[14] **14)** The value of V_{sp} shall be doubled for unreinforced masonry elements.

[15] **15)** Structures designed in accordance with this Article need not comply with the seismic requirements stated in the applicable design standard referenced in Section 4.3.

Impact analysis

The proposed change addresses an inconsistency in Subsection 4.1.8. by providing a harmonized specification of the datum to be used for the determination of $\bar{N}_{60}$ and $\bar{s}_u$. As a result, it would have a positive impact on Code users.

Since the proposed change does not involve a change to requirements, it should not result in any additional costs.

Enforcement implications

The proposed change would have positive implications for enforcement, as it would reduce inconsistency within Subsection 4.1.8. and facilitate error-free compliance with the NBC requirements regarding the determination of site properties.

Who is affected

Owners, designers, contractors and enforcement professionals dealing with the seismic design of buildings in low-seismicity locations that are covered under Article 4.1.8.1.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[4.1.8.1.] **4.1.8.1. ([1] 1) no attributions**

[4.1.8.1.] **4.1.8.1. ([2] 2) no attributions**

[4.1.8.1.] **4.1.8.1. ([2] 2) ([a] a) [F20-OS2.1]**

[4.1.8.1.] **4.1.8.1. ([2] 2) ([a] a) [F20-OP2.1,OP2.3] [F22-OP2.4]**

[4.1.8.1.] **4.1.8.1. ([2] 2) ([b] b) [F20-OS2.1]**

[4.1.8.1.] 4.1.8.1. ([2] 2) ([b] b) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([2] 2) ([c] c)

[4.1.8.1.] 4.1.8.1. ([3] 3) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([3] 3) [F20-OP2.1,OP2.4]

[4.1.8.1.] 4.1.8.1. ([4] 4) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([4] 4) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([5] 5) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([5] 5) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([6] 6) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([6] 6) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([7] 7) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([7] 7) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([8] 8) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([8] 8) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([9] 9) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([9] 9) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([10] 10) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([10] 10) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([11] 11) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([11] 11) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([12] 12) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([12] 12) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([13] 13) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([13] 13) [F20-OP2.3] [F22-OP2.3,OP2.4]

[4.1.8.1.] 4.1.8.1. ([14] 14) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([14] 14) [F20-OP2.3] [F22-OP2.3,OP2.4]

[4.1.8.1.] 4.1.8.1. ([15] 15) no attributions

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Proposed Change 1898

Code Reference(s):	**NBC20 Div.B 4.1.8.1. (first printing)**
Subject:	Earthquake Design
Title:	Revisions to Article 4.1.8.1. (Simplified Method)
Description:	The proposed change revises Article 4.1.8.1. by adjusting the triggers that determine the locations where the simplified method for seismic design applies and modifying the approach for determining the design spectral acceleration.

This change could potentially affect the following topic areas:

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

Problem

Article 4.1.8.1. of Division B of the NBC was introduced in the 2015 edition to provide a simplified method for the seismic design of buildings in localities where the seismic hazard is low. Due to the general increase in the seismic hazard values for the NBC 2020, the number of localities in the country where this method is permitted to be used for seismic design in compliance with the NBC has shrunk considerably.

In general, designers and enforcement professionals in localities where the simplified method was previously permitted are not familiar with the full (detailed) seismic design requirements. Therefore, the inability to use the simplified method presents a significant hardship for them.

Justification

The reduction in the number of localities where the simplified method can be used presents a hardship for Code users who have relied on this method since it was introduced in the NBC 2015 to satisfy seismic design requirements in localities where the seismic hazard is low. The use of the simplified method by designers in such localities ensured that buildings were designed for estimated earthquake loads without designers having to navigate the complexity of the seismic provisions in the rest of the Subsection 4.1.8.

However, the number of localities where this method is permitted be used has decreased significantly with the NBC 2020 seismic hazard values. If nothing is done, Code users in some localities where the simplified method was previously permitted will have to apply the full seismic design requirements. For localities with relatively low seismic hazard, this is an avoidable hardship. To mitigate this hardship, the proposed change increases the values of the hazard thresholds to expand the application of the simplified design method to match, to the extent possible, its application with the NBC 2015 seismic hazard values. It also harmonizes the determination of the values of the thresholds with the definitions in Article 4.1.8.2. to improve consistency between the simplified and full design methods.

PROPOSED CHANGE

[4.1.8.1.] 4.1.8.1. Analysis

[1] **1)** Except as permitted in Sentence (2), the deflections and specified loading due to earthquake motions shall be determined according to the requirements of Articles 4.1.8.2. to 4.1.8.23.

[2] **2)** Where $I_E\cancel{F_s}S_a(0.2,X_{\cancel{450}S})$ and $I_ES_a(0.5,X_S)$ are less than 0.2 and $I_E\cancel{F_s}S_a(\cancel{2}1.0,X_{\cancel{450}S})$ ~~are~~is less than ~~0.16 and 0.03 respectively~~0.1, the deflections and specified loading due to earthquake motions are permitted to be determined in accordance with Sentences (3) to (15), where

[a] a) I_E is the earthquake importance factor and has a value of 0.8, 1.0, 1.3 and 1.5 for *buildings* in the Low, Normal, High and Post-disaster Importance Categories respectively,

[b] b) ~~F_s is the site coefficient based on the average $\boxed{\overline{N}}_{60}$ or $\boxed{\overline{s}_u}$, as defined in Article 4.1.8.2., for the top 30 m of *soil* below the footings, *pile* caps, or mat *foundations* and has a value of~~

  [i] i) ~~1.0 for *rock* sites or when $\boxed{\overline{N}}_{60} > 50$ or $\boxed{\overline{s}_u} > 100$ kPa,~~

  [ii] ii) ~~1.6 when $15 \leq \boxed{\overline{N}}_{60} \leq 50$ or 50 kPa $\leq \boxed{\overline{s}_u} \leq 100$ kPa, and~~

  [iii] iii) ~~2.8 for all other cases, and~~

[c] c) $S_a(T,X_{\cancel{450}S})$ is the 5%-damped spectral acceleration ~~value~~ , expressed as a ratio to gravitational acceleration, at period T for

site designation X~~$_{450}$~~$_S$, as defined in ~~Article 4.1.8.2.~~Clause (d), determined in accordance with Subsection 1.1.3. and corresponding to a 2% probability of exceedance in 50 years~~,~~ and

[d] --) X_S is the site designation in terms of Site Class, where S is the Site Class determined using the average $\overline{N}_{60}$ or $\overline{s}_u$~~,~~ as defined in Article 4.1.8.2., for the top 30 m of *soil* and has a value of

[i] i) X_C for *rock* sites or where $\overline{N}_{60} > 50$ or $\overline{s}_u > 100$ kPa~~,~~

[ii] ii) X_D where $15 < \overline{N}_{60} \leq 50$ or 50 kPa $\leq \overline{s}_u \leq$ 100 kPa, and

[iii] iii) X_E for all other cases.

[3] 3) The structure shall have a clearly defined

[a] a) seismic force resisting system (SFRS) to resist the earthquake loads and their effects, and

[b] b) load path (or paths) that will transfer the inertial forces generated in an earthquake to the supporting ground.

[4] 4) An unreinforced masonry SFRS shall not be permitted where

[a] a) I_E is greater than 1.0, or

[b] b) the height above *grade* is greater than or equal to 30 m.

[5] 5) The height above *grade* of an SFRS designed in accordance with CSA S136, "North American Specification for the Design of Cold-Formed Steel Structural Members (using the Appendix B provisions applicable to Canada)", shall be less than 15 m.

[6] 6) Earthquake forces shall be assumed to act horizontally and independently about any two orthogonal axes.

[7] 7) The specified lateral earthquake force, V_s, at the base of the structure in the direction under consideration shall be calculated as follows:

$$\boxed{V_s = F_s S_a\left(T_s, X_{450}\right) I_E W \Big/ R_s}$$

$$V_s = S\left(T_s\right) I_E W \Big/ R_S$$

where

S~~$_a$~~(T_s~~,X_{450}~~) = ~~value of $S_a(T_s,X_{450})$~~design spectral acceleration at period T_s~~,~~ determined ~~by~~as follows, using linear interpolation for intermediate values of T_s~~between the values of $S_a(0.2,X_{450}\ ), S_a(0.5,X_{450})$ and $S_a(1.0,X_{450})$~~,

= S_a(0.2,X~~$_{450}$~~$_S$) or $S_a(0.5,X_S)$, whichever is greater, for $T_s \leq 0.2$ s, ~~and~~

= $S_a(0.5,X_S)$ for T_s = 0.5 s, and

= S_a(1.0,X~~$_{450}$~~$_S$) for $T_s \geq 1.0$ s,

W = sum of W_i over the height of the *building*, where W_i is defined in Article 4.1.8.2., and

R_s = 1.5, except R_s = 1.0 for structures where the *storey* strength is less than that in the *storey* above and for an unreinforced masonry SFRS,

where

$S_a(0.2,X_S)$, $S_a(0.5,X_S)$, $S_a(1.0,X_S)$ = 5%-damped spectral acceleration values at periods of 0.2 s, 0.5 s and 1.0 s, respectively, for site designation X_S, determined in accordance with Subsection 1.1.3. and corresponding to a 2% probability of exceedance in 50 years, and

T_s = fundamental lateral period of vibration of the *building*, as defined in Article 4.1.8.2.,
= $0.085(h_n)^{3/4}$ for steel moment frames,
= $0.075(h_n)^{3/4}$ for concrete moment frames,
= 0.1N for other moment frames,
= $0.025h_n$ for braced frames, and
= $0.05(h_n)^{3/4}$ for shear walls and other structures,

where

h_n = height, in m, above the base to level n, as defined in Article 4.1.8.2., and

N = total number of *storeys* above exterior *grade* to level n, as defined in Article 4.1.8.2.,

except that, in cases where $R_s = 1.5$, V_s need not be greater than ~~F_s~~$S_a(0.5,X_{\cancel{450}S})I_EW/R_s$.

[8] **8)** The specified lateral earthquake force, V_s, shall be distributed over the height of the *building* in accordance with the following formula:

$$F_x = \frac{V_s W_x h_x}{\sum_{i=1}^{n} W_i h_i}$$

where

F_x = force applied through the centre of mass at level x,

W_x, W_i = portion of W that is located at or is assigned to level x or i respectively, and

h_x, h_i = height, in m, above the base to level x or i respectively, as defined in Article 4.1.8.2.

[9] **9)** Accidental torsional effects applied concurrently with F_x shall be considered by applying torsional moments about the vertical axis at each level for each of the following cases considered separately:

[a] a) $+0.1D_{nx}F_x$, and

[b] b) $-0.1D_{nx}F_x$.

[10] **10)** Deflections obtained from a linear analysis shall include the effects of torsion and be multiplied by R_s/I_E to get realistic values of expected

deflections.

[11] **11)** The deflections referred to in Sentence (10) shall be used to calculate the largest inter*storey* deflection, which shall not exceed

[a] a) 0.01h_s for *post-disaster buildings*,

[b] b) 0.02h_s for High Importance Category *buildings*, and

[c] c) 0.025h_s for all other *buildings*,

where h_s is the inter*storey* height as defined in Article 4.1.8.2.

[12] **12)** When earthquake forces are calculated using R_S = 1.5, the following elements in the SFRS shall have their design forces due to earthquake effects increased by 33%:

[a] a) diaphragms and their chords, connections, struts and collectors,

[b] b) tie downs in wood or drywall shear walls,

[c] c) connections and anchor bolts in steel- and wood-braced frames,

[d] d) connections in precast concrete, and

[e] e) connections in steel moment frames.

[13] **13)** Except as provided in Sentence (14), where cantilever parapet walls, other cantilever walls, exterior ornamentation and appendages, towers, chimneys or penthouses are connected to or form part of a *building*, they shall be designed, along with their connections, for a lateral force, V_{sp}, distributed according to the distribution of mass of the element and acting in the lateral direction that results in the most critical loading for design using the following equation:

$$\boxed{V_{\mathrm{sp}} = 0.9S_a\left(0.2,\, X_{450}\right)F_s I_E W_p}$$

$$V_{\mathrm{sp}} = 0.9S_a\left(0.2, X_s\right)I_E W_p$$

where

W_p = weight of a portion of a structure as defined in Article 4.1.8.2.

[14] **14)** The value of V_{sp} shall be doubled for unreinforced masonry elements.

[15] **15)** Structures designed in accordance with this Article need not comply with the seismic requirements stated in the applicable design standard referenced in Section 4.3.

Impact analysis

The proposed change is expected to have a positive impact as it would alleviate a hardship for Code users in localities with relatively low seismic hazard where the simplified method is no longer permitted under the NBC 2020 due to an increase in the estimated values of seismic hazard.

The proposed change would provide relief for designers and enforcement professionals in such localities, as it reinstates the simplified method as a means of compliance with NBC in these localities.

Enforcement implications

The proposed change would have positive implications for enforcement, as it addresses the hardship resulting from the change of practice in the NBC 2020 for localities with relatively low seismic hazard.

The continued ability to use the simplified method for seismic design in localities with relatively low seismic hazard, where compliance with the full seismic design requirements would otherwise be required, would provide relief for enforcement professionals, as it would allow authorities having jurisdiction to use existing methods and resources without the need for additional training.

Who is affected

Owners, designers, contractors and enforcement professionals dealing with the seismic design of buildings in low-seismic-hazard localities covered under Article 4.1.8.1.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[4.1.8.1.] 4.1.8.1. ([1] 1) no attributions

[4.1.8.1.] 4.1.8.1. ([2] 2) no attributions

[4.1.8.1.] 4.1.8.1. ([2] 2) ([a] a) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([2] 2) ([a] a) [F20-OP2.1,OP2.3] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([2] 2) ([b] b) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([2] 2) ([b] b) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([2] 2) ([c] c)

[4.1.8.1.] 4.1.8.1. ([3] 3) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([3] 3) [F20-OP2.1,OP2.4]

[4.1.8.1.] 4.1.8.1. ([4] 4) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([4] 4) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([5] 5) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([5] 5) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([6] 6) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([6] 6) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([7] 7) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([7] 7) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([8] 8) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([8] 8) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([9] 9) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([9] 9) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([10] 10) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([10] 10) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([11] 11) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([11] 11) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([12] 12) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([12] 12) [F20-OP2.1] [F22-OP2.4]

[4.1.8.1.] 4.1.8.1. ([13] 13) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([13] 13) [F20-OP2.3] [F22-OP2.3,OP2.4]

[4.1.8.1.] 4.1.8.1. ([14] 14) [F20-OS2.1]

[4.1.8.1.] 4.1.8.1. ([14] 14) [F20-OP2.3] [F22-OP2.3,OP2.4]

[4.1.8.1.] 4.1.8.1. ([15] 15) no attributions

Submit a comment

Proposed Change 1996

Code Reference(s):	**NBC20 Div.B 4.1.8.3. (first printing)**
Subject:	Earthquake Load and Effects — General Requirements
Title:	Clarification of Provisions for Structural and Non-Structural Elements Not Part of the SFRS
Description:	The proposed change modifies the existing Code provisions for structural and non-structural elements that are not part of the defined seismic force resisting system (SFRS) of a building.

This change could potentially affect the following topic areas:

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

Problem

The ambiguity in the Code provisions for structural and non-structural elements that are not part of the designated seismic force resisting system (SFRS) in a building is a source of confusion among Code users, which has led to inconsistent interpretation of the Code.

The ambiguity causes difficulties for Code users, leads to varying compliance, and can result in unsafe structures that may carry a risk of damage and collapse that is higher than the level of risk acceptable in the NBC for a design-level earthquake event.

Justification

Earthquake design requires that a structure have a clearly defined SFRS that is designed to resist 100% of the earthquake loads and their effects. However, structural and non-structural elements that are part of the building but are not considered part of the SFRS must be accounted for, because their presence can contribute significantly to the overall behaviour of the building structure during an earthquake.

Article 4.1.8.3. of Division B of the NBC provides general requirements to help Code users deal with such elements. The provisions of the Article are currently being interpreted in different ways, leading to varying compliance. The proposed change separates non-load bearing masonry walls from other stiff non-load bearing elements, such as brick veneer and precast concrete wall panels, and provides specific requirements for each. The proposed change also provides additional guidance in explanatory Notes.

This proposed change will add clarity, reduce difficulties in complying with Article 4.1.8.3., and mitigate the risk of unsafe design resulting from incorrect interpretation of the Article.

PROPOSED CHANGE

[4.1.8.3.] 4.1.8.3. General Requirements

[1] 1) The *building* shall be designed to meet the requirements of this Subsection and of the design standards referenced in Section 4.3.

[2] 2) Structures shall be designed with a clearly defined load path, or paths, that will transfer the inertial forces generated in an earthquake to the supporting ground.

[3] 3) The structure shall have a clearly defined SFRS, as defined in Article 4.1.8.2.

[4] 4) The SFRS shall be designed to resist 100% of the earthquake loads and their effects. (See Note A-4.1.8.3.(4).)

[5] 5) ~~All s~~Structural ~~framing~~ elements that are not considered to be part of the SFRS must be investigated and shown to behave elastically or to have sufficient non-linear capacity to support their gravity loads while undergoing earthquake-induced deformations calculated from the deflections determined in Article 4.1.8.13.

[6] 6) Except as provided in Sentence (7), s~~S~~tiff non-*loadbearing* elements~~that are not considered part of the SFRS~~, such as ~~concrete,~~ ~~masonry,~~ brick veneer ~~or~~and precast concrete wall~~s or~~ panels, shall be separated from all structural elements of the *building* such that no interaction takes place as the *building* undergoes earthquake-induced deformations calculated from the deflections determined in Article 4.1.8.13.~~be~~

[a] a) ~~separated from all structural elements of the *building* such that no~~

~~interaction takes place as the *building* undergoes deflections due to earthquake effects as calculated in this Subsection, or~~

[b] b) ~~made part of the SFRS and satisfy the requirements of this Subsection.~~

~~(See Note A-4.1.8.3.(6).)~~

[7] --) Non-*loadbearing* masonry walls shall

[a] --) be separated from all structural elements of the *building* in accordance with Sentence (6), or

[b] --) be considered masonry infill shear walls that are part of the SFRS and satisfy the requirements of this Subsection.

(See Note A-4.1.8.3.(7)-2025.)

[8] --) Structural elements that have significant lateral stiffness, such as concrete walls, shall

[a] --) be made part of the SFRS and satisfy the requirements of this Subsection, or

[b] --) satisfy the requirements of Sentences (5) and (9)-2025.

(See Note A-4.1.8.3.(8)-2025.)

[9] 7) Stiffness imparted to the structure from structural elements that are not considered to be part of the SFRS, as described in Sentence (5) and Clause (8)(b)-2025~~, other than those described in Sentence (6)~~, shall not be used to resist earthquake deflections but shall be accounted for

[a] a) in calculating the period of the structure for determining ~~forces~~the earthquake loads and effects referred to in Sentence (4) if the added stiffness decreases the fundamental lateral period by more than 15%,

[b] b) in determining the irregularity of the structure, except the additional stiffness shall not be used to make an irregular SFRS regular or to reduce the effects of torsion ~~(see Note A-4.1.8.3.(7)(b) and (c))~~, and

[c] c) in designing the SFRS if inclusion of the structural elements that are not considered to be part of the SFRS in the analysis has an adverse effect on the SFRS. ~~(see Note A-4.1.8.3.(7)(b) and (c)).~~

(See Note A-4.1.8.3.(9)-2025.)

[10] 8) Structural modeling shall be representative of the magnitude and spatial distribution of the mass of the *building*, and of the stiffness ~~of all elements~~ of the SFRS~~, including stiff elements that are not separated in accordance with Sentence 4.1.8.3.(6),~~ and the elements described in Sentence (9)-2025, where appropriate, and shall account for

[a] a) the effect of cracked sections in reinforced concrete and reinforced masonry elements,

[b] b) the effect of the finite size of members and joints,

[c] c) sway effects arising from the interaction of gravity loads with the displaced configuration of the structure, and

[d] d) other effects that influence the lateral stiffness of the *building*.

(See Note A-4.1.8.3.(10~~8~~)-2025.

~~Note A-4.1.8.3.(6) General Design of Stiff Elements.~~

~~Information on the general design requirements for stiff elements can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)".~~

Note A-4.1.8.3.(7)-2025 Non-Loadbearing Masonry Walls.

When gaps are provided at the top and sides of a non-loadbearing masonry wall that are sufficient to ensure that no interaction takes place between the wall and the structural elements as the building undergoes earthquake-induced deformations, the wall will not contribute to the lateral stiffness of the structure and will not attract a significant portion of the earthquake loads. In this case, the wall would only need to be designed in accordance with Article 4.1.8.18. and CSA S304, “Design of masonry structures.”

When sufficient gaps are not provided, the wall may attract a significant lateral earthquake force and, therefore, must be designed to act as a masonry infill shear wall in accordance with CSA S304 to resist in-plane earthquake loads. Such walls are permitted to be included as “unreinforced masonry,” as defined in Table 4.1.8.9., in buildings in Seismic Categories SC1 and SC2 up to the permitted heights. In this case, the R_dR_o value of the combined SFRS with the “unreinforced masonry” must be taken as 1.0, in accordance with Table 4.1.8.9. and Sentence 4.1.8.9.(3).

For taller buildings in Seismic Categories SC1 and SC2 and for all buildings in Seismic Categories SC3 and SC4, the use of “unreinforced masonry” as an SFRS is not permitted. Therefore, any masonry walls that are made part of the SFRS in such buildings must satisfy, for the type of SFRS selected, the restrictions in Table 4.1.8.9. and the design and detailing requirements of CSA S304 corresponding to the appropriate value of R_dR_o.

Further information can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2025: Part 4 of Division B).”

Note A-4.1.8.3.(8)-2025 Concrete Walls.

A long concrete wall provided for architectural purposes, fire separation or another reason will often have high lateral stiffness in its strong-axis bending direction. Depending on how it is supported and connected to the floor diaphragms or other structural elements, the wall may attract a large portion of the earthquake loads. If this is the case, the wall should be made part of the SFRS. Such walls are permitted to be included, without any special seismic detailing, as “other concrete SFRSs not listed above,” as defined in Table 4.1.8.9., in buildings in Seismic Categories SC1 and SC2 up to the permitted heights. In this case, the R_dR_o value of the combined SFRS with the “other concrete SFRSs” must be taken as 1.0, in accordance with Table 4.1.8.9. and Sentence 4.1.8.9.(3).

For taller buildings in Seismic Categories SC1 and SC2 and for all buildings in Seismic Categories SC3 and SC4, the use of “other concrete SFRSs” is not permitted. Therefore, any concrete walls that are made part of the SFRS in such buildings must satisfy, for the type of SFRS selected, the restrictions in Table 4.1.8.9. and meet the design and detailing requirements of CSA A23.3, "Design of concrete structures," corresponding to the appropriate value of R_dR_o.

To be permitted to not be included as part of the SFRS, concrete walls must be sufficiently slender to remain elastic or must be subjected to sufficiently low levels of axial compression to have the necessary ductility, in order to meet the requirements of Sentence 4.1.8.3.(5). See CSA A23.3 for information on the design of concrete walls that are not part of the SFRS.

Further information can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2025: Part 4 of Division B)."

Note A-4.1.8.3.~~(7)(b) and (c)~~(9)-2025 Stiffness Imparted to the Structure from Structural Elements Not Part of the SFRS.

Information on stiffness imparted to the structure from structural elements that are not considered to be part of the SFRS can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)".

Note A-4.1.8.3.(~~8~~10)-2025 Structural Modeling.

The requirement in Sentence 4.1.8.3.(4) that the SFRS be designed to resist 100% of the earthquake loads and their effects and the requirement in Sentence 4.1.8.3.(9)-2025 that the structural modeling include the stiffness of all elements that influence the lateral stiffness of the building imply that two different structural models are necessary: a first model including the stiffness of the SFRS only and a second model including the stiffness of the SFRS and the additional elements that are not part of the SFRS. The results from the analysis of these models can be compared in order to determine whether a reduction in fundamental lateral period, a change in irregularity or any other adverse effect arises from the inclusion of the stiffness of the additional elements. Where required by Clause 4.1.8.3.(9)(c)-2025, the second model is used to scale the specified lateral earthquake force, V_d, determined for the first model.

Further ~~I~~information on structural modeling can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)".

Impact analysis

The proposed change clarifies the existing requirements of Article 4.1.8.3. It would help to ensure that interpretation and compliance are consistent with the intent of the Code and uniform across jurisdictions.

As a result, the impact of the proposed change is expected to be positive for Code users. As no new requirements are being proposed, the change would be cost neutral.

Enforcement implications

The proposed change clarifies the existing requirements of Article 4.1.8.3. It would help to ensure that interpretation and compliance are consistent with the intent of the Code and uniform across jurisdictions. Therefore, the proposed change is expected to have a positive impact on enforcement.

Who is affected

Owners, architects, designers and enforcement staff involved in building design and construction.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[4.1.8.3.] 4.1.8.3. ([1] 1) no attributions

[4.1.8.3.] 4.1.8.3. ([2] 2) [F20-OS2.1]

[4.1.8.3.] 4.1.8.3. ([2] 2) [F20-OP2.1,OP2.4]

[4.1.8.3.] 4.1.8.3. ([3] 3) [F20-OS2.1]

[4.1.8.3.] 4.1.8.3. ([3] 3) [F20-OP2.1] [F22-OP2.4]

[4.1.8.3.] 4.1.8.3. ([4] 4) [F20-OS2.1]

[4.1.8.3.] 4.1.8.3. ([4] 4) [F20-OP2.1] [F22-OP2.4]

[4.1.8.3.] 4.1.8.3. ([5] 5) [F20-OS2.1]

[4.1.8.3.] 4.1.8.3. ([5] 5) [F20-OP2.1] [F22-OP2.4]

[4.1.8.3.] 4.1.8.3. ([6] 6) [F20-OS2.1]

[4.1.8.3.] 4.1.8.3. ([6] 6) [F20-OP2.1] [F22-OP2.4]

[4.1.8.3.] -- ([7] --) [F20-OS2.1]

[4.1.8.3.] -- ([7] --) [F20-OP2.1] [F22-OP2.4]

[4.1.8.3.] -- ([8] --) [F20-OS2.1]

[4.1.8.3.] -- ([8] --) [F20-OP2.1] [F22-OP2.4]

[4.1.8.3.] 4.1.8.3. ([9] 7) [F20-OS2.1]

[4.1.8.3.] 4.1.8.3. ([9] 7) [F20-OP2.1] [F22-OP2.4]

[4.1.8.3.] 4.1.8.3. ([10] 8) [F20-OS2.1]

[4.1.8.3.] 4.1.8.3. ([10] 8) [F20-OP2.1] [F22-OP2.4]

Submit a comment

Proposed Change 1896

Code Reference(s):	**NBC20 Div.B 4.1.8.4. (first printing)**
Subject:	Earthquake Design — Site Properties
Title:	Clarification of the Scope of Article 4.1.8.4.
Description:	This proposed change adds an explanatory Note clarifying that the provisions of Article 4.1.8.4. may not apply to sites with certain ground profiles.

This change could potentially affect the following topic areas:

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

Problem

The requirements of Article 4.1.8.4. of Division B of the NBC may not apply to ground profiles that differ significantly from the generic ground profiles assumed in the models that underpin the NBC provisions. Therefore, the estimation of seismic hazard in accordance with Article 4.1.8.4. may not be appropriate for sites with such non-conforming ground profiles.

The NBC does not currently alert Code users to this important precondition for the application of the requirements of Article 4.1.8.4. The application of these requirements to sites with non-conforming ground profiles may lead to incorrect and inadequate design, which may increase the risk to life safety and the risk of injury beyond the risk levels that are currently acceptable in the NBC for a design-level earthquake event.

Justification

A wide range of ground profiles are found on construction sites. The models used to generate the estimated seismic hazard values for the NBC are based on generic ground profiles. Therefore, these estimates are not valid for sites with ground profiles that are significantly different from the generic profiles, such as sites with ground profiles having strong impedance contrast and sites above deep sedimentary basins. Use of the NBC provisions to calculate the seismic hazard for such sites would be inappropriate and may lead to incorrect results. Code users must be alerted to the limitations in the scope of Article 4.1.8.4.

Since it is not possible to codify all variations of ground profiles, an explanatory Note is proposed to inform Code users that certain ground profiles are not covered by the NBC. This information will prevent any increase (beyond the currently acceptable level in the NBC) in the risk to life safety and the risk of injury from the application of Code requirements to non-conforming ground profiles. A few examples of non-conforming ground profiles are provided in the Note. Additional guidance is proposed to be included in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2025: Part 4 of Division B)."

PROPOSED CHANGE

[4.1.8.4.] 4.1.8.4. Site Properties

(See Note 4.1.8.4.)

[1] 1) For site designation X, as determined in accordance with Sentence (2) or (3), the peak ground acceleration, PGA(X), the peak ground velocity, PGV(X), and the 5%-damped spectral acceleration values, $S_a(T,X)$, at periods T of 0.2 s, 0.5 s, 1.0 s, 2.0 s, 5.0 s and 10.0 s shall

[a] a) except as provided in Sentence (4), be determined in accordance with Subsection 1.1.3., and

[b] b) except as provided in Article 4.1.8.23., correspond to a 2% probability of exceedance in 50 years.

[2] 2) Except as provided in Sentence (3), the site designation referred to in Sentence (1) shall be determined using the average shear wave velocity, V_{s30}, calculated from in situ measurements of shear wave velocity, as follows:

[a] a) for the ground profiles described in Table 4.1.8.4.-A, the site designation shall be determined in accordance with the Table, and

[b] b) for all other ground profiles, the site designation shall be X_V, where V is the value of V_{s30}.

(See Note A-4.1.8.4.(2) and (3).)

Table [4.1.8.4.-A] 4.1.8.4.-A
Exceptions for Site Designation Using V_{s30} Calculated from In Situ Measurements
Forming Part of Sentence [4.1.8.4.] 4.1.8.4.([2] 2)

Ground Profile Characteristics		Site Designation
Average Shear Wave Velocity in Top 30 m, V_{s30}, Calculated from In Situ Measurements, in m/s	**Additional Characteristics**	
$V_{s30} > 760$	Ground profile contains more than 3 m of softer materials between *rock* and the underside of footing or mat foundations	X_{760}
$V_{s30} > 140$	Ground profile contains more than 3 m of *soil* with all the following characteristics: • plasticity index, PI > 20, • moisture content, w ≥ 40%, and • undrained shear strength, s_u < 25 kPa	X_E
$V_{s30} > 140$	Ground profile contains • liquefiable *soil*, quick and highly sensitive clay, collapsible weakly cemented *soil*, or other *soil* susceptible to failure or collapse under seismic loading, • more than 3 m of peat and/or highly organic clay, • more than 8 m of highly plastic *soil* (with PI > 75), or • more than 30 m of soft to medium-stiff clay	X_F
$V_{s30} \le 140$	n/a	X_F

[3] **3)** Where V_{s30} calculated from in situ measurements is not available, the site designation referred to in Sentence (1) shall be X_S, where S is the Site Class determined using the energy-corrected average standard penetration resistance, $\overline{N}_{60}$, or the average undrained shear strength, $\overline{s}_u$, in accordance with Table 4.1.8.4.-B, $\overline{N}_{60}$ and $\overline{s}_u$ being calculated based on rational analysis. (See Notes A-4.1.8.4.(3) and A-4.1.8.4.(2) and (3).)

Table [4.1.8.4.-B] 4.1.8.4.-B
Site Classes, S, for Site Designation X_S
Forming Part of Sentence [4.1.8.4.] 4.1.8.4.([3] 3)

Site Class, S	Ground Profile	Ground Profile Characteristics		
		Average Shear Wave Velocity in Top 30 m, V_{s30}, in m/s (1)	Average Standard Penetration Resistance in Top 30 m, $\bar{N}_{60}$, in Blows per 0.3 m	Average Undrained Shear Strength in Top 30 m, $\bar{s}_u$, in kPa
A	Hard *rock* (2)	$V_{s30} > 1\ 500$	n/a	n/a
B	*Rock* (2)	$760 < V_{s30} \leq 1\ 500$	n/a	n/a
C	Very dense *soil* and soft *rock*	$360 < V_{s30} \leq 760$	$\bar{N}_{60} > 50$	$\bar{s}_u > 100$
D	Stiff *soil*	$180 < V_{s30} \leq 360$	$15 < \bar{N}_{60} \leq 50$	$50 < \bar{s}_u \leq 100$
E	Soft *soil*	$140 < V_{s30} \leq 180$	$10 < \bar{N}_{60} \leq 15$	$40 < \bar{s}_u \leq 50$
		Any ground profile other than Site Class F that contains more than 3 m of *soil* with all the following characteristics: • plasticity index, PI > 20, • moisture content, w ≥ 40%, and • undrained shear strength, $s_u < 25$ kPa		
F	Other *soils* (3)	$V_{s30} \leq 140$	$\bar{N}_{60} \leq 10$	$\bar{s}_u \leq 40$
		Any ground profile that contains • liquefiable *soil*, quick and highly sensitive clay, collapsible weakly cemented *soil*, or other *soil* susceptible to failure or collapse under seismic loading, • more than 3 m of peat and/or highly organic clay, • more than 8 m of highly plastic *soil* (with PI > 75), or • more than 30 m of soft to medium-stiff clay		

Notes to Table [4.1.8.4.-B] 4.1.8.4.-B:

(1) See Note A-4.1.8.4.(2) and (3).

(2) Site designations X_A and X_B, corresponding to Site Classes A and B, are not to be used in cases where the ground profile contains more than 3 m of softer materials between *rock* and the underside of footing or mat *foundations*. The appropriate site designation for such cases is X_{760}.

(3) Site-specific geotechnical evaluation is required.

[4] **4)** Site-specific geotechnical evaluation is required to determine the values of PGA(X_F), PGV(X_F) and $S_a(T,X_F)$ for site designation X_F.

[5] **5)** Where structures on liquefiable *soils* have a fundamental lateral period, T_a, of 0.5 s or less, the site designation X and the corresponding values of $S_a(T,X)$ and PGA(X) are permitted to be determined in accordance with Sentence (1) by assuming that the *soils* are not liquefiable.

[6] **6)** The design spectral acceleration, S(T), shall be determined in accordance with Table 4.1.8.4.-C, using log–log or linear interpolation for intermediate values of T. (See Note A-4.1.8.4.(6).)

Table [4.1.8.4.-C] 4.1.8.4.-C
Design Spectral Acceleration
Forming Part of Sentence [4.1.8.4.] 4.1.8.4.([6] 6)

Period, T, in s	Design Spectral Acceleration, S(T)
≤ 0.2	$S_a(0.2,X)$ or $S_a(0.5,X)$, whichever is greater
0.5	$S_a(0.5,X)$
1.0	$S_a(1.0,X)$
2.0	$S_a(2.0,X)$
5.0	$S_a(5.0,X)$
10.0	$S_a(10.0,X)$

[7] **7)** Where required for the application of a standard referenced in this Subsection, the acceleration-based site coefficient, F_a, for site designation X shall be taken as $S(0.2)/S_a(0.2,X_{450})$ and the velocity-based site coefficient, F_v, for site designation X shall be taken as $S(1.0)/S_a(1.0,X_{450})$.

Note A-4.1.8.4. Site Properties.

The provisions of Article 4.1.8.4. may not be sufficient for determining the seismic hazard values for sites with ground profiles that differ significantly from the ground profiles implicit in the ground motion models (GMMs) used to establish the NBC seismic hazard values. A few examples of such sites are sites with ground profiles having strong impedance contrast, sites above deep sedimentary basins, sites near active faults, sloping bedrock sites, sites with ground profiles that are highly variable across the building footprint, and sites with ground improvements.

Information on the ground profiles used in the GMMs, as well as general guidance for sites with ground profiles that differ from those used in the GMMs, can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)".

Impact analysis

The proposed change is a clarification and does not add any new requirements. The impact would be neutral in terms of cost and positive in terms of facilitating the correct application of the Code.

Enforcement implications

The proposed change is a clarification of the scope of Article 4.1.8.4. It would help enforcement staff to properly understand the requirements of this Article and their application. No difficulties are expected to result from the proposed change.

Who is affected

Owners, designers, engineers, contractors and enforcement professionals dealing with geotechnical aspects of the design of buildings for earthquake loads.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[4.1.8.4.] 4.1.8.4. ([1] 1) [F20-OS2.1]

[4.1.8.4.] 4.1.8.4. ([1] 1) [F20-OP2.1] [F22-OP2.4]

[4.1.8.4.] 4.1.8.4. ([2] 2) [F20-OS2.1]

[4.1.8.4.] 4.1.8.4. ([2] 2) [F20-OP2.1] [F22-OP2.4]

[4.1.8.4.] 4.1.8.4. ([3] 3) no attributions

[4.1.8.4.] 4.1.8.4. ([4] 4) [F20-OS2.1]

[4.1.8.4.] 4.1.8.4. ([4] 4) [F20-OP2.1] [F22-OP2.4]

[4.1.8.4.] 4.1.8.4. ([5] 5) no attributions

[4.1.8.4.] 4.1.8.4. ([6] 6) [F20-OS2.1]

[4.1.8.4.] 4.1.8.4. ([6] 6) [F20-OP2.1] [F22-OP2.4]

[4.1.8.4.] 4.1.8.4. ([7] 7) no attributions

Submit a comment

Proposed Change 1897

Code Reference(s): **NBC20 Div.B 4.1.8.4. (first printing)**

Subject: Earthquake Design — Site Properties

Title: Clarification of the Permission for Liquefiable Soils

Description: The proposed change adds an explanatory Note clarifying the scope of the permission stated in Sentence 4.1.8.4.(5) for structures built on liquefiable soils.

This change could potentially affect the following topic areas:

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

Problem

The NBC provides a relaxation for the determination of spectral acceleration values for short-period structures on liquefiable soils. However, this relaxation could be incorrectly interpreted to bypass the requirement for checking the potential for liquefaction and its effect on the structure. A failure to check for this ground failure hazard could result in unsafe structures that carry a risk to life safety and a risk of injury that are above the risk levels currently acceptable in the NBC for a design-level earthquake event.

Justification

The relaxation provided in Sentence 4.1.8.4.(5) of Division B of the NBC for buildings on liquefiable soils has the potential to be misinterpreted. Misinterpretation and incorrect application of this relaxation may lead to geotechnical and structural failure, as well as an unacceptable risk of injury to the occupants and an unacceptable risk of damage to the building or loss of its use. The limited scope of this relaxation must be clearly expressed in the Code to prevent unsafe designs resulting from misinterpretation.

The proposed change clarifies the intent of the Code, by modifying Sentence 4.1.8.4.(5) and adding an explanatory Note, to prevent the potential misinterpretation of this Sentence, which could lead to inaccurate and unsafe building designs.

PROPOSED CHANGE

[4.1.8.4.] 4.1.8.4. Site Properties

[1] **1)** For site designation X, as determined in accordance with Sentence (2) or (3), the peak ground acceleration, PGA(X), the peak ground velocity, PGV(X), and the 5%-damped spectral acceleration values, $S_a(T,X)$, at periods T of 0.2 s, 0.5 s, 1.0 s, 2.0 s, 5.0 s and 10.0 s shall

- [a] a) except as provided in Sentence (4), be determined in accordance with Subsection 1.1.3., and
- [b] b) except as provided in Article 4.1.8.23., correspond to a 2% probability of exceedance in 50 years.

[2] **2)** Except as provided in Sentence (3), the site designation referred to in Sentence (1) shall be determined using the average shear wave velocity, V_{s30}, calculated from in situ measurements of shear wave velocity, as follows:

- [a] a) for the ground profiles described in Table 4.1.8.4.-A, the site designation shall be determined in accordance with the Table, and
- [b] b) for all other ground profiles, the site designation shall be X_V, where V is the value of V_{s30}.

(See Note A-4.1.8.4.(2) and (3).)

Table [4.1.8.4.-A] 4.1.8.4.-A
Exceptions for Site Designation Using V_{s30} Calculated from In Situ Measurements
Forming Part of Sentence [4.1.8.4.] 4.1.8.4.([2] 2)

Ground Profile Characteristics		Site Designation
Average Shear Wave Velocity in Top 30 m, V_{s30}, Calculated from In Situ Measurements, in m/s	Additional Characteristics	
$V_{s30} > 760$	Ground profile contains more than 3 m of softer materials between *rock* and the underside of footing or mat foundations	X_{760}
$V_{s30} > 140$	Ground profile contains more than 3 m of *soil* with all the following characteristics: • plasticity index, PI > 20, • moisture content, w ≥ 40%, and • undrained shear strength, s_u < 25 kPa	X_E
$V_{s30} > 140$	Ground profile contains • liquefiable *soil*, quick and highly sensitive clay, collapsible weakly cemented *soil*, or other *soil* susceptible to failure or collapse under seismic loading, • more than 3 m of peat and/or highly organic clay, • more than 8 m of highly plastic *soil* (with PI > 75), or • more than 30 m of soft to medium-stiff clay	X_F
$V_{s30} \leq 140$	n/a	X_F

[3] **3)** Where V_{s30} calculated from in situ measurements is not available, the site designation referred to in Sentence (1) shall be X_S, where S is the Site Class determined using the energy-corrected average standard penetration resistance, $\overline{N}_{60}$, or the average undrained shear strength, $\overline{s}_u$, in accordance with Table 4.1.8.4.-B, $\overline{N}_{60}$ and $\overline{s}_u$ being calculated based on rational analysis. (See Notes A-4.1.8.4.(3) and A-4.1.8.4.(2) and (3).)

Table [4.1.8.4.-B] 4.1.8.4.-B
Site Classes, S, for Site Designation X_S
Forming Part of Sentence [4.1.8.4.] 4.1.8.4.([3] 3)

<table>
<tr><th rowspan="2">Site Class, S</th><th rowspan="2">Ground Profile</th><th colspan="3">Ground Profile Characteristics</th></tr>
<tr><th>Average Shear Wave Velocity in Top 30 m, V_{s30}, in m/s (1)</th><th>Average Standard Penetration Resistance in Top 30 m, $\overline{N}_{60}$, in Blows per 0.3 m</th><th>Average Undrained Shear Strength in Top 30 m, $\overset{�}{s}_u$, in kPa</th></tr>
<tr><td>A</td><td>Hard <i>rock</i> (2)</td><td>$V_{s30} > 1\ 500$</td><td>n/a</td><td>n/a</td></tr>
<tr><td>B</td><td><i>Rock</i> (2)</td><td>$760 < V_{s30} \leq 1\ 500$</td><td>n/a</td><td>n/a</td></tr>
<tr><td>C</td><td>Very dense <i>soil</i> and soft <i>rock</i></td><td>$360 < V_{s30} \leq 760$</td><td>$\overline{N}_{60} > 50$</td><td>$\bar{s}_u > 100$</td></tr>
<tr><td>D</td><td>Stiff <i>soil</i></td><td>$180 < V_{s30} \leq 360$</td><td>$15 < \overline{N}_{60} \leq 50$</td><td>$50 < \bar{s}_u \leq 100$</td></tr>
<tr><td rowspan="2">E</td><td rowspan="2">Soft <i>soil</i></td><td>$140 < V_{s30} \leq 180$</td><td>$10 < \overline{N}_{60} \leq 15$</td><td>$40 < \bar{s}_u \leq 50$</td></tr>
<tr><td colspan="3">Any ground profile other than Site Class F that contains more than 3 m of <i>soil</i> with all the following characteristics:
• plasticity index, PI > 20,
• moisture content, w ≥ 40%, and
• undrained shear strength, $s_u < 25$ kPa</td></tr>
<tr><td rowspan="2">F</td><td rowspan="2">Other <i>soils</i> (3)</td><td>$V_{s30} \leq 140$</td><td>$\overline{N}_{60} \leq 10$</td><td>$\bar{s}_u \leq 40$</td></tr>
<tr><td colspan="3">Any ground profile that contains
• liquefiable <i>soil</i>, quick and highly sensitive clay, collapsible weakly cemented <i>soil</i>, or other <i>soil</i> susceptible to failure or collapse under seismic loading,
• more than 3 m of peat and/or highly organic clay,
• more than 8 m of highly plastic <i>soil</i> (with PI > 75), or
• more than 30 m of soft to medium-stiff clay</td></tr>
</table>

Notes to Table [4.1.8.4.-B] 4.1.8.4.-B:

(1) See Note A-4.1.8.4.(2) and (3).

---

(2) Site designations X_A and X_B, corresponding to Site Classes A and B, are not to be used in cases where the ground profile contains more than 3 m of softer materials between *rock* and the underside of footing or mat *foundations*. The appropriate site designation for such cases is X_{760}.

(3) Site-specific geotechnical evaluation is required.

---

[4] **4)** Site-specific geotechnical evaluation is required to determine the values of PGA(X_F), PGV(X_F) and S_a(T,X_F) for site designation X_F.

[5] **5)** Where structures on liquefiable *soils* have a fundamental lateral period, T_a, of 0.5 s or less, the site designation X and the corresponding values of S_a(T,X) and PGA(X) are permitted to be determined in accordance with Sentence (1) ~~by assuming that the~~ based on the pre-liquefaction *soil~~s~~* characteristics~~are not liquefiable~~. (See Note 4.1.8.4.(5).)

[6] **6)** The design spectral acceleration, S(T), shall be determined in accordance with Table 4.1.8.4.-C, using log−log or linear interpolation for intermediate values of T. (See Note A-4.1.8.4.(6).)

Table [4.1.8.4.-C] 4.1.8.4.-C
Design Spectral Acceleration
Forming Part of Sentence [4.1.8.4.] 4.1.8.4.([6] 6)

Period, T, in s	**Design Spectral Acceleration, S(T)**
≤ 0.2	S_a(0.2,X) or S_a(0.5,X), whichever is greater
0.5	S_a(0.5,X)
1.0	S_a(1.0,X)
2.0	S_a(2.0,X)
5.0	S_a(5.0,X)
10.0	S_a(10.0,X)

[7] **7)** Where required for the application of a standard referenced in this Subsection, the acceleration-based site coefficient, F_a, for site designation X shall be taken as S(0.2)/S_a(0.2,X_{450}) and the velocity-based site coefficient, F_v, for site designation X shall be taken as S(1.0)/S_a(1.0,X_{450}).

Note A-4.1.8.4.(5) Scope of the Permission for Structures on Liquefiable Soils.

The permission to use the pre-liquefaction soil characteristics, as stated in Sentence 4.1.8.4.(5), only applies for the purpose of determining the site designation, X, and the corresponding values of $S_a(T,X)$ and PGA(X). The potential for liquefaction of the soil and its consequences still need to be evaluated in accordance with Sentence 4.1.8.16.(10).

Impact analysis

The proposed change addresses the potential misinterpretation of Sentence 4.1.8.4.(5) by revising the Sentence and adding an explanatory Note clarifying its intent. The proposed change would have a positive impact, as it would remove the ambiguity in the requirement and, thereby, prevent inaccurate designs. The proposed change would not have a cost implication, as it is a clarification of an existing requirement.

Enforcement implications

The proposed change clarifies an existing requirement. As a result, it would alleviate the potential difficulties for enforcement officials arising from the ambiguity in this requirement. Awareness of the revised requirement would need to be raised, but no difficulty is expected to be encountered in checking compliance and no special testing is anticipated to be necessary.

Who is affected

Owners, designers, contractors and enforcement professionals dealing with the construction of low- or medium-rise buildings on liquefiable soils.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[4.1.8.4.] 4.1.8.4. ([1] 1) [F20-OS2.1]

[4.1.8.4.] 4.1.8.4. ([1] 1) [F20-OP2.1] [F22-OP2.4]

[4.1.8.4.] 4.1.8.4. ([2] 2) [F20-OS2.1]

[4.1.8.4.] 4.1.8.4. ([2] 2) [F20-OP2.1] [F22-OP2.4]

[4.1.8.4.] 4.1.8.4. ([3] 3) no attributions

[4.1.8.4.] 4.1.8.4. ([4] 4) [F20-OS2.1]

[4.1.8.4.] 4.1.8.4. ([4] 4) [F20-OP2.1] [F22-OP2.4]

[4.1.8.4.] 4.1.8.4. ([5] 5) no attributions

[4.1.8.4.] 4.1.8.4. ([6] 6) [F20-OS2.1]

[4.1.8.4.] 4.1.8.4. ([6] 6) [F20-OP2.1] [F22-OP2.4]

[4.1.8.4.] 4.1.8.4. ([7] 7) no attributions

Submit a comment

Proposed Change 1901

Code Reference(s): **NBC20 Div.B 4.1.8.18. (first printing)**
Subject: Earthquake Design — Parts and Portions
Title: Modification of the Requirements for Determining the Specified Lateral Earthquake Force
Description: This proposed change modifies the requirements for determining the specified lateral earthquake force, V_p, in Article 4.1.8.18.

This change could potentially affect the following topic areas:

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

Problem

The formula in Sentence 4.1.8.18.(1) of Division B of the NBC for the determination of the specified lateral earthquake force, V_p, on an element or component of a building provides incorrect results and, in some cases, unconservative design forces.

The formula is also inconsistent with those in standards used in other jurisdictions, such as ASCE and Eurocode standards. The force determined using the formula in the NBC may be either lower or higher than the actual estimated value.

In cases where the Code-calculated force is lower, the risk to life safety and risk of injury from the potential failure of the connection between the element or component and the structure are increased. In cases where the force is higher, unnecessary conservatism is introduced in the design of connections.

Justification

Sentence 4.1.8.18.(1) provides a formula for the determination of the lateral earthquake force, V_p, used to design the connections between structures and elements of structures, non-structural components and equipment. The current formula provides an unconservative value of the force for the design of connections in some cases. Such connections may fail in an earthquake.

A failure of the connections between elements and components and the structure poses significant risk to the safety of the building occupants and people in the vicinity of the building. In addition, past studies have indicated that damage from the failure of elements of structures and non-structural components is a major contributing factor to the overall impact of an earthquake. On the other hand, the formula provides overly conservative results in some cases, which may increase the cost of connections.

The proposed use of peak ground acceleration in the formula in Sentence 4.1.8.18.(1) instead of design spectral acceleration provides a value of V_p that is closer to its expected value in an earthquake. This change would, on one hand, mitigate the increased risk to life safety and higher probability of injury and, on the other hand, address the conservatism in the current requirement.

PROPOSED CHANGE

[4.1.8.18.] 4.1.8.18. Elements of Structures, Non-structural Components and Equipment

(See Note A-4.1.8.18.)

[1] **1)** Except as provided in Sentences (2), (7) and (16), elements and components of *buildings* described in Table 4.1.8.18. and their connections to the structure shall be designed to accommodate the *building* deflections calculated in accordance with Article 4.1.8.13. and the element or component deflections calculated in accordance with Sentence (9), and shall be designed for a specified lateral earthquake force, V_p, distributed according to the distribution of mass:

$$\boxed{V_p = 0.3S(0.2)I_E S_p W_p}$$

$$V_p = \mathrm{PGA}(X) I_E S_P W_P$$

where

~~S(0.2)~~ ~~= design spectral acceleration value at a period of 0.2 s, as defined in Sentence 4.1.8.4.(6),~~

PGA(X) = peak ground acceleration, expressed as a ratio to gravitational acceleration, for site designation X, as defined in Sentence 4.1.8.4.(1),

I_E = earthquake importance factor for the *building*, as defined in Article 4.1.8.5.,

~~S_p = $C_pA_rA_x/R_p$ (the maximum value of S_p shall be taken as 4.0 and the minimum value of S_p shall be taken as 0.7), where~~

~~C_p = element or component factor from Table 4.1.8.18.,~~

~~A_r = element or component force amplification factor from Table 4.1.8.18.,~~

~~A_x = height factor $(1 + 2h_x/h_n)$,~~

~~R_p = element or component response modification factor from Table 4.1.8.18., and~~

W_p = weight of the component or element, and~~.~~

S_p = horizontal force factor for the element or component and its connection, and

= $C_pA_rA_x/R_p$, but not less than 0.7 and not greater than 4.0,

where

C_p = element or component factor, as provided in Table 4.1.8.18.,

A_r = element or component force amplification factor, as provided in Table 4.1.8.18.,

R_p = element or component response modification factor, as provided in Table 4.1.8.18., and

A_x = height factor at level x to account for variation of response of the element or component with elevation within the *building*,

= 1 where the component or element is located at or below ground level, and

$$= 1 + 2.5\frac{h_x}{h_n} \text{ or } \frac{1 + \frac{1}{T_{ao}}\left(\frac{h_x}{h_n}\right) + \left(1 - \frac{0.4}{T_{ao}}\right)^2\left(\frac{h_x}{h_n}\right)^{10}}{\sqrt{\frac{1.1R_{do}}{I_E}}} \text{ otherwise,}$$

where

T_{ao} = lowest fundamental lateral period of the *building*, as defined in Sentence 4.1.8.11.(3), in either orthogonal direction, but not less than 0.4, and

R_{do} = ductility-related force modification factor of the *building*, as defined in Article 4.1.8.9., in the same orthogonal direction as T_{ao}, and

= 1.0 for the purposes of Article 4.1.8.23.

Table [4.1.8.18.] 4.1.8.18.
Elements of Structures and Non-structural Components and Equipment (1)
Forming Part of Sentences [4.1.8.18.] 4.1.8.18.([1] 1) to ([3] 3), ([6] 6), ([7] 7) and ([16] 16), and Clauses 4.1.8.23.(2)(c) and (3)(c)

Category	Part or Portion of *Building*	C_p	A_r	R_p
Architectural and Structural Components				
1	All exterior and interior walls, and cladding panels, except those in Category 2 or 3	1.00	1.00	2.50
2	Cantilever parapet and other cantilever walls, including cantilever cladding panels, except retaining walls	1.00	2.50	2.50
3	Exterior and interior ornamentations and appendages	1.00	2.50	2.50
4	Floors and roofs acting as diaphragms (2)	–	–	–
5	Towers, *chimneys*, smokestacks and penthouses when connected to or forming part of a *building*	1.00	2.50	2.50
6	Horizontally cantilevered floors, balconies, beams, etc.	1.00	1.00	2.50
7	Suspended ceilings, light fixtures and other attachments to ceilings with independent vertical support	1.00	1.00	2.50
8	Masonry veneer connections	1.00	1.00	1.50
9	Access floors	1.00	1.00	2.50
10	Masonry or concrete fences more than 1.8 m tall	1.00	1.00	2.50
Mechanical and Electrical Components				
11	Machinery, fixtures, equipment and tanks (including contents)			
	that are rigid and rigidly connected	1.00	1.00	1.25
	that are flexible or flexibly connected	1.00	2.50	2.50
12	Machinery, fixtures, equipment and tanks (including contents) containing toxic or explosive materials, materials having a *flash point* below 38°C or firefighting fluids			
	that are rigid and rigidly connected	1.50	1.00	1.25
	that are flexible or flexibly connected	1.50	2.50	2.50
13	Flat bottom tanks (including contents) attached directly to a floor at or below *grade* within a *building*	0.70	1.00	2.50

Category	**Part or Portion of *Building***	**C_p**	**A_r**	**R_p**
14	Flat bottom tanks (including contents) attached directly to a floor at or below *grade* within a *building* containing toxic or explosive materials, materials having a *flash point* below 38°C or firefighting fluids	1.00	1.00	2.50
15	Pipes, ducts (including contents)	1.00	1.00	3.00
16	Pipes, ducts (including contents) containing toxic or explosive materials	1.50	1.00	3.00
17	Electrical cable trays, bus ducts, conduits	1.00	2.50	5.00
Other System Components				
18	Rigid components with ductile material and connections	1.00	1.00	2.50
19	Rigid components with non-ductile material or connections	1.00	1.00	1.00
20	Flexible components with ductile material and connections	1.00	2.50	2.50
21	Flexible components with non-ductile material or connections	1.00	2.50	1.00
22	Elevators and escalators (3)			
	machinery and equipment	as per Category 11		
	elevator rails	1.00	1.00	2.50
23	Floor-mounted steel pallet storage racks (4)	1.00	2.50	2.50
24	Floor-mounted steel pallet storage racks on which are stored toxic or explosive materials or materials having a flash point below 38°C (4)	1.50	2.50	2.50

Notes to Table [4.1.8.18.] 4.1.8.18.:

(1) See Note A-Table 4.1.8.18.

(2) See Sentence (8).

(3) See also ASME A17.1/CSA B44, "Safety Code for Elevators and Escalators".

(4) See Sentence (13) and Note A-Table 4.1.8.18.

[2] **2)** For *buildings* in Seismic Category SC1 or SC2, other than *post-disaster buildings*, seismically isolated *buildings*, and *buildings* with supplemental

energy dissipation systems, the requirements of Sentence (1) need not apply to Categories 6 through 22 of Table 4.1.8.18.

[3] **3)** For the purpose of applying Sentence (1) for Categories 11 and 12 of Table 4.1.8.18., elements or components shall be assumed to be flexible or flexibly connected unless it can be shown that the fundamental period of the element or component and its connection is less than or equal to 0.06 s, in which case the element or component is classified as being rigid and rigidly connected.

[4] **4)** The weight of access floors shall include the *dead load* of the access floor and the weight of permanent equipment, which shall not be taken as less than 25% of the floor *live load*.

[5] **5)** When the mass of a tank plus its contents or the mass of a flexible or flexibly connected piece of machinery, fixture or equipment is greater than 10% of the mass of the supporting floor, the lateral forces shall be determined by rational analysis.

[6] **6)** Forces shall be applied in the horizontal direction that results in the most critical loading for design, except for Category 6 of Table 4.1.8.18., where the forces shall be applied up and down vertically.

[7] **7)** Connections to the structure of elements and components listed in Table 4.1.8.18. shall be designed to support the component or element for gravity loads, shall conform to the requirements of Sentence (1), and shall also satisfy these additional requirements:

[a] a) except as provided in Sentence (17), friction due to gravity loads shall not be considered to provide resistance to earthquake forces,

[b] b) R_p for non-ductile connections, such as adhesives or power-actuated fasteners, shall be taken as 1.0,

[c] c) R_p for shallow post-installed mechanical, post-installed adhesive, and cast-in-place anchors in concrete shall be 1.5, where shallow anchors are those with a ratio of embedment length to diameter of less than 8,

[d] d) post-installed mechanical, drop-in and adhesive anchors in concrete shall be pre-qualified for seismic applications by cyclic load testing in accordance with

[i] i) CSA A23.3, "Design of concrete structures", and

[ii] ii) ACI 355.2, "Qualification of Post-Installed Mechanical Anchors in Concrete (ACI 355.2-19) and Commentary", or ACI 355.4, "Qualification of Post-Installed Adhesive Anchors in Concrete (ACI 355.4-19) and Commentary", as applicable,

[e] e) post-installed mechanical and adhesive anchors in masonry and post-installed mechanical anchors in structural steel shall be pre-qualified for seismic applications by cyclic tension load testing (see Note A-4.1.8.18.(7)(e)),

[f] f) power-actuated fasteners shall not be used for cyclic tension loads,

[g] g) connections for non-structural elements or components of Category 1, 2 or 3 of Table 4.1.8.18. attached to the side of a *building* and

above the first level above *grade* shall satisfy the following requirements:

- [i] i) for connections where the body of the connection is ductile, the body shall be designed for values of C_p, A_r and R_p given in Table 4.1.8.18., and all of the other parts of the connection, such as anchors, welds, bolts and inserts, shall be capable of developing 2.0 times the nominal yield resistance of the body of the connection, and
- [ii] ii) connections where the body of the connection is not ductile shall be designed for values of $C_p = 2.0$, $R_p = 1.0$ and A_r given in Table 4.1.8.18., and

[h] h) a ductile connection is one where the body of the connection is capable of dissipating energy through cyclic inelastic behaviour.

[8] **8)** Floors and roofs acting as diaphragms shall satisfy the requirements for diaphragms stated in Article 4.1.8.15.

[9] **9)** Lateral deflections of elements or components shall be based on the loads defined in Sentence (1) and lateral deflections obtained from an elastic analysis shall be multiplied by R_p/I_E to give realistic values of the anticipated deflections.

[10] **10)** The elements or components shall be designed so as not to transfer to the structure any forces unaccounted for in the design, and rigid elements such as walls or panels shall satisfy the requirements of Sentence 4.1.8.3.(6).

[11] **11)** Seismic restraint for suspended equipment, pipes, ducts, electrical cable trays, etc. shall be designed to meet the force and displacement requirements of this Article and be constructed in a manner that will not subject hanger rods to bending.

[12] **12)** Isolated suspended equipment and components, such as pendent lights, may be designed as a pendulum system provided that adequate chains or cables capable of supporting 2.0 times the weight of the suspended component are provided and the deflection requirements of Sentence (10) are satisfied.

[13] **13)** Free-standing steel pallet storage racks are permitted to be designed to resist earthquake effects using rational analysis, provided the design achieves the minimum performance level required by Subsection 4.1.8. (See Note A-4.1.8.18.(13) and 4.4.3.1.(1).)

[14] **14)** Except as provided in Sentence (15), the relative displacement of glass in glazing systems, $D_{fallout}$, shall be equal to the greater of

[a] a) $D_{fallout} \geq 1.25 I_E D_p$, where

$D_{fallout}$ = relative displacement at which glass fallout occurs, and

D_p = relative earthquake displacement that the component must be designed to accommodate, calculated in accordance with Article 4.1.8.13. and applied over the height of the glass component, or

[b] b) 13 mm.

(See Note A-4.1.8.18.(14) and (15).)

[15] **15)** Glass need not comply with Sentence (14), provided at least one of the following conditions is met:

[a] a) the Seismic Category is SC1 or SC2,

[b] b) the glass has sufficient clearance from its frame such that $D_{clear} \geq 1.25D_p$ calculated as follows:

$$D_{\text{clear}} = 2C_1\left(1 + \frac{h_pC_2}{b_pC_1}\right)$$

where

D_{clear} = relative horizontal displacement measured over the height of the glass panel, which causes initial glass-to-frame contact,
C_1 = average of the clearances on both sides between the vertical glass edges and the frame,
h_p = height of the rectangular glass panel,
C_2 = averages of the top and bottom clearances between the horizontal glass edges and the frame, and
b_p = width of the rectangular glass panel,

[c] c) the glass is fully tempered, monolithic, installed in a non-*post-disaster building*, and no part of the glass is located more than 3 m above a walking surface, or

[d] d) the glass is annealed or heat-strengthened laminated glass in a single thickness with an interlayer no less than 0.76 mm and captured mechanically in a wall system glazing pocket with the perimeter secured to the frame by a wet, glazed, gunable, curing, elastomeric sealant perimeter bead of 13 mm minimum glass contact width.

(See Note A-4.1.8.18.(14) and (15).)

[16] **16)** ~~For structures with supplemental energy dissipation,~~Notwithstanding the requirements in the remainder of this Article, elements and components of *buildings* described in Table 4.1.8.18. and their connections to the structure ~~shall~~are permitted to be designed for a specified lateral earthquake force, V_p, determined at each floor level using a Non-linear Dynamic Analysis performed in accordance with Article 4.1.8.12., as follows:

$$V_p = S_{\text{sed}} I_E \left(\frac{C_p A_r}{R_p} \right) W_p$$

where

S_{sed} = peak spectral acceleration, $S_a(T,X)$, in the period range of T = 0 s to T = 0.5 s determined from the mean 5%-damped floor spectral acceleration values by averaging the individual 5%-damped floor response spectra at the centroid of the floor area at that floor level ~~determined using Non-linear Dynamic Analysis~~, and

I_E, C_p, A_r, R_p, W_p = as defined in Sentence (1).

(See Note A-4.1.8.18.(16).)

[17] **17)** For a ballasted array of interconnected solar panels mounted on a roof, where $I_E S(0.2)$ is less than or equal to 1.0, friction due to gravity loads is permitted to be considered to provide resistance to seismic forces, provided

- [a] a) the roof is not normally occupied,
- [b] b) the roof is surrounded by a parapet extending from the roof surface to not less than the greater of
  - [i] i) 150 mm above the centre of mass of the array, and
  - [ii] ii) 400 mm above the roof surface,
- [c] c) the height of the centre of mass of the array above the roof surface is less than the lesser of
  - [i] i) 900 mm, and
  - [ii] ii) one half of the smallest plan dimension of the supporting base of the array,
- [d] d) the roof slope at the location of the array is less than or equal to 3°,
- [e] e) the factored friction resistance calculated using the kinetic friction coefficient determined in accordance with Sentence (18) and a resistance factor of 0.7 is greater than or equal to the specified lateral earthquake force, V_p, on the array determined in accordance with Sentence (1) using values of $A_r = 1.0$, $A_x = 3.0$, $C_p = 1.0$, and $R_p = 1.25$,
- [f] f) the minimum clearance between the array and other arrays or fixed objects is the greater of
  - [i] i) 225 mm, and
  - [ii] ii) $1\,500(I_E S(0.2) - 0.4)^2$, in mm, and
- [g] g) the minimum clearance between the array and the roof parapet is the greater of
  - [i] i) 450 mm, and
  - [ii] ii) $3\,000(I_E S(0.2) - 0.4)^2$, in mm.

[18] **18)** For the purpose of Clause (17)(e), the kinetic friction coefficient shall be determined in accordance with ASTM G115, "Standard Guide for

Measuring and Reporting Friction Coefficients", through experimental testing that

[a] a) is carried out by an accredited laboratory on a full-scale array or a prototype of the array,

[b] b) models the interface between the supporting base of the array and the roof surface, and

[c] c) accounts for the adverse effects of anticipated climatic conditions on the friction resistance.

(See Note A-4.1.8.18.(18).)

Note A-4.1.8.18.(16) ~~Elements of Structures, Non-structural Components and Equipment in Structures with Supplemental Energy Dissipation~~Design Using Non-linear Dynamic Analysis.

Information on the requirements of Sentence 4.1.8.18.(16) can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)".

Impact analysis

The proposed change would not have a major impact on the design practice for and cost of connections for elements of structures and non-structural components. Modifications are proposed to an existing formula in Sentence 4.1.8.18.(1) for calculation of the specified lateral earthquake force, V_p. The triggers that determine the application of the Code requirements are not changed.

The cost impact of the change is expected to be very low. In most cases, the increase in V_p due to the use of peak ground acceleration in the formula is reduced by the decrease in V_p due to the use of the modified expression for the height factor, A_x.

On average, the increase in V_p is about 18%. The resulting increase in the overall cost of construction would be less than 0.05%.

Enforcement implications

The proposed change would have minimal enforcement implications, as it modifies existing formulae in the Code. The value of peak ground acceleration, which is proposed to be used in the formula for the specified lateral earthquake force, V_p, instead of design spectral acceleration, is provided by the NBC. The existing formula for the height factor, A_x, is retained to provide an option for Code users who do not want to use the new formula for A_x, which reduces the forces but is more complex.

The triggers for the application of the Code requirements are not changed. Code users would need to become familiar with the new formulae, but the proposed change would not involve a significant change in practice. Therefore, no difficulties are expected to be encountered in applying the change.

Who is affected

Owners, architects, designers, contractors and enforcement professionals dealing with the design of connections for elements of structures, non-structural components and equipment in large (Part 4) buildings.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[4.1.8.18.] 4.1.8.18. ([1] 1) [F20,F22-OS2.4]

[4.1.8.18.] 4.1.8.18. ([1] 1) [F20-OP2.3] [F22-OP2.3,OP2.4]

[4.1.8.18.] 4.1.8.18. ([2] 2) no attributions

[4.1.8.18.] 4.1.8.18. ([3] 3) no attributions

[4.1.8.18.] 4.1.8.18. ([4] 4) [F20,F22-OS2.4]

[4.1.8.18.] 4.1.8.18. ([4] 4) [F20,F22-OP2.3,OP2.4]

[4.1.8.18.] 4.1.8.18. ([5] 5) [F20,F22-OS2.1]

[4.1.8.18.] 4.1.8.18. ([5] 5) [F20,F22-OP2.1,OP2.4]

[4.1.8.18.] 4.1.8.18. ([6] 6) [F20,F22-OS2.4]

[4.1.8.18.] 4.1.8.18. ([6] 6) [F20,F22-OP2.3,OP2.4]

[4.1.8.18.] 4.1.8.18. ([7] 7) [F20,F22-OS2.4]

[4.1.8.18.] 4.1.8.18. ([7] 7) [F20,F22-OP2.3,OP2.4]

[4.1.8.18.] 4.1.8.18. ([7] 7) ([a] a) [F20,F22-OS2.4]

[4.1.8.18.] 4.1.8.18. ([7] 7) ([a] a) [F20,F22-OP2.3,OP2.4]

[4.1.8.18.] 4.1.8.18. ([7] 7) ([b] b),([c] c) [F20,F22-OS2.4]

[4.1.8.18.] 4.1.8.18. ([7] 7) ([b] b),([c] c) [F20,F22-OP2.3,OP2.4]

[4.1.8.18.] 4.1.8.18. ([7] 7) ([d] d),([f] f) [F20,F22-OS2.4]

[4.1.8.18.] 4.1.8.18. ([7] 7) ([d] d),([f] f) [F20,F22-OP2.3,OP2.4]

[4.1.8.18.] 4.1.8.18. ([7] 7) ([g] g) [F20,F22-OS2.4]

[4.1.8.18.] 4.1.8.18. ([7] 7) ([g] g) [F20,F22-OP2.3,OP2.4]

[4.1.8.18.] 4.1.8.18. ([7] 7) ([h] h)

[4.1.8.18.] 4.1.8.18. ([8] 8) no attributions

[4.1.8.18.] 4.1.8.18. ([9] 9) [F22-OS2.3,OS2.4]

[4.1.8.18.] 4.1.8.18. ([9] 9) [F22-OP2.3,OP2.4]

[4.1.8.18.] 4.1.8.18. ([10] 10) [F22-OS2.1,OS2.3,OS2.4]

[4.1.8.18.] 4.1.8.18. ([10] 10) [F22-OP2.1,OP2.3,OP2.4]

[4.1.8.18.] 4.1.8.18. ([11] 11) [F20-OS2.1] [F22-OS2.4]

[4.1.8.18.] 4.1.8.18. ([11] 11) [F20,F22-OP2.3,OP2.4]

[4.1.8.18.] 4.1.8.18. ([12] 12) [F20-OS2.1] [F22-OS2.3]

[4.1.8.18.] 4.1.8.18. ([12] 12) [F20-OP2.1] [F22-OP2.3]

[4.1.8.18.] 4.1.8.18. ([13] 13) no attributions

[4.1.8.18.] 4.1.8.18. ([14] 14) [F22-OS2.4]

[4.1.8.18.] 4.1.8.18. ([15] 15) no attributions

[4.1.8.18.] 4.1.8.18. ([16] 16) [F20,F22-OS2.4]

[4.1.8.18.] 4.1.8.18. ([16] 16) [F20-OP2.3] [F22-OP2.3,OP2.4]

[4.1.8.18.] 4.1.8.18. ([17] 17) no attributions

[4.1.8.18.] 4.1.8.18. ([18] 18) no attributions

Submit a comment

Proposed Change 1899

Code Reference(s): **NBC20 Div.B 4.1.8.23. (first printing)**

Subject: Earthquake Design — Other

Title: Clarification of the Performance Requirements for Post-disaster Buildings, High Importance Category Buildings, and a Subset of Normal Importance Category Buildings

Description: This proposed change clarifies the additional performance requirements in Article 4.1.8.23. for post-disaster buildings, High Importance Category buildings, and a subset of Normal Importance Category buildings.

This change could potentially affect the following topic areas:

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

Problem

A lack of clarity in some of the existing requirements of Article 4.1.8.23. of Division B of the NBC could result in difficulties for designers complying with the requirements and for enforcement staff checking compliance with the requirements. The lack of clarity may also lead to post-disaster buildings, High Importance Category buildings, and a subset of Normal Importance Category buildings that do not meet their performance objective (no structural damage) under lower-intensity, more frequently occurring earthquakes. In other cases, the lack of clarity may result in overconservative designs having a higher than necessary cost of construction.

Justification

Article 4.1.8.23. was introduced in the NBC 2020 to specify additional performance requirements for post-disaster buildings, High Importance Category buildings, and a subset of Normal Importance Category buildings. The performance requirements in this Article represent a novel approach for Code users. For the purpose of compliance with Article 4.1.8.23., the buildings must behave elastically and meet reduced drift limits when subjected to lower-intensity ground motions that occur more frequently than the design ground motions (DGMs).

The novelty of the approach in Article 4.1.8.23. requires clarification and additional information to support better understanding by Code users. Guidance was added to the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)," but more importantly, revisions must be made to clarify the Code for regulatory purposes. The proposed change makes the necessary modifications to improve understanding of the requirements and to ensure accurate compliance with the requirements. It clarifies how the requirements in Subsection 4.1.8. for earthquakes with a 2%-in-50-year probability of exceedance are to be applied for the purposes of compliance with Article 4.1.8.23. This clarification would reduce the difficulties encountered in the application of this Article and prevent unsafe or overconservative designs resulting from the lack of clarity in the Code.

PROPOSED CHANGE

[4.1.8.23.] 4.1.8.23. Additional Performance Requirements for Post-disaster Buildings, High Importance Category Buildings, and a Subset of Normal Importance Category Buildings

[1] 1) Except for *buildings* designed in accordance with Clause 4.1.8.22.(6)(b), this Article does not apply to ~~*B*~~*buildings* designed in accordance with Articles 4.1.8.19. to 4.1.8.22.~~need not comply with this Article~~.

[2] 2) The design of *post-disaster buildings* in Seismic Category SC2, SC3 or SC4 shall be verified using 5%-damped spectral acceleration values based on a 5% probability of exceedance in 50 years and shall satisfy the following requirements:

- [a] a) the *building* shall be shown to behave elastically for a specified lateral earthquake force~~, V,~~ determined in accordance with ~~Sentence 4.1.8.11.(2)~~Article 4.1.8.11. or 4.1.8.12., as appropriate, using I_E = 1.0 and R_dR_o = 1.3,
- [b] b) the largest inter*storey* deflection at any level of the *building*, as determined in accordance with Sentence 4.1.8.13.(2) using I_E = 1.0 and R_dR_o = ~~1.0~~1.3, shall not exceed $0.005h_s$, and
- [c] c) the connections of elements and components of the *building* described in Table 4.1.8.18. with R_p > ~~1.5~~1.3 shall be shown to behave elastically for a specified lateral earthquake force, V_p, determined in accordance with Sentence 4.1.8.18.(1) using I_E = 1.0

and R_p = ~~1.5~~1.3.

[3] 3) The design of High Importance Category *buildings* in Seismic Category SC3 or SC4 shall be verified using 5%-damped spectral acceleration values based on a 10% probability of exceedance in 50 years and shall satisfy the following requirements:

- [a] a) the *building* shall be shown to behave elastically for a specified lateral earthquake force~~, V,~~ determined in accordance with~~Sentence 4.1.8.11.(2)~~ Article 4.1.8.11. or 4.1.8.12., as appropriate, using I_E = 1.0 and R_dR_o = 1.3,
- [b] b) the largest inter*storey* deflection at any level of the *building*, as determined in accordance with Sentence 4.1.8.13.(2) using I_E = 1.0 and R_dR_o = ~~1.0~~1.3, shall not exceed $0.005h_s$, and
- [c] c) the connections of elements and components of the *building* described in Table 4.1.8.18. with R_p > 1.3 shall be shown to behave elastically for a specified lateral earthquake force, V_p, determined in accordance with Sentence 4.1.8.18.(1) using I_E = 1.0 and R_p = 1.3.

[4] 4) For Normal Importance Category *buildings* in Seismic Category SC4 with a height above *grade* of more than 30 m, the structural ~~framing~~ elements not considered to be part of the SFRS shall be designed to behave elastically for a specified lateral earthquake force~~, V,~~ determined in accordance with~~Sentence 4.1.8.11.(2)~~ Article 4.1.8.11. or 4.1.8.12., as appropriate, using 5%-damped spectral acceleration values based on a 10% probability of exceedance in 50 years and R_dR_o = 1.3.

[5] 5) For the purposes of applying Sentences (2) to (4), the following criteria shall apply: ~~torsional moments due to accidental eccentricities need not be considered if B, as determined in accordance with Sentence 4.1.8.11.(10), does not exceed 1.7.~~

- [a] --) the SFRS and structural elements not considered to be part of the SFRS are permitted to be used to resist earthquake loads and deflections,
- [b] --) the structural modeling shall be in accordance with Sentence 4.1.8.3.(8) using appropriate stiffness,
- [c] --) except as provided in Clause (d), the design spectral acceleration, S(T), shall be determined in accordance with Article 4.1.8.4. but using the 5%-damped spectral acceleration values specified in Sentences (2) to (4),
- [d] --) the Seismic Category shall be unchanged from that determined in accordance with Article 4.1.8.5. using
  - [i] --) the 5%-damped spectral acceleration values having a 2% probability of exceedance in 50 years, and
  - [ii] --) the value of I_E given in Table 4.1.8.5.-A,
- [e] --) the designation of the structure as regular or irregular determined in accordance with Article 4.1.8.6. shall be unchanged from that determined for the 5%-damped spectral acceleration values having a 2% probability of exceedance in 50 years,

[f] --) the method of analysis shall be in accordance with Article 4.1.8.7.,

[g] --) for *buildings* with a Type 9 or 10 irregularity as described in Table 4.1.8.6., the analysis shall account for

  [i] --) the effects of the vertical response of the *building* mass, and

  [ii] --) the vertical ground motions,

[h] --) except as provided in Clause (i), torsional effects shall be accounted for using the procedures given in Article 4.1.8.11. or 4.1.8.12., as appropriate,

[i] --) the torsional moments due to accidental eccentricities need not be considered if B, as determined in accordance with Sentence 4.1.8.11.(10) using a structural model satisfying Clause (b), does not exceed 1.7,

[j] --) where the Dynamic Analysis Procedure described in Article 4.1.8.12. is used to determine the specified lateral earthquake force, V_d, the requirements of Sentences 4.1.8.12.(8), (9) and (12) need not apply,

[k] --) the increased displacements of the structure resulting from *foundation* movement, as described in Sentence 4.1.8.16.(1), need not be considered, and

[l] --) except as provided in Clauses (a) to (k), the requirements of Articles 4.1.8.9., 4.1.8.10. and 4.1.8.14. to 4.1.8.17. need not apply.

(See Note A-4.1.8.23.(5).)

~~[6] 6)~~ ~~For the purposes of applying Sentences (2) to (4), elements of the SFRS and structural framing elements not considered to be part of the SFRS, when included in the analysis, shall be modeled in accordance with Sentence 4.1.8.3.(8) using elastic properties.~~

~~[7] 7)~~ ~~All other requirements of Articles 4.1.8.2. to 4.1.8.18. shall be satisfied in meeting the additional requirements of this Article.~~

Note A-4.1.8.23.(5) Elastic Analysis Required by Article 4.1.8.23.

When Article 4.1.8.11. is used to determine the specified lateral earthquake force, V, for the smaller design spectral acceleration values, $S(T_a)$, corresponding to the higher probabilities of exceedance specified in Sentences 4.1.8.23.(2) to (4), the fundamental lateral period, T_a, may need to be recalculated to account for the higher stiffness of a building that behaves elastically. In addition, the higher mode factor, M_v, and the base overturning moment reduction factor, J, may need to be recalculated to account for the different spectral ratios, S(0.2)/S(0.5), as well as the different fundamental lateral period, T_a.

Impact analysis

The proposed changes clarifies existing requirements. As a result, no cost impact is expected. The proposed clarifications would support a better understanding of the intent of Article 4.1.8.23. by Code users. Therefore, the impact on industry and enforcement is expected to be positive.

Enforcement implications

The proposed change supports a better understanding of the requirements of Article 4.1.8.23. This better understanding is expected to lead to improved compliance and smoother enforcement.

Who is affected

Owners, designers, contractors and enforcement professionals dealing with the construction of post-disaster buildings and High Importance Category buildings on sites with moderate or high seismic hazard and the construction of Normal Importance Category buildings more than 30 m tall on sites with high seismic hazard.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[4.1.8.23.] 4.1.8.23. ([1] 1) no attributions

[4.1.8.23.] 4.1.8.23. ([2] 2) [F20-OS2.1]

[4.1.8.23.] 4.1.8.23. ([2] 2) [F22-OP2.3,OP2.4]

[4.1.8.23.] 4.1.8.23. ([3] 3) [F20-OS2.1]

[4.1.8.23.] 4.1.8.23. ([3] 3) [F22-OP2.3,OP2.4]

[4.1.8.23.] 4.1.8.23. ([4] 4) [F20-OS2.1]

[4.1.8.23.] 4.1.8.23. ([5] 5) no attributions

~~[4.1.8.23.] 4.1.8.23. ([6] 6) no attributions~~

~~[4.1.8.23.] 4.1.8.23. ([7] 7) no attributions~~

Submit a comment

Proposed Change 1767

Code Reference(s):	**NBC20 Div.B 9.8.5.4. (first printing)**
Subject:	Accessibility — Anthropometrics
Title:	Slope of Ramps Not Located in Barrier-Free Paths of Travel
Description:	This proposed change modifies the maximum allowable slope of ramps not located in barrier-free paths of travel so they are safer to use.
Related Proposed Change(s):	PCF 1503

This change could potentially affect the following topic areas:

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

Problem

Ramps that are steeper than 1 in 12 are unsafe for many people and should not be allowed in access to exits, as they could impede the safe movement of people in the event of an emergency or in everyday use or navigation of the building. In the 2020 edition of the National Building Code of Canada (NBC), Part 3 was updated to limit ramp slopes to 1 in 12 unless the ramps are in industrial occupancies or in aisles of assembly occupancies. Part 9 has not yet been updated to reflect this change. This lack of consistency could lead to safety issues for people navigating ramps in Part 9 buildings if they expect gentler slopes as they would have in a Part 3 building.

Justification

A slope of 1 in 12 was

- identified through a cross-jurisdictional scan by the National Research Council of Canada as the minimum standard for ramps, and
- determined to be the international best practice in universal design.

People with low-level quadriplegia, older adults, people with low stamina, people with multiple disabilities (e.g., multiple sclerosis, amyotrophic lateral sclerosis, Parkinson's disease, cerebral palsy, low vision or balance issues) and other people with mobility impairments have difficulty climbing steeper slopes. People who wear prosthetic feet or foot orthotics that do not bend can also experience difficulty with steeper slopes, to the point of having to use the stairs if their orthotics do not bend at all, for example. The transition from a flat surface to a steep slope can cause foot plates or anti-tip bars to jam.

To provide safer ramps for building users of all abilities, this proposed change would limit the maximum slope of ramps in access to exits, except those in industrial occupancies, to 1 in 12. An exception would be provided for ramps serving dwelling units, as a gentler slope may be difficult to achieve on smaller lots due to space limitations. In such cases, the requirement would remain the same as in the NBC 2020.

Slope requirements for ramps not in barrier-free paths of travel were modified in Part 3 of the NBC ahead of the publication of the 2020 Codes. However, Part 9 requirements were not updated at the same time. This proposed change would therefore harmonize ramp slope requirements between the two Parts and ensure that occupants of Part 9 buildings receive the level of safety already required in Part 3 buildings.

PROPOSED CHANGE

[9.8.5.4.] 9.8.5.4. Ramp Slope

[1] **1)** Except as provided in Section 3.8,~~The slope of~~ *ramps* shall have a slope that is uniform along their length and~~be~~ not more than

[a] a) ~~1 in 10 for exterior *ramps*,~~

[b] b) 1 in 10 for interior and exterior *ramps* serving ~~*residential occupancies*~~*dwelling units*,

[c] c) 1 in 6 for interior *ramps* and 1 in 10 for exterior *ramps* serving *industrial occupancies*, and

[d] d) 1 in 12~~8~~ for interior and exterior *ramps* serving all other *occupancies*.

Impact analysis

The proposed change would reduce the maximum allowable ramp slope in most occupancies (i.e., other than industrial occupancies and dwelling units), thereby enabling people to use ramps more safely. For designs already using slopes of 1 in 12 or less, the proposed change would not create additional costs. For example, the slopes of ramps in barrier-free paths of travel are already limited to not more than 1 in 12 by Sentence 3.8.3.5.(1).

In areas where slopes steeper than 1 in 12 are currently permitted, the proposed change could result in more square footage being used to build ramps. Additional materials may also be required for the added ramp length and longer handrails. A relaxation for dwelling units that would maintain the requirement in the NBC 2020 is included in the proposed change, as residential building lots may have insufficient space to allow for longer ramps.

For example, for an exterior ramp that is not required to provide a barrier-free path of travel, the maximum slope would be reduced from 1 in 10 to 1 in 12. For a rise of 1 m, the new requirements would add 2 m in length (or about 1.8 m^2, if the ramp is 900 mm wide) to the 9 m^2 already used by a ramp conforming to the existing requirements. Cost data provided by RSMeans estimates that cast concrete access ramps with handrails cost around $2,700 per linear metre for a 900 mm wide ramp, while aluminum or steel ramps with handrails cost approximately $1,230 to $1,400 per linear metre.

A 1 m rise is substantial for any ramp, however, and in some cases, a mechanical lift may be safer, easier for people to navigate, more economical and less square footage intensive than a ramp. According to cost data published by RSMeans, the estimated cost for a lift ranges from $10,800 to $25,500, roughly, depending on its features (i.e., residential, commercial, capacity, range, indoor/outdoor), which is similar to the cost range for a steel ramp of about 9 m. However, it should be noted that a ramp may be more reliable in the case of an emergency (e.g., a power outage) and would require less maintenance than a mechanical lift.

Table 1 summarizes the impact analysis. Note that the cost estimates for the 1 in 10 ramp and 1 in 8 ramp are in relation to the estimates for a 1 in 12 ramp, representing the cost difference between an NBC 2020-compliant ramp and one that would be required by the proposed change.

Table 1. Summary of the Cost Impact and Benefits of Reduced Ramp Slope Maximum

Ramp Compliant With the NBC 2020	Cost Difference to Install 1 in 12 Ramp	Benefits of the Proposed Change
1 in 12 slope, 1 m rise (0.5 m rise)	$0 ($0)	It is not always clear whether a path of travel is barrier-free, so having uniform maximum slope requirements for all paths of travel would allow building users to be confident in their expectations of a ramp.
1 in 10 slope, 1 m rise (0.5 m rise)	+$5,400 (+$2,700) per ramp	Note A-3.8.3.5.(1)(b), Ramp Slopes, explains that "ramps with a slope of more than 1 in 16 can be very difficult for persons with physical disabilities with upper body mobility to manage." Decreasing the maximum permitted slope from 1 in 10 to 1 in 12 would therefore better align ramp requirements with what is considered manageable.
1 in 8 slope, 1 m rise (0.5 m rise)	+$10,800 (+$5,400) per ramp	

Enforcement implications

This proposed change could be enforced by the infrastructure currently in place to enforce the Code, through visual inspection and measurement tools.

Who is affected

Occupants would be able to use ramps more safely.

Designers and builders would need to ensure ramps comply with the requirements.

Building officials would need to evaluate compliance with the requirements.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.8.5.4.] 9.8.5.4. ([1] 1) [F30-OS3.1] [F10-OS3.7]

Submit a comment

Proposed Change 1969

Code Reference(s):	**NBC20 Div.B 9.10.17.10. (first printing)**
Subject:	Building Fire Safety
Title:	New Part 9 Provision with Cross-Reference to a Standard for Testing of Protective Coverings over Foamed Plastic Insulation
Description:	This proposed change introduces Clause 9.10.17.10.(1)(d), and its cross-reference to Part 3, to maintain harmonization between proposed changes to provisions in Parts 3 and 9 for the protection of foamed plastics.
Related Proposed Change(s):	PCF 1476, PCF 1967

This change could potentially affect the following topic areas:

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

Problem

The National Building Code of Canada (NBC) includes requirements for the protection of foamed plastics for both combustible and noncombustible construction in Part 3. Depending on the application, current acceptable solutions to achieve this protection include a variety of prescriptive options (e.g., interior finishes) or performance test methods.

Currently, the options in Part 9 for the protection of foamed plastics (Sentence 9.10.17.10.(1)) mirror those in Part 3 for combustible construction (Sentence 3.1.4.2.(1)). Furthermore, both Clauses 9.10.17.10.(1)(c) and 3.1.4.2.(1)(c) currently include a cross-reference to Sentence 3.1.5.15.(2), which provides additional (more stringent) protection options for noncombustible construction (on the basis that these options are also acceptable for combustible construction, as reiterated in explanatory Note A-3.1.4.2.(1)(c)).

A related proposed change (PCF 1967) introduces an additional compliance path in Sentences 3.1.4.2.(1), 3.1.5.15.(2) and 3.1.5.15.(3). The proposed compliance path provides an option of performance test method for the evaluation of assemblies that incorporate a protective covering (e.g., intumescent coating) by introducing a reference to a new standard, CAN/ULC-S145:2018, "Standard Method of Test for the Evaluation of Protective Coverings for Foamed Plastic Insulation – Full-Scale Room Test."

As more options for protective coverings enter the market, it becomes more critical to provide manufacturers, regulators and Code users with an additional compliance path that specifies a minimum level of performance for these products to be considered acceptable solutions where incorporated in a tested assembly. Furthermore, regulators and authorities having jurisdiction continue to struggle to accept such products, which could cause economic hardship within the foamed plastics industry.

In order for the same compliance path to be extended as an option for Part 9 buildings as intended, a cross-reference is needed in Sentence 9.10.17.10.(1) to proposed Clause 3.1.4.2.(1)(d) (PCF 1967). Otherwise, there would be no link from Part 9 to the proposed new compliance path for combustible construction in Part 3, and the only option for evaluating these types of products in accordance with CAN/ULC-S145 for Part 9 buildings would be the more stringent requirement provided in proposed Clause 3.1.5.15.(2)(f) (PCF 1967). This Clause also introduces a reference to CAN/ULC-S145, but requires an increased classification, which was found to be justified for buildings required to be of noncombustible construction.

Justification

This proposed change introduces new Clause 9.10.17.10.(1)(d) to provide cross-references to proposed Clause 3.1.4.2.(1)(d) and its explanatory Note, which harmonizes provisions for the protection of foamed plastics.

As stated in PCF 1967, the proposed change in Part 3 introduces a reference to CAN/ULC-S145 on the basis that it offers a suitable performance-based approach to limit the contribution of foamed plastic insulation to early fire growth. PCF 1967 provides Code users (including manufacturers, designers, regulators and authorities having jurisdiction) with an additional compliance path that outlines an acceptable level of performance for protective covering products to be considered acceptable solutions in assemblies, which facilitates enforcement.

The proposed new compliance path is consistent with the existing intent statements of the NBC. Performance-based room corner tests provide a clear indication of the onset of flashover, which impacts both the time available for egress and the potential contribution of a material to fire growth and spread. These tests are recognized and relied on worldwide in building code regulations. Feedback from many Canadian fire experts indicated that the proposed classifications for protective coverings in CAN/ULC-S145 relate directly to the hazard that the Code intends to limit.

This proposed change also updates Clause 9.10.17.10.(1)(c) on the basis that "protective coverings" should not necessarily be qualified as "thermal barriers". This change is needed in Part 9 to incorporate the correct technical language and remain consistent with the equivalent proposed changes in Part 3.

PROPOSED CHANGE

[9.10.17.10.] 9.10.17.10. Protection of Foamed Plastics

(See Note A-3.1.4.2.)

[1] **1)** Except as provided in Sentences (2) and (3), foamed plastics that form part of a wall or ceiling assembly shall be protected from adjacent space in the *building*, other than adjacent concealed spaces within *attic or roof spaces*, crawl spaces, wall assemblies and ceiling assemblies

- [a] a) by one of the interior finishes described in Subsections 9.29.4. to 9.29.9.,
- [b] b) provided the *building* does not contain a Group C *major occupancy*, by sheet metal that
  - [i] i) is mechanically fastened to the supporting assembly independent of the insulation,
  - [ii] ii) is not less than 0.38 mm thick, and
  - [iii] iii) has a melting point not less than 650°C, ~~or~~
- [c] c) by any ~~thermal barrier~~protection method that meets the requirements of Sentence 3.1.5.15.(2) (see Note A-3.1.4.2.(1)(c))~~.~~, or
- [d] --) by a protective covering, incorporated in the assembly, that meets the requirements of Clause 3.1.4.2.(1)(d) (see Note A-3.1.4.2.(1)(d)) (PCF 1967).

~~(See Note A-3.1.4.2.(1)(c).)~~

[2] **2)** A walk-in cooler or freezer consisting of factory-assembled wall, floor or ceiling panels containing foamed plastics is permitted to be used, provided the panels

- [a] a) are protected on both sides by sheet metal not less than 0.38 mm thick having a melting point not less than 650°C,
- [b] b) do not contain an air space, and
- [c] c) have a *flame-spread rating*, determined by subjecting a sample panel with an assembled joint typical of field installation to the applicable test described in Subsection 3.1.12., that is not more than that permitted for the room or space in which they are located or that they bound.

[3] **3)** Thermosetting foamed plastic insulation having a *flame-spread rating* of not more than 200 is permitted to be used in factory-assembled doors in *storage garages* serving single *dwelling units* provided that

- [a] a) the insulation is covered on the interior with a metallic foil,

[b] b) the assembly has a *flame-spread rating* of not more than 200, and
[c] c) the assembly incorporates no air spaces.

Impact analysis

This proposed change provides a cross-reference to proposed Clause 3.1.4.2.(1)(d), which benefits Code users by keeping Sentences 3.1.4.2.(1) and 9.10.17.10(1) aligned.

The proposed compliance option in Clause 3.1.4.2.(1)(d) provides flexibility to designers and fosters innovation without compromising safety by allowing a broader range of material to be used for the protection of foamed plastics.

This proposed change benefits manufacturers and Code users by clarifying a minimum level of performance required for assemblies incorporating a protective covering, which facilitates enforcement for regulators and authorities having jurisdiction.

Because the introduction of a reference to CAN/ULC-S145 is not intended to replace the existing options for acceptable solutions, there are no new forced costs for builders with respect to meeting the requirements for the protection of foamed plastics.

Furthermore, any additional costs associated with the testing of materials when using this proposed option could be offset by avoiding the cost of needing to pursue this option as an alternative solution.

Enforcement implications

This proposed change could be enforced by the current enforcement infrastructure for the Code and would harmonize Part 9 with the newly proposed changes in Part 3.

Regulators are familiar with assessing compliance through product testing in accordance with referenced standards. Having a performance-based requirement in the Code facilitates the interpretation and enforcement of the requirement and ensures consistency of the application throughout the country.

Furthermore, in jurisdictions where alternative solutions have been sought for protective covering products, it is anticipated that there is already familiarity with these types of products.

Who is affected

Architects, engineers, designers, regulators, manufacturers and builders would benefit from this proposed change as explained in the impact analysis.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.10.17.10.] 9.10.17.10. ([1] 1) [~~F01~~,~~F02~~,~~F05~~,F01-~~OS1.5~~,OS1.1] [F02-OS1.2] [F05-OS1.5]

[9.10.17.10.] 9.10.17.10. ([1] 1) ([a] a)

[9.10.17.10.] 9.10.17.10. ([1] 1) ([c] c)

[9.10.17.10.] 9.10.17.10. ([2] 2) [F05-OS1.5] [F02-OS1.2]

[9.10.17.10.] 9.10.17.10. ([2] 2) [F02-OP1.2]

[9.10.17.10.] 9.10.17.10. ([2] 2) no attributions

[9.10.17.10.] 9.10.17.10. ([3] 3) [F01,F02-OS1.2]

Submit a comment

Proposed Change 1920

Code Reference(s):	**NBC20 Div.B 9.10.18.2. (first printing)**
Subject:	Automatic Sprinkler System
Title:	Standardization of Terminology in NBC Sprinkler Requirements
Description:	This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NBC.
Related Proposed Change(s):	PCF 1910, PCF 1912, PCF 1915, PCF 1916, PCF 1917, PCF 1921, PCF 1922, PCF 1924, PCF 1925, PCF 1926, PCF 1927, PCF 1928, PCF 1929, PCF 1930, PCF 1931, PCF 1932, PCF 1933, PCF 1934

This change could potentially affect the following topic areas:

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

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NBC by using the defined term “sprinklered” and thereby eliminates any potential confusion.

Justification

As defined in the NBC, “sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers.”

In the NBC 2020 and National Fire Code of Canada (NFC) 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term “sprinklered” could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term “sprinklered” would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… to have an automatic sprinkler system installed throughout …”	NBC	1
“… an automatic sprinkler system shall be installed in …”	NBC	1
“… sprinklers shall be installed in …”	NBC	2
“… sprinklers shall be provided for …”	NBC	1
“… sprinklers shall not be omitted in …”	NBC	1
“… in which an automatic sprinkler system is installed …”	NBC	1
“… in which a sprinkler system is installed …”	NBC	2
“… in which a sprinkler system has been installed …”	NBC	1
“… area served by the sprinkler system …”	NBC	1
“… sprinklers are installed in …”	NBC	1
“… shall be equipped throughout with a sprinkler system …”	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are not mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… do not require the installation of an automatic sprinkler system …”	NBC	1
“… in which an automatic sprinkler system is not required to be installed …”	NBC	1
“… sprinklers are not required in …”	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
"… that is not protected by an automatic sprinkler system …"	NBC	1
"… in which sprinklers are not installed …"	NBC	2
"… where a sprinkler system is not installed …"	NBC	1
"… in which an automatic sprinkler system is not installed …"	NBC	2
"… need not be equipped throughout with a sprinkler system …"	NFC	2

PROPOSED CHANGE

[9.10.18.2.] 9.10.18.2. Fire Alarm System Required

[1] **1)** Except as permitted in Sentences (3) and (4), a fire alarm system shall be installed in *buildings* ~~in which a sprinkler system is installed~~that are *sprinklered*.

[2] **2)** Except as provided in Sentence (5), a fire alarm system shall be installed

[a] a) in every *building* that contains more than 3 *storeys*, including *storeys* below the *first storey*,

[b] b) where the total *occupant load* exceeds 300, or

[c] c) when the *occupant load* for any *major occupancy* in Table 9.10.18.2. is exceeded.

Table [9.10.18.2.] 9.10.18.2.
Maximum Occupant Load for Buildings without Fire Alarm Systems
Forming Part of Sentence [9.10.18.2.] 9.10.18.2.([2] 2)

***Major Occupancy* Classification**	***Occupant Load* Above which a Fire Alarm System is Required**
Residential	10 (sleeping accommodation)
Business and personal services, *Mercantile*	150 above or below the *first storey*
Low- or *medium-hazard industrial*	75 above or below the *first storey*

[3] **3)** In *buildings* ~~in which a sprinkler system has been installed~~that are *sprinklered* in accordance with NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes", a fire alarm system need not be installed.

[4] **4)** In *buildings* that contain fewer than 9 sprinklers conforming to Sentence 3.2.5.12.(4), a fire alarm system need not be installed.

[5] **5)** A fire alarm system is not required in a *residential occupancy* where an *exit* or *public corridor* serves not more than 4 *suites* or where each *suite* has direct access to an exterior *exit* facility leading to ground level.

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.10.18.2.] **9.10.18.2. ([1] 1)**
[F11-OS1.5] [F13-OS1.2,OS1.5] [F03-OS1.2]

[9.10.18.2.] **9.10.18.2. ([1] 1) [F13-OP1.2]**

[9.10.18.2.] **9.10.18.2. ([2] 2) [F11-OS1.5]**

[9.10.18.2.] **9.10.18.2. ([3] 3) no attributions**

[9.10.18.2.] **9.10.18.2. ([4] 4) no attributions**

[9.10.18.2.] **9.10.18.2. ([5] 5) no attributions**

Submit a comment

Proposed Change 1427

Code Reference(s):	**NBC20 Div.B 9.13.2.2. (first printing)** **NBC20 Div.B 9.25.4.2. (first printing)**
Subject:	Building Envelope - General
Title:	Replacement of an Outdated CGSB Standard
Description:	This proposed change replaces CAN/CGSB-1.501-M89, "Method for Permeance of Coated Wallboard," with ASTM D1653-13, "Standard Test Methods for Water Vapor Transmission of Organic Coating Films," in Part 9 of the NBC.
Related Code Change Request(s):	CCR 1238, CCR 1305
Related Proposed Change(s):	PCF 1426

This change could potentially affect the following topic areas:

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

Problem

Sentence 9.25.4.2.(7) of Division B of the National Building Code of Canada (NBC) currently references CAN/CGSB-1.501-M89, "Method for Permeance of Coated Wallboard," for the testing of vapour barrier properties of coatings applied to gypsum board. Although CAN/CGSB-1.501-M89 is still applicable, it has not been updated since its initial publication in 1989 and was withdrawn by the Canadian General Standards Board (CGSB) in October 2011. As a result, manufacturers no longer test vapour barrier properties of coatings in accordance with CAN/CGSB-1.501-M89. Instead, manufacturers test vapour barrier properties of coatings in accordance with

ASTM D1653-13, "Standard Test Methods for Water Vapor Transmission of Organic Coating Films," which is not currently referenced in the NBC. This creates enforcement issues for the authorities having jurisdiction (AHJs).

Justification

This proposed change would seek to resolve the enforcement issues noted above by replacing the reference to CAN/CGSB-1.501-M89 with a reference to ASTM D1653.

ASTM D1653

- is equivalent to CAN/CGSB-1.501-M89,
- represents the minimum Code requirements for testing the vapour barrier properties of coatings,
- does not create any conflicts within the NBC,
- does not modify any performance requirements in the NBC, and
- will harmonize the Code with the state-of-the-art of the building envelope industry.

ASTM D1653 has a broader scope for the testing of vapour barrier properties of coatings as it applies to any material and is not limited to gypsum board as is the case with CAN/CGSB-1.501-M89. For this reason, this proposed change also revises Sentence 9.25.4.2.(7) to reflect the application of ASTM D1653 to any material and not just to gypsum board. This would allow for the introduction of new technologies onto the market.

In addition, this proposed change would add an explanatory Note to Sentence 9.25.4.2.(7) that would provide guidance for the application of fluid-applied vapour barrier coatings by referring Code users to the manufacturer’s specifications.

PROPOSED CHANGE

[9.13.2.2.] **9.13.2.2. Dampproofing Materials**

[1] **1)** Materials installed to provide required dampproofing shall be

[a] a) capable of protecting assemblies against moisture transfer from the ground,

[b] b) compatible with adjoining materials, and

[c] c) resistant to mechanisms of deterioration that may reasonably be expected, given the nature, function and exposure of the materials.

[2] **2)** Except as otherwise specified in this Section, materials used for exterior dampproofing shall

[a] a) conform to one of the following standards:

[i] i) ASTM D1227/D1227M, "Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing", Type III, Class I,

    - [ii] ii) ASTM D4479/D4479M, "Standard Specification for Asphalt Roof Coatings – Asbestos-Free", Type III,
    - [iii] iii) CAN/CGSB-51.34-M, "Vapour Barrier, Polyethylene Sheet for Use in Building Construction", or
    - [iv] iv) CAN/CSA-A123.4, "Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems",or
  - [b] b) have a water vapour permeance of not more than 43 ng/(Pa×s×m^2) when tested in accordance with ~~Procedure A (wet cup) of~~ ASTM E96/E96M, "Standard Test Methods for Water Vapor Transmission of Materials", using the water method (wet cup) and consist of one of the following material types:
    - [i] i) a vapour-resistant coating,
    - [ii] ii) a cold-fluid-applied or hot-rubberized bituminous dampproofing membrane,
    - [iii] iii) a liquid-applied or spray-applied asphalt-based emulsion dampproofing, or
    - [iv] iv) a type III hot-applied asphalt.

[9.25.4.2.] 9.25.4.2. Vapour Barrier Materials

[1] **1)** Except as provided in Sentence (2), *vapour barriers* shall have a permeance not greater than 60 ng/(Pa×s×m^2) measured in accordance with ASTM E96/E96M, "Standard Test Methods for Water Vapor Transmission of Materials", using the desiccant method (dry cup).

[2] **2)** Thermally insulated *foundation* wall assemblies are permitted to be constructed with variable-permeance *vapour barriers* having a permeance not greater than 60 ng/(Pa×s×m^2) using the desiccant method (dry cup) and greater than 300 ng/(Pa×s×m^2) using the water method (wet cup) measured in accordance with ASTM E96/E96M, "Standard Test Methods for Water Vapor Transmission of Materials".(See Note A-9.25.4.2.(2).)

[3] **3)** Where the intended use of the interior space will result in high moisture generation, the assembly shall be designed according to Part 5. (See Note A-9.25.4.2.(3).)

[4] **4)** Where polyethylene is installed to serve only as the *vapour barrier*, it shall comply with Clause 4.4, Thermal Stability, and Clause 5.7, Oxidative Induction Time, of CAN/CGSB-51.34-M, "Vapour Barrier, Polyethylene Sheet for Use in Building Construction".

[5] **5)** Membrane-type *vapour barriers* other than polyethylene shall conform to the requirements of CAN/CGSB-51.33-M, "Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction".

[6] **6)** Membrane-type *vapour barriers* other than polyethylene that are susceptible to deterioration under prolonged exposure to direct ultraviolet radiation shall

- [a] a) be covered, or
- [b] b) only be installed in locations that are not exposed to direct ultraviolet radiation after the completion of construction.

(See Note A-9.25.4.2.(6).)

[7] **7)** Where a coating is applied to ~~gypsum board~~any materials to function as the *vapour barrier*, the permeance of the coating shall be determined in accordance with ~~CAN/CGSB-1.501-M, "Method for Permeance of Coated Wallboard".~~ASTM D1653, "Standard Test Methods for Water Vapor Transmission of Organic Coating Films," using the desiccant method (dry cup, Condition A). (See Note A-9.25.4.2.(7).)

[8] **8)** Where foamed plastic insulation functions as the *vapour barrier*, it shall be sufficiently thick so as to meet the requirement of Sentence (1).

Note A-9.25.4.2.(7) Application of Fluid-Applied Vapour Barriers.

The manufacturer's specifications should always be consulted when using fluid-applied vapour barriers, to ensure a smooth, continuous film is applied and to avoid using too little or too much material, which could impact the vapour-retarding performance of the vapour barrier.

Impact analysis

No additional costs are expected to be incurred as a result of replacing the reference to CAN/CGSB-1.501-M89 with a reference to ASTM D1653. Currently, manufacturers already test coatings used as vapour barriers in accordance with ASTM D1653 and other materials used as vapour barriers in accordance with ASTM E96/E96M, which is currently referenced in the Code.

Enforcement implications

This proposed change can be enforced by the existing infrastructure without additional resources; however, training on the new standard is anticipated to be necessary for AHJs. This proposed change avoids enforcement issues for the AHJs.

Who is affected

Designers, specifiers, manufacturers, contractors, building owners and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.13.2.2.] 9.13.2.2. ([1] 1) [F61-OH1.1,OH1.2,OH1.3]

[9.13.2.2.] 9.13.2.2. ([1] 1) [F61-OS2.3]

[9.13.2.2.] 9.13.2.2. ([2] 2) [F61-OH1.1,OH1.2,OH1.3]

[9.13.2.2.] 9.13.2.2. ([2] 2) [F61-OS2.3]

[9.25.4.2.] 9.25.4.2. ([1] 1) [F63-OS2.3]

[9.25.4.2.] 9.25.4.2. ([1] 1) [F63-OH1.1,OH1.2]

[9.25.4.2.] 9.25.4.2. ([2] 2) [F63-OS2.3]

[9.25.4.2.] 9.25.4.2. ([2] 2) [F63-OH1.1,OH1.2,OH1.3]

[9.25.4.2.] 9.25.4.2. ([3] 3) no attributions

[9.25.4.2.] 9.25.4.2. ([3] 3) [F62,F63-OS2.3]

[9.25.4.2.] 9.25.4.2. ([3] 3) [F62,F63-OH1.1,OH1.2,OH1.3]

[9.25.4.2.] 9.25.4.2. ([4] 4) [F63,F80-OS2.3]

[9.25.4.2.] 9.25.4.2. ([4] 4) [F63,F80-OH1.1,OH1.2]

[9.25.4.2.] 9.25.4.2. ([5] 5) [F63,F80-OS2.3]

[9.25.4.2.] 9.25.4.2. ([5] 5) [F63,F80-OH1.1,OH1.2]

[9.25.4.2.] 9.25.4.2. ([6] 6) [F63,F80-OS2.3]

[9.25.4.2.] 9.25.4.2. ([6] 6) [F63,F80-OH1.1,OH1.2]

[9.25.4.2.] 9.25.4.2. ([7] 7) [F63-OS2.3]

[9.25.4.2.] 9.25.4.2. ([7] 7) [F63-OH1.1,OH1.2]

[9.25.4.2.] 9.25.4.2. ([8] 8) [F63-OS2.3]

[9.25.4.2.] 9.25.4.2. ([8] 8) [F63-OH1.1,OH1.2]

Submit a comment

Proposed Change 1713

Code Reference(s):	**NBC20 Div.B 9.13.4. (first printing)**
Subject:	Radon and Soil Gas Mitigation
Title:	Passive Vertical Radon Stack
Description:	This proposed change adds requirements for radon mitigation by use of a passive vertical radon stack in dwelling units and home-type care occupancies that have a wall, roof or floor assembly in contact with the ground.
Related Code Change Request(s):	CCR 895, CCR 951, CCR 1330

This change could potentially affect the following topic areas:

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

Problem

Radon is a colourless, odourless, radioactive gas that occurs naturally as a result of the decay of radium. It is found in varying concentrations as a component of soil gas in all regions of Canada. It is known to enter dwelling units by infiltration into basements and crawl spaces.

Health Canada estimates that 7% of homes in Canada have levels exceeding the Canadian Guideline of 200 becquerels per metre cubed (Bq/m^3) [1]. However, research has shown that the majority of cases of radon-induced lung cancer occur in residents of dwellings that have concentrations of radon lower than 200 Bq/m^3. Radon is the second-leading cause of lung cancer deaths in Canada, after smoking. It accounts for 16% of lung cancer deaths, which is 3,200 Canadian deaths annually.

The potential for high levels of radon infiltration is very difficult to evaluate prior to construction, and thus a radon problem may only become apparent once the building is completed and occupied. The Canadian Guideline also recommends that construction of new buildings use techniques that minimize radon entry into conditioned space [1].

Current NBC provisions mandate the installation of an air barrier system between wall, roof and floor assemblies separating conditioned space from the ground and the provision of a rough-in for a radon extraction system. Although these provisions may facilitate the implementation of mitigation measures following proper testing of post-construction radon ingress, research has shown that these provisions do not mitigate radon ingress into conditioned spaces and, therefore, do not reduce exposure to radon.

Justification

This proposed change introduces a requirement for the installation of a passive stack subfloor depressurization system during initial construction. A passive stack subfloor depressurization system has been shown to reduce the level of radon by 40% to 90%, thus limiting the probability of negative effects on indoor air quality, including cases of radon-induced lung cancer.

There is no safe level of radon. The higher the radon concentration, the higher the risk of lung cancer. Therefore, an approach that minimizes radon entry during the construction of all buildings presents a much greater benefit because radon exposure in general is reduced, in contrast to the approach of post-occupancy testing with mitigation for only the highest levels of radon exposure. For example, it was estimated that most lung cancer deaths attributable to radon in Ontario (89%) would occur for levels of radon exposure below 200 Bq/m^3 and could not be prevented by post-occupancy testing and mitigation [2].

The proposed system (passive stack subfloor depressurization system installed during initial construction) is considered the ideal solution since the modification of an existing capped rough-in, installed according to the NBC, requires the installation of an active fan or alterations to existing walls and floor, which could cost two to three times more than the installation of the proposed system. This proposed change only addresses Part 9 dwelling units and home-type care occupancies, given that people only occupy other types of Part 9 occupancies about 25% of the time.

References

[1] Health Canada. Radon: A Guide for Canadian Homeowners. Canada Mortgage and Housing Corporation. NH15-180/1997E. 2007.

[2] Emily Peterson, Amira Aker, JinHee Kim, Ye Li, Kevin Brand and Ray Copes. "Lung cancer risk from radon in Ontario, Canada: how many lung cancers can we prevent?" Cancer Causes Control. 2013; 24(11): 2013–2020.

PROPOSED CHANGE

[9.13.4.] 9.13.4. Soil Gas Control

(See Note A-9.13.4.)

[9.13.4.1.] 9.13.4.1. Application and Scope

[1] **1)** This Subsection applies to

[a] a) ~~wall, roof and floor assemblies separating~~a *conditioned space* ~~from the ground, and~~that has a wall, roof or floor assembly that is in contact with the ground,

[b] b) the rough-in ~~to allow the future protection~~ of a *conditioned space* that has~~is separated from the ground by~~ a wall, roof or floor assembly~~.~~ that is in contact with the ground, and

[c] --) a passive vertical radon stack for a *conditioned space* that has a wall, roof or floor assembly that is in contact with the ground.

[2] **2)** This Subsection addresses the leakage of *soil* gas from the ground into the *building*.

[9.13.4.2.] 9.13.4.2. Protection from Soil Gas Ingress

[1] **1)** All wall, roof and floor assemblies separating a *conditioned space* from the ground shall be ~~protected by~~provided with an *air barrier system* conforming to Subsection 9.25.3. that provides a level of radon diffusion protection equivalent to that provided by 0.15 mm polyethylene sheet conforming to CAN/CGSB-51.34-M, "Vapour Barrier, Polyethylene Sheet for Use in Building Construction."

[2] **2)** ~~Unless the space between the *air barrier system* and the ground is designed to be accessible for the future installation of a subfloor depressurization system,~~ *D*~~*d*~~*welling units* and *home-type care occupancies* where 10% or more of the total area of a wall, roof or floor assembly separates a *conditioned space* from the ground~~and *buildings* containing *residential occupancies*~~ shall be provided with ~~the rough-in for a radon extraction system~~ a passive vertical radon stack conforming to Article 9.13.4.4. and made of components that are compatible with adjoining materials described in Articles 9.13.4.3. and 9.13.4.4.

[3] **3)** Where *buildings* are used for *occupancies* other than those described in Sentence (2), protection from radon ingress and the means to address high radon concentrations in the future shall conform to

[a] a) Article 9.13.4.3., or

[b] b) Parts 5 and 6 (see Article 5.4.1.1. and 6.2.1.1.).

(See Note A-9.13.4.2.(3).)

[9.13.4.3.] 9.13.4.3. ~~Providing for the~~ Rough-in for a Subfloor Depressurization System

~~(See Note A-9.13.4.3.)~~

[1] 1) Floors-on-ground shall be provided with a rough-in for subfloor depressurization consisting of

  [a] a) a gas-permeable layer, an inlet and an outlet as described in Sentence (2), or

  [b] b) clean granular material and a pipe as described in Sentence (3).

[2] 2) The rough-in referred to in Clause (1)(a) shall include

  [a] a) a gas-permeable layer installed in the space between the air barrier and the ground to allow the depressurization of that space,

  [b] b) an inlet that allows for the effective depressurization of the gas-permeable layer (see Note A-9.13.4.3.(2)(b) and (3)(b)(i)), and

  [c] c) an outlet in the *conditioned space* that

    [i] i) permits connection to depressurization equipment,

    [ii] ii) is sealed to maintain the integrity of the *air barrier system*, and

    [iii] iii) is clearly labeled to indicate that it is intended only for the removal of radon from below the floor-on-ground.

[3] 3) The rough-in referred to in Clause (1)(b) shall include

  [a] a) clean granular material installed below the floor-on-ground in accordance with Sentence 9.16.2.1.(1), and

  [b] b) a pipe not less than 100 mm in diameter installed through the floor, such that

    [i] i) its bottom ~~end~~ opening~~s~~ is located in~~to~~ the granular layer required in Clause (a) at or near the centre of the floor and not less than 100 mm of granular material projects beyond the bottom opening~~terminus~~ of the pipe measured along its axis (see Note A-9.13.4.3.(2)(b) and (3)(b)(i)),

    [ii] --) its bottom opening is protected by a low-pressure-drop stainless steel mesh with 10 mm to 12.5 mm openings or by a product and fitting system that provide an equivalent level of air-flow performance and corrosion resistance,

    [iii] ii) its top opening~~end~~ permits connection to depressurization equipment and is provided with an airtight cap, unless a passive vertical radon stack conforming to Article 9.13.4.4. is connected to the rough-in, and

    [iv] iii) the pipe is clearly labeled near the cap and, if applicable, at every 1.8 m and at every change in direction to indicate that it is intended only for the removal of radon from below the floor-on-ground.

[9.13.4.4.] --- Passive Vertical Radon Stack

[1] --) The passive vertical radon stack required by Sentence 9.13.4.2.(2) shall be installed

  [a] --) in a *conditioned space* in accordance with Clauses 7.2.2.3 and 7.2.3.2 to 7.2.4.3 of CAN/CGSB-149.11-2019, “Radon control options for new construction in low-rise residential buildings,”

[b] --) except as provided in Sentence (2), in the vertical direction, and

[c] --) such that its rooftop termination conforms to Table 9.13.4.4.-A.

Table [9.13.4.4.-A]
Minimum Clearances for Rooftop Termination of Passive Vertical Radon Stacks
Forming Part of Clause 9.13.4.4.(1)(c)

Description	**Minimum Clearance, m**
Vertical clearance above the roof at the point of penetration	0.15
Vertical clearance above windows and doors	0.6
Vertical clearance above mechanical air intakes	0.9
Horizontal clearance from windows, doors and mechanical air intakes	3
Clearance horizontally from vertical walls that extend above the penetrated roof	3

[2] --) Where it is not possible to install a passive vertical radon stack entirely in the vertical direction, the stack is permitted to include a horizontal offset on each *storey*, including the *basement*, provided each offset

[a] --) is not more than 3.6 m long,

[b] --) is connected using 22.5° to 90° fittings, and

[c] --) has a slope not less than 1 in 50.

(See Note A-9.13.4.4.(2).)

[3] --) Piping and connections for the passive vertical radon stack

[a] --) shall conform to Clauses 7.1.3.1.1 to 7.1.3.1.3 and 7.1.3.1.5 to 7.1.3.2.6 of CAN/CGSB-149.11-19, “Radon control options for new construction in low-rise residential buildings,” and

[b] --) shall not be perforated above the level of the air barrier system.

[4] --) Piping runs for the passive vertical radon stack that are located inside hollow walls or partitions within 43 mm of the wall or partition surface shall be protected against physical damage and puncture at the intersections of joists, studs, plates and other framing members by the use of steel plates or sleeves not less than 1.59 mm thick.

[5] --) Except as provided in Sentence (6), the portion of the passive vertical radon stack that passes through the unconditioned *attic or roof space* shall be

[a] --) located within a cylindrical space not less than 500 mm in diameter and not less than 1 000 mm high, and

[b] --) insulated in accordance with Table 9.13.4.4.-B.

(See Note A-9.13.4.4.(5) and (6).)

Table [9.13.4.4.-B]
Insulation of Passive Vertical Radon Stack in Unconditioned Space
Forming Part of Clause 9.13.4.4.(5)(b)

2.5% January Design Temperature, °C	Maximum Stack Height Above Roof, m	Insulation, RSI					
		0.70	1.41	2.11	2.82	3.52	4.23
		Maximum Length of Stack in Unconditioned Space, m					
−5 or warmer	0.30	4.71	6.86	7.92	9.45	10.48	11.70
−6 to −11	0.30	2.59	3.91	4.83	5.53	6.29	6.86
−12 to −17	0.30	1.28	2.59	3.08	3.43	3.78	4.11
−18 to −24	0.15	1.25	1.94	2.47	2.93	3.32	3.63
	0.30	0.64	0.98	1.28	1.52	1.68	1.86
	0.30 (1)	1.51	2.32	2.93	3.47	3.90	4.30
−25 to −29	0.15	1.16	1.52	1.95	2.32	2.62	2.90
	0.30	0.40	0.61	0.76	0.91	1.04	1.16
	0.30 (1)	1.34	1.92	2.47	2.90	3.26	3.60
−30 to −34	0.15	0.94	1.22	1.58	1.83	2.07	2.32
	0.30	0.21	0.30	0.40	0.46	0.52	0.58
	0.30 (1)	1.25	1.65	2.10	2.47	2.77	3.05
−35 or colder	0.15	0.76	0.98	1.25	1.52	1.71	2.59
	0.15 (1)	1.22	1.65	2.07	2.44	2.77	3.05
	0.30 (1)	1.05	1.28	1.74	2.01	2.29	2.53

Note to Table [9.13.4.4.-B] :

(1) The portion of the passive vertical radon stack that extends above the roof shall be insulated to RSI 0.704 and protected from physical damage.

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[6] --) Where it is not possible to provide the cylindrical space described in Clause (5)(a) within an unconditioned *attic or roof space* or where the passive vertical radon stack passes through a *dwelling unit* above, the cylindrical space shall be provided within the *conditioned space*. (See Note A-9.13.4.4.(5) and (6).)

[7] --) The top opening of the passive vertical radon stack shall be fitted with a stainless steel mesh with 10 mm to 12.5 mm openings or by a product and fitting system that provide an equivalent level of air-flow performance and corrosion resistance.

Note A-9.13.4. Soil Gas Control.

Outdoor air entering a dwelling through above-grade leaks in the building envelope normally improves the indoor air quality in the dwelling by reducing the concentrations of pollutants and water vapour. It is only undesirable because it cannot be controlled. On the other hand, air entering a dwelling through below-grade leaks in the envelope may increase the water vapour content of the indoor air and may also bring in a number of pollutants picked up from the soil. This mixture of air, water vapour and pollutants is sometimes referred to as "soil gas." One pollutant often found in soil gas is radon.

Sentence 9.13.4.2.(1), which requires the installation of an air barrier system, addresses the protection from all common naturally occurring soil gases, including nitrogen, carbon dioxide, oxygen, methane and radon, while the remainder of Article 9.13.4.2. along with Articles 9.13.4.3. and 9.13.4.4., which require the provision of the means to depressurize the space between the air barrier and the ground, specifically address the capability to mitigate high radon concentrations in the future, should this become necessary.

Radon is a colourless, odourless, radioactive gas that occurs naturally as a result of the decay of radium. It is found to varying degrees as a component of soil gas in all regions of Canada and is known to enter dwelling units by infiltration into basements and crawl spaces. The presence of radon in sufficient quantity can lead to an increased risk of lung cancer.

The potential for high levels of radon infiltration is very difficult to evaluate prior to construction and thus a radon problem may only become apparent once the building is completed and occupied. Therefore various sections of Part 9 require the application of certain ~~radon exclusion~~ measures that will minimize or prevent radon infiltration in all dwellings. These measures are

- low in cost,
- difficult to retrofit, and
- desirable for other benefits they provide.

The principal method of resisting the ingress of all soil gases, a resistance which is required for all buildings (see Sentence 9.13.4.2.(1)), is to seal the interface between the soil and the occupied space, so far as is reasonably practicable. Sections 9.18. and 9.25. contain requirements for air and soil gas barriers in assemblies in contact with ground, including those in crawl spaces. Providing control joints to reduce cracking of foundation walls and airtight covers for sump pits (see Section 9.14.) are other measures that can help achieve this objective. The requirements provided in Subsection 9.25.3. are explained in Notes A-9.25.3.4. and 9.25.3.6. and Note A-9.25.3.6.(2) and (3).

The principal method of ~~excluding radon~~minimizing radon infiltration into a building is to ensure that the pressure difference across the ground/space interface is positive (i.e., towards the outside) so that the inward flow of radon through any remaining leaks will be minimized. The requirements provided in Article 9.13.4.3. are explained in Note A-9.13.4.3.

Note A-9.13.4.3.

~~Completion of a Subfloor Depressurization System~~

~~The completion of a subfloor depressurization system may be necessary to reduce the radon concentration to a level below the guideline specified by Health Canada.~~

~~Further information on protection from radon ingress can be found in the following Health Canada publications:~~

- ~~"Radon: A Guide for Canadian Homeowners""Radon: A Guide for Canadian Homeowners” (CMHC/HC) , and~~
- ~~“Guide for Radon Measurements in Residential Dwellings (Homes)”."Guide for Radon Measurements in Residential Dwellings (Homes)".~~

Note A-9.13.4.4.(2) Fitting Angles for Horizontal Offsets.

The use of a straight pipe as a passive vertical radon stack is preferable to facilitate soil gas flow, but is not always possible in practice. Where horizontal offsets are required, the use of fittings with shallow angles is preferable to minimize the restriction of soil gas flow. However, fittings with angles up to 90° are acceptable for use in restricted spaces where a horizontal assembly using fittings with shallow angles is not feasible.

Note A-9.13.4.4.(5) and (6) Open Space Around the Passive Vertical Radon Stack.

Sentences 9.13.4.4.(5) and (6) require the provision of an open cylindrical space around the passive vertical radon stack to allow for the potential future installation of an active radon mitigation fan. If necessary, such a fan may be installed to reduce high radon concentrations that become apparent once the building is completed and occupied.

Impact analysis

Refer to the Impact Analysis Document, "Impact Analysis of Installing Passive Radon Stacks in Part 9 Residential Occupancies," for the full impact analysis. An Executive Summary is reproduced here.

The benefits of reducing radon by installing passive vertical radon stacks followed a pattern typical of preventive interventions, with the direct costs incurred up front and a delay before the benefits are experienced. The direct benefits included the number of lung cancer deaths that would be prevented and the associated lung cancer treatment costs avoided following the reduction in residential radon exposures. The results of the analysis were presented in two parts:

1. Example case: passive vertical radon stacks installed in relevant Part 9 units built in 1 year
2. Full analysis: passive vertical radon stacks installed in relevant Part 9 units built over 100 years

The methodology used to estimate the benefits of installing passive vertical radon stacks was defined as follows:

- two estimates of current radon exposure (lower and upper)
- effectiveness of passive vertical radon stacks at reducing indoor radon based on recent field studies
- 75-year service life of passive vertical radon stacks
- excess relative risk of lung cancer from radon modelled using cumulative radon exposure resulting from the duration and concentration of radon exposure over time (BEIR VI model)
- lung cancer incidence and survival defined by type and stage at diagnosis
- lifetable approach based on lung cancer incidence, all-cause mortality, and smoking prevalence

In 2021, the annual cost of installing passive vertical radon stacks in the 117,742 units of Part 9 residential occupancies in contact with the ground built in that one-year period was estimated to be $112,897,401 ($93,633,327–$131,261,476). The annual lung cancer cases prevented—and, therefore, the annual lung cancer treatment costs prevented—increased over the 75-year service life of the passive vertical radon stacks because there was a greater reduction in the relative annual risk of lung cancer for residents who lived for a longer period with reduced radon exposure.

The total lung cancer treatment costs prevented over the 75-year lifespan of the 117,742 units of new housing built in 2021 with passive vertical radon stacks installed ranged from $10 million to $16 million, at $10,231,105 ($8,443,980–$12,047,540) and $16,050,125 ($14,278,700–$17,554,105) for the lower and upper radon estimates, respectively. A total of 141 (117–167) and 222 (197–242) lung cancer deaths were estimated to be prevented for the lower and upper radon estimates, respectively, in the residents of the 117,742 units over 75 years following the installation of passive vertical radon stacks.

The impact analysis for this proposed change on installing passive vertical radon stacks in Part 9 residential occupancies demonstrated that the main benefit would be preventing 10,000 to 16,000 radon-associated lung cancer deaths in Canada over 100 years should this proposed change be adopted. The cumulative number of lung cancer deaths prevented over 100 years was estimated to be 10,356 (8,601–12,208) for the lower residential radon exposure and 16,132 (14,402–17,586) for the upper estimate of current residential radon exposure. Although the costs incurred for installing passive vertical radon stacks in new housing construction always exceeded the savings from lung cancer treatment for cases prevented, the cumulative cost per lung cancer death prevented decreased steeply after implementation and dropped below the Treasury Board of Canada Secretariat reference value after 30 to 40 years.

Enforcement implications

The proposed change would require the inspection of the passive subfloor depressurization system from where the capped rough-in previously ended to where it would terminate with the proposed change (i.e., above the roof line).

Who is affected

Designers may need to change their designs to better facilitate the termination of the passive vertical radon stack above the roof. This proposed change may require moving walls or changing framing to thicken walls to conceal the passive vertical radon stack or moving the location where the sub-slab collection pipe penetrates the slab.

Contractors would be required to add the passive subfloor depressurization system to their construction procedures. This proposed change may require them to change their designs to better facilitate the termination of the passive vertical radon stack above the roof. This change may also require moving walls or changing framing to thicken walls to conceal the passive vertical radon stack or moving the location where the sub-slab collection pipe penetrates the slab.

Occupants would benefit from the reduction of exposure to radon gas. This proposed change may require them to change their designs to better facilitate the termination of the passive vertical radon stack above the roof. This change may also require moving walls or changing framing to thicken walls to conceal the passive vertical radon stack or moving the location where the sub-slab collection pipe penetrates the slab.

Supporting Document(s)

Impact Analysis of Installing Passive Radon Stacks in Part 9 Residential Occupancies (pcf_1713_impact_analysis_edited_mjv_am_clean.pdf)

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.13.4.1.] 9.13.4.1. ([1] 1) no attributions

[9.13.4.1.] 9.13.4.1. ([2] 2) no attributions

[9.13.4.2.] 9.13.4.2. ([1] 1) no attributions

[9.13.4.2.] 9.13.4.2. ([1] 1) [F40-OH1.1]

[9.13.4.2.] 9.13.4.2. ([2] 2) [F40-OH1.1]

[9.13.4.2.] 9.13.4.2. ([3] 3) [F40-OH1.1]

[9.13.4.3.] 9.13.4.3. ([1] 1) [F40-OH1.1]

[9.13.4.3.] 9.13.4.3. ([2] 2) [F40-OH1.1]

[9.13.4.3.] 9.13.4.3. ([3] 3) [F40-OH1.1]

[9.13.4.4.] -- ([1] --) [F40-OH1.1]

[9.13.4.4.] -- ([2] --) [F40-OH1.1]

[9.13.4.4.] -- ([4] --) [F40-OH1.1]

[9.13.4.4.] -- ([4] --) [F40-OH1.1]

[9.13.4.4.] -- ([5] --) [F40-OH1.1]

[9.13.4.4.] -- ([5] --) [F51-OH1.1]

[9.13.4.4.] -- ([6] --) [F40-OH1.1]

[9.13.4.4.] -- ([7] --) [F42-OH2.5]

Submit a comment

Proposed Change 1993

Code Reference(s):	**NBC20 Div.B 9.18.6.2. (first printing)** **NBC20 Div.B 9.25.3.6. (first printing)**
Subject:	Radon and Soil Gas Mitigation
Title:	Sealed Overlapping Seams for Air Barriers on the Ground
Description:	This proposed change requires that air barriers in contact with the ground have overlapping seams that are sealed.

This change could potentially affect the following topic areas:

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

Problem

Currently, the National Building Code of Canada (NBC) does not require the seams of air barriers to be sealed when installed under a concrete slab. The previous assumption was that a mechanical clamping action between the concrete slab and the ground would provide continuous clamping along the length of the joint to seal the seam. However, the current requirements for granular fill to allow the movement of soil gases below the air barrier, as well as the presence of expansive/shrinking soils in certain areas of Canada, invalidate this original assumption.

An overlapping seam that is not properly sealed can cause soil gases, such as radon, to leak into the occupied space of the building. These gases affect indoor air quality, and radon exposure can cause an increase in the probability of lung cancer.

Justification

This proposed change requires that all overlapping seams of air barrier systems in contact with the ground be sealed prior to ballast, whether granular fill or a concrete slab is applied.

This action reduces the probability of soil gas leakage at the overlapping seams, which reduces the probability of soil gases, such as radon, leaking into the occupied space of the building where the health of the occupants could be impacted.

PROPOSED CHANGE

[9.18.6.2.] 9.18.6.2. Ground Cover in Heated Crawl Spaces

[1] **1)** Where a crawl space is heated, a ground cover consisting of not less than 0.15 mm polyethylene sheet conforming to CAN/CGSB-51.34-M, "Vapour Barrier, Polyethylene Sheet for Use in Building Construction", shall be installed as part of an *air barrier system* in accordance with Subsection 9.25.3.

[2] **2)** The ground cover required in Sentence (1) shall have its joints lapped not less than ~~3~~100 mm, be sealed, and

[a] a) be ~~sealed and~~ evenly weighted down, or

[b] b) be covered with concrete not less than 50 mm thick.

[3] **3)** The perimeter of the ground cover required in Sentence (1) shall be sealed to the *foundation* wall. (See Notes A-9.13.4., A-9.25.3.4. and 9.25.3.6., and A-9.25.3.6.(2)(a) ~~and (3)~~.)

[4] **4)** All penetrations of the ground cover required in Sentence (1) shall be sealed against air leakage. (See Subsection 9.25.3.)

[9.25.3.6.] 9.25.3.6. Air Barrier Systems in Floors-on-ground

(See Note A-9.25.3.4. and 9.25.3.6.)

[1] **1)** Materials used to provide a barrier to the ingress of air through floors-on-ground shall conform to CAN/CGSB-51.34-M, "Vapour Barrier, Polyethylene Sheet for Use in Building Construction".

[2] **2)** Where the floor-on-ground is a concrete slab, the air barrier shall be

[a] a) installed below the slab (see Note A-9.25.3.6.(2)(a)), or

[b] b) applied to the top of the slab, provided a separate floor is installed over the slab.

~~(See Note A-9.25.3.6.(2) and (3).)~~

[3] **3)** Where the air barrier installed below a floor-on-ground is flexible sheet material, ~~joints in~~ the air barrier shall ~~be lapped not less than 300 mm.~~ ~~(See Note A-9.25.3.6.(2) and (3).)~~

[a] --) have its joints lapped not less than 100 mm,

[b] --) be sealed
  [i] --) at all joints, penetrations and junctions with *foundation* walls, footings and adjacent air and soil gas barrier systems, and
  [ii] --) with flexible sealant conforming to Article 9.27.4.2.

~~[4]~~ ~~**4)**~~ ~~Where installed in conjunction with a framed floor-on-ground or above a floor-on-ground, the air barrier shall be installed in accordance with Article 9.25.3.3.~~

~~[5]~~ ~~**5)**~~ ~~A floor-on-ground shall be sealed around its perimeter to the inner surfaces of adjacent walls using flexible sealant.~~

[6] 6) All penetrations of a floor-on-ground that are required to drain water from the floor surface shall be sealed in a manner that prevents the upward flow of air without preventing the downward flow of liquid water.

Note A-9.25.3.6.(2)(a) ~~and (3)~~ Polyethylene Air Barriers under Floors-on-Ground.

Floors-on-ground separating conditioned space from the ground must be constructed to reduce the potential for the entry of air, radon or other soil gases. In most cases, this will be accomplished by placing 0.15 mm polyethylene under the floor.

Finishing a concrete slab placed directly on polyethylene can, in many cases, cause problems for the inexperienced finisher. A rule of finishing, whether concrete is placed on polyethylene or not, is to never finish or “work” the surface of the slab while bleed water is present or before all the bleed water has risen to the surface and evaporated. If finishing operations are performed before all the bleed water has risen and evaporated, surface defects such as blisters, crazing, scaling and dusting can result. In the case of slabs placed directly on polyethylene, the amount of bleed water that may rise to the surface and the time required for it to do so are increased compared to a slab placed on a compacted granular base. Because of the polyethylene, the excess water in the mix from the bottom portion of the slab cannot bleed downward and out of the slab and be absorbed into the granular material below. Therefore, all bleed water, including that from the bottom of the slab, must now rise through the slab to the surface. Quite often in such cases, finishing operations are begun too soon and surface defects result.

One solution that is often suggested is to place a layer of sand between the polyethylene and the concrete. However, this is not an acceptable solution for the following reason: it is unlikely that the polyethylene will survive the slab pouring process entirely intact. Nevertheless, the polyethylene will still be effective in retarding the flow of soil gas if it is in intimate contact with the concrete; soil gas will only be able to penetrate where a break in the polyethylene coincides with a crack in the concrete. The majority of concrete cracks will probably be underlain by intact polyethylene. On the other hand, if there is an intervening layer of a porous medium, such as sand, soil gas will be able to travel laterally from a break in the polyethylene to the nearest crack in the concrete and the total system will be much less resistant to soil gas penetration.

To reduce and/or control the cracking of concrete slabs, it is necessary to understand the nature and causes of volume changes of concrete and in particular those relating to drying shrinkage. The total amount of water in a mix is by far the largest contributor to the amount of drying shrinkage and resulting potential cracking that may be expected from a given concrete. The less total amount of water in the mix, the less volume change (due to evaporation of water), which means the less drying shrinkage that will occur. To lessen the volume change and potential cracking due to drying shrinkage, a mix with the lowest total amount of water that is practicable should always be used. To lower the water content of a mix, superplasticizers are often added to provide the needed workability of the concrete during the placing operation. Concretes with a high water-to-cementing-materials ratio usually have high water content mixes. They should be avoided to minimize drying shrinkage and cracking of the slab. The water-to-cementing-materials ratio for slabs-on-ground should be no higher than 0.55.

Impact analysis

This proposed change only pertains to overlapping seams under a concrete slab. The NBC currently requires all exterior seams and penetrations to be sealed, as well as where ballast is placed on ground cover instead of a concrete slab. The cost of material and labour to seal the overlapping seams is estimated to range between $55 and $60.

There is an expected benefit of an increase in airtightness. This increased airtightness would reduce radon entry into the building, which could cause the adverse health effect of lung cancer. Increased airtightness could also reduce moisture entry where excessive moisture could cause mould issues. However, there is no research at this time to quantify this impact.

Enforcement implications

There are no expected enforcement implications as the inspection of air barriers is already required and the sealed seams would be addressed during these inspections.

Who is affected

Occupants would benefit from the reduced risk of soil gases and moisture leaking into the building, causing adverse health effects.

Contractors would be affected by the labour and material required to seal overlapping seams where a concrete slab is to be poured.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.18.6.2.] 9.18.6.2. ([1] 1) [F40,F61-OH1.1] [F61-OH1.2]

[9.18.6.2.] 9.18.6.2. ([1] 1) [F61-OS2.3]

[9.18.6.2.] 9.18.6.2. ([1] 1) no attributions

[9.18.6.2.] 9.18.6.2. ([2] 2) [F40,F61-OH1.1] [F61-OH1.2]

[9.18.6.2.] 9.18.6.2. ([2] 2) [F61-OS2.3]

[9.18.6.2.] 9.18.6.2. ([3] 3) [F40-OH1.1]

[9.18.6.2.] 9.18.6.2. ([4] 4) [F40,F61-OH1.1,OH1.2]

[9.18.6.2.] 9.18.6.2. ([4] 4) [F61-OS2.3]

[9.25.3.6.] 9.25.3.6. ([1] 1) [F40-OH1.1]

[9.25.3.6.] 9.25.3.6. ([2] 2) [F40-OH1.1]

~~[9.25.3.6.] 9.25.3.6. ([3] 3) [F40-OH1.1]~~

[9.25.3.6.] 9.25.3.6. ([3] 3) [F40-OH1.1]

[9.25.3.6.] 9.25.3.6. ([3] 3) no attributions

~~[9.25.3.6.] 9.25.3.6. ([4] 4) no attributions~~

~~[9.25.3.6.] 9.25.3.6. ([5] 5) [F40-OH1.1]~~

[9.25.3.6.] 9.25.3.6. ([6] 6) [F40-OH1.1]

Submit a comment

Proposed Change 1964

Code Reference(s):	**NBC20 Div.B 9.25.2.2. (first printing)** **NBC20 Div.B 9.25.2.5. (first printing)**
Subject:	Spray-Applied Polyurethane Insulation
Title:	Introduction of References to New Material and Installation Standards for Light-Density, Open-Cell, Spray-Applied Polyurethane Foam
Description:	This proposed change introduces references to CAN/ULC-S712.1:2021, "Standard for Thermal Insulation – Light Density, Open Cell Spray Applied Semi-Rigid Polyurethane Foam – Material Specification," and CAN/ULC-S712.2:2020, "Standard for Thermal Insulation – Light Density, Open Cell Spray Applied Semi-Rigid Polyurethane Foam – Installation," in Part 9 of the NBC.

This change could potentially affect the following topic areas:

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

Problem

There are currently no explicit requirements related to light-density, open-cell, spray-applied, semi-rigid polyurethane foam in Part 9 of Division B of the NBC. Nevertheless, this material is commonly used in practice to provide resistance to heat flow and air movement.

This situation leads to inconsistencies in the design, construction and performance of these materials across Canada. These inconsistencies could result in poor thermal barrier and air barrier performance, which could result in poor indoor air quality, mould growth and a reduced resistance to the deterioration of wall and roof assemblies, which could damage the building and potentially impact the health of people.

Justification

The current practice of using light-density, open-cell, spray-applied, semi-rigid polyurethane foam in Canada is not governed by minimum requirements in the NBC. Therefore, it is very difficult for building officials to enforce minimum performance requirements, which has led to inconsistent design and construction. Therefore, there is a need to introduce references to standards in Part 9 of the NBC that provide the minimum material and installation requirements for light-density, open-cell, spray-applied, semi-rigid polyurethane foam.

References to CAN/ULC-S712.1, "Standard for Thermal Insulation – Light Density, Open Cell Spray Applied Semi-Rigid Polyurethane Foam – Material Specification," and CAN/ULC-S712.2, "Standard for Thermal Insulation – Light Density, Open Cell Spray Applied Semi-Rigid Polyurethane Foam – Installation," are also proposed to be introduced into Part 5 of the NBC 2020 (PCF 1803-2023).

These standards

- reflect the minimum performance level in terms of material and installation,
- are suitable for referencing in the NBC,
- will harmonize the minimum performance of this material across Canada, and
- will support minimizing the risks to the health of Canadians caused by poor thermal and air barrier performance, which could result in poor indoor air quality, mould growth and a reduced resistance to the deterioration of wall and roof assemblies.

It should be noted that the 2017 editions of CAN/ULC-S712.1 and CAN/ULC-S712.2 were reviewed. However, this proposed change recommends referring to the latest editions of these standards (2021 and 2020, respectively).

The revisions in CAN/ULC-S712.1:2021 relative to the 2017 edition, which have no effect on the objectives of the Code provisions and should not warrant further review, include the following:

- added non-building applications to the scope of the standard;
- added a reference to ASTM C1045;
- added tolerances to measurements and dimensions;
- changed the test data period from 90 days to 30 days per “Spray Polyurethane Foam Open-Cell (Low-Density) Thermal Aging Study Report”;
- aligned wording with CAN/ULC-S705.1; and
- other editorial changes.

The revisions in CAN/ULC-S712.2:2020 relative to the 2017 edition, which have no effect on the objectives of the Code provisions and should not warrant further review, include the following:

- clarified the warning sign as to when a location can be occupied;
- replaced the term "heater vent" with the more appropriate term "B-vent";
- clarified the isolation of inhabited buildings by deleting C5.5.1; and
- referenced publications updated to the latest editions.

PROPOSED CHANGE

[9.25.2.2.] 9.25.2.2. Insulation Materials

[1] **1)** Except as required in Sentence (2), thermal insulation shall conform to the requirements of

[a] a) ASTM C726, "Standard Specification for Mineral Wool Roof Insulation Board",

[b] b) CAN/CGSB-51.25-M, "Thermal Insulation, Phenolic, Faced",

[c] c) CGSB 51-GP-27M, "Thermal Insulation, Polystyrene, Loose Fill",

[d] d) CAN/ULC-S701.1, "Standard for Thermal Insulation, Polystyrene Boards",

[e] e) CAN/ULC-S702.1, "Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification",

[f] f) CAN/ULC-S703, "Standard for Cellulose Fibre Insulation (CFI) for Buildings",

[g] g) CAN/ULC-S704.1, "Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced",

[h] h) CAN/ULC-S705.1, "Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Material Specification", ~~or~~

[i] i) CAN/ULC-S706.1, "Standard for Wood Fibre Insulating Boards for Buildings", or

[j] --) CAN/ULC-S712.1:2021, "Standard for Thermal Insulation – Light Density, Open Cell Spray Applied Semi-Rigid Polyurethane Foam – Material Specification."

[2] **2)** The *flame-spread ratings* requirements contained in the standards listed in Sentence (1) shall not apply. (See Note A-9.25.2.2.(2).)

[3] **3)** Insulation in contact with the ground shall be inert to the action of *soil* and water and shall be such that its insulative properties are not significantly reduced by moisture.

[9.25.2.5.] 9.25.2.5. Installation of Spray-Applied Polyurethane

[1] **1)** Spray-applied polyurethane insulation shall be installed in accordance with

[a] --) CAN/ULC-S705.2, "Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Application", or

[b] --) CAN/ULC-S712.2:2020, "Standard for Thermal Insulation – Light Density, Open Cell Spray Applied Semi-Rigid Polyurethane Foam – Installation."

Impact analysis

In practice, manufacturers have been expected to meet the material standard (CAN/ULC-S712.1) since it was first published in 2010. Designers and installers have had access to the installation standard (CAN/ULC-S712.2) since it was first published in 2017. However, neither of these standards have ever been included in Part 9 of the NBC and, therefore, designers and authorities having jurisdiction have not been able to enforce minimum requirements when light-density, open-cell, spray-applied, semi-rigid polyurethane foam is used.

Adding references to these two standards would decrease the likelihood of confusion for building officials, designers, specification writers, contractors and manufacturers, as there would be explicit minimum performance requirements within the Code.

Similar to what is involved with closed-cell, spray-applied polyurethane, for which standards are already referenced in both Parts 5 and 9, manufacturers of materials for open-cell foams would be required to train installers and have training programs available in Canada.

Open-cell, spray-applied polyurethane must be installed in accordance with CAN/ULC S712.2 under a site quality assurance program (SQAP). Manufacturers require that only specific, certified installers be authorized to install their proprietary spray-polyurethane insulation in buildings. Currently, there are

- at least four different companies offering open-cell, spray-applied polyurethane foam in Canada, and
- three SQAP providers that are accredited to ISO 17024, "Conformity assessment – General requirements for bodies operating certification of persons," as a personnel certification body and accredited to ISO 17020, "Conformity assessment – Requirements for the operation of various types of bodies performing inspection," as an inspection body.

Both CAN/ULC-S712.1 and CAN/ULC-S712.2 are accessible online to the public at no cost.

Enforcement implications

Building officials would be able to request proof of compliance with the material standard CAN/ULC-S712.1 and the installation standard CAN/ULC-S712.2. Compliance with these standards could be enforced without additional resources, and they are accessible online at no cost.

In addition, the inclusion of references to these standards would provide uniform minimum performance requirements for use by building officials when evaluating design submissions, thus improving the enforcement of the Code.

Who is affected

Designers, specification writers, manufacturers, contractors, building owners and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.25.2.2.] 9.25.2.2. ([1] 1) [F51,F63,F80-OH1.1,OH1.2]

[9.25.2.2.] 9.25.2.2. ([1] 1) [F63,F80-OS2.3]

[9.25.2.2.] 9.25.2.2. ([2] 2) no attributions

[9.25.2.2.] 9.25.2.2. ([3] 3) [F51,F63-OH1.1,OH1.2]

[9.25.2.2.] 9.25.2.2. ([3] 3) [F63-OS2.3]

[9.25.2.5.] 9.25.2.5. ([1] 1) [F51,F41,F63-OH1.1] [F51,F63-OH1.2]

[9.25.2.5.] 9.25.2.5. ([1] 1) [F63-OS2.3]

Submit a comment

Proposed Change 1467

Code Reference(s):	**NBC20 Div.B 9.26.2.1. (first printing)**
Subject:	Roofing, Dampproofing and Waterproofing Standards
Title:	Introduction of a New Standard for Asphalt Core Boards
Description:	This proposed change introduces CSA A123.25:18, “Asphalt core boards used in roofing,” into Table 9.26.2.1.-B.
Related Code Change Request(s):	CCR 1270
Related Proposed Change(s):	PCF 1483

This change could potentially affect the following topic areas:

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

Problem

There are currently no explicit requirements related to asphalt core boards in Part 9 of Division B of the National Building Code of Canada (NBC), although the material is commonly used in practice as a substrate in flat or low-slope roofing. This lack of requirements leads to inconsistency in the design, construction and performance of asphalt core boards across Canada, which can lead to roof membrane issues and potential water ingress, which could put Canadians at an unacceptable risk of illness due to poor indoor air quality (e.g., exposure to mould resulting from water ingress) and inadequate thermal comfort resulting from the degradation of thermal insulation material following contact with moisture.

Justification

Given the current inconsistency in the design, construction and performance of asphalt core boards used as roofing materials in Canada, there is a need to introduce a reference to a standard into the NBC.

CSA A123.25:18, “Asphalt core boards used in roofing,” is suitable for referencing in the NBC and reflects the minimum performance requirements for substrates of asphalt-based and low-slope roofing membranes (e.g., built-up roofing or modified bitumen). In such systems, the roofing membrane can be adhered to the asphalt core board with hot asphalt or cold-applied adhesive, heat-welded to the asphalt core board, or mechanically attached to the structural deck through the asphalt core board.

Adding the standard to Table 9.26.2.1.-B would introduce minimum requirements for the performance of asphalt core boards across Canada and thus limit the probability of roof membrane issues and water ingress, which would help minimize health risks associated with poor indoor air quality, inadequate thermal comfort and exposure to moisture.

PROPOSED CHANGE

[9.26.2.1.] 9.26.2.1. Material Standards

[1] 1) Where materials used for the preparation of the substrate for roofing are covered in the scope of a standard listed in Table 9.26.2.1.-A, they shall conform to that standard.

Table [9.26.2.1.-A] 9.26.2.1.-A
Materials for Preparation of the Substrate for Roofing
Forming Part of Sentence [9.26.2.1.] 9.26.2.1.([1] 1)

Type of Material	Standards
Sheathing membranes	CAN/CGSB-51.32-M, "Sheathing, Membrane, Breather Type"
Primers	CGSB 37-GP-9Ma, "Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing"

[2] 2) Where roofing materials are covered in the scope of a standard listed in Table 9.26.2.1.-B, they shall conform to that standard.

Table [9.26.2.1.-B] 9.26.2.1.-B
Roofing Materials
Forming Part of Sentence [9.26.2.1.] 9.26.2.1.([2] 2)

Types of Roof Covering	Standards
Built-up roofing (BUR)	ASTM D3019/D3019M, "Standard Specification for Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, and Fibered" (1)
	ASTM D4479/D4479M, "Standard Specification for Asphalt Roof Coatings – Asbestos-Free"
	CAN/CGSB-37.50-M, "Hot-Applied, Rubberized Asphalt for Roofing and Waterproofing"
	CGSB 37-GP-56M, "Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing"
	CAN/CSA-A123.2, "Asphalt-Coated Roofing Sheets"
	CSA A123.25, “Asphalt core boards used in roofing”
	CSA A123.3, "Asphalt Saturated Organic Roofing Felt"
	CAN/CSA-A123.4, "Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems"
	CSA A123.17, "Asphalt Glass Felt Used in Roofing and Waterproofing"
	CSA A123.23, "Product specification for polymer-modified bitumen sheet, prefabricated and reinforced"
Single-ply membranes	ASTM D4637/D4637M, "Standard Specification for EPDM Sheet Used In Single-Ply Roof Membrane"
	ASTM D4811/D4811M, "Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing"
	ASTM D6878/D6878M, "Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing"
	CAN/CGSB-37.54, "Polyvinyl Chloride Roofing and Waterproofing Membrane"
	CAN/CGSB-37.58-M, "Membrane, Elastomeric, Cold-Applied Liquid, for Non-Exposed Use in Roofing and Waterproofing"
Shingles, shakes, tiles, panels	CSA A123.5, "Asphalt shingles made from glass felt and surfaced with mineral granules"
	CAN/CSA-A220 Series, "Concrete Roof Tiles"

Types of Roof Covering	Standards
	CSA O118.1, "Western Red Cedar Shakes and Shingles"
	CSA O118.2, "Eastern White Cedar Shingles"
Eave protection	CAN/CSA-A123.16, "Asphalt-coated glass-base sheets"
	CSA A123.22, "Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection"
Flashing	ASTM D4811/D4811M, "Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing"

Note to Table [9.26.2.1.-B] 9.26.2.1.-B:

(1) For the purpose of this Subsection, ASTM D3019/D3019M shall only apply to the non-fibered and non-asbestos-fibered types (I and III) of asphalt roll roofing.

Impact analysis

Manufacturers would need to test their materials according to the standard. The cost of the test ranges from $7,000 to $9,000. This requirement can be a benefit to manufacturers, as it gives them an opportunity to acquire market share through an initial investment in testing, but it may also be a barrier to entry for smaller companies. Since it is an initial investment decision by the manufacturer to acquire market share, no significant additional cost is expected to be incurred by Code users or end users of the building.

Building officials would need to verify that the materials have been tested according to the standard. This verification can be accomplished through communication with the certifying agency or by confirming with the manufacturer’s published literature (e.g., technical data sheets).

Adding the standard to the NBC would decrease workloads for contractors, manufacturers, designers, specification writers and building officials in determining Code compliance by providing minimum performance requirements.

Enforcement implications

The standard can be enforced without additional resources.

Who is affected

Designers, specifiers, manufacturers, contractors, building owners and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.26.2.1.] 9.26.2.1. ([1] 1) [F61-OH1.1,OH1.2,OH1.3]

[9.26.2.1.] 9.26.2.1. ([1] 1) [F61-OS2.3]

[9.26.2.1.] 9.26.2.1. ([2] 2) [F61-OH1.1,OH1.2,OH1.3]

[9.26.2.1.] 9.26.2.1. ([2] 2) [F61-OS2.3]

Submit a comment

Proposed Change 1845

Code Reference(s):	**NBC20 Div.B 9.29.5.2. (first printing)**
Subject:	Other — Fire Protection
Title:	Introduction of References to Standards Related to Gypsum Board to Article 9.29.5.2.
Description:	This proposed change introduces references to two standards that are already referenced elsewhere in the NBC to Article 9.29.5.2., ASTM C1177/C1177M, “Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing,” and ASTM C1658/C1658M, “Standard Specification for Glass Mat Gypsum Panels.”
Related Code Change Request(s):	CCR 1801
Related Proposed Change(s):	PCF 1846

This change could potentially affect the following topic areas:

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

Problem

Several common Type X gypsum board products are available on the market and used across Canada. However, Article 9.29.5.2. of Division B of the NBC currently references only two standards for Type X gypsum board. This results in a limited selection of Type X gypsum board products that can be used to comply with the requirements of Subsection 9.29.5. If the list of gypsum board standards referenced in Article 9.29.5.2. is not updated, it will continue to limit the flexibility of design and construction.

The current edition of the NBC needs to be updated to reflect the standardized industry language and gypsum products that are currently used in Canada.

Justification

This proposed change would introduce references to two Type X gypsum board standards to Article 9.29.5.2., ASTM C1177/C1177M, "Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing," and ASTM C1658/C1658M, "Standard Specification for Glass Mat Gypsum Panels." These two standards are already referenced elsewhere in the NBC 2020, and referencing them in Article 9.29.5.2. is not expected to result in any conflicts.

This proposed change would permit Type X gypsum board with glass mat facer to be used in high-moisture environments where paper-faced products are not appropriate. This proposed change would also improve flexibility in the design and construction of buildings since more options would be available to Code users.

PROPOSED CHANGE

[9.29.5.2.] 9.29.5.2. Materials

[1] 1) Gypsum products shall conform to

- [a] a) ASTM C1178/C1178M, "Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel", ~~or~~
- [b] b) ASTM C1396/C1396M, "Standard Specification for Gypsum Board", except that the *flame-spread rating* of gypsum board shall be determined in accordance with CAN/ULC-S102, "Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies",
- [c] --) ASTM C1177/C1177M, "Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing," or
- [d] --) ASTM C1658/C1658M, "Standard Specification for Glass Mat Gypsum Panels."

Impact analysis

No additional costs are expected to be incurred as a result of adding references to these two standards to Article 9.29.5.2. The proposed change would simply add more options. Formally including more gypsum board products as desired by the construction industry will simplify enforcement and allow the use of gypsum board products that are more appropriate to the end use.

Enforcement implications

This proposed change can be enforced by the existing infrastructure. Since the two additional standards are already referenced in the NBC 2020, the industry and regulators are familiar with the products conforming to these standards. As such, no additional training is anticipated to be necessary for Code users. Formally including more gypsum board products as desired by the construction industry will simplify enforcement of the Code.

Who is affected

Builders, consumers, manufacturers, regulators, designers, contractors and building owners.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.29.5.2.] 9.29.5.2. ([1] 1) [F20,F80-OP2.1,OP2.3] [F22,F80-OP2.4]

[9.29.5.2.] 9.29.5.2. ([1] 1) [F20,F80-OS2.1,OS2.3]

[9.29.5.2.] 9.29.5.2. ([1] 1) [F20,F22,F80-OS1.2]

[9.29.5.2.] 9.29.5.2. ([1] 1) [F20,F22,F80,F81-OH1.1,OH1.2]

Submit a comment

Proposed Change 1830

Code Reference(s):	**NBC20 Div.B 9.36. (first printing)**
Subject:	Energy Efficiency for Houses
Title:	Energy Performance Tier 5 of the Prescriptive Path
Description:	This proposed change provides energy-efficiency requirements for compliance with Tier 5 of the energy performance compliance prescriptive path.
Related Proposed Change(s):	PCF 1823, PCF 2042

This change could potentially affect the following topic areas:

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

Problem

The 2020 edition of the National Building Code of Canada (NBC) introduced energy-efficiency performance tiers in Section 9.36. of Division B, with increasing levels of improvement for buildings and houses, to provide authorities having jurisdiction with the option to adopt the energy performance level most suitable to their needs.

Although performance modeling is common in the industry, many participants have requested that prescriptive compliance paths remain in the Code to provide simplicity in achieving energy compliance. However, there are no prescriptive paths provided beyond Energy Performance Tier 2 in Section 9.36.

Failure to develop a prescriptive compliance path for Energy Performance Tier 5 would force Code users to rely on the performance-based requirements that use energy modeling to achieve the energy-efficiency targets for Tier 5 performance. This would prevent compliance with Tier 5 for Code users who do not have access to performance modeling.

Justification

For the 2025 Code cycle, the Provinces and Territories identified “improved energy provisions leading to the adoption of 2030 net-zero energy ready model codes” as a priority. To provide a net-zero energy level of performance by 2030, authorities having jurisdiction could choose to adopt the highest tier of energy efficiency, which is Tier 5.

Prescriptive Tier 5 requirements would provide acceptable solutions for different components of the building to improve the total energy performance. Together with the tiered energy performance path in Subsection 9.36.7. and the tiered energy points-based prescriptive trade-off path in Subsection 9.36.8., the prescriptive path is one of three compliance options that provide an acceptable means of achieving the performance goal of reducing energy consumption by at least 70% for buildings over 300 m^3 and by at least 60% for buildings under 300 m^3.

In developing the Tier 5 prescriptive solutions, many different possible solutions were considered.

Building Envelope

Two Tier 5 building envelope packages were developed for each climate zone: one for buildings with conditioned internal volumes greater than 300 m^3 and one for buildings with conditioned volumes less than or equal to 300 m^3. This distinction was made to acknowledge the different requirements for tiered performance compliance based on conditioned volume, as described in Table 9.36.7.2. The 240 building archetypes were separated by volume, with 219 building archetypes having a conditioned volume greater than 300 m^3 and 21 having a volume of less than or equal to 300 m^3.

For each building volume group and climate zone, two criteria were used to define acceptable Tier 5 building envelope package solutions:

1. At least 80% of the building archetypes had to comply with the Tier 5 requirement for percentage heat loss reduction, as follows:

   - 40% for volumes greater than 300 m^3, and
   - 25% for volumes less than and equal to 300 m^3.

2. On average the building archetypes had to have a peak heating load less than their reference building.

There are numerous combinations of envelope measures that meet the criteria above. Therefore, additional selection criteria needed to be defined to reduce the number of prescriptive building envelope package solutions to one for each climate zone and building volume.

The two additional criteria were:

1. minimal incremental costs make a solution desirable, and

2. component performance of the building envelope must consistently increase across climate zones.

A fourth criterion was defined to ensure that, when going from a warmer to colder climate zone, the thermal performance of a building envelope component was not reduced. For example, a solution that uses 4.88 RSI for the effective thermal resistance of above-grade walls in climate zone 6 would not be used if the solution for climate zone 5 used 5.69 RSI for above-grade walls.

Airtightness

Mandatory airtightness testing is required in the Tier 5 prescriptive path, which follows the direction provided by the Canadian Board for Harmonized Construction Codes (CBHCC) to validate the compliance with airtightness level (AL) 4, considering that:

- Increasing the AL of the house is essential for achieving Tier 5 energy performance, as the energy loss due to air leakage/infiltration accounts for a significant portion of the overall building energy loss.
- It is difficult to verify whether the current prescriptive measures to minimize the air leakage of building components and assemblies were properly constructed based on a visual inspection alone without conducting a whole building airtightness test, especially for houses built to meet high energy performance tiers.
- Conducting an airtightness test would be the most economical way to achieve the energy-saving goal for Tier 5, as the cost of an airtightness test would be offset by decreasing construction costs for a Tier 5 design at increasing levels of airtightness.

In spring 2023, Codes Canada conducted a survey on the availability and cost of airtightness testing in Canada, which supports the rationale that airtightness testing is available at fairly low prices and the price increase due to long-distance travel costs associated with this testing is reasonable.

HVAC and Service Water Heating System

Three fuel-sources (i.e., electric, natural gas and oil) were considered. Additionally, electric-only and dual-energy packages were proposed. A fossil-fuel-only package was not developed for mechanical equipment, as modeling results indicated that Tier 5 performance goals are not achieved with drafted packages (i.e., they missed the target by about 10%).

Heat-recovery ventilators or energy-recovery ventilators (HRVs/ERVs) were considered as an easy and economical way to save energy, especially for the Tier 5 prescriptive path; it was proposed that all Tier 5 houses should be equipped with HRVs/ERVs with minimum 75% sensible recovery efficiency.

Drain-water heat-recovery (DWHR) units were also considered as essential to a high efficiency house; therefore, it was proposed that DWHR units with minimum 42% heat recovery efficiency should be installed for all Tier 5 houses.

Based on the analysis conducted during the 2020 Code cycle for the tiered energy performance requirements in the NBC, a heat pump is required as the primary equipment for space heating to achieve the energy performance goal for higher tiers. Both air-source and gas-fired heat pumps were considered. As gas-fired heat pumps are mainly being used in commercial, not residential, applications at present, only air-source heat pumps were proposed to be used in the Tier 5 prescriptive path.

With well-insulated building envelopes and highly efficient space heating equipment, the performance of the service water heating system is another important factor that determines if the Tier 5 energy saving goals can be met. Heat pump water heaters, electric conserver water heating tanks, oil-fired water storage tanks and gas-fired instantaneous condensing water heaters were considered because they are the water heating equipment that is most commonly used available on the market.

It is worth noting that the fossil-fuel based mechanical systems (i.e., natural-gas fired or oil-fired systems) are still permitted through the use of the points-based prescriptive trade-off path or the performance path and when combined with a heat pump system in the dual-energy package.

PROPOSED CHANGE

[9.36.] 9.36. Energy Efficiency

[9.36.1.] 9.36.1. General

[9.36.1.1.] 9.36.1.1. Scope

[9.36.1.2.] 9.36.1.2. Definitions

[9.36.1.3.] 9.36.1.3. Compliance and Application

(See Note A-9.36.1.3.)

[1] **1)** Except as provided in Sentences (2) to (6), *buildings* shall comply with
  - [a] a) the prescriptive or trade-off requirements in Subsections 9.36.2. to 9.36.4.,
  - [b] b) the performance requirements in Subsection 9.36.5.,
  - [c] c) the tiered performance requirements in Subsection 9.36.7.,
  - [d] d) the tiered points-based prescriptive trade-off requirements in Subsection 9.36.8., ~~or~~
  - [e] --) the tiered prescriptive requirements in Subsection 9.36.9., or
  - [f] e) the NECB.

[2] **2)** Subsections 9.36.2. to 9.36.4. and 9.36.9. apply to
  - [a] a) *buildings* of *residential occupancy* to which Part 9 applies,
  - [b] b) *buildings* containing *business and personal services*, *mercantile* or *low-hazard industrial occupancies* to which Part 9 applies whose combined total *floor area* does not exceed 300 m^2, excluding parking garages that serve *residential occupancies*, and
  - [c] c) *buildings* containing a mix of the *residential* and non-*residential occupancies* described in Clauses (a) and (b).

[3] **3)** Subsection 9.36.5. and 9.36.7. apply only to
  - [a] a) houses with or without a *secondary suite*, and

[b] b) *buildings* containing only *dwelling units* and common spaces whose total *floor area* does not exceed 20% of the total *floor area* of the *building*.

(See Note A-9.36.1.3.(3).)

[4] **4)** Subsection 9.36.8. applies only to *buildings* of *residential occupancy* to which Part 9 applies.

[5] **5)** *Buildings* containing non-*residential occupancies* whose combined total *floor area* exceeds 300 m^2 or *medium-hazard industrial occupancies* shall comply with the NECB.

[6] **6)** *Buildings* or portions of *buildings* that are not required to be *conditioned spaces* are exempted from the requirements of this Section. (See Note A-9.36.1.3.(6).)

[9.36.2.] 9.36.2. Building Envelope

[9.36.2.1.] 9.36.2.1. Scope and Application

[9.36.2.2.] 9.36.2.2. Determination of Thermal Characteristics of Materials, Components and Assemblies

[9.36.2.3.] 9.36.2.3. Calculation of Ceiling, Wall, Fenestration and Door Areas

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

[9.36.2.5.] 9.36.2.5. Continuity of Insulation

[9.36.2.6.] 9.36.2.6. Thermal Characteristics of Above-ground Opaque Building Assemblies

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

[9.36.2.8.] 9.36.2.8. Thermal Characteristics of Building Assemblies Below-Grade or in Contact with the Ground

[9.36.2.9.] 9.36.2.9. Airtightness

[9.36.2.10.] 9.36.2.10. Construction of Air Barrier Details

[9.36.2.11.] 9.36.2.11. Trade-off Options for Above-ground Building Envelope Components and Assemblies

[9.36.3.] 9.36.3. HVAC Requirements

[9.36.3.1.] 9.36.3.1. Scope and Application

[9.36.3.2.] 9.36.3.2. Equipment and Ducts

[9.36.3.3.] 9.36.3.3. Air Intake and Outlet Dampers

[9.36.3.4.] 9.36.3.4. Piping for Heating and Cooling Systems

[9.36.3.5.] 9.36.3.5. Equipment for Heating and Air-conditioning Systems

[9.36.3.6.] 9.36.3.6. Temperature Controls

[9.36.3.7.] 9.36.3.7. Humidification

[9.36.3.8.] 9.36.3.8. Heat Recovery from Dehumidification in Spaces with an Indoor Pool or Hot Tub

[9.36.3.9.] 9.36.3.9. Heat Recovery from Ventilation Systems

[9.36.8.9.] 9.36.8.9. Energy Conservation Measures for HVAC Systems

[9.36.8.10.] 9.36.8.10. Energy Conservation Measures for Service Water Heating Equipment

[9.36.8.11.] 9.36.8.11. Energy Conservation Points for Building Volume

[9.36.9.] -- Tiered Energy Performance Compliance: Tier 5 Prescriptive Path

[9.36.9.1.] --- Scope and Application

[1] --) This Subsection is concerned with achieving compliance with Energy Performance Tier 5, as specified in Table 9.36.7.2., through prescriptive requirements.

[2] --) This Subsection applies only to *buildings* that

- [a] --) are tested for airtightness as required by Article 9.36.9.6.,
- [b] --) are equipped with a heat- or energy-recovery ventilator,
- [c] --) use a heat pump as the principal *space-heating appliance*,
- [d] --) are equipped with at least one drain-water heat-recovery unit, and
- [e] --) use an electric heat pump water heater for service water heating.

(See Note A-9.36.9.1.(2).)

[9.36.9.2.] --- Compliance

[1] --) Compliance with this Subsection shall be achieved by

- [a] --) designing and constructing the *building* envelope in accordance with Articles 9.36.2.1. to 9.36.2.5. and 9.36.9.3. to 9.36.9.6., and
- [b] --) designing and constructing systems and equipment for heating, ventilating or air-conditioning in accordance with Article 9.36.9.7., and
- [c] --) designing and constructing systems and equipment for service water heating in accordance with Article 9.36.9.8.

[9.36.9.3.] --- Above-Ground Opaque Building Assemblies

[1] --) Except as provided in Article 9.36.2.5. and Sentence 9.36.2.6.(3), the effective thermal resistance of above-ground opaque *building* assemblies or portions thereof shall be not less than that shown for the applicable heating degree-days of the *building* location in

- [a] --) Table 9.36.9.3.-A where the total volume of *conditioned space* within the *building* is greater than 300 m^3 or not determined, and
- [b] --) Table 9.36.9.3.-B where the total volume of *conditioned space* within the *building* is less than or equal to 300 m^3.

Table [9.36.9.3.-A]
Tier 5 Thermal Characteristics of Above-Ground Opaque Building Assemblies Where Building Volume > 300 m^3
Forming Part of Clause 9.36.9.3.(1)(a)

Above-Ground Opaque *Building* Assembly	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
	Minimum Effective Thermal Resistance (RSI), (m^2×K)/W					
Ceilings below attics	10.43	12.19	12.19	12.19	12.19	12.19
Cathedral ceilings and flat roofs	4.67	5.02	5.02	5.02	5.80	5.80
Floors over unheated spaces	4.67	5.02	5.02	5.02	5.42	5.42
Walls above grade	5.69	5.69	5.69	5.77	6.65	6.65

Note to Table [9.36.9.3.-A] :

(1) See Article 1.1.3.1.

Table [9.36.9.3.-B]
Tier 5 Thermal Characteristics of Above-Ground Opaque Building Assemblies Where Building Volume ≤ 300 m^3
Forming Part of Clause 9.36.9.3.(1)(b)

Above-Ground Opaque *Building* Assembly	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
	Minimum Effective Thermal Resistance (RSI), (m^2×K)/W					
Ceilings below attics	8.67	8.67	8.67	10.43	10.43	10.43
Cathedral ceilings and flat roofs	5.02	5.02	5.02	5.02	5.02	5.02
Floors over unheated spaces	5.02	5.02	5.02	5.02	5.02	5.02
Walls above grade	3.23	3.85	3.85	3.85	4.80	4.80

Note to Table [9.36.9.3.-B] :

(1) See Article 1.1.3.1.

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[2] --) Where the top of a section of *foundation* wall is on average greater than or equal to 600 mm above the adjoining ground level, the effective thermal resistance of the above-ground portion of that section of wall shall be not less than that of the above-ground walls.

[3] --) Except for tubular daylighting devices, the effective thermal resistance of skylight shafts shall be not less than that of the above-ground walls.

[9.36.9.4.] --- Fenestration, Doors and Skylights

[1] --) Except as provided in Sentences (2) to (8), fenestration and doors shall have an overall thermal transmittance (U-value) not greater than, or an Energy Rating not less than that shown in Table 9.36.9.4. for the applicable heating-degree days of the *building* location. (See Note 9.36.2.7.(1) and (2).)

Table [9.36.9.4.]
Tier 5 Thermal Characteristics of Fenestration, Doors and Skylights
Forming Part of Sentences 9.36.9.4.(1) and (2)

Component	Thermal Characteristics	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
Windows and sliding glass doors	Max. U-value, W/(m^2×K)	1.05	1.05	0.94	0.94	0.82	0.82
	Min. Energy Rating	40	40	42	42	44	44
Skylights	Max. U-value, W/(m^2×K)	2.02	2.02	1.84	1.84	1.61	1.61

Note to Table [9.36.9.4.] :

(1) See Article 1.1.3.1.

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[2] --) The solar heat gain coefficient of fenestration and doors shall comply with Sentence 9.36.2.7.(2)-2025 (PCF 1823).

[3] --) Skylights shall have a U-value not greater than that shown in Table 9.36.9.4. for the applicable heating-degree days of the *building* location. (See Note 9.36.2.7.(1) and (2).)

[4] --) Glass block assemblies separating *conditioned space* from unconditioned space or the exterior shall have

[a] --) a U-value 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 a U-value 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.

[9.36.9.5.] --- Opaque Building Assemblies Below-Grade or in Contact with the Ground

[1] --) Opaque *building* assemblies below-grade or in contact with the ground shall be designed and constructed in accordance with Sentence 9.36.2.8.(3) and this Article.

[2] --) Except as provided in Article 9.36.2.5., the effective thermal resistance of *foundation* walls shall be not less than that shown for the applicable heating degree-days of the *building* location in

- [a] --) Table 9.36.9.5.-A where the total volume of conditioned space within the building is greater than 300 m^3 or not determined, and
- [b] --) Table 9.36.9.5.-B where the total volume of conditioned space within the building is less than or equal to 300 m^3.

Table [9.36.9.5.-A]
Tier 5 Thermal Characteristics of Building Assemblies Below Grade or in Contact with the Ground Where Building Volume > 300 m^3
Forming Part of Clause 9.36.9.5.(2)(a)

Above-Ground Opaque *Building* Assembly	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
	Minimum Effective Thermal Resistance (RSI), (m^2×K)/W					
Foundation walls	3.46	3.46	3.97	4.78	5.22	5.22
Unheated Floors above frost line	1.96	1.96	1.96	1.96	2.84	2.84
Unheated floors below frost line	1.96	1.96	1.96	1.96	1.96	1.96
Heated and unheated floors on permafrost	–	–	–	–	4.62	4.62
Heated floors	2.32	3.72	3.72	3.72	4.62	4.62
Slabs-on-grade with an integral footing	1.96	3.72	3.72	3.72	4.62	4.62

Note to Table [9.36.9.5.-A] :

---

(1) See Article 1.1.3.1.

Table [9.36.9.5.-B]
Tier 5 Thermal Characteristics of Building Assemblies Below Grade or in Contact with the Ground Where Building Volume ≤ 300 m^3
Forming Part of Clause 9.36.9.5.(2)(b)

Above-Ground Opaque *Building* Assembly	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
	Minimum Effective Thermal Resistance (RSI), (m^2×K)/W					
Foundation walls	3.46	3.46	3.97	4.78	5.22	5.22
Unheated Floors above frost line	1.96	1.96	1.96	1.96	1.96	1.96
Unheated floors below frost line	1.96	1.96	1.96	1.96	1.96	1.96
Heated and unheated floors on permafrost	–	–	–	–	4.44	4.44
Heated floors	2.84	2.84	2.84	3.72	3.72	4.62
Slabs-on-grade with an integral footing	2.84	2.84	2.84	3.72	3.72	4.62

Note to Table [9.36.9.5.-B] :

(1) See Article 1.1.3.1.

[9.36.9.6.] --- Airtightness

[1] --) *Buildings* to which this Subsection applies shall

[a] --) be designed and constructed in accordance with Articles 9.36.2.9. and 9.36.2.10., and

[b] --) be tested for airtightness in accordance with Subsection 9.36.6. to demonstrate compliance with Airtightness Level AL-4A or AL-4B as specified in Table 9.36.6.4.-A or 9.36.6.4.-B.

[9.36.9.7.] --- HVAC Systems

[1] --) HVAC systems, equipment and installations shall be designed and constructed in accordance with Articles 9.36.3.2. to 9.36.3.8. and 9.36.3.11. and this Article.

[2] --) Where HVAC systems, equipment or techniques other than those described in Articles 9.36.3.2. to 9.36.3.8. and 9.36.3.11. and this Article are used, the *building* shall be designed and constructed in accordance with the NECB.

[3] --) Ventilation systems serving *buildings* to which this Subsection applies shall be equipped with a heat- or energy-recovery ventilator conforming to Article 9.36.3.9.

[4] --) The sensible recovery efficiency (SRE) measured at an outside air test temperature of 0°C of the heat- or energy-recovery ventilator described in Sentence (3) shall be no less than 75%.

[5] --) Heat pumps shall have an output capacity tested at the standard test temperature of 8.3°C that is equivalent to at least 75% of the design heat loss of the *building*.

[6] --) HVAC equipment and components shall comply with the performance requirements stated in

[a] --) Table 9.36.9.7.-A where only electricity is used as the energy source, or

[b] --) Table 9.36.9.7.-B where a heat pump is used as the principal *space-heating appliance* and an oil- or gas-fired furnace is used as the supplementary heating system.

Table [9.36.9.7.-A]
Tier 5 Performance Requirements for Heat Pumps — Electrically Operated
Forming Part of Clause 9.36.9.7.(6)(a)

Heating System	**Minimum Performance**
Principal Heat pump (for space heating) (1) (2)	HSPF V ≥ 8.7 / HSPF2 V ≥ 6.4 / SEER2 ≥ 15.2 / EER2 ≥ 11.7 (3)
	Heating capacity at −15°C ≥ 70% of that at 8.3°C / COP_h ≥ 1.5 at −15°C (4)
Supplementary Electric resistance-based (for space heating)	See Table 9.36.3.10.

Notes to Table [9.36.9.7.-A] :

(1) See Table 9.36.3.10. for the corresponding performance testing standard.

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(2) A supplementary heating system is not needed if the heat pump can meet the full design load. Where a supplementary heating system is required, it shall be an electric resistance-based system.

(3) The symbols and abbreviations that appear in this column have the following meanings:

EER2 = energy-efficiency ratio 2, in (Btu/h)/W
HSPF V = heating seasonal performance factor for region V (see map in CSA C656), in (Btu/h)/W
HSPF2 V = heating seasonal performance factor 2 for region V (see map in CSA C656), in (Btu/h)/W
SEER2 = seasonal energy-efficiency ratio 2, in (Btu/h)/W

(4)

COP_h = coefficient of performance in heating mode, in W/W

Table [9.36.9.7.-B]
Tier 5 Performance Requirements for Heat Pumps — Dual Energy
Forming Part of Clause 9.36.9.7.(6)(b)

Heating System	**Minimum Performance**
Principal Heat pump (for space heating) (1)	HSPF V ≥ 8.7 / HSPF2 V ≥ 6.4 / SEER2 ≥ 15.2 / EER2 ≥ 11.7 (2)
	Heating capacity at −15°C ≥ 70% of that at 8.3°C / COP_h ≥ 1.5 at −15°C (3)
Supplementary Oil-fired furnace	AFUE ≥ 87% (4)
Gas-fired furnace (5)	See Table 9.36.3.10.

Notes to Table [9.36.9.7.-B] :

(1) See Table 9.36.3.10. for the corresponding performance testing standard.

(2) The symbols and abbreviations that appear in this column have the following meanings:

EER2 = energy-efficiency ratio 2, in (Btu/h)/W
HSPF V = heating seasonal performance factor for region V (see map in CSA C656), in (Btu/h)/W
HSPF2 V = heating seasonal performance factor 2 for region V (see map in CSA C656), in (Btu/h)/W
SEER2 = seasonal energy-efficiency ratio 2, in (Btu/h)/W

(3)

COP_h = coefficient of performance in heating mode, in W/W

(4)

AFUE = annual fuel utilization efficiency

(5) Includes propane.

[7] --) Natural gas and propane fireplaces shall comply with Sentence 9.36.3.10.(2).

[8] --) The heat source component of combined space and service water heating systems that are not within the scope of CAN/CSA-P.9, "Test method for determining the performance of combined space and water heating systems (combos)", shall comply with Sentence 9.36.3.10.(3).

[9.36.9.8.] --- Service Water Heating Equipment

[1] --) Service water heating equipment and components shall be designed and constructed in accordance with Subsection 9.36.4. and this Article.

[2] --) Where service water heating equipment or techniques other than those described in Subsection 9.36.4. and this Article are used, the *building* shall be designed and constructed in accordance with the NECB.

[3] --) Electric heat pump water heaters shall have a uniform energy factor (UEF) not less than 2.95, as determined in accordance with CAN/CSA-C745, ”Energy Efficiency of Electric Storage Tank Water Heaters and Heat Pump Water Heaters.”

[4] --) At least one of the above-ground showers installed in the *building* to which this Subsection applies shall be served by a drain-water heat-recovery unit.

[5] --) Drain-water heat-recovery units shall

[a] --) be installed in a *conditioned space* according to the manufacturer's instructions, and

[b] --) have a heat-recovery efficiency no less than 42%, as determined in accordance with CSA B55.1, “Test method for measuring efficiency and pressure loss of drain water heat recovery units.”

Note A-9.36.9.1.(2) Other Compliance Options.

Buildings that do not comply with requirements of the Tier 5 prescriptive path set out in Subsection 9.36.9. are permitted to meet the requirements of the performance path (Subsection 9.36.7.) or the points-based prescriptive trade-off path (Subsection 9.36.8.) to achieve the Tier 5 energy performance target provided in Table 9.36.7.2.

Impact analysis

This proposed change would improve energy performance by following the prescriptive requirements for building envelopes and, HVAC and service water heating systems to achieve Energy Performance Tier 5. Detailed costing data can be found in the supporting document.

Energy Performance Base Code versus Tier 5: Small House Archetype

The assumed building archetype is a small two-storey house of approximately 2 500 ft.^{2} of livable space with a walk-out basement. The dimensions of the building archetype are provided in Table 1. The base case is a house that is assumed to meet the minimum requirements of Section 9.36. (Base Code).

Table 1. Total Area of the Building Envelope Components of the Small House Archetype

Area Part of or Surrounded by Building Envelope	Total Area, m^2
Above-grade walls	235
Foundation walls	58
Insulated attic area	96
Window area	34
Heated floor area	78

As shown in Table 2, the incremental cost by region varies by climate zone, described in Table 3.

Table 2. Incremental Cost of Tier 5 Compared to Base Code by Region

Region	Incremental Cost, $
British Columbia	33 873–39 893
Alberta	35 512–39 893
Saskatchewan and Manitoba	35 512–39 893
Ontario	35 284–39 893
Quebec	35 512–39 893
Atlantic Canada	35 284–39 893
Northern Canada	38 440–39 893

Table 3. Climate Zones by Region

Degree-Days Below 18°C	BC	Alberta	Saskatchewan and Manitoba	Ontario	Quebec	Atlantic Canada	Northern Canada
Zone 4: HDD < 3000	Yes	No	No	No	No	No	No
Zone 5: HDD 3000 to 3999	Yes	No	No	Yes	No	Yes	No
Zone 6: HDD 4000 to 4999	Yes	Yes	Yes	Yes	Yes	Yes	No
Zone 7A: HDD 5000 to 5999	Yes	Yes	Yes	Yes	Yes	Yes	No
Zone 7B: HDD 6000 to 6999	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zone 8: HDD ≥ 7000	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 4 provides an example of possible incremental costs by region (and climate zone).

Table 4. Example of Incremental Costs to Achieve Energy Performance Tier 5 for Components of Building Envelope Assemblies and HVAC Systems in the Small House Archetype across Canada(1)

Total Incremental Cost in British Columbia (Climate Zone 4), $	
Building Envelope	
Above-grade walls	8 835.00
Foundation walls	1 631.54
Insulated attic area	1 410.24
Window area	3 580.88
Heated floor area	0.00
Airtightness testing	475.00
Total Building Envelope	**15 933.66**
HVAC System	
HRV/ERV 75% SRE	300.00
24000 BTU Heat Pump, 9.6 HSPF5	13 740.00
Gas furnace 95% AFUE	0.00
Electric heat pump water heater	3 400.00
DWHR 42% HRE	500.00
Total HVAC	**17 940.00**
Total Small House	**33 873.70**

Total Incremental Cost in Alberta (Climate Zone 7A), $	
Building Envelope	
Above-grade walls	10 539.80
Foundation walls	1 849.04
Insulated attic area	704.64
Window area	2 748.56
Heated floor area	1 305.72
Airtightness testing	425.00
Total Building Envelope	**17 572.71**
HVAC System	
HRV/ERV 75% SRE	300.00
24000 BTU Heat Pump, 9.6 HSPF5	13 740.00
Gas furnace 95% AFUE	0.00
Electric heat pump water heater	3 400.00
DWHR 42% HRE	500.00
Total HVAC	**17 940.00**
Total Small House	**35 512.70**

Total Incremental Cost in Saskatchewan and Manitoba (Climate Zone 7B), $	
Building Envelope	
Above-grade walls	12 151.90
Foundation walls	2 133.24
Insulated attic area	704.64
Window area	2 400.06
Heated floor area	2 609.88
Airtightness testing	501.00
Total Building Envelope	**25 720.43**
HVAC System	
HRV/ERV 75% SRE	300.00
24000 BTU Heat Pump, 9.6 HSPF5	13 740.00
Gas furnace 95% AFUE	0.00
Electric heat pump water heater	3 400.00
DWHR 42% HRE	500.00
Total HVAC	**17 940.00**
Total Small House	**38 440.70**

Total Incremental Cost in Ontario (Climate Zone 5), $	
Building Envelope	
Above-grade walls	9 898.20
Foundation walls	251.14
Insulated attic area	1 480.32
Window area	3 580.88
Heated floor area	1 559.22
Airtightness testing	575.00
Total Building Envelope	**17 344.76**
HVAC System	
HRV/ERV 75% SRE	300.00
24000 BTU Heat Pump, 9.6 HSPF5	13 740.00
Gas furnace 95% AFUE	0.00
Electric heat pump water heater	3 400.00
DWHR 42% HRE	500.00
Total HVAC	**17 940.00**
Total Small House	**35 284.80**

Total Incremental Cost in Quebec (Climate Zone 6), $	
Building Envelope	
Above-grade walls	9 898.20
Foundation walls	1 547.44
Insulated attic area	1 480.32
Window area	2 748.56
Heated floor area	1 559.22
Airtightness testing	500.00
Total Building Envelope	**17 733.74**
HVAC System	
HRV/ERV 75% SRE	300.00
24000 BTU Heat Pump, 9.6 HSPF5	13 740.00
Gas furnace 95% AFUE	0.00
Electric heat pump water heater	3 400.00
DWHR 42% HRE	500.00
Total HVAC	**17 940.00**
Total Small House	**35 673.70**

Total Incremental Cost in Atlantic Canada (Climate Zone 6), $	
Building Envelope	
Above-grade walls	9 898.20
Foundation walls	1 547.44
Insulated attic area	1 480.32
Window area	2 748.56
Heated floor area	1 559.22
Airtightness testing	750.00
Total Building Envelope	**17 983.74**
HVAC System	
HRV/ERV 75% SRE	300.00
24000 BTU Heat Pump, 9.6 HSPF5	13 740.00
Gas furnace 95% AFUE	0.00
Electric heat pump water heater	3 400.00
DWHR 42% HRE	500.00
Total HVAC	**17 940.00**
Total Small House	**35 923.70**

Total Incremental Cost in Northern Canada (Climate Zone 8), $	
Building Envelope	
Above-grade walls	12 151.90
Foundation walls	836.94
Insulated attic area	704.64
Window area	2 400.06
Heated floor area	2 609.88
Airtightness testing	3 250.00
Total Building Envelope	**21 953.37**
HVAC System	
HRV/ERV 75% SRE	300.00
24000 BTU Heat Pump, 9.6 HSPFV	13 740.00
Gas furnace 95% AFUE	0.00
Electric heat pump water heater	3 400.00
DWHR 42% HRE	500.00
Total HVAC	**17 940.00**
Total Small Building	**39 893.40**

Note to Table 4:

(1) The abbreviations that appear in this Table have the following meanings:

AFUE = annual fuel utilization efficiency
DWHR = drain-water heat recovery
HRE = heat recovery efficiency
HRV/ERV = heat- or energy-recovery ventilator
HSPF V = heating seasonal performance factor for region V
HVAC = heating, ventilating and air-conditioning
SRE = sensible recovery efficiency measured at an outside air test temperature of 0°C

Enforcement implications

This proposed change could be enforced by the infrastructure currently available to enforce the Code.

This proposed change would facilitate the effective enforcement of high-performance energy solutions in jurisdictions where complying with the performance path is problematic.

Who is affected

Regulators, builders, designers, engineers, architects, contractors and consultants in provinces and territories where Energy Performance Tier 5 of the NBC has been adopted for housing and small buildings.

Supporting Document(s)

Supporting Costing Information for PCF 1830 (pcf_1830_supporting_document.pdf)

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.36.1.1.] 9.36.1.1. ([1] 1) no attributions

[9.36.1.2.] 9.36.1.2. ([1] 1) no attributions

[9.36.1.2.] 9.36.1.2. ([2] 2) no attributions

[9.36.1.2.] 9.36.1.2. ([3] 3) no attributions

[9.36.1.2.] 9.36.1.2. ([4] 4) no attributions

[9.36.1.2.] 9.36.1.2. ([5] 5) no attributions

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[9.36.1.2.] 9.36.1.2. ([7] 7) no attributions

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[9.36.1.3.] 9.36.1.3. ([2] 2) no attributions

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[9.36.1.3.] 9.36.1.3. ([5] 5) no attributions

[9.36.1.3.] 9.36.1.3. ([6] 6) no attributions

[9.36.2.1.] 9.36.2.1. ([1] 1) no attributions

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[9.36.2.1.] 9.36.2.1. ([5] 5) no attributions

[9.36.2.2.] 9.36.2.2. ([1] 1) [F92-OE1.1]

[9.36.2.2.] 9.36.2.2. ([2] 2) [F92-OE1.1]

[9.36.2.2.] 9.36.2.2. ([3] 3) [F92-OE1.1]

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[9.36.2.2.] 9.36.2.2. ([5] 5) [F92-OE1.1]

[9.36.2.3.] 9.36.2.3. ([1] 1) no attributions

[9.36.2.3.] 9.36.2.3. ([2] 2) no attributions

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[9.36.2.3.] 9.36.2.3. ([5] 5) no attributions

[9.36.2.4.] 9.36.2.4. ([1] 1) [F92-OE1.1]

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[9.36.2.4.] 9.36.2.4. ([3] 3) [F92-OE1.1]

[9.36.2.4.] 9.36.2.4. ([4] 4) no attributions

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[9.36.2.5.] 9.36.2.5. ([3] 3) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([4] 4) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([5] 5) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([6] 6) [F92-OE1.1]

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[9.36.2.6.] 9.36.2.6. ([4] 4) [F92-OE1.1]

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

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

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

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

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

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

[9.36.2.8.] 9.36.2.8. ([1] 1) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([2] 2) [F92-OE1.1]

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[9.36.2.8.] 9.36.2.8. ([4] 4) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([5] 5) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([6] 6) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([7] 7) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([8] 8) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([9] 9) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([10] 10) no attributions

[9.36.2.9.] 9.36.2.9. ([1] 1) [F90-OE1.1]

[9.36.2.9.] 9.36.2.9. ([2] 2) [F90-OE1.1]

[9.36.2.9.] 9.36.2.9. ([3] 3) [F90-OE1.1]

[9.36.2.9.] 9.36.2.9. ([4] 4) [F90-OE1.1]

[9.36.2.9.] 9.36.2.9. ([5] 5) [F90-OE1.1]

[9.36.2.9.] 9.36.2.9. ([6] 6) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([1] 1) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([2] 2) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([3] 3) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([4] 4) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([5] 5) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([6] 6) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([7] 7) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.2.10.] 9.36.2.10. ([8] 8) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([9] 9) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([10] 10) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([11] 11) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([12] 12) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([13] 13) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([14] 14) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([15] 15) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([16] 16) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([17] 17) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([18] 18) [F90-OE1.1]

[9.36.2.11.] 9.36.2.11. ([1] 1) no attributions

[9.36.2.11.] 9.36.2.11. ([2] 2) [F92-OE1.1]

[9.36.2.11.] 9.36.2.11. ([2] 2) no attributions

[9.36.2.11.] 9.36.2.11. ([3] 3) [F92-OE1.1]

[9.36.2.11.] 9.36.2.11. ([3] 3) no attributions

[9.36.2.11.] 9.36.2.11. ([4] 4) [F92-OE1.1]

[9.36.2.11.] 9.36.2.11. ([5] 5) [F92-OE1.1]

[9.36.2.11.] 9.36.2.11. ([6] 6) [F92-OE1.1]

[9.36.2.11.] 9.36.2.11. ([7] 7) [F92-OE1.1]

[9.36.2.11.] 9.36.2.11. ([8] 8) [F92-OE1.1]

[9.36.3.1.] 9.36.3.1. ([1] 1) no attributions

[9.36.3.1.] 9.36.3.1. ([2] 2) no attributions

[9.36.3.2.] 9.36.3.2. ([1] 1) [F95-OE1.1]

[9.36.3.2.] 9.36.3.2. ([2] 2) no attributions

[9.36.3.2.] 9.36.3.2. ([3] 3) [F91,F93-OE1.1]

[9.36.3.2.] 9.36.3.2. ([4] 4) [F91,F93-OE1.1]

[9.36.3.2.] 9.36.3.2. ([5] 5) no attributions

[9.36.3.2.] 9.36.3.2. ([5] 5) [F91,F93-OE1.1]

[9.36.3.3.] 9.36.3.3. ([1] 1) [F91,F95-OE1.1]

[9.36.3.3.] 9.36.3.3. ([2] 2) [F91,F95-OE1.1]

[9.36.3.3.] 9.36.3.3. ([3] 3) no attributions

[9.36.3.3.] 9.36.3.3. ([4] 4) no attributions

[9.36.3.4.] 9.36.3.4. ([1] 1) no attributions

[9.36.3.4.] 9.36.3.4. ([2] 2) [F93-OE1.1]

[9.36.3.5.] 9.36.3.5. ([1] 1) [F98-OE1.1]

[9.36.3.6.] 9.36.3.6. ([1] 1) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([1] 1) no attributions

[9.36.3.6.] 9.36.3.6. ([2] 2) [F95,F98-OE1.1]

[9.36.3.6.] 9.36.3.6. ([3] 3) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([4] 4) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([5] 5) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([6] 6) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([7] 7) [F95-OE1.1]

[9.36.3.7.] 9.36.3.7. ([1] 1) [F95-OE1.1]

[9.36.3.8.] 9.36.3.8. ([1] 1) [F95,F100-OE1.1]

[9.36.3.8.] 9.36.3.8. ([2] 2) no attributions

[9.36.3.8.] 9.36.3.8. ([3] 3) no attributions

[9.36.3.8.] 9.36.3.8. ([4] 4) [F98,F100-OE1.1]

[9.36.3.8.] 9.36.3.8. ([5] 5) [F98,F100-OE1.1]

[9.36.3.9.] 9.36.3.9. ([1] 1) no attributions

[9.36.3.9.] 9.36.3.9. ([2] 2) [F95,F100-OE1.1]

[9.36.3.9.] 9.36.3.9. ([3] 3) [F95,F100-OE1.1]

[9.36.3.9.] 9.36.3.9. ([4] 4) [F95,F98,F100-OE1.1]

[9.36.3.10.] 9.36.3.10. ([1] 1) [F95,F98,F99-OE1.1]

[9.36.3.10.] 9.36.3.10. ([2] 2) [F95,F98,F99-OE1.1]

[9.36.3.10.] 9.36.3.10. ([3] 3) no attributions

[9.36.3.11.] 9.36.3.11. ([1] 1) [F95,F98,F99-OE1.1]

[9.36.3.11.] 9.36.3.11. ([2] 2) no attributions

[9.36.3.11.] 9.36.3.11. ([3] 3) [F93,F96-OE1.1]

[9.36.4.1.] 9.36.4.1. ([1] 1) no attributions

[9.36.4.1.] 9.36.4.1. ([2] 2) no attributions

[9.36.4.2.] 9.36.4.2. ([1] 1) [F96,F98-OE1.1]

[9.36.4.2.] 9.36.4.2. ([2] 2) [F93,F96-OE1.1]

[9.36.4.2.] 9.36.4.2. ([3] 3) [F98-OE1.1]

[9.36.4.3.] 9.36.4.3. ([1] 1) [F96,F98-OE1.1]

[9.36.4.3.] 9.36.4.3. ([2] 2) no attributions

[9.36.4.3.] 9.36.4.3. ([3] 3) [F93,F96-OE1.1]

[9.36.4.4.] 9.36.4.4. ([1] 1) [F93,F96-OE1.1]

[9.36.4.4.] 9.36.4.4. ([2] 2) [F93,F96-OE1.1]

[9.36.4.4.] 9.36.4.4. ([3] 3) [F93,F96-OE1.1]

[9.36.4.5.] 9.36.4.5. ([1] 1) [F96-OE1.1]

[9.36.4.6.] 9.36.4.6. ([1] 1) [F96-OE1.1]

[9.36.4.6.] 9.36.4.6. ([2] 2) [F96-OE1.1]

[9.36.5.1.] 9.36.5.1. ([1] 1) no attributions

[9.36.5.1.] 9.36.5.1. ([2] 2) no attributions

[9.36.5.2.] 9.36.5.2. ([1] 1) no attributions

[9.36.5.2.] 9.36.5.2. ([2] 2) no attributions

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

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

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

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

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

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

[9.36.5.4.] 9.36.5.4. ([1] 1) no attributions

[9.36.5.4.] 9.36.5.4. ([2] 2) no attributions

[9.36.5.4.] 9.36.5.4. ([3] 3) [F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([4] 4) [F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([5] 5) [F95,F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([6] 6) [F95,F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([7] 7) [F95,F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([8] 8) [F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([9] 9) [F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([10] 10) [F90,F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([11] 11) [F90,F99-OE1.1]

[9.36.5.5.] 9.36.5.5. ([1] 1) [F99-OE1.1]

[9.36.5.5.] 9.36.5.5. ([2] 2) [F99-OE1.1]

[9.36.5.5.] 9.36.5.5. ([3] 3) [F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([1] 1) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([2] 2) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([3] 3) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([4] 4) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([5] 5) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([6] 6) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([7] 7) [F92,F93,F95,F96,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([8] 8) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([9] 9) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([10] 10) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([11] 11) [F92,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([1] 1) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([2] 2) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([3] 3) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([4] 4) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([5] 5) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([6] 6) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([7] 7) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([8] 8) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([9] 9) [F95,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([1] 1) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([2] 2) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([3] 3) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([4] 4) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([5] 5) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([6] 6) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([7] 7) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([8] 8) [F96,F99-OE1.1]

[9.36.5.9.] 9.36.5.9. ([1] 1) [F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([1] 1) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([2] 2) no attributions

[9.36.5.10.] 9.36.5.10. ([3] 3) no attributions

[9.36.5.10.] 9.36.5.10. ([4] 4) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([5] 5) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([6] 6) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([7] 7) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([8] 8) no attributions

[9.36.5.10.] 9.36.5.10. ([9] 9) [F90,F91,F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([10] 10) [F90,F91,F92,F93,F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([1] 1) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([2] 2) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([3] 3) [F92,F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([4] 4) [F95,F99,F100-OE1.1]

[9.36.5.11.] 9.36.5.11. ([5] 5) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([6] 6) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([7] 7) no attributions

[9.36.5.11.] 9.36.5.11. ([8] 8) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([9] 9) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([10] 10) [F95,F99,F100-OE1.1]

[9.36.5.11.] 9.36.5.11. ([11] 11) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([12] 12) [F95,F99,F100-OE1.1]

[9.36.5.11.] 9.36.5.11. ([13] 13) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([14] 14) [F95,F99,F100-OE1.1]

[9.36.5.11.] 9.36.5.11. ([15] 15) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([16] 16) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([17] 17) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([18] 18) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([19] 19) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([20] 20) [F95,F99-OE1.1]

[9.36.5.12.] 9.36.5.12. ([1] 1) [F96,F99-OE1.1]

[9.36.5.12.] 9.36.5.12. ([2] 2) no attributions

[9.36.5.13.] 9.36.5.13. ([1] 1) [F99-OE1.1]

[9.36.5.13.] 9.36.5.13. ([2] 2) [F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([1] 1) [F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([2] 2) [F90,F91,F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([3] 3) [F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([4] 4) [F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([5] 5) [F92,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([6] 6) [F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([7] 7) [F92,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([8] 8) [F92,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([9] 9) [F92,F99,F95-OE1.1]

[9.36.5.14.] 9.36.5.14. ([10] 10) [F92,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([1] 1) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([2] 2) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([3] 3) [F95,F99,F100-OE1.1]

[9.36.5.15.] 9.36.5.15. ([4] 4) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([5] 5) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([6] 6) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([7] 7) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([8] 8) [F95,F99,F100-OE1.1]

[9.36.5.15.] 9.36.5.15. ([9] 9) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([10] 10) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([11] 11) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([12] 12) [F95,F99,F100-OE1.1]

[9.36.5.15.] 9.36.5.15. ([13] 13) [F95,F99,F100-OE1.1]

[9.36.5.15.] 9.36.5.15. ([14] 14) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([15] 15) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([16] 16) [F95,F99-OE1.1]

[9.36.5.16.] 9.36.5.16. ([1] 1) [F95,F99-OE1.1]

[9.36.5.16.] 9.36.5.16. ([2] 2) [F95,F99-OE1.1]

[9.36.5.16.] 9.36.5.16. ([3] 3) [F95,F99-OE1.1]

[9.36.6.1.] 9.36.6.1. ([1] 1) no attributions

[9.36.6.2.] 9.36.6.2. ([1] 1) no attributions

[9.36.6.3.] 9.36.6.3. ([1] 1) no attributions

[9.36.6.3.] 9.36.6.3. ([1] 1) [F90-OE1.1]

[9.36.6.3.] 9.36.6.3. ([2] 2) no attributions

[9.36.6.3.] 9.36.6.3. ([3] 3) no attributions

[9.36.6.4.] 9.36.6.4. ([1] 1) no attributions

[9.36.6.4.] 9.36.6.4. ([1] 1) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.6.4.] 9.36.6.4. ([2] 2) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.6.4.] 9.36.6.4. ([3] 3) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.6.4.] 9.36.6.4. ([4] 4) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.7.1.] 9.36.7.1. ([1] 1) no attributions

[9.36.7.1.] 9.36.7.1. ([2] 2) no attributions

[9.36.7.2.] 9.36.7.2. ([1] 1) no attributions

[9.36.7.2.] 9.36.7.2. ([1] 1) [F90,F91,F92,F93,F95,F96,F98,F99,F100-OE1.1]

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

[9.36.7.3.] 9.36.7.3. ([2] 2) [F95-OE1.1]

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

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

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

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

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

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

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

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

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

[9.36.8.1.] 9.36.8.1. ([1] 1) no attributions

[9.36.8.2.] 9.36.8.2. ([1] 1) no attributions

[9.36.8.2.] 9.36.8.2. ([1] 1) [F90,F91,F92,F93,F95,F96,F98,F99,F100-OE1.1]

[9.36.8.4.] 9.36.8.4. ([1] 1) no attributions

[9.36.8.5.] 9.36.8.5. ([1] 1) no attributions

[9.36.8.5.] 9.36.8.5. ([2] 2) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([3] 3) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([4] 4) no attributions

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[9.36.8.5.] 9.36.8.5. ([5] 5) no attributions

[9.36.8.5.] 9.36.8.5. ([5] 5) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([6] 6) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([7] 7) [F92-OE1.1]

[9.36.8.6.] 9.36.8.6. ([1] 1) [F92-OE1.1]

[9.36.8.6.] 9.36.8.6. ([2] 2) no attributions

[9.36.8.6.] 9.36.8.6. ([3] 3) no attributions

[9.36.8.6.] 9.36.8.6. ([3] 3) [F92-OE1.1]

[9.36.8.6.] 9.36.8.6. ([4] 4) [F92-OE1.1]

[9.36.8.7.] 9.36.8.7. ([1] 1) no attributions

[9.36.8.7.] 9.36.8.7. ([2] 2) [F92-OE1.1]

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[9.36.8.7.] 9.36.8.7. ([4] 4) no attributions

[9.36.8.8.] 9.36.8.8. ([1] 1) no attributions

[9.36.8.8.] 9.36.8.8. ([2] 2) [F90-OE1.1]

[9.36.8.9.] 9.36.8.9. ([1] 1) no attributions

[9.36.8.9.] 9.36.8.9. ([2] 2) no attributions

[9.36.8.9.] 9.36.8.9. ([3] 3) no attributions

[9.36.8.9.] 9.36.8.9. ([3] 3) [F95,F100-OE1.1]

[9.36.8.9.] 9.36.8.9. ([4] 4) [F95-OE1.1]

[9.36.8.10.] 9.36.8.10. ([1] 1) no attributions

[9.36.8.10.] 9.36.8.10. ([2] 2) no attributions

[9.36.8.10.] 9.36.8.10. ([3] 3) [F96-OE1.1]

[9.36.8.11.] 9.36.8.11. ([1] 1) [F95-OE1.1]

[9.36.8.11.] 9.36.8.11. ([2] 2) [F95-OE1.1]

[9.36.9.1.] -- ([1] --) no attributions

[9.36.9.1.] -- ([2] --) no attributions

[9.36.9.1.] -- ([2] --) (a) [F90-OE1.1]

[9.36.9.2.] -- ([1] --) no attributions

[9.36.9.3.] -- ([1] --) no attributions

[9.36.9.3.] -- ([1] --) no attributions

[9.36.9.3.] -- ([2] --) no attributions

[9.36.9.3.] -- ([2] --) [F92,F95-OE1.1]

[9.36.9.3.] -- ([3] --) no attributions

[9.36.9.3.] -- ([3] --) [F92,F95-OE1.1]

[9.36.9.4.] -- ([1] --) no attributions

[9.36.9.4.] -- ([1] --) [F92-OE1.1]

[9.36.9.4.] -- ([2] --) no attributions

[9.36.9.4.] -- ([3] --) [F92-OE1.1]

[9.36.9.4.] -- ([4] --) [F92,F95-OE1.1]

[9.36.9.4.] -- ([5] --) [F92-OE1.1]

[9.36.9.4.] -- ([6] --) no attributions

[9.36.9.4.] -- ([7] --) [F92-OE1.1]

[9.36.9.4.] -- ([8] --) [F92,F95-OE1.1]

[9.36.9.5.] -- ([1] --) no attributions

[9.36.9.5.] -- ([2] --) no attributions

[9.36.9.5.] -- ([2] --) [F92,F95-OE1.1]

[9.36.9.6.] -- ([1] --) no attributions

[9.36.9.7.] -- ([1] --) no attributions

[9.36.9.7.] -- ([2] --) no attributions

[9.36.9.7.] -- ([3] --) no attributions

[9.36.9.7.] -- ([3] --) [F95,F100-OE1.1]

[9.36.9.7.] -- ([4] --) [F95,F98,F100-OE1.1]

[9.36.9.7.] -- ([5] --) [F95,F98,F100-OE1.1]

[9.36.9.7.] -- ([6] --) [F95,F98,F99-OE1.1]

[9.36.9.7.] -- ([7] --) no attributions

[9.36.9.7.] -- ([8] --) no attributions

[9.36.9.8.] -- ([1] --) no attributions

[9.36.9.8.] -- ([2] --) no attributions

[9.36.9.8.] -- ([3] --) no attributions

[9.36.9.8.] -- ([4] --) [F95,F100-OE1.1]

[9.36.9.8.] -- ([5] --) [F96,F98-OE1.1]

Submit a comment

Proposed Change 1869

Code Reference(s):	**NBC20 Div.B 9.36. (first printing)**
Subject:	Energy Use Intensity
Title:	Energy Use Intensity Compliance Path
Description:	This proposed change introduces an energy performance compliance path based on the energy use intensity target of the building to Section 9.36.
Related Proposed Change(s):	PCF 1868

This change could potentially affect the following topic areas:

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

Problem

Section 9.36. of Division B of the National Building Code of Canada (NBC) 2020 does not account for the energy savings that Code users can achieve through compact architectural design. Smaller attached houses are subject to the same insulation requirements as larger detached houses with extensive floorplans, even though the smaller houses require much less energy. This approach is not only inconsistent with the environment objective of the NBC (which includes limiting the probability of excessive use of energy), but also unnecessarily burdens Code users who build very efficient houses.

The current energy performance path in Section 9.36. requires Code users to demonstrate that the proposed house uses an equal or smaller amount of energy than an equivalent reference house. In accordance with the modeling rules prescribed by Subsection 9.36.5., the reference house comprises a hypothetical house with similar geometry to that of the proposed design, but it is constructed to the minimum prescriptive requirements of Subsections 9.36.2. to 9.36.4. Accordingly, a proposed house's energy budget reflects the minimum efficiency requirements of Section 9.36., but varies according to the shape and size of the house. As a result, larger houses benefit from larger energy budgets, while smaller houses must meet smaller energy budgets.

The reference house energy budget also varies with building shape; "compact" designs that minimize heat loss area (e.g., row houses, stacked houses, houses with simple shapes or low ceilings) receive more stringent budgets than extensive designs with greater building envelope area per unit of floor area (e.g., ranch-style detached bungalows). While this framework ensures that all buildings complying with Section 9.36. reflect similar levels of energy efficiency (e.g., through use of insulation, glazing, equipment efficiency), it permits the construction of buildings with varying energy use.

This outcome is inconsistent with the environment objective, which seeks to limit energy use. In addition, the existing performance path needlessly burdens Code users who choose more compact and efficient forms by obliging these Code users to construct very well insulated buildings even though the chosen design form inherently uses much less energy than other Code-compliant houses. These requirements may increase housing costs in affordable and entry-level housing markets, which largely comprise compact housing forms (including attached, row and stacked housing units).

Justification

Introducing an alternate energy performance compliance path based on energy use intensity (EUI) would allow Code users to demonstrate compliance through compact architectural design. This proposed change enables authorities having jurisdiction to recognize the inherent efficiency of attached, row and stacked housing forms and to credit these houses for energy savings relative to other Code-compliant houses.

The proposed EUI compliance path will also enable Code users to benefit from two inherent advantages of absolute energy targets:

- To better reflect a building's expected energy consumption.
- To reduce the administrative burden of the code by eliminating the reference house modelling requirements.

For these reasons, other jurisdictions in Canada (e.g., British Columbia, City of Toronto) and abroad have introduced compliance paths based on absolute energy use metrics. Experiences from those jurisdictions also attest to specific challenges associated with EUI compliance for small dwellings and in local climates. Reflecting those lessons, the proposed EUI approach includes requirements that adapt EUI targets to local heating degree-days and to relax EUI limits for smaller houses.

Overall, this EUI compliance path will provide more flexibility for Code users when designing to the tiered energy requirements of Section 9.36. Under this compliance path, Code users can demonstrate energy savings achieved through smaller, simpler and attached compact architectural forms in addition to insulation and mechanical systems efficiency. The introduction of this compliance path could lead to reduced housing costs in affordable and entry-level housing markets.

Finally, this proposed change does not limit the use of existing compliance paths, including the reference and proposed modeling requirements of Subsections 9.36.5. and 9.36.7. Code users who construct houses with high envelope-to-floor area ratios (including houses on narrow lots, prefabricated houses and houses on piles above permafrost) may still use the enhanced energy efficiency measures prescribed elsewhere in Section 9.36. to meet the energy performance requirements.

PROPOSED CHANGE

[9.36.] 9.36. Energy Efficiency

[9.36.1.] 9.36.1. General

[9.36.1.1.] 9.36.1.1. Scope

[9.36.1.2.] 9.36.1.2. Definitions

[9.36.1.3.] 9.36.1.3. Compliance and Application

(See Note A-9.36.1.3.)

[1] **1)** Except as provided in Sentences (2) to (6), *buildings* shall comply with
  - [a] a) the prescriptive or trade-off requirements in Subsections 9.36.2. to 9.36.4.,
  - [b] b) the performance requirements in Subsection 9.36.5.,
  - [c] c) the tiered performance requirements in Subsection 9.36.7.,
  - [d] --) the tiered energy use intensity requirements in Subsection 9.36.8.-2025,
  - [e] d) the tiered prescriptive requirements in Subsection 9.36.8., or
  - [f] e) the NECB.

[2] **2)** Subsections 9.36.2. to 9.36.4. apply to
  - [a] a) *buildings* of *residential occupancy* to which Part 9 applies,
  - [b] b) *buildings* containing *business and personal services*, *mercantile* or *low-hazard industrial occupancies* to which Part 9 applies whose combined total *floor area* does not exceed 300 m^2, excluding parking garages that serve *residential occupancies*, and
  - [c] c) *buildings* containing a mix of the *residential* and non-*residential occupancies* described in Clauses (a) and (b).

[3] **3)** Subsections 9.36.5., ~~and~~ 9.36.7. and 9.36.8.-2025 apply only to
  - [a] a) houses with or without a *secondary suite*, and
  - [b] b) *buildings* containing only *dwelling units* and common spaces whose total *floor area* does not exceed 20% of the total *floor area* of the *building*.

(See Note A-9.36.1.3.(3).)

[4] **4)** Subsection 9.36.8. applies only to *buildings* of *residential occupancy* to which Part 9 applies.

[5] **5)** *Buildings* containing non-*residential occupancies* whose combined total *floor area* exceeds 300 m^2 or *medium-hazard industrial occupancies* shall comply with the NECB.

[6] **6)** *Buildings* or portions of *buildings* that are not required to be *conditioned spaces* are exempted from the requirements of this Section. (See Note A-9.36.1.3.(6).)

[9.36.2.] 9.36.2. Building Envelope

[9.36.2.1.] 9.36.2.1. Scope and Application

[9.36.2.2.] 9.36.2.2. Determination of Thermal Characteristics of Materials, Components and Assemblies

[9.36.2.3.] 9.36.2.3. Calculation of Ceiling, Wall, Fenestration and Door Areas

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

[9.36.2.5.] 9.36.2.5. Continuity of Insulation

[9.36.2.6.] 9.36.2.6. Thermal Characteristics of Above-ground Opaque Building Assemblies

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

[9.36.2.8.] 9.36.2.8. Thermal Characteristics of Building Assemblies Below-Grade or in Contact with the Ground

[9.36.2.9.] 9.36.2.9. Airtightness

[9.36.2.10.] 9.36.2.10. Construction of Air Barrier Details

[9.36.2.11.] 9.36.2.11. Trade-off Options for Above-ground Building Envelope Components and Assemblies

[9.36.3.] 9.36.3. HVAC Requirements

[9.36.3.1.] 9.36.3.1. Scope and Application

[9.36.3.2.] 9.36.3.2. Equipment and Ducts

[9.36.3.3.] 9.36.3.3. Air Intake and Outlet Dampers

[9.36.3.4.] 9.36.3.4. Piping for Heating and Cooling Systems

[9.36.3.5.] 9.36.3.5. Equipment for Heating and Air-conditioning Systems

[9.36.3.6.] 9.36.3.6. Temperature Controls

[9.36.3.7.] 9.36.3.7. Humidification

[9.36.3.8.] 9.36.3.8. Heat Recovery from Dehumidification in Spaces with an Indoor Pool or Hot Tub

[9.36.3.9.] 9.36.3.9. Heat Recovery from Ventilation Systems

[9.36.4.] 9.36.4. Service Water Heating Systems

[9.36.5.] 9.36.5. Energy Performance Compliance

[9.36.5.14.] 9.36.5.14. Modeling Building Envelope of Reference House

[9.36.5.15.] 9.36.5.15. Modeling HVAC System of Reference House

[9.36.5.16.] 9.36.5.16. Modeling Service Water Heating System of Reference House

[9.36.6.] 9.36.6. Airtightness of Building Envelope

[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. Determination of Airtightness

[9.36.6.4.] 9.36.6.4. Determination of Airtightness Level

[9.36.7.] 9.36.7. Tiered Energy Performance Compliance: Performance Path

[9.36.7.1.] 9.36.7.1. Scope and Application

[9.36.7.2.] 9.36.7.2. Compliance

[9.36.7.3.] 9.36.7.3. Energy Performance Improvement Compliance Calculations

[9.36.8.] -- Tiered Energy Performance Compliance: Energy Use Intensity Path

[9.36.8.1.] --- Scope and Application

[1] --) This Subsection is concerned with determining compliance with one of the energy performance tiers through modeling of the energy performance of components, systems and assemblies that are installed in *buildings* and houses with or without a *secondary suite* described in Sentence 9.36.1.3.(3).

[2] --) For the purpose of this Subsection, the term "house" shall mean all houses, with or without a *secondary suite*, that

- [a] --) have HVAC systems that serve only the house, only the *secondary suite*, or both the house and the *secondary suite*,
- [b] --) have service water heating systems that serve only the house, only the *secondary suite*, or both the house and the *secondary suite*, and
- [c] --) do not share common spaces intended for *occupancy* with other *dwelling units* or houses, except for a *secondary suite*.

[3] --) For the purpose of this Subsection, the term "heated *floor area*" shall mean the sum of all *floor areas* served by heating equipment throughout the year, in m².

[4] --) For the purpose of this Subsection, the term “local heat loss factor” shall mean the reference heat loss intensity for local climatic conditions at the *building* location, in kWh/m² per year, calculated as follows:

$$\text{Local heat loss factor} = (0.02 \times \text{HDD}) + 32.6$$

where

HDD = degree-days below 18°C of the *building* location, determined in accordance with Article 1.1.3.1.

[5] --) For the purpose of this Subsection, the term “local energy use factor” shall mean the reference energy use for local climatic conditions, inkWh/m² per year, calculated as follows:

$$\text{Local energy use factor} = (0.02 \times \text{HDD}) - 12.3$$

[9.36.8.2.] --- Compliance

[1] --) Compliance with this Subsection shall be achieved by demonstrating that

- [a] --) the annual gross space heat loss of the proposed house calculated in accordance with Sentence 9.36.7.3.(5) does not exceed the annual gross space heat loss target calculated in accordance with Sentence 9.36.8.3.(1)-2025 (see Note A-9.36.7.3.(1)),
- [b] --) the design cooling load of the proposed house calculated in accordance with Sentence 9.36.8.4.(1)-2025 does not exceed the design cooling load budget calculated in accordance with Sentence 9.36.8.4.(2)-2025, and
- [c] --) the annual energy consumption of the proposed house calculated in accordance with Sentence 9.36.5.4.(1) does not exceed the annual energy consumption target calculated in accordance with Sentence 9.36.8.5.(1)-2025.

[2] --) Except where otherwise stated in this Subsection, the proposed house shall be modeled in accordance with Subsection 9.36.5.

[9.36.8.3.] --- Annual Gross Space Heat Loss

[1] --) The annual gross space heat loss target shall be calculated by multiplying the annual gross space heat loss budget, calculated in accordance with Sentence (2), by the gross space heat loss adjustment factor, as provided in Table 9.36.8.3.-A for the applicable energy performance tier, in kWh per year.

Table [9.36.8.3.-A]
Gross Space Heat Loss Adjustment Factor
Forming Part of Sentence 9.36.8.3.(1)

Energy Performance Tier	**Gross Space Heat Loss Adjustment Factor**
1	1
2	0.95
3	0.90
4	0.80
5	0.60

[2] --) The annual gross space heat loss budget for the applicable heated *floor area* shall be determined in accordance with Table 9.36.8.3.-B, in kWh per year.

Table [9.36.8.3.-B]
Annual Gross Space Heat Loss Budget
Forming Part of Sentence 9.36.8.3.(2)

Heated *Floor Area*, m^2	**Annual Gross Space Heat Loss Budget, kWh per year**
Heated *floor area* < 115	Local heat loss factor × 115
115 < heated *floor area* < 350	Local heat loss factor × heated *floor area*
Heated *floor area* > 350	Local heat loss factor × 350

[9.36.8.4.] --- Design Cooling Load

[1] --) The design cooling load shall be calculated in accordance with CSA F280, “Determining the required capacity of residential space heating and cooling appliances.”

[2] --) The design cooling load budget shall be calculated by multiplying the heated *floor area* by 15 W/m².

[3] --) *Buildings* and houses with a design cooling load greater than the design cooling load budget shall be equipped with cooling equipment that

[a] --) is sized in accordance with CSA F280, “Determining the required capacity of residential space heating and cooling appliances,” and

[b] --) complies with Subsection 9.36.3.

[9.36.8.5.] --- Annual Energy Consumption Target

[1] --) The annual energy consumption target shall be calculated by multiplying the reference energy use budget, calculated in accordance with Sentence (2), by the energy consumption target adjustment factor as provided in Table 9.36.8.5.-A for the applicable energy performance tier.

Table [9.36.8.5.-A]
Energy Consumption Target Adjustment Factor
Forming Part of Sentence 9.36.8.5.(1)

Energy Performance Tier	**Energy Consumption Target Adjustment Factor**
1	1
2	0.90
3	0.80
4	0.60
5	0.30

[2] --) The reference energy use budget for the applicable heated *floor area* shall be determined in accordance with Table 9.36.8.5.-B.

Table [9.36.8.5.-B]
Reference Energy Use Budget
Forming Part of Sentence 9.36.8.5.(2)

Heated *Floor Area*, m^2	**Reference Energy Use Budget, kWh per year**
Heated *floor area* < 115	(Local energy use factor × 115) + 6 500
115 < heated *floor area* < 350	(Local energy use factor × heated *floor area*) + 6 500
Heated *floor area* > 350	(Local energy use factor × 350) + 6 500

[9.36.9.] 9.36.8. Tiered Energy Performance Compliance: Prescriptive Path

[9.36.9.1.] 9.36.8.1. Scope

[9.36.9.2.] 9.36.8.2. Compliance

[9.36.9.3.] 9.36.8.3. Definitions

[9.36.9.4.] 9.36.8.4. Building Envelope – General

[9.36.9.5.] 9.36.8.5. Energy Conservation Measures for Above-Ground Opaque Building Assemblies

[9.36.9.6.] 9.36.8.6. Energy Conservation Measures for Fenestration and Doors

[9.36.9.7.] 9.36.8.7. Energy Conservation Measures for Opaque Building Assemblies Below-Grade or in Contact with the Ground

[9.36.9.8.] 9.36.8.8. Energy Conservation Measures Relating to Airtightness

[9.36.9.9.] 9.36.8.9. Energy Conservation Measures for HVAC Systems

[9.36.9.10.] 9.36.8.10. Energy Conservation Measures for Service Water Heating Equipment

[9.36.9.11.] 9.36.8.11. Energy Conservation Points for Building Volume

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Impact analysis

This proposed change provides an alternate compliance path for meeting the energy-efficiency requirements of Section 9.36., including the energy performance tiers provided in Subsection 9.36.7. This proposed change does not limit or restrict the continued use of the existing compliance paths provided in Section 9.36; Code users who deem the energy use intensity (EUI) compliance path to be more onerous than the existing prescriptive or performance paths may continue to comply via those other paths. Accordingly, this proposed change is not expected to increase the cost or effort required to comply with the Code.

However, many Code users will likely find that complying via the EUI compliance path is simpler and more cost-effective than compliance via the existing prescriptive or performance paths. This outcome is expected because the EUI compliance path recognizes the energy savings inherent in more compact architectural forms. Where Subsection 9.36.7. limits compliance measures to improved building envelopes and enhanced equipment efficiencies, the EUI compliance path offers Code users another tool (i.e., reducing building envelope area) to achieve the same objective.

Research by Natural Resources Canada (NRCan) supports this conclusion. NRCan analyzed the various energy compliance paths using 240 building archetypes representing contemporary residential construction in different locations across Canada. Each of these building archetypes was configured to reflect the minimum prescriptive requirements described in Subsections 9.36.2. to 9.36.4.

When the compliance of these same building archetypes was assessed via the proposed EUI compliance path, NRCan found that 25% of the building archetypes achieved at least Energy Performance Tier 1 without further modification. An additional 25% of the building archetypes would achieve Energy Performance Tier 1 if equipped with cooling equipment to satisfy the requirement of proposed Article 9.36.8.4.-2025 on design cooling load. The remaining 50% of the building archetypes would not benefit from using the proposed EUI compliance path and would be best served by the existing compliance paths.

Of the 25% of building archetypes that would achieve at least Energy Performance Tier 1, many would be able to achieve higher tier performance under the EUI compliance path without employing additional energy conservation measures. Table 1 provides the percentage of building archetypes that would comply with each of the energy performance tiers when constructed to the minimum requirements of Subsections 9.36.2. to 9.36.4.

Table 1: Building Archetype Compliance via EUI Compliance Path(1) by Compliance Tier and Housing Form

Form	Non-compliant with Subsection 9.36.8.-2025(2)	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Attached	40%	5%	12%	28%	15%	1%
Detached	69%	13%	9%	7%	2%	0%

Notes to Table:

(1) When constructed to the prescriptive requirements of NBC Section 9.36.

(2) These archetypes would still comply with the prescriptive requirements of Subsections 9.36.2. to 9.36.4. as well as Energy Performance Tier 1 described in Subsection 9.36.7.

Although all of these building archetypes reflect Code-compliant construction, the EUI compliance path would allow Code users to benefit from demonstrating compliance with higher energy tiers because the architectural form of the building reduces heat loss and overall energy use. The extent to which the EUI compliance path would enable building archetypes to meet the performance levels of higher tiers when constructed to the minimum prescriptive requirements of Subsections 9.36.2. to 9.36.4. depends on the architectural form. Stacked dwelling units that share walls as well as ceilings and/or floors with adjacent units would receive the greatest benefit.

In practice, this result means that the Code users who select compact building designs could comply with a higher energy tier at a lower cost. Highly compact and attached buildings might comply with a higher tier at no additional cost. Additionally, Code users would benefit from considering different architectural forms as an option to reduce the cost of compliance with higher energy performance tiers.

Enforcement implications

The EUI compliance path would have similar administrative requirements as the existing performance compliance paths. Both approaches rely on modeling and simulation to estimate energy consumption and then compare the results to a benchmark. Some authorities having jurisdiction that use EUI metrics report that administration of this path is somewhat simpler because the reference benchmark is readily computed using heating degree-day and floor area parameters.

Authorities having jurisdiction that adopt this EUI compliance path should note that the local heat loss factor and local energy use factor described in this proposed change reflect current NBC prescriptive requirements (Subsections 9.36.2. to 9.36.4.) and modeling rules (Subsection 9.36.5.). Changes to these requirements and rules in future Code editions would require adjustment to the factors used in the EUI compliance path.

Who is affected

This proposed change would affect designers, building owners, and energy consultants who might choose to use the proposed EUI path to demonstrate compliance.

Code users might find that administration of performance compliance via the EUI path is somewhat easier, as only one energy model would have to be completed instead of two.

In addition, Code users would have the ability to use changes to architectural form as a means of meeting energy conservation requirements.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.36.1.1.] 9.36.1.1. ([1] 1) no attributions

[9.36.1.2.] 9.36.1.2. ([1] 1) no attributions

[9.36.1.2.] 9.36.1.2. ([2] 2) no attributions

[9.36.1.2.] 9.36.1.2. ([3] 3) no attributions

[9.36.1.2.] 9.36.1.2. ([4] 4) no attributions

[9.36.1.2.] 9.36.1.2. ([5] 5) no attributions

[9.36.1.2.] 9.36.1.2. ([6] 6) no attributions

[9.36.1.2.] 9.36.1.2. ([7] 7) no attributions

[9.36.1.2.] 9.36.1.2. ([8] 8) no attributions

[9.36.1.3.] 9.36.1.3. ([1] 1) no attributions

[9.36.1.3.] 9.36.1.3. ([1] 1) ([f] e)

[9.36.1.3.] 9.36.1.3. ([2] 2) no attributions

[9.36.1.3.] 9.36.1.3. ([2] 2) no attributions

[9.36.1.3.] 9.36.1.3. ([3] 3) no attributions

[9.36.1.3.] 9.36.1.3. ([4] 4) no attributions

[9.36.1.3.] 9.36.1.3. ([5] 5) no attributions

[9.36.1.3.] 9.36.1.3. ([6] 6) no attributions

[9.36.2.1.] 9.36.2.1. ([1] 1) no attributions

[9.36.2.1.] 9.36.2.1. ([2] 2) no attributions

[9.36.2.1.] 9.36.2.1. ([3] 3) no attributions

[9.36.2.1.] 9.36.2.1. ([4] 4) no attributions

[9.36.2.1.] 9.36.2.1. ([5] 5) no attributions

[9.36.2.2.] 9.36.2.2. ([1] 1) [F92-OE1.1]

[9.36.2.2.] 9.36.2.2. ([2] 2) [F92-OE1.1]

[9.36.2.2.] 9.36.2.2. ([3] 3) [F92-OE1.1]

[9.36.2.2.] 9.36.2.2. ([4] 4) [F92-OE1.1]

[9.36.2.2.] 9.36.2.2. ([5] 5) [F92-OE1.1]

[9.36.2.3.] 9.36.2.3. ([1] 1) no attributions

[9.36.2.3.] 9.36.2.3. ([2] 2) no attributions

[9.36.2.3.] 9.36.2.3. ([3] 3) no attributions

[9.36.2.3.] 9.36.2.3. ([4] 4) no attributions

[9.36.2.3.] 9.36.2.3. ([5] 5) no attributions

[9.36.2.4.] 9.36.2.4. ([1] 1) [F92-OE1.1]

[9.36.2.4.] 9.36.2.4. ([2] 2) no attributions

[9.36.2.4.] 9.36.2.4. ([3] 3) [F92-OE1.1]

[9.36.2.4.] 9.36.2.4. ([4] 4) no attributions

[9.36.2.5.] 9.36.2.5. ([1] 1) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([2] 2) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([3] 3) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([4] 4) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([5] 5) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([6] 6) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([7] 7) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([8] 8) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([9] 9) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([10] 10) no attributions

[9.36.2.6.] 9.36.2.6. ([1] 1) [F92-OE1.1]

[9.36.2.6.] 9.36.2.6. ([2] 2) [F92-OE1.1]

[9.36.2.6.] 9.36.2.6. ([3] 3) [F92-OE1.1]

[9.36.2.6.] 9.36.2.6. ([4] 4) [F92-OE1.1]

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

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

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

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

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

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

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

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

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

[9.36.2.8.] 9.36.2.8. ([1] 1) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([2] 2) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([3] 3) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([4] 4) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([5] 5) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([6] 6) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([7] 7) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([8] 8) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([9] 9) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([10] 10) no attributions

[9.36.2.9.] 9.36.2.9. ([1] 1) [F90-OE1.1]

[9.36.2.9.] 9.36.2.9. ([2] 2) [F90-OE1.1]

[9.36.2.9.] 9.36.2.9. ([3] 3) [F90-OE1.1]

[9.36.2.9.] 9.36.2.9. ([4] 4) [F90-OE1.1]

[9.36.2.9.] 9.36.2.9. ([5] 5) [F90-OE1.1]

[9.36.2.9.] 9.36.2.9. ([6] 6) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([1] 1) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([2] 2) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([3] 3) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([4] 4) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([5] 5) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([6] 6) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([7] 7) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.2.10.] 9.36.2.10. ([8] 8) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([9] 9) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([10] 10) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([11] 11) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([12] 12) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([13] 13) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([14] 14) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([15] 15) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([16] 16) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([17] 17) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([18] 18) [F90-OE1.1]

[9.36.2.11.] 9.36.2.11. ([1] 1) no attributions

[9.36.2.11.] 9.36.2.11. ([2] 2) [F92-OE1.1]

[9.36.2.11.] 9.36.2.11. ([2] 2) no attributions

[9.36.2.11.] 9.36.2.11. ([3] 3) [F92-OE1.1]

[9.36.2.11.] 9.36.2.11. ([3] 3) no attributions

[9.36.2.11.] 9.36.2.11. ([4] 4) [F92-OE1.1]

[9.36.2.11.] 9.36.2.11. ([5] 5) [F92-OE1.1]

[9.36.2.11.] 9.36.2.11. ([6] 6) [F92-OE1.1]

[9.36.2.11.] 9.36.2.11. ([7] 7) [F92-OE1.1]

[9.36.2.11.] 9.36.2.11. ([8] 8) [F92-OE1.1]

[9.36.3.1.] 9.36.3.1. ([1] 1) no attributions

[9.36.3.1.] 9.36.3.1. ([2] 2) no attributions

[9.36.3.2.] 9.36.3.2. ([1] 1) [F95-OE1.1]

[9.36.3.2.] 9.36.3.2. ([2] 2) no attributions

[9.36.3.2.] 9.36.3.2. ([3] 3) [F91,F93-OE1.1]

[9.36.3.2.] 9.36.3.2. ([4] 4) [F91,F93-OE1.1]

[9.36.3.2.] 9.36.3.2. ([5] 5) no attributions

[9.36.3.2.] 9.36.3.2. ([5] 5) [F91,F93-OE1.1]

[9.36.3.3.] 9.36.3.3. ([1] 1) [F91,F95-OE1.1]

[9.36.3.3.] 9.36.3.3. ([2] 2) [F91,F95-OE1.1]

[9.36.3.3.] 9.36.3.3. ([3] 3) no attributions

[9.36.3.3.] 9.36.3.3. ([4] 4) no attributions

[9.36.3.4.] 9.36.3.4. ([1] 1) no attributions

[9.36.3.4.] 9.36.3.4. ([2] 2) [F93-OE1.1]

[9.36.3.5.] 9.36.3.5. ([1] 1) [F98-OE1.1]

[9.36.3.6.] 9.36.3.6. ([1] 1) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([1] 1) no attributions

[9.36.3.6.] 9.36.3.6. ([2] 2) [F95,F98-OE1.1]

[9.36.3.6.] 9.36.3.6. ([3] 3) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([4] 4) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([5] 5) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([6] 6) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([7] 7) [F95-OE1.1]

[9.36.3.7.] 9.36.3.7. ([1] 1) [F95-OE1.1]

[9.36.3.8.] 9.36.3.8. ([1] 1) [F95,F100-OE1.1]

[9.36.3.8.] 9.36.3.8. ([2] 2) no attributions

[9.36.3.8.] 9.36.3.8. ([3] 3) no attributions

[9.36.3.8.] 9.36.3.8. ([4] 4) [F98,F100-OE1.1]

[9.36.3.8.] 9.36.3.8. ([5] 5) [F98,F100-OE1.1]

[9.36.3.9.] 9.36.3.9. ([1] 1) no attributions

[9.36.3.9.] 9.36.3.9. ([2] 2) [F95,F100-OE1.1]

[9.36.3.9.] 9.36.3.9. ([3] 3) [F95,F100-OE1.1]

[9.36.3.9.] 9.36.3.9. ([4] 4) [F95,F98,F100-OE1.1]

[9.36.3.10.] 9.36.3.10. ([1] 1) [F95,F98,F99-OE1.1]

[9.36.3.10.] 9.36.3.10. ([2] 2) [F95,F98,F99-OE1.1]

[9.36.3.10.] 9.36.3.10. ([3] 3) no attributions

[9.36.3.11.] 9.36.3.11. ([1] 1) [F95,F98,F99-OE1.1]

[9.36.3.11.] 9.36.3.11. ([2] 2) no attributions

[9.36.3.11.] 9.36.3.11. ([3] 3) [F93,F96-OE1.1]

[9.36.4.1.] 9.36.4.1. ([1] 1) no attributions

[9.36.4.1.] 9.36.4.1. ([2] 2) no attributions

[9.36.4.2.] 9.36.4.2. ([1] 1) [F96,F98-OE1.1]

[9.36.4.2.] 9.36.4.2. ([2] 2) [F93,F96-OE1.1]

[9.36.4.2.] 9.36.4.2. ([3] 3) [F98-OE1.1]

[9.36.4.3.] 9.36.4.3. ([1] 1) [F96,F98-OE1.1]

[9.36.4.3.] 9.36.4.3. ([2] 2) no attributions

[9.36.4.3.] 9.36.4.3. ([3] 3) [F93,F96-OE1.1]

[9.36.4.4.] 9.36.4.4. ([1] 1) [F93,F96-OE1.1]

[9.36.4.4.] 9.36.4.4. ([2] 2) [F93,F96-OE1.1]

[9.36.4.4.] 9.36.4.4. ([3] 3) [F93,F96-OE1.1]

[9.36.4.5.] 9.36.4.5. ([1] 1) [F96-OE1.1]

[9.36.4.6.] 9.36.4.6. ([1] 1) [F96-OE1.1]

[9.36.4.6.] 9.36.4.6. ([2] 2) [F96-OE1.1]

[9.36.5.1.] 9.36.5.1. ([1] 1) no attributions

[9.36.5.1.] 9.36.5.1. ([2] 2) no attributions

[9.36.5.2.] 9.36.5.2. ([1] 1) no attributions

[9.36.5.2.] 9.36.5.2. ([2] 2) no attributions

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

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

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

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

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

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

[9.36.5.4.] 9.36.5.4. ([1] 1) no attributions

[9.36.5.4.] 9.36.5.4. ([2] 2) no attributions

[9.36.5.4.] 9.36.5.4. ([3] 3) [F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([4] 4) [F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([5] 5) [F95,F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([6] 6) [F95,F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([7] 7) [F95,F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([8] 8) [F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([9] 9) [F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([10] 10) [F90,F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([11] 11) [F90,F99-OE1.1]

[9.36.5.5.] 9.36.5.5. ([1] 1) [F99-OE1.1]

[9.36.5.5.] 9.36.5.5. ([2] 2) [F99-OE1.1]

[9.36.5.5.] 9.36.5.5. ([3] 3) [F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([1] 1) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([2] 2) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([3] 3) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([4] 4) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([5] 5) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([6] 6) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([7] 7) [F92,F93,F95,F96,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([8] 8) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([9] 9) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([10] 10) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([11] 11) [F92,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([1] 1) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([2] 2) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([3] 3) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([4] 4) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([5] 5) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([6] 6) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([7] 7) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([8] 8) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([9] 9) [F95,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([1] 1) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([2] 2) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([3] 3) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([4] 4) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([5] 5) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([6] 6) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([7] 7) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([8] 8) [F96,F99-OE1.1]

[9.36.5.9.] 9.36.5.9. ([1] 1) [F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([1] 1) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([2] 2) no attributions

[9.36.5.10.] 9.36.5.10. ([3] 3) no attributions

[9.36.5.10.] 9.36.5.10. ([4] 4) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([5] 5) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([6] 6) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([7] 7) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([8] 8) no attributions

[9.36.5.10.] 9.36.5.10. ([9] 9) [F90,F91,F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([10] 10) [F90,F91,F92,F93,F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([1] 1) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([2] 2) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([3] 3) [F92,F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([4] 4) [F95,F99,F100-OE1.1]

[9.36.5.11.] 9.36.5.11. ([5] 5) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([6] 6) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([7] 7) no attributions

[9.36.5.11.] 9.36.5.11. ([8] 8) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([9] 9) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([10] 10) [F95,F99,F100-OE1.1]

[9.36.5.11.] 9.36.5.11. ([11] 11) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([12] 12) [F95,F99,F100-OE1.1]

[9.36.5.11.] 9.36.5.11. ([13] 13) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([14] 14) [F95,F99,F100-OE1.1]

[9.36.5.11.] 9.36.5.11. ([15] 15) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([16] 16) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([17] 17) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([18] 18) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([19] 19) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([20] 20) [F95,F99-OE1.1]

[9.36.5.12.] 9.36.5.12. ([1] 1) [F96,F99-OE1.1]

[9.36.5.12.] 9.36.5.12. ([2] 2) no attributions

[9.36.5.13.] 9.36.5.13. ([1] 1) [F99-OE1.1]

[9.36.5.13.] 9.36.5.13. ([2] 2) [F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([1] 1) [F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([2] 2) [F90,F91,F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([3] 3) [F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([4] 4) [F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([5] 5) [F92,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([6] 6) [F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([7] 7) [F92,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([8] 8) [F92,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([9] 9) [F92,F99,F95-OE1.1]

[9.36.5.14.] 9.36.5.14. ([10] 10) [F92,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([1] 1) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([2] 2) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([3] 3) [F95,F99,F100-OE1.1]

[9.36.5.15.] 9.36.5.15. ([4] 4) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([5] 5) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([6] 6) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([7] 7) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([8] 8) [F95,F99,F100-OE1.1]

[9.36.5.15.] 9.36.5.15. ([9] 9) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([10] 10) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([11] 11) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([12] 12) [F95,F99,F100-OE1.1]

[9.36.5.15.] 9.36.5.15. ([13] 13) [F95,F99,F100-OE1.1]

[9.36.5.15.] 9.36.5.15. ([14] 14) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([15] 15) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([16] 16) [F95,F99-OE1.1]

[9.36.5.16.] 9.36.5.16. ([1] 1) [F95,F99-OE1.1]

[9.36.5.16.] 9.36.5.16. ([2] 2) [F95,F99-OE1.1]

[9.36.5.16.] 9.36.5.16. ([3] 3) [F95,F99-OE1.1]

[9.36.6.1.] 9.36.6.1. ([1] 1) no attributions

[9.36.6.2.] 9.36.6.2. ([1] 1) no attributions

[9.36.6.3.] 9.36.6.3. ([1] 1) no attributions

[9.36.6.3.] 9.36.6.3. ([1] 1) [F90-OE1.1]

[9.36.6.3.] 9.36.6.3. ([2] 2) no attributions

[9.36.6.3.] 9.36.6.3. ([3] 3) no attributions

[9.36.6.4.] 9.36.6.4. ([1] 1) no attributions

[9.36.6.4.] 9.36.6.4. ([1] 1) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.6.4.] 9.36.6.4. ([2] 2) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.6.4.] 9.36.6.4. ([3] 3) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.6.4.] 9.36.6.4. ([4] 4) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.7.1.] 9.36.7.1. ([1] 1) no attributions

[9.36.7.1.] 9.36.7.1. ([2] 2) no attributions

[9.36.7.2.] 9.36.7.2. ([1] 1) no attributions

[9.36.7.2.] 9.36.7.2. ([1] 1) [F90,F91,F92,F93,F95,F96,F98,F99,F100-OE1.1]

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

[9.36.7.3.] 9.36.7.3. ([2] 2) [F95-OE1.1]

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

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

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

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

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

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

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

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

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

[9.36.8.1.] -- ([1] --) no attributions

[9.36.8.1.] -- ([2] --) no attributions

[9.36.8.1.] -- ([3] --) no attributions

[9.36.8.1.] -- ([4] --) no attributions

[9.36.8.1.] -- ([5] --) no attributions

[9.36.8.2.] -- ([1] --) no attributions

[9.36.8.2.] -- ([2] --) no attributions

[9.36.8.3.] -- ([1] --) [F99-OE1.1]

[9.36.8.3.] -- ([2] --) [F99-OE1.1]

[9.36.8.4.] -- ([1] --) [F99-OE1.1]

[9.36.8.4.] -- ([2] --) [F99-OE1.1]

[9.36.8.4.] -- ([3] --) no attributions

[9.36.8.4.] -- ([3] --) [F98-OE1.1]

[9.36.8.5.] -- ([1] --) [F99-OE1.1]

[9.36.8.5.] -- ([2] --) [F99-OE1.1]

[9.36.9.1.] 9.36.8.1. ([1] 1) no attributions

[9.36.9.2.] 9.36.8.2. ([1] 1) no attributions

[9.36.9.2.] 9.36.8.2. ([1] 1) [F90,F91,F92,F93,F95,F96,F98,F99,F100-OE1.1]

[9.36.9.4.] 9.36.8.4. ([1] 1) no attributions

[9.36.9.5.] 9.36.8.5. ([1] 1) no attributions

[9.36.9.5.] 9.36.8.5. ([2] 2) [F92-OE1.1]

[9.36.9.5.] 9.36.8.5. ([3] 3) [F92-OE1.1]

[9.36.9.5.] 9.36.8.5. ([4] 4) no attributions

[9.36.9.5.] 9.36.8.5. ([4] 4) [F92-OE1.1]

[9.36.9.5.] 9.36.8.5. ([5] 5) no attributions

[9.36.9.5.] 9.36.8.5. ([5] 5) [F92-OE1.1]

[9.36.9.5.] 9.36.8.5. ([6] 6) [F92-OE1.1]

[9.36.9.5.] 9.36.8.5. ([7] 7) [F92-OE1.1]

[9.36.9.6.] 9.36.8.6. ([1] 1) [F92-OE1.1]

[9.36.9.6.] 9.36.8.6. ([2] 2) no attributions

[9.36.9.6.] 9.36.8.6. ([3] 3) no attributions

[9.36.9.6.] 9.36.8.6. ([3] 3) [F92-OE1.1]

[9.36.9.6.] 9.36.8.6. ([4] 4) [F92-OE1.1]

[9.36.9.7.] 9.36.8.7. ([1] 1) no attributions

[9.36.9.7.] 9.36.8.7. ([2] 2) [F92-OE1.1]

[9.36.9.7.] 9.36.8.7. ([3] 3) [F92-OE1.1]

[9.36.9.7.] 9.36.8.7. ([4] 4) no attributions

[9.36.9.8.] 9.36.8.8. ([1] 1) no attributions

[9.36.9.8.] 9.36.8.8. ([2] 2) [F90-OE1.1]

[9.36.9.9.] 9.36.8.9. ([1] 1) no attributions

[9.36.9.9.] 9.36.8.9. ([2] 2) no attributions

[9.36.9.9.] 9.36.8.9. ([3] 3) no attributions

[9.36.9.9.] 9.36.8.9. ([3] 3) [F95,F100-OE1.1]

[9.36.9.9.] 9.36.8.9. ([4] 4) [F95-OE1.1]

[9.36.9.10.] 9.36.8.10. ([1] 1) no attributions

[9.36.9.10.] 9.36.8.10. ([2] 2) no attributions

[9.36.9.10.] 9.36.8.10. ([3] 3) [F96-OE1.1]

[9.36.9.11.] 9.36.8.11. ([1] 1) [F95-OE1.1]

[9.36.9.11.] 9.36.8.11. ([2] 2) [F95-OE1.1]

Submit a comment

Proposed Change 2004

Code Reference(s):	**NBC20 Div.B 9.36. (first printing)**
Subject:	Greenhouse Gas Emissions
Title:	Operational GHG Emissions: Tiered Performance Requirements in the NBC
Description:	This proposed change introduces performance requirements in Section 9.36. of the NBC to reduce operational GHG emissions.
Related Proposed Change(s):	PCF 1820, PCF 1843, PCF 1989, PCF 2003, PCF 2016, PCF 2026

This change could potentially affect the following topic areas:

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

Problem

Approximately 13% of Canada's total greenhouse gas (GHG) emissions can be attributed to houses and buildings. This is primarily a result of using fossil fuels for space and water heating. Additionally, the combined impact of electricity consumption for cooling, lighting and running other appliances raises the overall contribution of buildings to GHG emissions to approximately 18%.[1] The 2020 GHG emissions from residential and building sectors are outlined in Table 1, which shows the sources and their percentage of electricity consumption.

Table 1. 2020 GHG Emissions in the Residential and Building Sectors(1)

Sector	Source	Electricity Consumption, %
Residential	Space heating	64
	Water heating	20
	Running appliances	11
	Lighting	3
	Space cooling	2
Building	Space heating	65
	Running auxiliary equipment	12
	Lighting	10
	Water heating	7
	Space cooling	3
	Other	3

Note to Table 1:

(1) https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/menus/trends/comprehensive_tables/list.cfm

There has been a growing recognition of the importance of addressing climate change and reducing GHG emissions from all sectors, including the built environment. However, the National Model Codes (the Codes) do not presently consider the type or quality of energy sources used by buildings and houses, nor do they address or regulate embodied and operational GHG emissions. As the industry moves towards higher energy efficiencies, the differences between energy sources must be examined because they contribute to GHG emissions differently. Historically, the Codes focused on design and construction requirements related to safety, structural integrity, accessibility and energy efficiency. With the latter, the emphasis was on reducing energy consumption during the construction and operational phases, but did not explicitly address operational GHG emissions. Furthermore, Canada is a large and diverse country with different climatic regions and building practices. This reality has led to regional variations in building codes and regulations, making it challenging to establish a unified approach to address operational GHG emissions at the national level.

The Codes currently contain an energy-efficiency objective and related requirements for the design and construction of new buildings and houses. In the 2020 editions of the National Energy Code of Canada for Buildings (NECB) and National Building Code of Canada (NBC), energy-efficiency tiers were introduced, containing measures that progressively increase energy efficiency and reduce the amount of energy needed to operate a building. These requirements play a crucial role in reducing GHG emissions by focusing on the amount of energy used. However, the Canadian Board for Harmonized Construction Codes (CBHCC) recognizes that energy savings alone will not lead to reducing emissions to meet the national goals stated in the Pan-Canadian Framework.

GHG emissions across Canadian provinces and territories exhibit substantial variations, influenced by factors such as population density, climate, energy sources and economic considerations.[2] Provinces and territories with larger populations, resource-based economies or heavy reliance on fossil fuels for electricity generation generally register higher emissions levels. This demonstrates a greatly varied energy landscape across Canada.

Ultimately, the goal is to reduce operational GHG emissions to zero or near zero across provinces and territories by 2050. Consequently, authorities having jurisdiction require a flexible framework to regulate GHG emissions due to building operation by using "levels" that move towards lower operational GHG emissions.

References

[1] https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/climate-plan-overview/healthy-environment-healthy-economy/annex-homes-buildings.html

[2] https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html

Justification

Since 2010, the NBC and NECB have included requirements to prevent excessive use of energy. Though these requirements have improved the energy efficiency of new houses and buildings, the Codes remain silent on the type of energy used and the emissions associated with production, distribution and use. As a result, many new Code-compliant buildings contribute GHG emissions through their year-over-year operation. Reducing these emissions is an important step to enable action towards climate goals. Climate change is the biggest challenge facing humanity today, consequently, it is vital that the Codes address this gap to support Canada in reaching its emissions reduction target of 40% below 2005 levels by 2030 and net-zero emissions by 2050. Furthermore, achieving long-term climate goals requires early action on operational GHG emissions. Failure to address this pivotal issue could impede Canada's progress towards its emissions-reduction targets, jeopardizing the ability to effectively combat climate change and protect the future well-being of the country. The commitment to a sustainable future demands that these emissions be addressed comprehensively and urgently.

If these emissions are to be regulated, designers, builders and enforcement officials need a consistent and accurate means to convert expected energy use into expected GHG emissions. For years, governments and industry have relied on emissions factors (also referred to as emissions intensity factors) for this task. Emissions factors describe the amount of GHG emissions (in kg CO_2 equivalent) per unit of energy consumed, for instance, of electricity (in kWh), of natural gas (in m^3), and of heating oil (in L). Environment and Climate Change Canada compiles this data annually and publishes estimates as part of Canada’s national greenhouse gas inventory report. Emissions factors reflect the carbon intensity of different fuels, as well as regional differences in energy production and distribution. Data is generally published after two years; factors reflecting 2021 data were published in April 2023.

If Canada’s energy sector were unchanging, this data would suffice for building design and Code-administration purposes. But provincial, territorial and regional utilities are presently undergoing unprecedented transition. Electric utilities are shifting away from coal power generation, while gas utilities are experimenting with new technologies to lower emissions through use of hydrogen and renewable biogas sources. These changes are expected to occur rapidly; some provincial utilities expect to reduce electric emissions by 60% or more by 2030. In this environment, referencing the most recent (2021) emissions data currently available in the Codes could encourage the construction of buildings with higher-than-expected emissions. For this reason, this proposed change is based on the best available future-looking forecasts for utility emissions, averaged for the years 2031 to 2035. Emissions factor forecasts for electricity are sourced from Environment and Climate Change Canada’s most recent (2023) projections. While no similar projections are currently available for natural gas utilities, such projections are expected in future years and could be incorporated into the Codes at a later date.

PROPOSED CHANGE

[9.36.] 9.36. Energy Efficiency

[9.36.1.] 9.36.1. General

[9.36.1.1.] 9.36.1.1. Scope

[9.36.1.2.] 9.36.1.2. Definitions

[9.36.1.3.] 9.36.1.3. Compliance and Application

(See Note A-9.36.1.3.)

[1] 1) Except as provided in ~~Sentences (2)to (6)~~Sentences (3) to (7)-2025, *buildings* shall comply with
  - [a] a) the prescriptive or trade-off requirements in Subsections 9.36.2. to 9.36.4.,
  - [b] b) the performance requirements in Subsection 9.36.5.,
  - [c] c) the tiered performance requirements in Subsection 9.36.7.,
  - [d] d) the tiered prescriptive requirements in Subsection 9.36.8., or
  - [e] e) the NECB.

[2] --) Except as provided in Sentence (6)-2025, *buildings* shall comply with
  - [a] --) the tiered operational GHG emissions performance requirements in Subsection 9.36.11., or
  - [b] --) the NECB.

[3] 2) Subsections 9.36.2. to 9.36.4. apply to
  - [a] a) *buildings* of *residential occupancy* to which Part 9 applies,
  - [b] b) *buildings* containing *business and personal services*, *mercantile* or *low-hazard industrial occupancies* to which Part 9 applies whose combined total *floor area* does not exceed 300 m^2, excluding parking garages that serve *residential occupancies*, and
  - [c] c) *buildings* containing a mix of the *residential* and non-*residential occupancies* described in Clauses (a) and (b).

[4] 3) Subsection 9.36.5., 9.36.7. and 9.36.11. apply only to
  - [a] a) houses with or without a *secondary suite*, and
  - [b] b) *buildings* containing only *dwelling units* and common spaces whose total *floor area* does not exceed 20% of the total *floor area* of the *building*.

(See Note A-9.36.1.3.(3).)

[5] 4) Subsection 9.36.8. applies only to *buildings* of *residential occupancy* to which Part 9 applies.

[6] 5) *Buildings* containing non-*residential occupancies* whose combined total *floor area* exceeds 300 m^2 or *medium-hazard industrial occupancies* shall comply with the NECB.

[7] 6) *Buildings* or portions of *buildings* that are not required to be *conditioned spaces* are exempted from the requirements of this Section. (See Note A-9.36.1.3.(6).)

[9.36.8.5.] 9.36.8.5. Energy Conservation Measures for Above-Ground Opaque Building Assemblies

[9.36.8.6.] 9.36.8.6. Energy Conservation Measures for Fenestration and Doors

[9.36.8.7.] 9.36.8.7. Energy Conservation Measures for Opaque Building Assemblies Below-Grade or in Contact with the Ground

[9.36.8.8.] 9.36.8.8. Energy Conservation Measures Relating to Airtightness

[9.36.8.9.] 9.36.8.9. Energy Conservation Measures for HVAC Systems

[9.36.8.10.] 9.36.8.10. Energy Conservation Measures for Service Water Heating Equipment

[9.36.8.11.] 9.36.8.11. Energy Conservation Points for Building Volume

[9.36.9.] -- Reserved

[9.36.10.] -- Reserved

[9.36.11.] -- Tiered Operational GHG Emissions Performance Compliance

[9.36.11.1.] --- Scope

[1] --) This Subsection is concerned with GHG emissions, determined at the time of design, resulting from the supply and consumption of the energy used by the *building*

- [a] --) for
  - [i] --) systems used for heating, ventilating and air-conditioning, and
  - [ii] --) systems used to heat service water, or
- [b] --) as determined in accordance with Subsection 9.36.5.

[9.36.11.2.] --- Application

[1] --) This Subsection applies to the *buildings* described in Article 9.36.1.3.-2025.

[9.36.11.3.] --- Definitions

[1] --) For the purpose of this Subsection, the term “house” shall mean all houses, with or without a *secondary suite*, that

- [a] --) have HVAC systems that serve only the house, only the *secondary suite* or both the house and the *secondary suite*,
- [b] --) have service water heating systems that serve only the house, only the *secondary suite* or both the house and the *secondary suite*, and
- [c] --) do not share common spaces intended for *occupancy* with other *dwelling units* or houses, except for a *secondary suite*.

[2] --) For the purpose of this Subsection, the term “annual operational GHG emissions” shall mean the annual sum of GHG emissions produced on the *building* site in meeting the annual energy demand loads or produced off-site in generating the energy sources used to meet the annual energy demand loads.

[3] --) For the purpose of this Subsection, the term “operational GHG emissions target” shall mean the annual operational GHG emissions of a hypothetical replica of the proposed *building*, produced on the *building* site in meeting the house energy target or produced off-site in generating the energy sources used to meet the house energy target.

[9.36.11.4.] --- Compliance

[1] --) 1) Compliance with this Subsection shall be achieved by designing and constructing *buildings* in accordance with

- [a] --) the tiered performance requirements in Article 9.36.11.5., or
- [b] --) the NECB.

[9.36.11.5.] --- Performance Compliance

[1] --) Except as provided in Sentence (5), compliance with this Subsection shall be achieved by designing and constructing *buildings* in accordance with one of the GHG emissions performance levels A to F specified in Table 9.36.11.5., each of which corresponds to

[a] --) the annual operational GHG emissions of the proposed house, expressed as a percent operational GHG emissions target, or

[b] --) the percentage of improvement of the annual operational GHG emissions of the proposed house relative to the operational GHG emissions target of the reference house, expressed as a percent improvement.

Table [9.36.11.5.]
GHG Emissions Performance Levels
Forming Part of Sentences 9.36.11.5.(1) and (2) -- (--)

GHG Emissions Performance Level	Percent Operational GHG Emissions Target (1)	Percent Improvement
A	≤ 10%	≥ 90%
B	≤ 25%	≥ 75%
C	≤ 50%	≥ 50%
D	≤ 75%	≥ 25%
E	≤ 90%	≥ 10%
F	≤ 100%	≥ 0%

Note to Table [9.36.11.5.] :

(1) See Sentence (2)

[2] --) Compliance of the proposed house with one of GHG emissions performance levels A to F specified in Table 9.36.11.5. shall be determined by

[a] --) dividing the annual operational GHG emissions of the proposed house by the operational GHG emissions target of the reference house to derive the percent operational GHG emissions target, or

[b] --) subtracting the annual operational GHG emissions of the proposed house from the operational GHG emissions target of the reference house and dividing the result by the operational GHG emissions target of the reference house to derive the percent improvement.

[3] --) The annual operational GHG emissions of the proposed house shall be determined in accordance with Article 9.36.11.7.

[4] --) The operational GHG emissions target of the reference house shall be determined in accordance with Article 9.36.11.8.

[5] --) Where the house cannot reasonably be connected to the provincial or territorial electrical power grid, compliance with this Subsection shall be achieved by reporting the annual operational GHG emissions of the proposed house calculated in accordance with Article 9.36.11.7.

[9.36.11.6.] --- GHG Emissions Factors

(See Note A-9.36.11.6.)

[1] --) Except as provided in Sentences (2) to (5), the GHG emissions factors used in Articles 9.36.11.7. and 9.36.11.8. shall be in conformance with the values established by the provincial or territorial government having jurisdiction.

[2] --) Where permitted by the provincial or territorial government having jurisdiction, the GHG emissions factor for an energy source may be obtained from the regulated utility responsible for providing the energy source to the *building* site.

[3] --) Except as provided in Sentence (5), where they have not been established in accordance with Sentences (1) and (2), the GHG emissions factors shall be in conformance with Tables 9.36.11.6.-A and 9.36.11.6.-B.

Table [9.36.11.6.-A]
GHG Emissions Factors for Electricity and Utility Gas by Province or Territory
Forming Part of Sentence 9.36.11.6.(3) -- (--)

Province or Territory	GHG Emissions Factor by Energy Source, g CO_2e/kWh	
	Electricity (1)	Utility Gas (2)
British Columbia	1.32	190
Alberta	181.86	189
Saskatchewan	146.60	185
Manitoba	0.00	185
Ontario	57.90	185
Quebec	0.38	186
New Brunswick	77.88	185
Nova Scotia	161.64	190
Prince Edward Island	80.42	185
Newfoundland and Labrador	11.08	185
Yukon	25.00	190
Northwest Territories	6.82	185
Nunavut	465.16	190

Notes to Table [9.36.11.6.-A] :

(1) GHG emissions factors for electricity are an average of the 2031–2035 values provided by Environment and Climate Change Canada at data-donnees.az.ec.gc.ca/data/substances/monitor/canada-s-greenhouse-gas-emissions-projections as of June 2023.

(2) GHG emissions factors for utility gas are based on estimates in the Environment and Climate Change Canada "National Inventory Report 1990–2020: Greenhouse Gas Sources and Sinks in Canada."

Table [9.36.11.6.-B]
GHG Emission Factors for Other Energy Sources
Forming Part of Sentence 9.36.11.6.(3) -- (--)

Energy Source	**GHG Emissions Factor (1)**	
	In g CO_2e/L	**In g CO_2e/kWh**
Diesel	2 690	250
Oil, heating or light fuel	2 755	270
Oil, heavy fuel	3 176	274
Propane	1 548	218

Note to Table [9.36.11.6.-B] :

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(1) GHG emissions factors are values provided by Environment and Climate Change Canada at www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/output-based-pricing-system/federal-greenhouse-gas-offset-system/emission-factors-reference-values.html as of June 19, 2023.

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[4] --) Except as provided in Sentence (5), for energy sources supplied by a district energy plant, the GHG emissions factors shall

[a] --) be in conformance with Table 9.36.11.6.-C, or

[b] --) be determined by a qualified person representing the district energy plant operator (see Note A-9.36.11.6.(4)(b) and (5)).

Table [9.36.11.6.-C]
GHG Emissions Factors for Energy Sources Supplied by a District Energy Plant
Forming Part of Sentence 9.36.11.6.(4) -- (--)

Energy Source	**GHG Emissions Factor,** (1) **g CO_2e/kWh**
Chilled water	128
Hot water	362
Steam	383

Note to Table [9.36.11.6.-C] :

(1) GHG emissions factors are from ANSI/ASHRAE 228-2023, “Standard Method of Evaluating Zero Net Energy and Zero Net Carbon Building Performance.”

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[5] --) For energy sources not listed in Tables 9.36.11.6.-A to 9.36.11.6.-C, the GHG emissions factors shall be determined by a qualified person. (See Note A-9.36.11.6.(4)(b) and (5).)

[9.36.11.7.] --- Annual Operational GHG Emissions of the Proposed House

[1] --) The annual operational GHG emissions of the proposed house, $CO_2e_{proposed}$, in kg CO_2e, shall be determined using the following equation:

$$CO_2e_{proposed} = \sum_{ES} (E_{reg,ES} \times GEF_{ES})/1\ 000$$

where

$E_{reg,ES}$ = annual energy consumption of the equipment and systems regulated by the NBC, as listed in Clauses 9.36.5.4.(1)(a) to (d), for each energy source (ES), in kWh, determine by modeling the proposed house in accordance with Article 9.36.5.9., and

GEF_{ES} = GHG emissions factor for the corresponding energy source, in CO_2e/kWh, as specified in Article 9.36.11.6.

[9.36.11.8.] --- Operational GHG Emissions Target of the Reference House

[1] --) The operational GHG emissions target of the reference house, CO_2e_{target}, in kg CO_2e, shall be determined using the following equation:

$$CO_2e_{target} = CO_2e_{NHreg} + CO_2e_{SH} + CO_2e_{SWH}$$

where

CO_2e_{NHreg} = annual operational GHG emissions of all non-heating equipment and systems regulated by the NBC, in kg CO_2e, determined in accordance with Sentence (2),

CO_2e_{SH} = annual operational GHG emissions from space heating, in kg CO_2e, determined in accordance with Sentence (3), and
CO_2e_{SWH} = annual operational GHG emissions from service water heating, in kg CO_2e, determined in accordance with Sentence (4).

[2] --) The annual operational GHG emissions of all non-heating equipment and systems regulated by the NBC, $CO_2e_{otherregloads}$, in kg CO_2e, shall be determined using the following equation:

$$CO_2e_{NHreg} = E_{NHreg} \times GEF_{elec} \Big/ 1\,000$$

where

E_{NHreg} = annual energy consumption of all non-heating systems and equipment regulated by the NBC, as listed in Clauses 9.36.5.4.(1)(b) and (d), in the reference house, in kWh, determined by modeling the reference house in accordance with Article 9.36.5.13., and
GEF_{elec} = GHG emissions factor for electricity, in g CO_2e/kWh, as specified in Article 9.36.11.7.

[3] --) The annual operational GHG emissions from space heating, CO_2e_{SH}, in kg CO_2e, shall be determined using the following equation:

$$CO_2e_{SH} = TED_{SH} \times 235 \Big/ 1\,000$$

where

TED_{SH} = annual thermal energy demand of the space-heating system, including baseboard heating, in the reference house, in kWh, determined by medoling the refrence house in accordance with Subsection 9.36.5., and
235 = reference GHG emissions factor for space heating, in g CO_2e/kWh.
(See Note A-9.36.11.8.(3) and (4).)

[4] --) The annual operational GHG emissions from service water heating, CO_2e_{SWH}, in kg CO_2e, shall be determined using the following equation:

$$CO_2e_{SWH} = TED_{SWH} \times 260 \Big/ 1\,000$$

where

TED_{SWH} = annual thermal energy demand of the service water heating system in the reference house, in kWh, determined by modeling the refrence house in accordance with Subsection 9.36.5., and
260 = reference GHG emissions factor for service water heating, in g CO_2e/kWh.
(See Note A-9.36.11.8.(3) and (4).)

Note A-9.36.11.6. Unit Conversions.

A volumetric quantity of a fuel can be converted to an equivalent amount of energy, in kWh, using the conversion factors provided in Table A-9.36.11.6.

Table [9.36.11.6.]
Unit Conversions for Energy Sources

Energy Source	Unit	Energy per Unit, (1) kWh
Diesel	L	10.74
Natural gas	m^3	10.36
Oil, heating or light fuel	L	10.20
Oil, heavy fuel	L	11.59
Propane	L	7.09

Note to Table [9.36.11.6.] :

(1) The energy per unit is the approximate energy content, in GJ, of the fuel from apps.cer-rec.gc.ca/Conversion/conversion-tables.aspx converted to kWh (1GJ = 277.7778 kWh).

Note A-9.36.11.6.(4)(b) and (5) Qualified Person.

A "qualified person" is a person with training and expertise in building energy analysis and includes

- a. a GHG verifier certified in accordance with ISO/IEC-17024:2012, "Conformity assessment General requirements for bodies operating certification of persons," who
  - i. demonstrates competence with the use of ISO-14064–1:2018, "Greenhouse gases Part 1 — Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals," or
  - ii. is accredited in accordance with ISO-14065:2020, "General principles and requirements for bodies validating and verifying environmental information," and ISO-14066:2023, "Environmental information — Competence requirements for teams validating and verifying environmental information,"
- b. a licensed professional engineer, and
- c. a person qualified by the authority having jurisdiction.

Note A-9.36.11.8.(3) and (4) Thermal Energy Demand.

Thermal energy demand is the amount of heating energy that is output from all types of heating equipment.

For space heating, heating equipment includes electric, gas, hot water, or any other equipment used for the purpose of space heating and ventilation. The heating output of any equipment whose source of energy is not directly provided by a utility (electricity, gas or district) must still be counted towards TED_{SH}.

For service water heating, heating equipment includes electric resistances elements or gas heaters/burners of hot water storage tanks or instantaneous water heaters, heat pump water heaters and any other equipment used for the purpose of service water heating. The heating output of any equipment whose source of energy is not directly provided by a utility (electricity, gas or district) must still be counted towards TED_{SWH}.

Impact analysis

This section describes the approach that was adopted for performing an impact analysis of the proposed tiered operational GHG emissions requirements for the NBC. The impact analysis was done in accordance with the methodologies in this proposed change to introduce operational GHG emissions requirements into the Codes. The impact analysis was performed using simulated scenarios. Specifically, the simulation results that were used in this impact analysis correspond to cases that use the reference equivalent carbon intensity factor values of 235 g CO_2e/kWh and 260 g CO_2e/kWh for determining the GHG emissions target for space heating and for service water heating, respectively. The GHG emissions of all non-heating regulated loads were calculated taking into account the emissions factor of electricity for each province and territory (2031-2035 values).

Table 1 shows the percentage of natural-gas-heated archetypes that comply with the different GHG emissions performance levels. All the cases presented in the tables correspond to buildings that meet the minimum requirements established in the NBC. In addition to the NBC requirements, it was assumed that all archetypes have a heat recovery ventilator. Since the scenario with natural gas as the main energy source is considered as the base case, no incremental costs are associated with that scenario. As Table 1 illustrates, most natural gas heated buildings will reach Level E (i.e., percent improvement ≥ 10%) and Level F (i.e., percent improvement ≥ 0%) without any incremental costs. In most locations, the percentage of buildings that can reach Level F is higher than the percentage of buildings that can reach Level E. There are a small number of natural-gas-heated houses that will not comply with the GHG emissions requirements in different locations. In the majority of cases, the non-compliant houses are small, with floor areas that are less than 100 m^2. The exception is British Columbia, where more than 50% of the houses are not meeting the target emissions. This is likely due to service water heating being the dominant load in most cases. The efficiency of the service water heating system taken into account when calculating the reference equivalent carbon intensity factors is higher than the minimum efficiency required by the NBC.

Table 1. Percentage of Natural-Gas-Heated Archetypes—with Natural Gas for Space and Service Water Heating—That Comply with the Operational GHG Emissions (GHGe) Performance Levels

		Provinces and Territories (primary heating: natural gas)												
		Low GHGe Intensity					Mid GHGe Intensity				High GHGe Intensity			
Operational GHGe Performance Level	**Percent Improvement**	**BC**	**MB**	**NL**	**NT**	**QC**	**NB**	**ON**	**PE**	**YT**	**AB**	**NS**	**NU**	**SK**
Level A	≥ 90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level B	≥ 75%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level C	≥ 50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level D	≥ 25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level E	≥ 10%	0%	52%	31%	43%	26%	28%	33%	23%	27%	24%	26%	32%	54%
Level F	≥ 0%	46%	48%	63%	57%	67%	66%	64%	71%	69%	73%	70%	68%	46%
Non-compliant house archetypes	< 0%	54%	0%	6%	0%	7%	6%	3%	6%	4%	3%	4%	0%	0%

Table 2 presents the percentage of archetypes that comply with the different GHG emissions performance levels using natural gas for space heating and electricity for service water heating. As Table 2 illustrates, for provinces with low and mid GHG emissions intensities, most houses will achieve Level D (i.e., percent improvement ≥ 25%) and for provinces with high GHG emissions intensities, most houses will achieve Level E (i.e., percent improvement ≥ 10%). The exception is Nunavut, which has an emissions factor for electricity that is significantly higher than the one for natural gas. This proposed change has specific provisions for such cases.

Table 2. Percentage of Natural-Gas-Heated and Electrically Heated Archetypes—with Natural Gas for Space Heating and Electricity (Service Tank) for Service Water Heating—That Comply with the Operational GHG Emissions (GHGe) Performance Levels

		Provinces and Territories (primary heating: natural gas and electricity)												
		Low GHGe Intensity					Mid GHGe Intensity				High GHGe Intensity			
Operational GHGe Performance Level	**Percent Improvement**	**BC**	**MB**	**NL**	**NT**	**QC**	**NB**	**ON**	**PE**	**YT**	**AB**	**NS**	**NU**	**SK**
Level A	≥ 90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level B	≥ 75%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level C	≥ 50%	28%	3%	6%	0%	8%	0%	0%	0%	0%	0%	0%	0%	0%
Level D	≥ 25%	70%	95%	93%	85%	92%	77%	92%	79%	86%	0%	0%	0%	5%
Level E	≥ 10%	0%	2%	1%	15%	0%	23%	8%	21%	14%	100%	100%	0%	95%
Level F	≥ 0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	49%	0%
Non-compliant house archetypes	< 0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	51%	0%

Table 3 presents the percentage of archetypes that comply with the different GHG emissions performance levels using electricity for both space and service water heating. As Table 3 illustrates, for provinces with low GHG emissions intensities, houses are able to achieve Level A (i.e., percent improvement ≥ 90%); for provinces with mid GHG emissions intensities, houses are able to achieve Levels B (i.e., percent improvement ≥ 75%) or C (i.e., percent improvement ≥ 50%); and for provinces with high GHG emissions intensities, houses are able to achieve Levels D (i.e., percent improvement ≥ 25%) or E (i.e., percent improvement ≥ 10%). As in the previous case, the exception is Nunavut.

Table 3. Percentage of Electrically Heated Archetypes—with Baseboards for Space Heating and Storage Tanks for Service Water Heating—That Comply with the Operational GHG Emissions (GHGe) Performance Levels

		Provinces and Territories (primary heating: electricity)												
		Low GHGe Intensity					Mid GHGe Intensity				High GHGe Intensity			
Operational GHGe Performance Level	**Percent Improvement**	**BC**	**MB**	**NL**	**NT**	**QC**	**NB**	**ON**	**PE**	**YT**	**AB**	**NS**	**NU**	**SK**
Level A	≥ 90%	100%	100%	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%
Level B	≥ 75%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%

Table 3. Percentage of Electrically Heated Archetypes—with Baseboards for Space Heating and Storage Tanks for Service Water Heating—That Comply with the Operational GHG Emissions (GHGe) Performance Levels (Continued)

Operational GHGe Performance Level	Percent Improvement	Provinces and Territories (primary heating: electricity)												
		Low GHGe Intensity					Mid GHGe Intensity				High GHGe Intensity			
		BC	MB	NL	NT	QC	NB	ON	PE	YT	AB	NS	NU	SK
Level C	≥ 50%	0%	0%	0%	0%	0%	100%	100%	100%	0%	0%	0%	0%	0%
Level D	≥ 25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	100%
Level E	≥ 10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%
Level F	≥ 0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Non-compliant house archetypes	< 0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%

Table 4 presents the percentage of archetypes that comply with the different GHG emissions performance levels using electric air source heat pumps for space heating and electric heat pump water heaters for service water heating. As Table 4 illustrates, for provinces with low GHG emissions intensities, all houses are able to achieve Level A (i.e., percent improvement ≥ 90%); for provinces with mid GHG emissions intensities, houses are able to achieve Levels A (i.e., percent improvement ≥ 90%) or B (i.e., percent improvement ≥ 75%); and for provinces with high GHG emissions intensities, houses are able to achieve Levels C (i.e., percent improvement ≥ 50%) or D (i.e., percent improvement ≥ 25%). As in the previous case, the exception is Nunavut.

Table 4. Percentage of Electrically Heated Archetypes—with Air Source Heat Pumps for Space Heating and Heat Pump Water Heaters for Service Water Heating—That Comply with the Operational GHG Emissions (GHGe) Performance Levels

Operational GHGe Performance Level	Percent Improvement	Provinces and Territories (primary heating: electricity)												
		Low GHGe Intensity					Mid GHGe Intensity				High GHGe Intensity			
		BC	MB	NL	NT	QC	NB	ON	PE	YT	AB	NS	NU	SK
Level A	≥ 90%	100%	100%	100%	100%	100%	0%	100%	0%	97%	0%	0%	0%	0%
Level B	≥ 75%	0%	0%	0%	0%	0%	98%	0%	86%	3%	0%	0%	0%	0%
Level C	≥ 50%	0%	0%	0%	0%	0%	2%	0%	14%	0%	0%	100%	0%	84%
Level D	≥ 25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	16%
Level E	≥ 10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level F	≥ 0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Non-compliant house archetypes	< 0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%

Finally, Table 5 presents the percentage of archetypes that comply with the different GHG emissions performance levels using cold climate electric air source heat pumps for space heating and electric heat pump water heaters for service water heating. As Table 5 illustrates, for provinces with low GHG emissions intensities, all houses are able to achieve Level A (i.e., percent improvement ≥ 90%); for provinces with mid GHG emissions intensities, houses are able to achieve Levels A (i.e., percent improvement ≥ 90%) or B (i.e., percent improvement ≥ 75%); and for provinces with high GHG emissions intensities, houses are able to achieve Levels C (i.e., percent improvement ≥ 50%) or D (i.e., percent improvement ≥ 25%). As in the previous case, the exception is Nunavut.

Table 5. Percentage of Electrically Heated Archetypes—with Cold Climate Air Source Heat Pumps for Space Heating and Heat Pump Water Heaters for Service Water Heating—That Comply with the Operational GHG Emissions (GHGe) Performance Levels

Operational GHGe Performance Level	Percent Improvement	Provinces and Territories (primary heating: electricity)												
		Low GHGe Intensity					Mid GHGe Intensity				High GHGe Intensity			
		BC	MB	NL	NT	QC	NB	ON	PE	YT	AB	NS	NU	SK
Level A	≥ 90%	100%	100%	100%	100%	100%	0%	100%	0%	100%	0%	0%	0%	0%
Level B	≥ 75%	0%	0%	0%	0%	0%	100%	0%	100%	0%	0%	0%	0%	0%
Level C	≥ 50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	57%	100%	0%	100%
Level D	≥ 25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	43%	0%	0%	0%
Level E	≥ 10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level F	≥ 0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Non-compliant house archetypes	< 0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%

From the results presented in Tables 1 to 5, where natural gas or electricity is the primary source of energy, it is evident that the majority of NBC-compliant buildings can achieve different operational GHG emissions performance levels without any additional cost. As Tables 2 illustrates, for British Columbia, replacing the natural gas service water heating system with an electric one results in all archetypes meeting the GHG emissions target.

According to Tables 1 to 5, different operational GHG emissions performance levels can be achieved depending on the primary heating source and the GHG emissions intensity level (low, mid or high) to which they are connected. Buildings implementing measures above the minimum requirements of the NBC will have an incremental cost associated with the specific measure that is implemented.

Table 6 presents the average cost of space and service water heating equipment having a higher performance than the minimum requirements of the NBC. However, since the cost associated with reaching a specific GHG emissions performance level cannot be generalized to all provinces and territories, the incremental cost must be evaluated individually on a case-by-case basis.

Table 6. Cost of Energy-Efficient Mechanical Equipment for an Average House

Equipment	Type	Cost ($)(1)
Space heating or cooling	Gas furnace	4,750(2)
	Electric baseboards	6,000(3)
	Electric furnace	3,400(4)
	Air source heat pump (2 ton, 24 000 BTU)	15,500(5)
	Cold climate air source heat pump (24 000 BTU)	24,000(6)
Service water heating	Storage tank (natural gas)	2,500(7)
	Storage tank (electric)	1,500(8)
	Heat pump water heater	4,000(8)

Notes to Table:

(1) The cost takes into account the equipment, materials and installation; the cost of the heating equipment is based on the sizing for an average house (floor area approximately 200 m^2); the cost of the service water heating is based on the load for a four-member family; the cost does not take into account the variability between provinces and territories and the cost for some locations—especially arctic locations—may be higher.

(2) Home Depot (www.homedepot.ca/en/home/ideas-how-to/heating-and-cooling/cost-install-gas-furnace.html)

(3) HomeAdvisor (www.homeadvisor.com/cost/heating-and-cooling/install-an-electric-baseboard-or-wall-heater/)

(4) Modernize Home Services (www.modernize.com/hvac/heating-repair-installation/furnace/electric)

(5) HVAC Trust (www.hvactrust.ca/)

(6) 1Click Heating&Cooling (www.1clickheat.com/)

(7) Enercare (www.enercare.ca/water/water-heating/buyers-guide-to-water-heaters)

(8) Home Depot (www.homedepot.ca/en/home/categories/building-materials/plumbing/water-heaters/tank-water-heaters/tank-electric-water-heaters.html)

Taking into account the costs presented in Table 6, an incremental cost was calculated for each of the previously presented scenarios. It was assumed that when the energy source is either natural gas or electricity, the incremental cost is zero. Table 7 presents the incremental costs for all scenarios.

Table 7. Incremental Costs Associated with the Adoption of Energy Efficient Mechanical Equipment

Scenario	Energy source	Incremental Cost ($)
1	Natural gas (space and service water heating)	0
2	Natural gas (space heating), electricity (service water heating)	0
3	Electricity (space and service water heating)	0
4	Electric Air Source Heat Pump and Heat pump water heater	12,250
5	Electric Cold Climate Air Source Heat Pump and Heat pump water heater	20,750

As previously mentioned, there are no additional costs associated with scenarios 1 and scenario 2 because the proposed house will have mechanical equipment that is compliant with the NBC. Scenario 3 was considered to have no incremental cost either because it includes a combination of natural gas space heating system and electric service water heating system, both of which are compliant with the NBC. Scenario 4 and scenario 5 assume the adoption of energy conservation measures to achieve energy tiers above tier 1, and they have an incremental cost associated with them as presented in Table 7.

Each scenario, if implemented, will result in a decrease in the annual amount of operational GHG emissions. For example, implementing scenario 1 in Alberta (a province with a high GHG emissions intensity) will result in 24% of the house archetypes (out of 240) achieving Level E (i.e., percent improvement ≥ 10%) and 73% of the house archetypes achieving Level F (i.e., percent improvement ≥ 0%). If the natural gas service water heating system is replaced with an electric one (scenario 2) or both natural gas systems are replaced with electric ones (scenario 3), then 100% of the house archetypes will achieve Level E (i.e., percent improvement ≥ 10%). The implementation of scenario 4 (air source heat pumps) will result in 100% of the house archetypes achieving Level D (i.e., percent improvement ≥ 25%), while the implementation of scenario 5 (cold climate air source heat pumps) will result in 100% of the house archetypes achieving Level C (i.e., percent improvement ≥ 50%).

Building envelope measures that are above the minimum energy performance of tier 1 result in energy conservation points that allow the NBC user to obtain credit for the energy savings associated with the building envelope measures that were adopted. The energy savings associated with the building envelope measures will result in a reduction of operational GHG emissions of the house as well, allowing the NBC user to achieve higher operational GHG emissions levels.

Estimations of the costs associated with envelope improvement are presented below. RSMeans data for residential costs was used to estimate the incremental costs associated with improvement of exterior walls insulation. A range of estimated values was calculated to account for the variability between the provinces and territories (location factors provided by RSMeans).

Table 8. Incremental Costs Associated with Insulation Improvement of Above-Ground Walls

Effective RSI value (m^2K/W)	Energy savings (%)	Incremental cost ($\$/m^2$)	Incremental cost for a 200 m^2 house ($)
2.97	2.0	14.1 – 19.5	3,384 – 4,680
3.08	2.3	14.3 – 19.9	3,432 – 4,776
3.69	4.3 - 6.3	16.1 – 23.7	3,864 – 5,688
3.85	5.0 - 6.9	17.4 – 23.7	4,176 – 5,688
3.96	0.6 - 7.5	17.9 – 24.5	4,296 – 5,880
4.29	2.3 - 8.9	22.8 – 31.2	5,472 – 7,488
4.40	2.7 - 9.2	24.8 – 33.9	5,952 – 8,136
4.57	3.4 - 9.8	27.1 – 36.8	6,504 – 8,832
4.73	4.1 - 10.4	27.2 – 37.0	6,528 – 8,880

Table 8. Incremental Costs Associated with Insulation Improvement of Above-Ground Walls (Continued)

Effective RSI value (m^2K/W)	Energy savings (%)	Incremental cost ($\$/m^2$)	Incremental cost for a 200 m^2 house ($)
4.84	4.5 - 10.7	27.3 – 37.2	6,552 – 8,928
5.01	5.0 - 11.1	27.8 – 37.9	6,672 – 9,096
5.45	6.4 - 12.2	28.5 – 39.3	6,840 – 9,432

Notes to Table:

- Source: RSMeans 2023 – Residential costs;
- Insulation type: non-rigid insulation (batts), fiberglass, kraft faced.

As Table 8 illustrates, the energy savings and the incremental costs increase with an increase in the effective RSI value of the exterior wall. According to the NBC, no-cost measures such as a decrease in the volume of the house can result in energy saving points of between 1 and 10, depending on the volume reduction.

The NBC provides energy conservation measures for fenestration as well. Table 9 presents the costs associated with the performance improvement of windows.

Table 9. Costs Associated with the Performance Improvement of Windows

U value (W/m^2K)	Energy savings (%)	Cost ($\$/m^2$)	Incremental cost ($\$/m^2$)	Incremental cost for a 200 m^2 house with 20% WWR ($)
1.84	-	410	-	-
1.61	1.8 – 1.9	450	40	1,920
1.44	1.6 – 3.8	480	70	2,800
1.22	3.2 – 7.0	510	100	4,800

As Table 9 illustrates, the incremental costs associated with the performance improvement of windows increase with decreasing U values (or increasing RSI values) of the window. The percentage energy savings depends on the U value of the window and climate zone.

Applying energy conservation measures to achieve higher energy tiers than tier 1 will result in the achievement of higher operational GHG emissions levels as well. However, depending on the energy conservation measures, these will have an incremental cost compared with the minimum requirements of the NBC for energy tier 1.

Enforcement implications

The enforcement of the proposed technical requirements to minimize the excessive emission of operational GHG emissions would require additional effort by authorities having jurisdiction.

A consistent set of technical requirements to minimize the excessive emission of operational greenhouse gases across Canada would contribute to meeting provincial, territorial and federal reduction targets and climate action plans, including Canada's goal to reduce its total GHG emissions to 40% to 45% below 2005 levels by 2030 and to reach net-zero GHG emissions by 2050.

Who is affected

Designers, engineers, architects, builders and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.36.1.1.] 9.36.1.1. ([1] 1) no attributions

[9.36.1.2.] 9.36.1.2. ([1] 1) no attributions

[9.36.1.2.] 9.36.1.2. ([2] 2) no attributions

[9.36.1.2.] 9.36.1.2. ([3] 3) no attributions

[9.36.1.2.] 9.36.1.2. ([4] 4) no attributions

[9.36.1.2.] 9.36.1.2. ([5] 5) no attributions

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[9.36.1.2.] 9.36.1.2. ([7] 7) no attributions

[9.36.1.2.] 9.36.1.2. ([8] 8) no attributions

[9.36.1.3.] 9.36.1.3. ([1] 1) no attributions

[9.36.1.3.] 9.36.1.3. ([1] 1) ([e] e)

[9.36.1.3.] -- ([2] --) no attributions

[9.36.1.3.] 9.36.1.3. ([3] 2) no attributions

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[9.36.1.3.] 9.36.1.3. ([7] 6) no attributions

[9.36.2.1.] 9.36.2.1. ([1] 1) no attributions

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[9.36.2.1.] 9.36.2.1. ([4] 4) no attributions

[9.36.2.1.] 9.36.2.1. ([5] 5) no attributions

[9.36.2.2.] 9.36.2.2. ([1] 1) [F92-OE1.1]

[9.36.2.2.] 9.36.2.2. ([2] 2) [F92-OE1.1]

[9.36.2.2.] 9.36.2.2. ([3] 3) [F92-OE1.1]

[9.36.2.2.] 9.36.2.2. ([4] 4) [F92-OE1.1]

[9.36.2.2.] 9.36.2.2. ([5] 5) [F92-OE1.1]

[9.36.2.3.] 9.36.2.3. ([1] 1) no attributions

[9.36.2.3.] 9.36.2.3. ([2] 2) no attributions

[9.36.2.3.] 9.36.2.3. ([3] 3) no attributions

[9.36.2.3.] 9.36.2.3. ([4] 4) no attributions

[9.36.2.3.] 9.36.2.3. ([5] 5) no attributions

[9.36.2.4.] 9.36.2.4. ([1] 1) [F92-OE1.1]

[9.36.2.4.] 9.36.2.4. ([2] 2) no attributions

[9.36.2.4.] 9.36.2.4. ([3] 3) [F92-OE1.1]

[9.36.2.4.] 9.36.2.4. ([4] 4) no attributions

[9.36.2.5.] 9.36.2.5. ([1] 1) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([2] 2) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([3] 3) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([4] 4) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([5] 5) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([6] 6) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([7] 7) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([8] 8) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([9] 9) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([10] 10) no attributions

[9.36.2.6.] 9.36.2.6. ([1] 1) [F92-OE1.1]

[9.36.2.6.] 9.36.2.6. ([2] 2) [F92-OE1.1]

[9.36.2.6.] 9.36.2.6. ([3] 3) [F92-OE1.1]

[9.36.2.6.] 9.36.2.6. ([4] 4) [F92-OE1.1]

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

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

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

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

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

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

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

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

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

[9.36.2.8.] 9.36.2.8. ([1] 1) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([2] 2) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([3] 3) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([4] 4) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([5] 5) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([6] 6) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([7] 7) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([8] 8) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([9] 9) [F92-OE1.1]

[9.36.2.8.] 9.36.2.8. ([10] 10) no attributions

[9.36.2.9.] 9.36.2.9. ([1] 1) [F90-OE1.1]

[9.36.2.9.] 9.36.2.9. ([2] 2) [F90-OE1.1]

[9.36.2.9.] 9.36.2.9. ([3] 3) [F90-OE1.1]

[9.36.2.9.] 9.36.2.9. ([4] 4) [F90-OE1.1]

[9.36.2.9.] 9.36.2.9. ([5] 5) [F90-OE1.1]

[9.36.2.9.] 9.36.2.9. ([6] 6) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([1] 1) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([2] 2) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([3] 3) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([4] 4) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([5] 5) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([6] 6) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([7] 7) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.2.10.] 9.36.2.10. ([8] 8) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([9] 9) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([10] 10) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([11] 11) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([12] 12) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([13] 13) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([14] 14) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([15] 15) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([16] 16) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([17] 17) [F90-OE1.1]

[9.36.2.10.] 9.36.2.10. ([18] 18) [F90-OE1.1]

[9.36.2.11.] 9.36.2.11. ([1] 1) no attributions

[9.36.2.11.] 9.36.2.11. ([2] 2) [F92-OE1.1]

[9.36.2.11.] 9.36.2.11. ([2] 2) no attributions

[9.36.2.11.] 9.36.2.11. ([3] 3) [F92-OE1.1]

[9.36.2.11.] 9.36.2.11. ([3] 3) no attributions

[9.36.2.11.] 9.36.2.11. ([4] 4) [F92-OE1.1]

[9.36.2.11.] 9.36.2.11. ([5] 5) [F92-OE1.1]

[9.36.2.11.] 9.36.2.11. ([6] 6) [F92-OE1.1]

[9.36.2.11.] 9.36.2.11. ([7] 7) [F92-OE1.1]

[9.36.2.11.] 9.36.2.11. ([8] 8) [F92-OE1.1]

[9.36.3.1.] 9.36.3.1. ([1] 1) no attributions

[9.36.3.1.] 9.36.3.1. ([2] 2) no attributions

[9.36.3.2.] 9.36.3.2. ([1] 1) [F95-OE1.1]

[9.36.3.2.] 9.36.3.2. ([2] 2) no attributions

[9.36.3.2.] 9.36.3.2. ([3] 3) [F91,F93-OE1.1]

[9.36.3.2.] 9.36.3.2. ([4] 4) [F91,F93-OE1.1]

[9.36.3.2.] 9.36.3.2. ([5] 5) no attributions

[9.36.3.2.] 9.36.3.2. ([5] 5) [F91,F93-OE1.1]

[9.36.3.3.] 9.36.3.3. ([1] 1) [F91,F95-OE1.1]

[9.36.3.3.] 9.36.3.3. ([2] 2) [F91,F95-OE1.1]

[9.36.3.3.] 9.36.3.3. ([3] 3) no attributions

[9.36.3.3.] 9.36.3.3. ([4] 4) no attributions

[9.36.3.4.] 9.36.3.4. ([1] 1) no attributions

[9.36.3.4.] 9.36.3.4. ([2] 2) [F93-OE1.1]

[9.36.3.5.] 9.36.3.5. ([1] 1) [F98-OE1.1]

[9.36.3.6.] 9.36.3.6. ([1] 1) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([1] 1) no attributions

[9.36.3.6.] 9.36.3.6. ([2] 2) [F95,F98-OE1.1]

[9.36.3.6.] 9.36.3.6. ([3] 3) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([4] 4) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([5] 5) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([6] 6) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([7] 7) [F95-OE1.1]

[9.36.3.7.] 9.36.3.7. ([1] 1) [F95-OE1.1]

[9.36.3.8.] 9.36.3.8. ([1] 1) [F95,F100-OE1.1]

[9.36.3.8.] 9.36.3.8. ([2] 2) no attributions

[9.36.3.8.] 9.36.3.8. ([3] 3) no attributions

[9.36.3.8.] 9.36.3.8. ([4] 4) [F98,F100-OE1.1]

[9.36.3.8.] 9.36.3.8. ([5] 5) [F98,F100-OE1.1]

[9.36.3.9.] 9.36.3.9. ([1] 1) no attributions

[9.36.3.9.] 9.36.3.9. ([2] 2) [F95,F100-OE1.1]

[9.36.3.9.] 9.36.3.9. ([3] 3) [F95,F100-OE1.1]

[9.36.3.9.] 9.36.3.9. ([4] 4) [F95,F98,F100-OE1.1]

[9.36.3.10.] 9.36.3.10. ([1] 1) [F95,F98,F99-OE1.1]

[9.36.3.10.] 9.36.3.10. ([2] 2) [F95,F98,F99-OE1.1]

[9.36.3.10.] 9.36.3.10. ([3] 3) no attributions

[9.36.3.11.] 9.36.3.11. ([1] 1) [F95,F98,F99-OE1.1]

[9.36.3.11.] 9.36.3.11. ([2] 2) no attributions

[9.36.3.11.] 9.36.3.11. ([3] 3) [F93,F96-OE1.1]

[9.36.4.1.] 9.36.4.1. ([1] 1) no attributions

[9.36.4.1.] 9.36.4.1. ([2] 2) no attributions

[9.36.4.2.] 9.36.4.2. ([1] 1) [F96,F98-OE1.1]

[9.36.4.2.] 9.36.4.2. ([2] 2) [F93,F96-OE1.1]

[9.36.4.2.] 9.36.4.2. ([3] 3) [F98-OE1.1]

[9.36.4.3.] 9.36.4.3. ([1] 1) [F96,F98-OE1.1]

[9.36.4.3.] 9.36.4.3. ([2] 2) no attributions

[9.36.4.3.] 9.36.4.3. ([3] 3) [F93,F96-OE1.1]

[9.36.4.4.] 9.36.4.4. ([1] 1) [F93,F96-OE1.1]

[9.36.4.4.] 9.36.4.4. ([2] 2) [F93,F96-OE1.1]

[9.36.4.4.] 9.36.4.4. ([3] 3) [F93,F96-OE1.1]

[9.36.4.5.] 9.36.4.5. ([1] 1) [F96-OE1.1]

[9.36.4.6.] 9.36.4.6. ([1] 1) [F96-OE1.1]

[9.36.4.6.] 9.36.4.6. ([2] 2) [F96-OE1.1]

[9.36.5.1.] 9.36.5.1. ([1] 1) no attributions

[9.36.5.1.] 9.36.5.1. ([2] 2) no attributions

[9.36.5.2.] 9.36.5.2. ([1] 1) no attributions

[9.36.5.2.] 9.36.5.2. ([2] 2) no attributions

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

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

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

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

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

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

[9.36.5.4.] 9.36.5.4. ([1] 1) no attributions

[9.36.5.4.] 9.36.5.4. ([2] 2) no attributions

[9.36.5.4.] 9.36.5.4. ([3] 3) [F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([4] 4) [F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([5] 5) [F95,F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([6] 6) [F95,F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([7] 7) [F95,F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([8] 8) [F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([9] 9) [F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([10] 10) [F90,F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([11] 11) [F90,F99-OE1.1]

[9.36.5.5.] 9.36.5.5. ([1] 1) [F99-OE1.1]

[9.36.5.5.] 9.36.5.5. ([2] 2) [F99-OE1.1]

[9.36.5.5.] 9.36.5.5. ([3] 3) [F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([1] 1) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([2] 2) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([3] 3) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([4] 4) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([5] 5) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([6] 6) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([7] 7) [F92,F93,F95,F96,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([8] 8) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([9] 9) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([10] 10) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([11] 11) [F92,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([1] 1) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([2] 2) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([3] 3) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([4] 4) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([5] 5) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([6] 6) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([7] 7) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([8] 8) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([9] 9) [F95,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([1] 1) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([2] 2) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([3] 3) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([4] 4) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([5] 5) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([6] 6) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([7] 7) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([8] 8) [F96,F99-OE1.1]

[9.36.5.9.] 9.36.5.9. ([1] 1) [F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([1] 1) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([2] 2) no attributions

[9.36.5.10.] 9.36.5.10. ([3] 3) no attributions

[9.36.5.10.] 9.36.5.10. ([4] 4) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([5] 5) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([6] 6) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([7] 7) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([8] 8) no attributions

[9.36.5.10.] 9.36.5.10. ([9] 9) [F90,F91,F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([10] 10) [F90,F91,F92,F93,F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([1] 1) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([2] 2) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([3] 3) [F92,F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([4] 4) [F95,F99,F100-OE1.1]

[9.36.5.11.] 9.36.5.11. ([5] 5) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([6] 6) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([7] 7) no attributions

[9.36.5.11.] 9.36.5.11. ([8] 8) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([9] 9) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([10] 10) [F95,F99,F100-OE1.1]

[9.36.5.11.] 9.36.5.11. ([11] 11) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([12] 12) [F95,F99,F100-OE1.1]

[9.36.5.11.] 9.36.5.11. ([13] 13) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([14] 14) [F95,F99,F100-OE1.1]

[9.36.5.11.] 9.36.5.11. ([15] 15) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([16] 16) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([17] 17) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([18] 18) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([19] 19) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([20] 20) [F95,F99-OE1.1]

[9.36.5.12.] 9.36.5.12. ([1] 1) [F96,F99-OE1.1]

[9.36.5.12.] 9.36.5.12. ([2] 2) no attributions

[9.36.5.13.] 9.36.5.13. ([1] 1) [F99-OE1.1]

[9.36.5.13.] 9.36.5.13. ([2] 2) [F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([1] 1) [F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([2] 2) [F90,F91,F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([3] 3) [F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([4] 4) [F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([5] 5) [F92,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([6] 6) [F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([7] 7) [F92,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([8] 8) [F92,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([9] 9) [F92,F99,F95-OE1.1]

[9.36.5.14.] 9.36.5.14. ([10] 10) [F92,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([1] 1) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([2] 2) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([3] 3) [F95,F99,F100-OE1.1]

[9.36.5.15.] 9.36.5.15. ([4] 4) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([5] 5) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([6] 6) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([7] 7) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([8] 8) [F95,F99,F100-OE1.1]

[9.36.5.15.] 9.36.5.15. ([9] 9) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([10] 10) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([11] 11) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([12] 12) [F95,F99,F100-OE1.1]

[9.36.5.15.] 9.36.5.15. ([13] 13) [F95,F99,F100-OE1.1]

[9.36.5.15.] 9.36.5.15. ([14] 14) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([15] 15) [F95,F99-OE1.1]

[9.36.5.15.] 9.36.5.15. ([16] 16) [F95,F99-OE1.1]

[9.36.5.16.] 9.36.5.16. ([1] 1) [F95,F99-OE1.1]

[9.36.5.16.] 9.36.5.16. ([2] 2) [F95,F99-OE1.1]

[9.36.5.16.] 9.36.5.16. ([3] 3) [F95,F99-OE1.1]

[9.36.6.1.] 9.36.6.1. ([1] 1) no attributions

[9.36.6.2.] 9.36.6.2. ([1] 1) no attributions

[9.36.6.3.] 9.36.6.3. ([1] 1) no attributions

[9.36.6.3.] 9.36.6.3. ([1] 1) [F90-OE1.1]

[9.36.6.3.] 9.36.6.3. ([2] 2) no attributions

[9.36.6.3.] 9.36.6.3. ([3] 3) no attributions

[9.36.6.4.] 9.36.6.4. ([1] 1) no attributions

[9.36.6.4.] 9.36.6.4. ([1] 1) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.6.4.] 9.36.6.4. ([2] 2) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.6.4.] 9.36.6.4. ([3] 3) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.6.4.] 9.36.6.4. ([4] 4) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.7.1.] 9.36.7.1. ([1] 1) no attributions

[9.36.7.1.] 9.36.7.1. ([2] 2) no attributions

[9.36.7.2.] 9.36.7.2. ([1] 1) no attributions

[9.36.7.2.] 9.36.7.2. ([1] 1) [F90,F91,F92,F93,F95,F96,F98,F99,F100-OE1.1]

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

[9.36.7.3.] 9.36.7.3. ([2] 2) [F95-OE1.1]

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

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

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

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

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

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

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

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

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

[9.36.8.1.] 9.36.8.1. ([1] 1) no attributions

[9.36.8.2.] 9.36.8.2. ([1] 1) no attributions

[9.36.8.2.] 9.36.8.2. ([1] 1) [F90,F91,F92,F93,F95,F96,F98,F99,F100-OE1.1]

[9.36.8.4.] 9.36.8.4. ([1] 1) no attributions

[9.36.8.5.] 9.36.8.5. ([1] 1) no attributions

[9.36.8.5.] 9.36.8.5. ([2] 2) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([3] 3) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([4] 4) no attributions

[9.36.8.5.] 9.36.8.5. ([4] 4) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([5] 5) no attributions

[9.36.8.5.] 9.36.8.5. ([5] 5) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([6] 6) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([7] 7) [F92-OE1.1]

[9.36.8.6.] 9.36.8.6. ([1] 1) [F92-OE1.1]

[9.36.8.6.] 9.36.8.6. ([2] 2) no attributions

[9.36.8.6.] 9.36.8.6. ([3] 3) no attributions

[9.36.8.6.] 9.36.8.6. ([3] 3) [F92-OE1.1]

[9.36.8.6.] 9.36.8.6. ([4] 4) [F92-OE1.1]

[9.36.8.7.] 9.36.8.7. ([1] 1) no attributions

[9.36.8.7.] 9.36.8.7. ([2] 2) [F92-OE1.1]

[9.36.8.7.] 9.36.8.7. ([3] 3) [F92-OE1.1]

[9.36.8.7.] 9.36.8.7. ([4] 4) no attributions

[9.36.8.8.] 9.36.8.8. ([1] 1) no attributions

[9.36.8.8.] 9.36.8.8. ([2] 2) [F90-OE1.1]

[9.36.8.9.] 9.36.8.9. ([1] 1) no attributions

[9.36.8.9.] 9.36.8.9. ([2] 2) no attributions

[9.36.8.9.] 9.36.8.9. ([3] 3) no attributions

[9.36.8.9.] 9.36.8.9. ([3] 3) [F95,F100-OE1.1]

[9.36.8.9.] 9.36.8.9. ([4] 4) [F95-OE1.1]

[9.36.8.10.] 9.36.8.10. ([1] 1) no attributions

[9.36.8.10.] 9.36.8.10. ([2] 2) no attributions

[9.36.8.10.] 9.36.8.10. ([3] 3) [F96-OE1.1]

[9.36.8.11.] 9.36.8.11. ([1] 1) [F95-OE1.1]

[9.36.8.11.] 9.36.8.11. ([2] 2) [F95-OE1.1]

[9.36.11.1.] -- ([1] --) no attributions

[9.36.11.2.] -- ([1] --) no attributions

[9.36.11.3.] -- ([1] --) no attributions

[9.36.11.3.] -- ([2] --) no attributions

[9.36.11.3.] -- ([3] --) no attributions

[9.36.11.4.] -- ([1] --) no attributions

[9.36.11.5.] -- ([1] --) no attributions

[9.36.11.5.] -- ([1] --) [F101-OE2.1]

[9.36.11.5.] -- ([2] --) [F101-OE2.1]

[9.36.11.5.] -- ([3] --) no attributions

[9.36.11.5.] -- ([4] --) no attributions

[9.36.11.5.] -- ([5] --) [F101-OE2.1]

[9.36.11.6.] -- ([1] --) no attributions

[9.36.11.6.] -- ([2] --) [F101-OE2.1]

[9.36.11.6.] -- ([3] --) [F101-OE2.1]

[9.36.11.6.] -- ([4] --) [F101-OE2.1]

[9.36.11.6.] -- ([5] --) no attributions

[9.36.11.7.] -- ([1] --) [F101-OE2.1]

[9.36.11.8.] -- ([1] --) [F101-OE2.1]

[9.36.11.8.] -- ([2] --) [F101-OE2.1]

[9.36.11.8.] -- ([3] --) [F101-OE2.1]

[9.36.11.8.] -- ([4] --) [F101-OE2.1]

Submit a comment

Proposed Change 2026

Code Reference(s): **NBC20 Div.B 9.36. (first printing)**
Subject: Greenhouse Gas Emissions
Title: Operational GHG Emissions: Tiered Prescriptive Requirements in the NBC
Description: This proposed change introduces prescriptive requirements in the NBC to reduce operational GHG emissions.
Related Proposed Change(s): PCF 1820, PCF 1843, PCF 1989, PCF 2003, PCF 2004, PCF 2016

This change could potentially affect the following topic areas:

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

Problem

Approximately 13% of Canada's total greenhouse gas (GHG) emissions can be attributed to houses and buildings. This is primarily a result of using fossil fuels for space and water heating. Additionally, the combined impact of electricity consumption for cooling, lighting and running other appliances raises the overall contribution of buildings to GHG emissions to approximately 18%.[1] The 2020 GHG emissions from residential and building sectors are outlined in Table 1, which shows the sources and their percentage of electricity consumption.

Table 1. 2020 GHG Emissions in the Residential and Building Sectors(1)

Sector	Source	Electricity Consumption, %
Residential	Space heating	64
	Water heating	20
	Running appliances	11
	Lighting	3
	Space cooling	2
Building	Space heating	65
	Running auxiliary equipment	12
	Lighting	10

	Water heating	7
	Space cooling	3
	Other	3

Note to Table 1:

(1)
https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/menus/trends/comprehensive_tables/list.cfm

There has been a growing recognition of the importance of addressing climate change and reducing GHG emissions from all sectors, including the built environment. However, the National Model Codes (the Codes) do not presently consider the type or quality of energy sources used by buildings and houses, nor do they address or regulate embodied and operational GHG emissions. As the industry moves towards higher energy efficiencies, the differences between energy sources must be examined because they contribute to GHG emissions differently. Historically, the Codes focused on design and construction requirements related to safety, structural integrity, accessibility and energy efficiency. With the latter, the emphasis was on reducing energy consumption during the construction and operational phases, but did not explicitly address operational GHG emissions. Furthermore, Canada is a large and diverse country with different climatic regions and building practices. This reality has led to regional variations in building codes and regulations, making it challenging to establish a unified approach to address operational GHG emissions at the national level.

The Codes currently contain an energy-efficiency objective and related requirements for the design and construction of new buildings and houses. In the 2020 editions of the National Energy Code of Canada for Buildings (NECB) and National Building Code of Canada (NBC), energy-efficiency tiers were introduced, containing measures that progressively increase energy efficiency and reduce the amount of energy needed to operate a building. These requirements play a crucial role in reducing GHG emissions by focusing on the amount of energy used. However, the Canadian Board for Harmonized Construction Codes (CBHCC) recognizes that energy savings alone will not lead to reducing emissions to meet the national goals stated in the Pan-Canadian Framework.

GHG emissions across Canadian provinces and territories exhibit substantial variations, influenced by factors such as population density, climate, energy sources and economic considerations.[2] Provinces and territories with larger populations, resource-based economies or heavy reliance on fossil fuels for electricity generation generally register higher emissions levels. This demonstrates a greatly varied energy landscape across Canada.

Ultimately, the goal is to reduce operational GHG emissions to zero or near zero across provinces and territories by 2050. Consequently, authorities having jurisdiction require a flexible framework to regulate GHG emissions due to building operation by using "levels" that move towards lower operational GHG emissions.

References

[1] https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/climate-plan-overview/healthy-environment-healthy-economy/annex-homes-buildings.html

[2] https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html

Justification

Since 2010, the NBC and NECB have included requirements to prevent excessive use of energy. Though these requirements have improved the energy efficiency of new houses and buildings, the Codes remain silent on the type of energy used and the emissions associated with production, distribution and use. As a result, many new Code-compliant buildings contribute GHG emissions through their year-over-year operation. Reducing these emissions is an important step to enable action towards climate goals. Climate change is the biggest challenge facing humanity today, consequently, it is vital that the Codes address this gap to support Canada in reaching its emissions reduction target of 40% below 2005 levels by 2030 and net-zero emissions by 2050. Furthermore, achieving long-term climate goals requires early action on operational GHG emissions. Failure to address this pivotal issue could impede Canada's progress towards its emissions-reduction targets, jeopardizing the ability to effectively combat climate change and protect the future well-being of the country. The commitment to a sustainable future demands that these emissions be addressed comprehensively and urgently.

If these emissions are to be regulated, designers, builders and enforcement officials need a consistent and accurate means to convert expected energy use into expected GHG emissions. For years, governments and industry have relied on emissions factors (also referred to as emissions intensity factors) for this task. Emissions factors describe the amount of GHG emissions (in kg CO_2 equivalent) per unit of energy consumed, for instance, of electricity (in kWh), of natural gas (in m^3), and of heating oil (in L). Environment and Climate Change Canada compiles this data annually and publishes estimates as part of Canada’s national greenhouse gas inventory report. Emissions factors reflect the carbon intensity of different fuels, as well as regional differences in energy production and distribution. Data is generally published after two years; factors reflecting 2021 data were published in April 2023.

If Canada’s energy sector were unchanging, this data would suffice for building design and Code-administration purposes. But provincial, territorial and regional utilities are presently undergoing unprecedented transition. Electric utilities are shifting away from coal power generation, while gas utilities are experimenting with new technologies to lower emissions through use of hydrogen and renewable biogas sources. These changes are expected to occur rapidly; some provincial utilities expect to reduce electric emissions by 60% or more by 2030. In this environment, referencing the most recent (2021) emissions data currently available in the Codes could encourage the construction of buildings with higher-than-expected emissions. For this reason, this proposed change is based on the best available future-looking forecasts for utility emissions, averaged for the years 2031 to 2035. Emissions factor forecasts for electricity are sourced from Environment and Climate Change Canada’s most recent (2023) projections. While no similar projections are currently available for natural gas utilities, such projections are expected in future years and could be incorporated into the Codes at a later date.

PROPOSED CHANGE

NBC20 Div.B 9.36. (first printing)

[9.36.] 9.36. Energy Efficiency

[9.36.1.] 9.36.1. General

[9.36.1.1.] 9.36.1.1. Scope

[9.36.1.2.] 9.36.1.2. Definitions

[9.36.1.3.] 9.36.1.3. Compliance and Application

(See Note A-9.36.1.3.)

[1] 1) Except as provided in Sentences (3) to (7)-2025 ~~(2) to (6)~~, *buildings* shall comply with

[a] a) the prescriptive or trade-off requirements in Subsections 9.36.2. to 9.36.4.,
[b] b) the performance requirements in Subsection 9.36.5.,
[c] c) the tiered performance requirements in Subsection 9.36.7.,
[d] d) the tiered prescriptive requirements in Subsection 9.36.8., or
[e] e) the NECB.

[2] --) Except as provided in Sentence (6)-2025, *buildings* shall comply with

[a] --) the tiered operational GHG emissions prescriptive requirements in Subsection 9.36.12.-2025, or
[b] --) the NECB.

[3] 2) Subsections 9.36.2. to 9.36.4. apply to

[a] a) *buildings* of *residential occupancy* to which Part 9 applies,
[b] b) *buildings* containing *business and personal services*, *mercantile* or *low-hazard industrial occupancies* to which Part 9 applies whose combined total *floor area* does not exceed 300 m^2, excluding parking garages that serve *residential occupancies*, and
[c] c) *buildings* containing a mix of the *residential* and non-*residential occupancies* described in Clauses (a) and (b).

[4] 3) Subsection 9.36.5. and 9.36.7. apply only to

[a] a) houses with or without a *secondary suite*, and
[b] b) *buildings* containing only *dwelling units* and common spaces whose total *floor area* does not exceed 20% of the total *floor area* of the *building*.

(See Note A-9.36.1.3.(3).)

[5] 4) Subsections 9.36.8. and 9.36.12.-2025 ~~applies~~apply only to *buildings* of *residential occupancy* to which Part 9 applies.

[6] 5) *Buildings* containing non-*residential occupancies* whose combined total *floor area* exceeds 300 m^2 or *medium-hazard industrial occupancies* shall comply with the NECB.

[7] 6) *Buildings* or portions of *buildings* that are not required to be *conditioned spaces* are exempted from the requirements of this Section. (See Note A-9.36.1.3.(6).)

[9.36.6.4.] 9.36.6.4. Determination of Airtightness Level

[9.36.7.] 9.36.7. Tiered Energy Performance Compliance: Performance Path

[9.36.7.1.] 9.36.7.1. Scope and Application

[9.36.7.2.] 9.36.7.2. Compliance

[9.36.7.3.] 9.36.7.3. Energy Performance Improvement Compliance Calculations

[9.36.8.] 9.36.8. Tiered Energy Performance Compliance: Prescriptive Path

[9.36.8.1.] 9.36.8.1. Scope

[9.36.8.2.] 9.36.8.2. Compliance

[9.36.8.3.] 9.36.8.3. Definitions

[9.36.8.4.] 9.36.8.4. Building Envelope – General

[9.36.8.5.] 9.36.8.5. Energy Conservation Measures for Above-Ground Opaque Building Assemblies

[9.36.8.6.] 9.36.8.6. Energy Conservation Measures for Fenestration and Doors

[9.36.8.7.] 9.36.8.7. Energy Conservation Measures for Opaque Building Assemblies Below-Grade or in Contact with the Ground

[9.36.8.8.] 9.36.8.8. Energy Conservation Measures Relating to Airtightness

[9.36.8.9.] 9.36.8.9. Energy Conservation Measures for HVAC Systems

[9.36.8.10.] 9.36.8.10. Energy Conservation Measures for Service Water Heating Equipment

[9.36.8.11.] 9.36.8.11. Energy Conservation Points for Building Volume

[9.36.9.] -- Reserved

[9.36.10.] -- Reserved

[9.36.11.] -- Reserved

[9.36.12.] -- Tiered Operational GHG Emissions Prescriptive Compliance

[9.36.12.1.] --- Scope

[1] --) This Subsection is concerned with GHG emissions, determined at the time of design, resulting from the supply and consumption of energy used by the *building* for

- [a] --) systems used for heating, ventilating and air-conditioning, and
- [b] --) systems used to heat service water.

[9.36.12.2.] --- Application

[1] --) This Subsection applies to the *buildings* described in Article 9.36.1.3.-2025.

[9.36.12.3.] --- Compliance

[1] --) The GHG emissions factor (GEF) for an energy source shall be determined in accordance with Article 9.36.11.6.-2025 (PCF 2004).

[2] --) The energy performance tier achieved by the *building* shall be determined in accordance with

[a] --) the tiered points-based prescriptive trade-off requirements in Subsection 9.36.8., or

[b] --) the tiered prescriptive requirements in Subsection 9.36.9.-2025 (PCF 1830).

[3] --) Compliance with this Subsection shall be achieved by designing and constructing *buildings* in accordance with one of the GHG emissions performance levels A to F specified in Article 9.36.12.4.

[9.36.12.4.] --- GHG Emissions Performance Levels

[1] --) Except as provided in Sentence (2), to comply with one of the GHG emissions performance levels A to F, the *building* shall be designed and constructed so that its energy performance meets or exceeds the minimum energy performance tier required for that performance level, as specified in Tables 9.36.12.4.-A to 9.36.12.4.-F for the energy sources or types of equipment used for space and service water heating and the applicable GHG emissions factor for electricity.

Table [9.36.12.4.-A]
Minimum Energy Performance Tier for GHG Emissions Performance Level A
Forming Part of Sentence 9.36.12.4.(1)

Energy Source or Type of Equipment		**Electricity GEF,** (1) **g CO_2e/kWh**	**Minimum Energy Performance Tier** (2)
Space Heating	**Service Water Heating**		
Electricity	Electricity	GEF ≤ 25	2
		25 < GEF ≤ 100	4
Heat pump (3) with electric back-up (4)	Electric *storage-type service water heater* or heat pump water heater	GEF ≤ 25	1
		25 < GEF ≤ 100	3
Heat pump (3) with natural gas or propane back-up (4)	Electric *storage-type service water heater* or heat pump water heater	GEF ≤ 100	4
Cold-climate heat pump (3) (5) with electric back-up (4)	Heat pump water heater	GEF ≤ 25	1
		25 < GEF ≤ 100	2
		100 < GEF < 200	4
	Electric *storage-type service water heater*	GEF ≤ 25	1
		25 < GEF ≤ 100	3
Other source with GEF < 25	Other source with GEF < 25	GEF < 200	2

Notes to Table [9.36.12.4.-A] :

(1) GEF = GHG emissions factor

(2) See Sentence 9.36.12.3.(2).

(3) Electrically operated.

(4) The heat pump must be sized to meet at least 60% of the heating load of the *building*.

(5) A cold-climate heat pump is an air-source heat pump that has a rated coefficient of performance not less than 1.8 at −15°C and a rated capacity at −15°C not less than 70% of the rated capacity at 8.3°C.

Table [9.36.12.4.-B]
Minimum Energy Performance Tier for GHG Emissions Performance Level B
Forming Part of Sentence 9.36.12.4.(1)

Energy Source or Type of Equipment		**Electricity GEF, (1) g CO$_2$e/kWh**	**Minimum Energy Performance Tier (2)**
Space Heating	**Service Water Heating**		
Electricity	Electricity	GEF ≤ 25	2
		25 < GEF ≤ 100	3
Heat pump (3) with electric back-up (4)	Electric *storage-type service water heater* or heat pump water heater	GEF ≤ 25	1
		25 < GEF ≤ 100	2
		100 < GEF < 200	4
Heat pump (3) with natural gas or propane back-up (4)	Electric *storage-type service water heater* or heat pump water heater	GEF ≤ 100	3
		100 < GEF < 200	4
Other source with GEF < 25	Other source with GEF < 25	GEF < 200	2

Notes to Table [9.36.12.4.-B] :

(1) GEF = GHG emissions factor

(2) See Sentence 9.36.12.3.(2).

(3) Electrically operated.

(4) The heat pump must be sized to meet at least 60% of the heating load of the *building*.

Table [9.36.12.4.-C]
Minimum Energy Performance Tier for GHG Emissions Performance Level C
Forming Part of Sentence 9.36.12.4.(1)

Energy Source or Type of Equipment		**Electricity GEF,** (1) **g CO_2e/kWh**	**Minimum Energy Performance Tier** (2)
Space Heating	**Service Water Heating**		
Electricity	Electricity	GEF ≤ 100	2
		100 < GEF < 200	3
Heat pump (3) with electric back-up (4)	Electric *storage-type service water heater* or heat pump water heater	GEF ≤ 100	1
		100 < GEF < 200	2
Heat pump (3) with natural gas or propane back-up (4)	Electric *storage-type service water heater* or heat pump water heater	GEF ≤ 100	2
		100 < GEF < 200	3
Other source with GEF < 25	Other source with GEF < 25	GEF < 200	2

Notes to Table [9.36.12.4.-C] :

(1) GEF = GHG emissions factor

(2) See Sentence 9.36.12.3.(2).

(3) Electrically operated.

(4) The heat pump must be sized to meet at least 60% of the heating load of the *building*.

Table [9.36.12.4.-D]
Minimum Energy Performance Tier for GHG Emissions Performance Level D
Forming Part of Sentence 9.36.12.4.(1)

Energy Source or Type of Equipment		Electricity GEF, (1) $g\ CO_2e/kWh$	Minimum Energy Performance Tier (2)
Space Heating	**Service Water Heating**		
Natural gas	Natural gas	Any	4
	Electricity	GEF ≤ 100	1
Electricity	Electricity	GEF ≤ 100	2
		100 < GEF < 200	3
Heat pump (3) with electric, natural gas, or propane back-up, (4) or other source with GEF < 25	Electricity, including electric *storage-type service water heaters* and heat pump water heaters, or other source with GEF < 25	Any	1

Notes to Table [9.36.12.4.-D] :

(1) GEF = GHG emissions factor

(2) See Sentence 9.36.12.3.(2).

(3) Electrically operated.

(4) The heat pump must be sized to meet at least 60% of the heating load of the *building*.

Table [9.36.12.4.-E]
Minimum Energy Performance Tier for GHG Emission Performance Level E
Forming Part of Sentence 9.36.12.4.(1)

Energy Source		**Minimum Energy Performance Tier** (1)
Space Heating	**Service Water Heating** (2)	
Natural gas	Natural gas	3
Natural gas	Electricity or other source with GEF ≤ 25	1
Electricity, heat pump (3) with electric, natural gas, or propane back-up, (4) or other source with GEF ≤ 25	Natural gas, electricity or other source with GEF ≤ 25	1

Notes to Table [9.36.12.4.-E] :

(1) See Sentence 9.36.12.3.(2).

(2) GEF = GHG emissions factor in g CO_2e/kWh

(3) Electrically operated.

(4) The heat pump must be sized to meet at least 60% of the heating load of the *building*.

Table [9.36.12.4.-F]
Minimum Energy Performance Tier for GHG Emission Performance Level F
Forming Part of Sentence 9.36.12.4.(1)

Energy Source		**Minimum Energy Performance Tier** (1)
Space Heating	**Service Water Heating**	
Natural gas, electricity, heat pump (2) with electric, natural gas, or propane back-up, (3) or other source with GEF (4) ≤ 25	Natural gas, electricity or other source with GEF (4) ≤ 25	1

Notes to Table [9.36.12.4.-F] :

(1) See Sentence 9.36.12.3.(2).

(2) Electrically operated.

(3) The heat pump must be sized to meet at least 60% of the heating load of the *building*.

(4) GEF = GHG emissions factor in g CO_2e/kWh

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[2] --) Where the *building* cannot reasonably be connected to the provincial or territorial electrical power grid, the *building* shall be deemed to comply with GHG emissions performance level F.

Impact analysis

This section describes the approach that was adopted for performing an impact analysis of the tiered prescriptive operational GHG emissions requirements for the NBC. The analysis is in accordance with the methodologies developed PCF 2004 to propose operational GHG emissions requirements in Section 9.36. The impact analysis was performed using simulations that use reference emissions factor values of 235 g CO_2e/kWh and 260 g CO_2e/kWh for determining the GHG emissions target for space heating and service water heating, respectively. The GHG emissions of all non-heating regulated loads were calculated taking into account the emissions factor of electricity for each province or territory (average projected 2031–2035 values). PCFs 2004 and 2026 were developed based on average emissions factors, not marginal emissions factors.

The introduction of tiered operational GHG emissions levels would provide the provinces and territories with the option to adopt the operational GHG emissions level that is the most suitable for their needs. Even though energy performance modeling is commonly used in the industry currently, in order to provide simplicity in achieving compliance with the proposed operational GHG emissions levels, in addition to the performance path, Section 9.36. would provide a prescriptive compliance path as well.

The 2020 edition of the NBC introduced energy performance tiers for buildings and houses, with increasing levels of energy performance improvement. The amount of annual operational GHG emissions is directly correlated with the annual energy use of the house. In order to provide simplicity for Code users in achieving both energy efficiency and operational GHG emissions reduction, the following correlation between energy tiers and operational GHG emissions levels was proposed.

Table 1 presents the operational GHG emissions performance levels that can be achieved through the implementation of energy conservation measures, using utility gas as the energy source for space heating and service water heating in the proposed house.

Table 1. Operational GHG Emissions Performance Levels using Utility Gas as the Energy Source for Space Heating and Service Water Heating

Energy Performance Tier	GHG Emissions Performance Level	GHG Emissions Percentage Improvement
1	F	≥ 0%
2	F	≥ 0%
3	E	≥ 10%
4	D	≥ 25%
5	C	≥ 50%

According to Table 1, using utility gas as the energy source for the proposed house, achieving Energy Performance Tier 5 would result in operational GHG emissions Level C (GHG emissions percentage improvement less than 75% and greater than or equal to 50%). The achievement of higher performing GHG emissions levels would require either more stringent energy-efficiency measures or an energy source having emissions factors less than the emissions factor of utility gas.

The scenario using electricity as the energy source was investigated as well. Depending on the emissions factor for electricity for each province or territory (2031–2035 values), there is a significant variability between provinces and territories, as such the electric grids were divided into groups based on the emissions factor value (high, moderate or low), as presented in Table 2.

Table 2. Classification of Provincial and Territorial Electric Grids.

Province or Territory	**Electric Grid GHG Emissions**(1)	**Electric Grid GHG Emissions Factor, g CO_2e/kWh**
British Columbia	Low	1.32
Alberta	High	181.86
Saskatchewan	High	146.60
Manitoba	Low	0.00
Ontario	Moderate	57.90
Quebec	Low	0.38
New Brunswick	Moderate	77.88
Nova Scotia	High	161.64
Prince Edward Island	Moderate	80.42
Newfoundland and Labrador	Low	11.08
Northwest Territories	Low	6.82
Yukon	Low	25.00
Nunavut	High	465.16

Note to Table 2:

(1) High: emissions factor greater than 100 g CO_2e/kWh

Moderate: emissions factor greater than 25 g CO_2e/kWh and less than or equal to 100 g CO_2e/kWh

Low: emissions factor less than or equal to 25 g CO_2e/kWh

Table 3. GHG Emissions Performance Levels for Electric Space Heating and Service Water Heating

Grid GHG Emissions Factor	**Energy Performance Tier**	**GHG Emissions Performance Level**
Low (less than or equal to 25 g CO_2e/kWh)	5	Level A
	4	Level A
	3	Level A
	2	Level A

Moderate (more than 25 g CO_2e/kWh and less than or equal to 100 g CO_2e/kWh)	5	Level B
	4	Level B
	3	Level C
	2	Level C
High (more than 100 g CO_2e/kWh)	5	Level B
	4	Level C
	3	Level D
	2	Level D

Note to Table 3: Nunavut with an electricity emissions factor of 465.16 g CO_2e/kWh (significantly higher than the average emission factor for utility gas) was excluded from the analysis.

According to Table 3, a noticeable improvement in operational GHG emissions performance levels can be observed across all provinces/territories at higher energy performance tiers. For example, achieving Energy Performance Tier 2 would result in operational GHG emissions Level A for grids with low emissions factors, Level C for grids with moderate emissions factors, and Level D for grids with high emissions factors.

Table 4 presents the operational GHG emissions levels for the scenario of the proposed house using utility gas for space heating and electricity for service water heating.

Table 4. GHG Emission Performance Levels for Utility Gas Space Heating and Electric Service Water Heating

Grid GHG Emissions Factor	**GHG Emission Performance Level**
Low (less than or equal to 25 g CO_2e/kWh)	Level D
Moderate (more than 25 g CO_2e/kWh and less than or equal to 100 g CO_2e/kWh)	Level D
High (more than 100 g CO_2e/kWh)	Level E

As Table 4 illustrates, replacing utility gas with electricity for service water heating results in better operational GHG emissions levels without implementing any energy-efficiency measures. The provinces and territories with low and moderate emissions grids are able to achieve Level D (compared with Level F when utility gas is the energy source), while the provinces and territories with high emissions grids can achieve Level E (compared with Level F when utility gas is the energy source).

Installing an air-source heat pump in the proposed house contributes to significant energy savings. Code users who choose to install a high-efficiency air-source heat pump would benefit from the additional energy savings provided by the equipment and, at the same time, from the reduction of operational GHG emissions. Table 5 presents the operational GHG emissions levels that can be achieved across provinces and territories when installing an air-source heat pump for space heating and a heat pump water heater for service water.

Table 5. GHG Emissions Performance Levels for Electrically Operated, Air-Source Heat Pump for Space Heating and Heat Pump Service Water Heating

Province or Territory	**Grid GHG Emissions**	**GHG Emissions Performance Level**
British Columbia	Low	Level A
Alberta	High	Level D
Saskatchewan	High	Level C

Manitoba	Low	Level A
Ontario	Moderate	Level A
Quebec	Low	Level A
New Brunswick	Moderate	Level B
Nova Scotia	High	Level C
Prince Edward Island	Moderate	Level B
Newfoundland and Labrador	Low	Level A
Northwest Territories	Low	Level A
Yukon	Low	Level A

According to Table 5, when using an air-source heat pump for space heating and a heat pump for service water heating, the provinces and territories having low emissions grids would be able to achieve operational GHG emissions Level A. The provinces and territories having moderate emissions grids would be able to achieve Level A or B, while the ones having high emissions grids would achieve Level A, D or C, depending on climate and grid emissions factor.

For some locations, a cold climate air-source heat pump would be more appropriate than a regular air-source heat pump. Table 6 presents the operational GHG emissions levels that could be achieved by each province or territory where the air-source heat pump is replaced with a cold climate air-source heat pump.

Table 6. GHG Emissions Performance Levels for Electrically Operated, Cold Climate Air-Source Heat Pump for Space Heating and Heat Pump Service Water Heating

Province or Territory	Grid GHG Emissions	GHG Emissions Performance Level
British Columbia	Low	Level A
Alberta	High	Level D
Saskatchewan	High	Level C
Manitoba	Low	Level A
Ontario	Moderate	Level A
Quebec	Low	Level A
New Brunswick	Moderate	Level B
Nova Scotia	High	Level C
Prince Edward Island	Moderate	Level B
Newfoundland and Labrador	Low	Level A
Northwest Territories	Low	Level A
Yukon	Low	Level A

As in the previous scenario, when using a cold climate air-source heat pump for space heating and a heat pump for service water heating, the provinces and territories having low emissions grids are able to achieve operational GHG emissions Level A. The provinces and territories having moderate emissions grids are able to achieve Level A or B, while the ones having high emissions grids achieve Level A, C or D, depending on climate and grid emissions factor.

From the results presented in Tables 1 to 6, it is evident that the majority of house archetypes are able to meet the minimum level of operational GHG emissions without implementing energy-efficiency measures (Tier 1 in Section 9.36.). As Table 3 illustrates, when electricity is the energy source, depending on the emissions factor of the grid, some house archetypes compliant with Tier 1 are able to reach better operational GHG emissions levels. However, in some cases, changing the energy source is not enough to achieve better operational GHG emissions levels. The prescriptive trade-off path in Subsection 9.36.8. allows Code users to obtain energy conservation points associated with the energy savings and implicitly with operational GHG emissions reduction from a variety of measures, such as increasing the insulation of exterior walls, improving the energy performance of windows or installing mechanical equipment exceeding NBC minimum requirements

(Energy Performance Tier 1 and operational GHG emissions Level F). All of these energy performance/operational GHG emissions conservation measures would have incremental costs associated with their implementation.

Table 7 presents the average cost of equipment for space heating and service water heating to meet or better the minimum performance requirements in Section 9.36. However, since the cost associated with reaching a specific GHG emissions performance level cannot be generalized for all provinces and territories, the incremental cost must be evaluated in more depth, individually case by case.

Table 7. Cost of Energy-Efficient Mechanical Equipment for an Average House

Type	**Equipment**	**Cost(1), $**
Space heating/cooling	Gas furnace	4 750(2)
	Electric baseboard heater	6 000(3)
	Electric furnace	3 400(4)
	Air-source heat pump	15 500(5)
	Cold climate air-source heat pump	24 000(6)
Service water heating	Storage tank (natural gas)	2 500(7)
	Storage tank (electric)	1 500(8)
	Heat pump water heater	4 000(8)

Notes to Table 7:

(1) The cost:

- takes into account the equipment, materials and installation,
- of the heating equipment is based on the sizing for an average house (floor area approx. 200 m^2),
- of the service water heating is based on the load for a family of four members, and
- does not take into account inter-province/territory variability. For some locations (especially in the North), the cost may be higher.

(2) Homedepot, Gas Furnace Prices (including Installation), https://www.homedepot.ca/en/home/ideas-how-to/heating-and-cooling/cost-install-gas-furnace.html

(3) HomeAdvisor, How Much Does an Electric Baseboard Heater Cost?, https://www.homeadvisor.com/cost/heating-and-cooling/install-an-electric-baseboard-or-wall-heater/

(4) Modernize Home Services, 2023 Buying Guide: Electric Furnace Costs, https://modernize.com/hvac/heating-repair-installation/furnace/electric

(5) 2 Ton, 24000 BTU, HVACTrust, https://hvactrust.ca/

(6) 24000 BTU, 1Click Heating&Cooling, https://1clickheat.com/

(7) Enercare, 2023 Water Heater Buyer's Guide for Homeowners, https://www.enercare.ca/water/water-heating/buyers-guide-to-water-heaters

(8) Homedepot, Tank Electric Water Heaters, https://www.homedepot.ca/en/home/categories/building-materials/plumbing/water-heaters/tank-water-heaters/tank-electric-water-heaters.html

Building envelope measures exceeding the minimum energy performance for tier 1 result in energy conservation points that allow the Code user to obtain credit for the energy savings associated with the building envelope measures adopted. The energy savings associated with envelope measures result in a reduction of operational GHG emissions of the house as well.

A further estimation of the costs associated with building envelope improvement will be presented. RSMeans data for residential costs was used to estimate the incremental costs associated with the improvement of exterior wall insulation. A range of estimated values was calculated to account for the inter-province/territory variability (location factors provided by RSMeans).

Table 8. Incremental Costs Associated with the Improvement of Insulation of Above-Ground Walls

Effective RSI Value, $(m^2 \times K)/W$	**Energy Savings, %**	**Incremental Cost of Insulation[(1)], $/$m^2$**	**Incremental Cost for a 200 m^2 House, $**
2.97	2.0	14.10–19.5	3 384–4 680
3.08	2.3	14.30–19.90	3 432–4 776
3.69	4.3–6.3	16.10–23.70	3 864–5 688
3.85	5.0–6.9	17.40–23.70	4 176–5 688
3.96	0.6–7.5	17.90–24.50	4 296–5 880
4.29	2.3–8.9	22.80–31.20	5 472–7 488
4.40	2.7–9.2	24.80–33.90	5 952–8 136
4.57	3.4–9.8	27.10–36.80	6 504–8 832
4.73	4.1–10.4	27.20–37.00	6 528–8 880
4.84	4.5–10.7	27.3–37.20	6 552–8 928
5.01	5.0–11.1	27.80–37.90	6 672–9 096
5.45	6.4–12.2	28.50–39.30	6 840–9 432

Source: RSMeans 2023 – Residential costs.

Note to Table 8:

(1) Insulation type: non-rigid insulation (batt), fibre-glass, kraft-faced.

As Table 8 illustrates, the energy savings and the incremental costs increasewith an increase in the effective RSI value of the exterior wall. In Section 9.36., no-cost measures, such as a decrease in the volume of the house, can result in between 1 and 10 energy-saving points, depending on the volume reduction.

Section 9.36. provides energy conservation measures for fenestration as well. Table 9 presents the costs associated with window performance improvement.

Table 9. Costs Associated with Window Performance Improvement

U-Value, $W/(m^2 \times K)$	**Energy Savings, %**	**Cost, $/$m^2$**	**Incremental Cost, $/$m^2$**	**Incremental Cost for a 200 m^2 House with 20% WWR[(1)], $**
1.84	–	410	–	–
1.61	1.8–1.9	450	40	1 920
1.44	1.6–3.8	480	70	2 800
1.22	3.2–7.0	510	100	4 800

Note to Table 9:

(1) WWR = window-to-wall ratio

According to Table 9, the incremental costs associated with performance improvement of windows increase with a decreasing U-value (or increasing RSI value) of the window. The percentage energy savings depends on the U-value of the window and the climate zone.

Taking into account the costs presented in Tables 6 to 9, an incremental cost can be calculated for various combinations of building envelope and mechanical system improvements (i.e., "packages"). It is assumed that when the energy source is either natural gas or electricity and the properties of the building envelope meet tier 1 in Section 9.36. the incremental cost is zero. Table 10 presents the incremental costs for certain packages resulting in decreased energy use and, implicitly, decreased annual GHG emissions.

Table 10. Incremental costs associated with the adoption of energy performance/GHG emissions reduction measures

Energy Performance/GHG Emissions Conservation Measure	Incremental Cost, $
Tier 1 building envelope + Tier 1 natural gas space heating and service water heating systems	0
Tier 1 building envelope + Tier 1 electric space heating and service water heating systems	0
Tier 1 building envelope + Tier 1 natural gas space heating system, and electric service water heating system	0
Tier 1 building envelope + electrically operated, air-source heat pump and heat pump water heater	12 250
Tier 1 building envelope + electrically operated, cold climate air-source heat pump and heat pump water heater	20 750
Tier 2 building envelope(1) + Tier 1 natural gas space heating and service water heating systems	8 488
Tier 2 building envelope(1) + electrically operated, air-source heat pump and heat pump water heater	20 738

Note to Table 10:

(1) Incremental cost varies with climate zone and house size. The example assumes climate zone 4 and floor area of approximately 200 m^2.

As Table 10 illustrates, the incremental cost depends on the energy conservation measures adopted to reach a specific energy performance tier/GHG emissions level. Section 9.36 provides detailed prescriptive measures for achieving Energy Performance Tier 2. The proposed changes for the 2025 edition of NBC provide Code users with prescriptive measures for achieving energy performance tiers beyond tier 2. According to Tables 1 to 6, the GHG emissions level achieved depends on the energy source and value of electricity grid emissions factor of each province or territory. Together with the tiered energy prescriptive path, the operational GHG emissions prescriptive path would provide an acceptable means of achieving the goal of reducing energy consumption and GHG emissions.

Enforcement implications

Enforcement of the technical requirements to minimize the excessive emission of operational GHG emissions would require additional effort by authorities having jurisdiction.

A consistent set of technical requirements to minimize the excessive emission of operational GHG emissions across Canada would contribute to meeting provincial, territorial and federal GHG emissions reduction targets and climate action plans, including Canada’s goal to reduce total national GHG emissions to 40% to 45% below 2005 levels by 2030 and to reach net-zero by 2050.

Who is affected

Designers, engineers, architects, builders, and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

NBC20 Div.B 9.36. (first printing)

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[9.36.3.2.] 9.36.3.2. ([1] 1) [F95-OE1.1]

[9.36.3.2.] 9.36.3.2. ([2] 2) no attributions

[9.36.3.2.] 9.36.3.2. ([3] 3) [F91,F93-OE1.1]

[9.36.3.2.] 9.36.3.2. ([4] 4) [F91,F93-OE1.1]

[9.36.3.2.] 9.36.3.2. ([5] 5) no attributions

[9.36.3.2.] 9.36.3.2. ([5] 5) [F91,F93-OE1.1]

[9.36.3.3.] 9.36.3.3. ([1] 1) [F91,F95-OE1.1]

[9.36.3.3.] 9.36.3.3. ([2] 2) [F91,F95-OE1.1]

[9.36.3.3.] 9.36.3.3. ([3] 3) no attributions

[9.36.3.3.] 9.36.3.3. ([4] 4) no attributions

[9.36.3.4.] 9.36.3.4. ([1] 1) no attributions

[9.36.3.4.] 9.36.3.4. ([2] 2) [F93-OE1.1]

[9.36.3.5.] 9.36.3.5. ([1] 1) [F98-OE1.1]

[9.36.3.6.] 9.36.3.6. ([1] 1) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([1] 1) no attributions

[9.36.3.6.] 9.36.3.6. ([2] 2) [F95,F98-OE1.1]

[9.36.3.6.] 9.36.3.6. ([3] 3) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([4] 4) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([5] 5) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([6] 6) [F95-OE1.1]

[9.36.3.6.] 9.36.3.6. ([7] 7) [F95-OE1.1]

[9.36.3.7.] 9.36.3.7. ([1] 1) [F95-OE1.1]

[9.36.3.8.] 9.36.3.8. ([1] 1) [F95,F100-OE1.1]

[9.36.3.8.] 9.36.3.8. ([2] 2) no attributions

[9.36.3.8.] 9.36.3.8. ([3] 3) no attributions

[9.36.3.8.] 9.36.3.8. ([4] 4) [F98,F100-OE1.1]

[9.36.3.8.] 9.36.3.8. ([5] 5) [F98,F100-OE1.1]

[9.36.3.9.] 9.36.3.9. ([1] 1) no attributions

[9.36.3.9.] 9.36.3.9. ([2] 2) [F95,F100-OE1.1]

[9.36.3.9.] 9.36.3.9. ([3] 3) [F95,F100-OE1.1]

[9.36.3.9.] 9.36.3.9. ([4] 4) [F95,F98,F100-OE1.1]

[9.36.3.10.] 9.36.3.10. ([1] 1) [F95,F98,F99-OE1.1]

[9.36.3.10.] 9.36.3.10. ([2] 2) [F95,F98,F99-OE1.1]

[9.36.3.10.] 9.36.3.10. ([3] 3) no attributions

[9.36.3.11.] 9.36.3.11. ([1] 1) [F95,F98,F99-OE1.1]

[9.36.3.11.] 9.36.3.11. ([2] 2) no attributions

[9.36.3.11.] 9.36.3.11. ([3] 3) [F93,F96-OE1.1]

[9.36.4.1.] 9.36.4.1. ([1] 1) no attributions

[9.36.4.1.] 9.36.4.1. ([2] 2) no attributions

[9.36.4.2.] 9.36.4.2. ([1] 1) [F96,F98-OE1.1]

[9.36.4.2.] 9.36.4.2. ([2] 2) [F93,F96-OE1.1]

[9.36.4.2.] 9.36.4.2. ([3] 3) [F98-OE1.1]

[9.36.4.3.] 9.36.4.3. ([1] 1) [F96,F98-OE1.1]

[9.36.4.3.] 9.36.4.3. ([2] 2) no attributions

[9.36.4.3.] 9.36.4.3. ([3] 3) [F93,F96-OE1.1]

[9.36.4.4.] 9.36.4.4. ([1] 1) [F93,F96-OE1.1]

[9.36.4.4.] 9.36.4.4. ([2] 2) [F93,F96-OE1.1]

[9.36.4.4.] 9.36.4.4. ([3] 3) [F93,F96-OE1.1]

[9.36.4.5.] 9.36.4.5. ([1] 1) [F96-OE1.1]

[9.36.4.6.] 9.36.4.6. ([1] 1) [F96-OE1.1]

[9.36.4.6.] 9.36.4.6. ([2] 2) [F96-OE1.1]

[9.36.5.1.] 9.36.5.1. ([1] 1) no attributions

[9.36.5.1.] 9.36.5.1. ([2] 2) no attributions

[9.36.5.2.] 9.36.5.2. ([1] 1) no attributions

[9.36.5.2.] 9.36.5.2. ([2] 2) no attributions

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

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

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

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

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

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

[9.36.5.4.] 9.36.5.4. ([1] 1) no attributions

[9.36.5.4.] 9.36.5.4. ([2] 2) no attributions

[9.36.5.4.] 9.36.5.4. ([3] 3) [F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([4] 4) [F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([5] 5) [F95,F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([6] 6) [F95,F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([7] 7) [F95,F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([8] 8) [F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([9] 9) [F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([10] 10) [F90,F99-OE1.1]

[9.36.5.4.] 9.36.5.4. ([11] 11) [F90,F99-OE1.1]

[9.36.5.5.] 9.36.5.5. ([1] 1) [F99-OE1.1]

[9.36.5.5.] 9.36.5.5. ([2] 2) [F99-OE1.1]

[9.36.5.5.] 9.36.5.5. ([3] 3) [F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([1] 1) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([2] 2) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([3] 3) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([4] 4) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([5] 5) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([6] 6) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([7] 7) [F92,F93,F95,F96,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([8] 8) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([9] 9) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([10] 10) [F92,F99-OE1.1]

[9.36.5.6.] 9.36.5.6. ([11] 11) [F92,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([1] 1) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([2] 2) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([3] 3) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([4] 4) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([5] 5) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([6] 6) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([7] 7) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([8] 8) [F95,F99-OE1.1]

[9.36.5.7.] 9.36.5.7. ([9] 9) [F95,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([1] 1) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([2] 2) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([3] 3) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([4] 4) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([5] 5) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([6] 6) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([7] 7) [F96,F99-OE1.1]

[9.36.5.8.] 9.36.5.8. ([8] 8) [F96,F99-OE1.1]

[9.36.5.9.] 9.36.5.9. ([1] 1) [F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([1] 1) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([2] 2) no attributions

[9.36.5.10.] 9.36.5.10. ([3] 3) no attributions

[9.36.5.10.] 9.36.5.10. ([4] 4) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([5] 5) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([6] 6) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([7] 7) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([8] 8) no attributions

[9.36.5.10.] 9.36.5.10. ([9] 9) [F90,F91,F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([10] 10) [F90,F91,F92,F93,F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([1] 1) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([2] 2) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([3] 3) [F92,F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([4] 4) [F95,F99,F100-OE1.1]

[9.36.5.11.] 9.36.5.11. ([5] 5) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([6] 6) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([7] 7) no attributions

[9.36.5.11.] 9.36.5.11. ([8] 8) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([9] 9) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([10] 10) [F95,F99,F100-OE1.1]

[9.36.5.11.] 9.36.5.11. ([11] 11) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([12] 12) [F95,F99,F100-OE1.1]

[9.36.5.11.] 9.36.5.11. ([13] 13) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([14] 14) [F95,F99,F100-OE1.1]

[9.36.5.11.] 9.36.5.11. ([15] 15) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([16] 16) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([17] 17) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([18] 18) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([19] 19) [F95,F99-OE1.1]

[9.36.5.11.] 9.36.5.11. ([20] 20) [F95,F99-OE1.1]

[9.36.5.12.] 9.36.5.12. ([1] 1) [F96,F99-OE1.1]

[9.36.5.12.] 9.36.5.12. ([2] 2) no attributions

[9.36.5.13.] **9.36.5.13. ([1] 1) [F99-OE1.1]**

[9.36.5.13.] **9.36.5.13. ([2] 2) [F99-OE1.1]**

[9.36.5.14.] **9.36.5.14. ([1] 1) [F92,F95,F99-OE1.1]**

[9.36.5.14.] **9.36.5.14. ([2] 2) [F90,F91,F92,F95,F99-OE1.1]**

[9.36.5.14.] **9.36.5.14. ([3] 3) [F92,F95,F99-OE1.1]**

[9.36.5.14.] **9.36.5.14. ([4] 4) [F92,F95,F99-OE1.1]**

[9.36.5.14.] **9.36.5.14. ([5] 5) [F92,F99-OE1.1]**

[9.36.5.14.] **9.36.5.14. ([6] 6) [F92,F95,F99-OE1.1]**

[9.36.5.14.] **9.36.5.14. ([7] 7) [F92,F99-OE1.1]**

[9.36.5.14.] **9.36.5.14. ([8] 8) [F92,F99-OE1.1]**

[9.36.5.14.] **9.36.5.14. ([9] 9) [F92,F99,F95-OE1.1]**

[9.36.5.14.] **9.36.5.14. ([10] 10) [F92,F99-OE1.1]**

[9.36.5.15.] **9.36.5.15. ([1] 1) [F95,F99-OE1.1]**

[9.36.5.15.] **9.36.5.15. ([2] 2) [F95,F99-OE1.1]**

[9.36.5.15.] **9.36.5.15. ([3] 3) [F95,F99,F100-OE1.1]**

[9.36.5.15.] **9.36.5.15. ([4] 4) [F95,F99-OE1.1]**

[9.36.5.15.] **9.36.5.15. ([5] 5) [F95,F99-OE1.1]**

[9.36.5.15.] **9.36.5.15. ([6] 6) [F95,F99-OE1.1]**

[9.36.5.15.] **9.36.5.15. ([7] 7) [F95,F99-OE1.1]**

[9.36.5.15.] **9.36.5.15. ([8] 8) [F95,F99,F100-OE1.1]**

[9.36.5.15.] **9.36.5.15. ([9] 9) [F95,F99-OE1.1]**

[9.36.5.15.] **9.36.5.15. ([10] 10) [F95,F99-OE1.1]**

[9.36.5.15.] **9.36.5.15. ([11] 11) [F95,F99-OE1.1]**

[9.36.5.15.] **9.36.5.15. ([12] 12) [F95,F99,F100-OE1.1]**

[9.36.5.15.] **9.36.5.15. ([13] 13) [F95,F99,F100-OE1.1]**

[9.36.5.15.] **9.36.5.15. ([14] 14) [F95,F99-OE1.1]**

[9.36.5.15.] **9.36.5.15. ([15] 15) [F95,F99-OE1.1]**

[9.36.5.15.] **9.36.5.15. ([16] 16) [F95,F99-OE1.1]**

[9.36.5.16.] **9.36.5.16. ([1] 1) [F95,F99-OE1.1]**

[9.36.5.16.] **9.36.5.16. ([2] 2) [F95,F99-OE1.1]**

[9.36.5.16.] **9.36.5.16. ([3] 3) [F95,F99-OE1.1]**

[9.36.6.1.] **9.36.6.1. ([1] 1) no attributions**

[9.36.6.2.] **9.36.6.2. ([1] 1) no attributions**

[9.36.6.3.] **9.36.6.3. ([1] 1) no attributions**

[9.36.6.3.] **9.36.6.3. ([1] 1) [F90-OE1.1]**

[9.36.6.3.] 9.36.6.3. ([2] 2) no attributions

[9.36.6.3.] 9.36.6.3. ([3] 3) no attributions

[9.36.6.4.] 9.36.6.4. ([1] 1) no attributions

[9.36.6.4.] 9.36.6.4. ([1] 1) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.6.4.] 9.36.6.4. ([2] 2) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.6.4.] 9.36.6.4. ([3] 3) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.6.4.] 9.36.6.4. ([4] 4) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.7.1.] 9.36.7.1. ([1] 1) no attributions

[9.36.7.1.] 9.36.7.1. ([2] 2) no attributions

[9.36.7.2.] 9.36.7.2. ([1] 1) no attributions

[9.36.7.2.] 9.36.7.2. ([1] 1) [F90,F91,F92,F93,F95,F96,F98,F99,F100-OE1.1]

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

[9.36.7.3.] 9.36.7.3. ([2] 2) [F95-OE1.1]

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

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

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

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

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

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

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

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

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

[9.36.8.1.] 9.36.8.1. ([1] 1) no attributions

[9.36.8.2.] 9.36.8.2. ([1] 1) no attributions

[9.36.8.2.] 9.36.8.2. ([1] 1) [F90,F91,F92,F93,F95,F96,F98,F99,F100-OE1.1]

[9.36.8.4.] 9.36.8.4. ([1] 1) no attributions

[9.36.8.5.] 9.36.8.5. ([1] 1) no attributions

[9.36.8.5.] 9.36.8.5. ([2] 2) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([3] 3) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([4] 4) no attributions

[9.36.8.5.] 9.36.8.5. ([4] 4) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([5] 5) no attributions

[9.36.8.5.] 9.36.8.5. ([5] 5) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([6] 6) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([7] 7) [F92-OE1.1]

[9.36.8.6.] 9.36.8.6. ([1] 1) [F92-OE1.1]

[9.36.8.6.] 9.36.8.6. ([2] 2) no attributions

[9.36.8.6.] 9.36.8.6. ([3] 3) no attributions

[9.36.8.6.] 9.36.8.6. ([3] 3) [F92-OE1.1]

[9.36.8.6.] 9.36.8.6. ([4] 4) [F92-OE1.1]

[9.36.8.7.] 9.36.8.7. ([1] 1) no attributions

[9.36.8.7.] 9.36.8.7. ([2] 2) [F92-OE1.1]

[9.36.8.7.] 9.36.8.7. ([3] 3) [F92-OE1.1]

[9.36.8.7.] 9.36.8.7. ([4] 4) no attributions

[9.36.8.8.] 9.36.8.8. ([1] 1) no attributions

[9.36.8.8.] 9.36.8.8. ([2] 2) [F90-OE1.1]

[9.36.8.9.] 9.36.8.9. ([1] 1) no attributions

[9.36.8.9.] 9.36.8.9. ([2] 2) no attributions

[9.36.8.9.] 9.36.8.9. ([3] 3) no attributions

[9.36.8.9.] 9.36.8.9. ([3] 3) [F95,F100-OE1.1]

[9.36.8.9.] 9.36.8.9. ([4] 4) [F95-OE1.1]

[9.36.8.10.] 9.36.8.10. ([1] 1) no attributions

[9.36.8.10.] 9.36.8.10. ([2] 2) no attributions

[9.36.8.10.] 9.36.8.10. ([3] 3) [F96-OE1.1]

[9.36.8.11.] 9.36.8.11. ([1] 1) [F95-OE1.1]

[9.36.8.11.] 9.36.8.11. ([2] 2) [F95-OE1.1]

[9.36.12.1.] -- ([1] --) no attributions

[9.36.12.2.] -- ([1] --) no attributions

[9.36.12.3.] -- ([1] --) no attributions

[9.36.12.3.] -- ([2] --) no attributions

[9.36.12.3.] -- ([3] --) no attributions

[9.36.12.4.] -- ([1] --) [F101-OE2.1]

[9.36.12.4.] -- ([2] --) [F101-OE2.1]

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Subject:	Building Envelope - General
Title:	Continuity of Insulation
Description:	This proposed change lowers the insulation requirements for the rough opening gap around windows and doors, excluding the sill.

This change could potentially affect the following topic areas:

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

Problem

The energy efficiency requirements in Sentence 9.36.2.5.(9) of Division B of the National Building Code of Canada regarding the insulation in rough opening gaps of windows and doors, particularly the sills of windows and doors, may create water-drainage issues in the gap between the window or door unit and the framing.

Failure to maintain a dry and airtight environment will negatively impact the effectiveness of the insulation as well as the long-term performance of the building envelope. This may result in costly retrofits and discomfort to occupants.

Justification

The continuity of the air barrier and the provision of adequate drainage provides a greater impact on energy performance than does the amount of insulation or the effective thermal resistance (RSI) value of the assembly. Therefore, the gap between the window or door and the supporting structure should be drainable and the rough opening should have a sloped sill or back dam to facilitate water drainage to the exterior of the building envelope.

To facilitate positive drainage at the sill, this proposed change would permit a relaxation to the requirements regarding continuity of insulation and minimum effective thermal resistance for the rough opening gap around windows and doors.

PROPOSED CHANGE

[9.36.2.5.] 9.36.2.5. Continuity of Insulation

[1] 1) Except as provided in Sentences (2) to (11) ~~Sentences (2) to (10)~~ and in Sentence 9.36.2.4.(3) regarding balcony and canopy slabs, and except for clearances around components required for fire safety reasons, interior *building* components that meet *building* envelope components and major structural members that partly penetrate the *building* envelope shall not break the continuity of the insulation and shall not decrease the effective thermal resistance at their projected area to less than that required in Articles 9.36.2.6. and 9.36.2.8. (See Note A-9.36.2.5.(1).)

[2] 2) Where an interior wall, *foundation* wall, *firewall*, *party wall* or structural element penetrates an exterior wall or insulated roof or ceiling and breaks the continuity of the plane of insulation, the penetrating element shall be insulated

- [a] a) on both of its sides, inward or outward from the *building* envelope, for a distance equal to 4 times its uninsulated thickness to an effective thermal resistance not less than that required for exterior walls as stated in Table 9.36.2.6.-A or 9.36.2.6.-B,
- [b] b) within the plane of insulation of the penetrated element to an effective thermal resistance not less than 60% of that required for the penetrated element, or
- [c] c) within itself to an effective thermal resistance not less than that required for the penetrated element.

(See Note A-9.36.2.5.(2).)

[3] 3) Where a masonry fireplace or flue penetrates an exterior wall and breaks the continuity of the plane of insulation, it shall be insulated within the plane of insulation of the wall or within itself to an effective thermal resistance not less than 55% of that required for the exterior wall as stated in Table 9.36.2.6.-A or 9.36.2.6.-B (See Note A-9.36.2.5.(3).)

[4] 4) Where an ornamentation or appendage penetrates an exterior wall and breaks the continuity of the plane of insulation, the penetrating element shall be insulated

- [a] a) on both of its sides, inward or outward from the *building* envelope, for a distance equal to 4 times the insulated thickness of the exterior wall to an effective thermal resistance not less than that required for the wall as stated in Table 9.36.2.6.-A or 9.36.2.6.-B,

[b] b) within the plane of insulation of the wall to an effective thermal resistance not less than 55% of that required for the exterior wall, or

[c] c) within the penetrating element to an effective thermal resistance not less than that required for the exterior wall.

[5] **5)** Except as provided in Sentences (9) and (10), where two planes of insulation are separated by a *building* envelope assembly and cannot be physically joined, one of the planes of insulation shall be extended for a distance equal to at least 4 times the thickness of the assembly separating the two planes. (See Note A-9.36.2.5.(5).)

[6] **6)** Except as provided in Sentence (7) and Article 9.36.2.11., where mechanical, plumbing or electrical system components, such as pipes, ducts, conduits, cabinets, chases, panels or recessed heaters, are placed within and parallel to a wall assembly required to be insulated, the effective thermal resistance of that wall at the projected area of the system component shall be not less than that required by Tables 9.36.2.6.-A, 9.36.2.6.-B, 9.36.2.8.-A and 9.36.2.8.-B (See Note A-9.36.2.5.(6).)

[7] **7)** The effective thermal resistance of a wall at the projected areas of plumbing and electrical system components, such as plumbing vent pipes, conduits, and electrical outlet and switch boxes, need not comply with Sentence (6), provided

[a] a) the effective thermal resistance at the projected area of the system component is not less than 60% of that required in Articles 9.36.2.6. and 9.36.2.8., and

[b] b) the insulation is continuous on the cold side behind the system component.

[8] **8)** Except as permitted by Article 9.36.2.11., where mechanical ducts, plumbing pipes, conduits for electrical services or communication cables are placed within the insulated portion of a floor or ceiling assembly, the effective thermal resistance of the assembly at the projected area of the ducts, pipes, conduits or cables shall be not less than 2.78 (m^2×K)/W.

[9] **9)** Except as provided in Sentence (11), ~~J~~joints and junctions between walls and other *building* envelope components shall be insulated in a manner that provides an effective thermal resistance that is no less than the lower of the minimum values required for the respective adjoining components. (See Note A-9.36.2.5.(9).)

[10] **10)** Sentence (1) does not apply where the continuity of the insulation is interrupted

[a] a) between the insulation in the *foundation* wall and that of the floor slab,

[b] b) by an integral perimeter footing of a slab-on-grade (see Sentences 9.25.2.3.(5) and 9.36.2.8.(8)), or

[c] c) at the horizontal portion of a *foundation* wall that supports masonry

veneer and is insulated on the exterior.

[11] --) The rough opening gap around windows and doors, excluding the sill, shall have an effective thermal resistance (RSI value) not less than 0.56 (m^2×K)/W. (See Note A-9.36.2.5.(11).)

Note A-9.36.2.5.(11) Proper Drainage of the Rough Opening Gap Around Windows, Doors and Sills.

Any solution employed to meet the effective thermal resistance and air barrier requirements for the rough opening gap around windows, doors and sills should ensure that proper drainage to the exterior is not compromised. Installing the insulation (where required) and the air barrier at the interior perimeter of the window or door will facilitate positive drainage at the sill. Any exterior sealing at the header and jambs should be considered part of the second plane of protection.

Impact analysis

This proposed change is not expected to result in any additional costs or changes to current installation practices. Eliminating insulation at the sill does not have a significant or easily quantifiable impact on the overall energy performance of the building as a whole. A study done by the National Research Council Canada showed that the insulation of the rough opening gap around windows has a limited effect on the temperature differential as compared to the airtightness of the assembly.

For more information, see the following publication: "Window-wall interface details to evaluate the risk of condensation on box windows" by Maref, W.; Van Den Bossche, N.; Armstrong, M. M.; Lacasse, M. A.; Elmahdy, A. H.; Glazer, R. in 1st Central European Symposium on Building Physics (Cracow, Poland; September 13-15, 2010).

The proposed change to facilitate positive drainage at the sill will prevent the deterioration of the building envelope and facilitate the avoidance of costly retrofits.

Enforcement implications

This proposed change can be enforced by the existing infrastructure without additional resources.

Who is affected

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

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.36.2.5.] 9.36.2.5. ([1] 1) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([2] 2) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([3] 3) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([4] 4) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([5] 5) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([6] 6) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([7] 7) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([8] 8) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([9] 9) [F92-OE1.1]

[9.36.2.5.] 9.36.2.5. ([10] 10) no attributions

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

-- (--) no attributions

Submit a comment

Proposed Change 2011

Code Reference(s): **NBC20 Div.B 9.36.4.2. (first printing)**
NBC20 Div.B 9.36.8.10. (first printing)
NECB20 Div.B 6.2.2.1. (first printing)

Subject: Service Water Heating Equipment Efficiency Table

Title: Updated Performance Metric for Heat Pump Water Heaters

Description: This proposed change updates the metric used to state the performance requirements for heat pump water heaters by replacing the energy factor (EF) metric with the uniform energy factor (UEF) metric.

This change could potentially affect the following topic areas:

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

Problem

PCF 1804, "Updates to Referenced Documents," proposes to update CAN/CSA-C745, "Energy efficiency of electric storage tank water heaters and heat pump water heaters," to the 2020 edition. The new edition of the CSA standard lists the heat pump water heater performance requirements using the uniform energy factor (UEF) metric instead of the energy factor (EF) metric. Tables 9.36.4.2. and 9.36.8.10. of Division B of the National Building Code of Canada (NBC) and Table 6.2.2.1. of Division B of the National Energy Code of Canada for Buildings (NECB) both state the minimum service water heating equipment performance requirements for heat pump water heaters using the EF metric, and they should be updated to state the minimum performance requirements for this equipment using the UEF metric instead.

Failure to use the UEF metric when stating heat pump water heater performance requirements in the NECB and NBC would create issues for Code users and regulators when evaluating equipment performance and conformance with the Codes.

Justification

Stating the heat pump water heater performance requirements in the Codes using the same metric (i.e., UEF) as the referenced standard (i.e., CAN/CSA-C745) would facilitate conformance with the Code requirements.

This proposed change would make Code compliance easier, as the Codes would state the minimum performance requirements using the same metric as the labels on the equipment.

PROPOSED CHANGE

NBC20 Div.B 9.36.4.2. (first printing)

[9.36.4.2.] 9.36.4.2. Equipment Efficiency

[1] **1)** *Service water heaters*, *boilers*, pool heaters and storage tanks shall comply with the performance requirements stated in Table 9.36.4.2. (See Note A-9.36.4.2.(1).)

[2] **2)** Hot service water storage tanks not listed in Table 9.36.4.2. shall be covered with insulation having a minimum thermal resistance of 1.8 (m^2×K)/W.

Table [9.36.4.2.] 9.36.4.2.
Service Water Heating Equipment Performance Requirements
Forming Part of Sentences [9.36.4.2.] 9.36.4.2.([1] 1) and ([2] 2)

Type of Equipment	Input (1)	Performance Testing Standard	Performance Requirement (2)
Storage-Type Service Water Heaters			
Electric	≤ 12 kW (V_r > 50 L but ≤ 270 L)	CAN/CSA-C191	SL ≤ 35 + (0.20 V_r) (top inlet)
			SL ≤ 40 + (0.20 V_r) (bottom inlet)
	≤ 12 kW (V_r > 270 L but ≤ 454 L)		SL ≤ (0.472 V_r) – 38.5 (top inlet)
			SL ≤ (0.472 V_r) – 33.5 (bottom inlet)

Type of Equipment	**Input** (1)	**Performance Testing Standard**	**Performance Requirement** (2)
	>12 kW	ANSI Z21.10.3/CSA 4.3 or DOE 10 CFR, Part 431, Subpart G, Appendix B	SL ≤ 0.30 +(102.2 V_s)
Heat pump water heaters	≤ 24 A and ≤ 250 V	CAN/CSA-C745	~~EF ≥ 2.1~~UEF ≥ 2.23
Gas-fired (3)	≤ 22 kW and first-hour rating < 68 L	CAN/CSA-P.3	UEF ≥ 0.3456 – (0.00053 V_s) (4)
	≤ 22 kW and first-hour rating ≥ 68 L but < 193 L		UEF ≥ 0.5982 – (0.00050 V_s) (4)
	≤ 22 kW and first-hour rating ≥ 193 L but < 284 L		UEF ≥ 0.6483 – (0.00045 V_s) (4)
	≤ 22 kW and first-hour rating ≥ 284 L		UEF ≥ 0.6920 – (0.00034 V_s) (4)
	> 22 kW but ≤ 30.5 kW and V_r ≤ 454 L		UEF ≥ 0.8107 – (0.00021 V_s) (4)
	> 22 kW	DOE 10 CFR, Part 431, Subpart G, Appendix A	E_t ≥ 90% and SL ≤ 0.84 [(1.25 Q) + (16.57 $\sqrt{V_r}$)]
Oil-fired	≤ 30.5 kW and first-hour rating < 68 L	CAN/CSA-B211 for EF or CAN/CSA-P.3 for UEF	EF ≥ 0.68 – (0.0005 V_r) or UEF ≥ 0.2509 – (0.00032 V_s)
	≤ 30.5 kW and first-hour rating ≥ 68 L but < 193 L		EF ≥ 0.68 – (0.0005 V_r) or UEF ≥ 0.5330 – (0.00042 V_s)
	≤ 30.5 kW and first-hour rating ≥ 193 L but < 284 L		EF ≥ 0.68 – (0.0005 V_r) or UEF ≥ 0.6078 – (0.00042 V_s)
	≤ 30.5 kW and first-hour rating ≥ 284 L		EF ≥ 0.68 – (0.0005 V_r) or UEF ≥ 0.6815 – (0.00037 V_s)

Type of Equipment	Input (1)	Performance Testing Standard	Performance Requirement (2)
	> 30.5 kW but ≤ 40.99 kW and V_r ≤ 454 L		UEF ≥ 0.6740 – (0.00035 V_s)
	> 40.99 kW	DOE 10 CFR, Part 431, Subpart G, Appendix A	E_t ≥ 80% and SL ≤ (1.25 Q) + (16.57 $\sqrt{V_r}$)
Tankless Service Water Heaters			
Gas-fired	< 58.56 kW, V_r ≤ 7.6 L and max. flow rate < 6.4 L/min	CAN/CSA-P.3	UEF ≥ 0.86
	< 58.56 kW, V_r ≤ 7.6 L and max. flow rate ≥ 6.4 L/min		UEF ≥ 0.87
	≥ 58.56 kW, V_r ≤ 37.85 L and input rate to V_r ratio ≥ 309 W/L	DOE 10 CFR, Part 431, Subpart G, Appendix C	E_t ≥ 94%
Oil-fired	≤ 61.5 kW (5)	DOE 10 CFR, Part 430, Subpart B, Appendix E	EF ≥ 0.59 − (0.0005 V_r)
	Other	ANSI Z21.10.3/CSA 4.3 and DOE 10 CFR, Part 431, Subpart G	E_t ≥ 80%
Electric	—	—	(6)
Combined space- and water-heating systems (combos)	≤ 87.9 kW if *boiler*-based	CAN/CSA-P.9	TPF = 0.80
	≤ 73.2 kW if based on *service water heater*		
Integrated mechanical systems	—	CSA P.10	OTPF = 0.85
Pool Heaters			
Gas-fired (3)	< 117.2 kW	ANSI Z21.56/CSA 4.7 or CSA P.6	E_t ≥ 82%
Oil-fired	—	CSA B140.12	E_t ≥ 78%

Notes to Table [9.36.4.2.] 9.36.4.2.:

(1) 1 kW = 3412 Btu/h

(2) The symbols and abbreviations used in this column have the following meanings:

EF = energy factor
E_t = thermal efficiency with a 38.9°C (70°F) water temperature difference
OTPF = overall thermal performance factor
Q = nameplate input rate, in kW
SL = standby loss, in W
TPF = thermal performance factor
UEF = uniform energy factor
V_r = rated nominal storage volume, in L
Vs = measured storage volume, in L

(3) Includes propane.

(4) Industry and regulators are transitioning from using EF to UEF as the metric to evaluate *service water heater* performance. While this Code sets out performance requirements for gas-fired *storage-type service water heaters* within the scope of CAN/CSA-P.3 in terms of UEF, the "Energy Efficiency Regulations" set out performance standards for such *service water heaters* in terms of both EF and UEF.

(5) Consistent with the U.S. Congress "National Appliance Energy Conservation Act of 1987".

(6) No standard addresses the performance efficiency of electric tankless *service water heaters*; however, their efficiency typically approaches 100%.

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[3] **3)** Except for components that are required to be installed outdoors, service water heating equipment shall be installed in a *conditioned space*. (See Note A-9.36.4.2.(3).)

NBC20 Div.B 9.36.8.10. (first printing)

[9.36.8.10.] 9.36.8.10. Energy Conservation Measures for Service Water Heating Equipment

[1] **1)** Service water heating equipment and components shall be designed and constructed in accordance with Subsection 9.36.4. and this Article.

[2] **2)** Where service water heating equipment or techniques other than those described in Subsection 9.36.4. and this Article are used, the *building* shall be designed and constructed in accordance with the NECB.

[3] **3)** Service water heating equipment that complies with one of the energy

conservation measures prescribed in Table 9.36.8.10. shall be credited with the corresponding energy conservation points stipulated therein.

Table [9.36.8.10.] 9.36.8.10.
Energy Conservation Measures and Points for Service Water Heating Equipment
Forming Part of Sentence [9.36.8.10.] 9.36.8.10.([3] 3)

Type of Equipment	**Energy Conservation Measures for Service Water Heating Equipment – Energy Efficiency, EF or UEF** (1) (2)	**Performance Testing Standard**	**Heating Degree-Days of *Building* Location, 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**
			Energy Conservation Points					
Gas- or oil-fired tankless condensing water heater	EF ≥ 0.95 or UEF ≥ 0.92	CAN/CSA-P.3	8.9	5.4	4.9	3.1	3.1	3.1
Gas- or oil-fired residential *storage-type service water heater*	EF ≥ 0.80 or UEF ≥ 0.83		8.9	5.4	4.9	3.1	3.1	3.1

Type of Equipment	**Energy Conservation Measures for Service Water Heating Equipment – Energy Efficiency, EF or UEF** (1) (2)	**Performance Testing Standard**	**Heating Degree-Days of *Building* Location, 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**
			Energy Conservation Points					
Gas- or oil-fired residential-duty commercial *storage-type service water heater*	UEF ≥ 0.79		4.6	2.7	2.4	1.5	1.5	1.5
	UEF ≥ 0.85		6.0	3.6	3.2	2.0	2.0	2.0
Heat pump water heater	~~EF ≥ 2.35~~UEF ≥ 2.44	CAN/CSA-C745	6.4	3.9	3.8	3.0	3.0	3.0

Notes to Table [9.36.8.10.] 9.36.8.10.:

(1) EF = energy factor
UEF = uniform energy factor

(2) Applies to *storage-type service water heaters* that heat potable water, including *storage-type service water heaters* used to generate heat in combined space- and water-heating systems.

NECB20 Div.B 6.2.2.1. (first printing)

[6.2.2.1.] 6.2.2.1. Equipment Efficiency

[1] **1)** *Service water* heaters and pool heaters with the capacities listed in Table 6.2.2.1. shall comply with the performance requirements stated therein. (See Notes A-6.2.2.1.(1) and A-5.2.12.1.(1) and 6.2.2.1.(1).)

Table [6.2.2.1.] 6.2.2.1.
Service Water Heating Equipment Performance Requirements
Forming Part of Sentences 5.2.12.4.(1), [6.2.2.1.] 6.2.2.1.([1] 1), 6.2.2.4.(2) and 6.2.2.5.(1)

Type of Equipment	Input Power	Rated Storage Capacity (V_r), L	Volume of Tank (V_s), L	Input/V_s, W/L	Performance Testing Standard	Rating Conditions (1)	Performance Requirement (2) (3)
Electric-Powered *Service Water* Heaters							
Storage-type (4)	≤ 12 kW	≥ 50 and ≤ 270	—	—	CAN/CSA-C191	Bottom inlet	SL ≤ 40 + (0.2 V_r)
						Top inlet	SL ≤ 35 + (0.2 V_r)
		> 270 and ≤ 454				Bottom inlet	SL ≤ (0.472 V_r) – 33.5
						Top inlet	SL ≤ (0.472 V_r) – 38.5
	> 12 kW	—	—	—	ANSI Z21.10.3/CSA 4.3 (5) or DOE 10 CFR, Part 431, Subpart G, Appendix B	ΔT = 44.4°C	SL ≤ 0.3 + 102.2/V_r
Storage-type, heat pump	≤ 24 A and ≤ 250 V	—	—	—	CAN/CSA-C745	—	~~EF ≥ 2.1~~UEF ≥ 2.23
Instantaneous	—	—	—	—	—	—	(6)
Fuel-Fired *Service Water* Heaters							

Type of Equipment	Input Power	Rated Storage Capacity (V_r), L	Volume of Tank (V_s), L	Input/V_s, W/L	Performance Testing Standard	Rating Conditions (1)	Performance Requirement (2) (3)
Gas-fired, storage-type (4) (7)	≤ 22 kW	—	≥ 76 and < 208	—	CAN/CSA-P.3	FHR < 68	$UEF \geq 0.3456 - (0.00053 V_s)$
						68 ≤ FHR < 193	$UEF \geq 0.5982 - (0.00050 V_s)$
						193 ≤ FHR < 284	$UEF \geq 0.6483 - (0.00045 V_s)$
						FHR ≥ 284	$UEF \geq 0.6920 - (0.00034 V_s)$
			≥ 208 and < 380			FHR < 68	$UEF \geq 0.6470 - (0.00016 V_s)$
						68 ≤ FHR < 193	$UEF \geq 0.7689 - (0.00013 V_s)$
						193 ≤ FHR < 284	$UEF \geq 0.7897 - (0.00011 V_s)$
						FHR ≥ 284	$UEF \geq 0.8072 - (0.00008 V_s)$
	> 22 kW and ≤ 30.5 kW	≤ 454	—	—	CAN/CSA-P.3	All values of FHR	$UEF \geq 0.8107 - (0.00021 V_s)$
	All others	—	—	—	DOE 10 CFR, Part 431, Subpart G, Appendix A	ΔT = 50°C	$E_t \geq 90\%$ $SL \leq 0.84 [(1.25 Q) + (16.57 \sqrt{V_r})]$

Type of Equipment	Input Power	Rated Storage Capacity (V_r), L	Volume of Tank (V_s), L	Input/V_s, W/L	Performance Testing Standard	Rating Conditions (1)	Performance Requirement (2) (3)
Gas-fired, instantaneous (4) (7) (8)	< 59 kW	≤ 7.6	—	≥ 310	CAN/CSA-P.3	< 6.4 L/min	UEF ≥ 0.86
						≥ 6.4 L/min	UEF ≥ 0.87
	All others	—			DOE 10 CFR, Part 431, Subpart G, Appendix C	—	$E_t \geq 94\%$
Oil-fired, storage-type (4)	≤ 30.5 kW	> 76	—	—	CAN/CSA-B211	—	EF ≥ 0.68 – $(0.0005\ V_r)$
					CAN/CSA-P.3	FHR < 68	UEF ≥ 0.2509 – $(0.00032\ V_s)$
						68 ≤ FHR < 193	UEF ≥ 0.5330 – $(0.00042\ V_s)$
						193 ≤ FHR < 284	UEF ≥ 0.6078 – $(0.00042\ V_s)$
						FHR ≥ 284	UEF ≥ 0.6815 – $(0.00037\ V_s)$
	> 30.5 kW and ≤ 41 kW	≤ 454	—	< 310	CAN/CSA-P.3	All values of FHR	UEF ≥ 0.6740 – $(0.00035\ V_s)$
	All others	—	—	—	DOE 10 CFR, Part 431, Subpart G, Appendix A	—	$E_t \geq 80\%$ SL ≤ (1.25 Q) + $(16.57 \sqrt{V_r})$

Type of Equipment	**Input Power**	**Rated Storage Capacity (V_r), L**	**Volume of Tank (V_s), L**	**Input/V_s, W/L**	**Performance Testing Standard**	**Rating Conditions (1)**	**Performance Requirement (2) (3)**
Oil-fired, instantaneous (4)	≤ 61.5 kW	—	—	—	DOE 10 CFR, Part 430, Subpart B, Appendix E	—	EF ≥ 0.59 – (0.0005 V_r)
	All others	—	< 37.8	≥ 310	DOE 10 CFR, Part 431, Subpart G, Appendix A	—	E_t ≥ 80%
			≥ 37.8			ΔT = 50°C	E_t ≥ 78% SL ≤ (1.25 Q) + (16.57 $\sqrt{V_r}$)
Solar Thermal *Service Water* Heaters							
With electric back-up	All capacities	—	—	—	ICC 900/SRCC 300	See standard	SEF ≥ 1.4
With gas-fired back-up (7)							SEF ≥ 0.9
Pool Heaters							
Gas-fired (7)	< 117.2 kW	—	—	—	ANSI Z21.56/CSA 4.7 or CSA P.6	See standard	E_t ≥ 82%
Oil-fired	—				CSA B140.12		E_t ≥ 78%
Heat pump	All values	—	—	—	AHRI 1160 (I-P)	Outdoor air 10°C db / 6.8°C wb 26.7°C entering water	4.0 COP

Notes to Table [6.2.2.1.] 6.2.2.1.:

(1) The symbols and abbreviations used in this column have the following meanings:

db = dry-bulb outdoor air temperature
FHR = first-hour rating: the amount of hot service water supplied within the first hour, in L
ΔT = difference in temperature of water from inlet versus water from outlet of water heater
wb = wet-bulb outdoor air temperature

(2) The symbols and abbreviations used in this column have the following meanings:

COP = *coefficient of performance*
E_t = *thermal efficiency* with a 38.9°C (70°F) water temperature difference
EF = *energy factor*
Q = rated input, in kW
SEF = solar *energy factor*: a normalized ratio of energy output over energy consumption (only electricity or fuel input) over a 24-h period
SL = *standby losses*, in %/h or in W, depending on which testing standard is used
UEF = uniform *energy factor*
V_r = rated volume, as specified by the manufacturer
V_s = volume of tank, as measured in accordance with the listed test standard, in L

(3) Where more than one performance requirement applies to a given type/capacity/size combination, the equipment must comply with at least one of them.

(4) Components or equipment regulated in the "Energy Efficiency Regulations" at the time of publication of the Code (see Article 1.1.1.3. of Division A).

(5) When testing an electric *storage-type service water heater* for *standby losses* using the test procedure described in the referenced standard, the electrical supply voltage shall be maintained within ±1% of the centre of the voltage range specified on the water heater nameplate. Also, when needed for calculations, the *thermal efficiency* (E_t) shall be 98%.

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(6) No standards address the performance efficiency of electric instantaneous *service water* heaters; however, their efficiency typically approaches 100%.

(7) Includes propane.

(8) See also Article 6.2.2.3.

Impact analysis

This proposed change is not expected to result in additional costs for Code users, who would benefit from the Codes using the same performance metric as the referenced document.

Enforcement implications

This proposed change could be enforced by the existing Code enforcement infrastructure without requiring additional resources. This proposed change would make enforcement easier, as the two Codes would state the minimum performance requirements using the same performance metric as the labels on the equipment.

Who is affected

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

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

NBC20 Div.B 9.36.4.2. (first printing)

[9.36.4.2.] 9.36.4.2. ([1] 1) [F96,F98-OE1.1]

[9.36.4.2.] 9.36.4.2. ([2] 2) [F93,F96-OE1.1]

[9.36.4.2.] 9.36.4.2. ([3] 3) [F98-OE1.1]

NBC20 Div.B 9.36.8.10. (first printing)

[9.36.8.10.] 9.36.8.10. ([1] 1) no attributions

[9.36.8.10.] 9.36.8.10. ([2] 2) no attributions

[9.36.8.10.] 9.36.8.10. ([3] 3) [F96-OE1.1]

NECB20 Div.B 6.2.2.1. (first printing)

[6.2.2.1.] 6.2.2.1. ([1] 1) [F96,F98-OE1.1]

Submit a comment

Proposed Change 1819

Code Reference(s): **NBC20 Div.B 9.36.5.10. (first printing)**
NBC20 Div.B 9.36.5.14. (first printing)
NBC20 Div.B 9.36.6.4. (first printing)
NBC20 Div.B 9.36.7.3. (first printing)

Subject: Airtightness

Title: Removing ACH_{50} and Harmonizing Airtightness Requirements in Section 9.36.

Description: This proposed change replaces ACH_{50} with NLR_{50} as the regulating airtightness metric in Section 9.36. and revises the airtightness requirements in the compliance paths and for proposed house modeling.

Related Proposed Change(s): PCF 1954

This change could potentially affect the following topic areas:

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

Problem

Section 9.36. of Division B of the National Building Code of Canada (NBC) currently uses ACH_{50} (air changes per hour at 50 Pa pressure differential) for energy modeling of the proposed and reference houses. Given that ACH_{50} is a measurement of airtightness that expresses air flow as a function of the air volume within a building, a fixed ACH_{50} value for the reference house (Sentence 9.36.5.14.(2)) or proposed house (Sentence 9.36.5.10.(9)) does not sufficiently account for variations in surface-area-to-volume ratios (SVs) or the geometry of buildings. This limitation creates a misalignment between the requirements of Subsection 9.25.3. and Articles 9.36.2.9. and 9.36.2.10., which specifically address improvements of the building envelope assembly that are not tied to the geometry or physical size of the building.

The inclusion of multiple metrics, i.e., ACH_{50}, NLR_{50} (normalized leakage rate at 50 Pa pressure differential), and NLA_{10} (normalized leakage area at 10 Pa pressure differential), to define airtightness levels in Tables 9.36.6.4.-A and 9.36.6.4.-B adds unnecessary complexity and confusion to the Code by implying equivalency between the three metrics that is only true at a specific SV.

A related issue adding yet more complexity is the lack of consistency between the airtightness values assigned to the proposed house in the performance path (Subsection 9.36.5.) and in the tiered performance path (Subsection 9.36.7.). Currently, the performance path permits an ACH_{50} value of 2.5 in the proposed house when the requirements of Subsection 9.25.3. and Articles 9.36.2.9 and 9.36.2.10 are met. The tiered performance path only allows an ACH_{50} value of 3.2 when the same requirements are met unless a blower door test is performed. There is no requirement in the tiered performance path to use the results of the blower door test. Also, no differentiation is made in either path between the use of these assumed ACH_{50} values in attached houses and detached houses.

To address the issues listed above, this proposed change suggests

- using NLR_{50} as the regulating metric to align the airtightness metrics with building envelope requirements,
- simplifying the airtightness metric in the Code by removing ACH_{50} from all airtightness level tables and only using ACH_{50} as a calculated value from NLR_{50} for energy model input, and
- aligning the tiered performance path with the performance path by only referencing NLR_{50} values.

Justification

Using NLR_{50} would increase internal Code alignment by addressing air leakage through the building envelope assemblies and create a more equitable metric to measure building envelope airtightness.

1. Alignment of Airtightness Metrics with Building Envelope Requirements

NLR_{50} (in L/s×m^2) is an airtightness metric that is based on the airtightness of assemblies and surfaces, which is in turn directly aligned with the materials used and assemblies built by the builders. The prescriptive requirements in Subsection 9.25.3. and Articles 9.36.2.9. and 9.36.2.10. of Division B of NBC address the airtightness of materials and assemblies as a means of achieving a continuous air barrier system that is a part of the building envelope. Table 1 shows the volume, surface area and ACH_{50} of three detached houses of varying size, all with an applied consistent NLR_{50} building envelope airtightness of 0.89 L/(s×m^2).

Table 1. Examples of the Conversion of Airtightness Metrics for Detached Houses

Description	**Volume (V)**	**Total Surface Area (A_t)**	**NLR_{50}**	**ACH_{50}**
1 300 ft.^{2} slab-on-grade/ground (SOG) construction	290 m^3	292 m^2	0.89 L/(s×m^2)	3.23
3 300 ft.^{2} with basement	791 m^3	605 m^2	0.89 L/(s×m^2)	2.45
4 000 ft.^{2} with basement	1 534 m^3	969.7 m^2	0.89 L/(s×m^2)	2.03

Table 1 shows that houses built with the same quality of air barrier system achieve different ACH_{50} values due to the impact of the variation in geometry on the calculations and not because of differences in how the air barrier system was constructed.

Assumptions about airtightness in the reference house are, therefore, proposed to also vary with geometry based on a fixed NLR_{50} building envelope value, rather than by assuming a fixed ACH_{50} value as is currently prescribed by Article 9.36.5.14. The result is a definition of the reference house that applies a consistent building envelope airtightness, rather than a variable airtightness controlled by a fixed application of ACH_{50}. It is proposed that the NLR_{50} values from level AL-1A in Table 9.36.6.4.-A and level AL-1B in Table 9.36.6.4.-B are more appropriate for all reference house cases depending on the type of house and the test performed, i.e.:

- 0.89 L/(s×m^2) for detached zones, and
- 1.17 L/(s×m^2) for attached zones.

To determine compliance with the airtightness levels in Article 9.36.6.4., unguarded test results would continue to use Table 9.36.6.4-B, while guarded test results would be compared against Table 9.36.6.4-A.

Application of NLR_{50} and A_e for Modelling Attached Houses

There exists at present an additional misalignment in the airtightness assumptions used in modeling attached houses. The NBC requires that attached houses use an ACH_{50} value of 3.0 (when unguarded testing is performed), but this value is not adjusted to address the degree of attachment of the modeled house (reference or proposed). As a result, the energy model assumes all air leakage associated with this ACH_{50} value to be coming from unconditioned space, thereby, effectively overestimating the percentage of heat loss attributed to air leakage for attached houses.

It is possible to overcome this error using guarded testing; however, this type of test is typically impractical and expensive for attached houses. Since unguarded testing provides the most practical and cost-effective method for airtightness testing, a work-around is required to fairly assess the acceptable airtightness of attached houses when using an energy model.

It is proposed that only the exposed area (A_e) be used when converting NLR_{50} to ACH_{50}. An assumption is made that the rate of air leakage across all surfaces facing the interior of an attached unit is the same. A_e is defined as the interior surface area of exterior walls, ceilings and floors that separate conditioned from unconditioned space. A party wall, for example, would not be considered exposed area as the space on either side is conditioned, even though the conditioned areas are located in different suites.

Figure 1 shows how the following three archetype houses were evaluated to determine the overall impact of this approach:

- detached house, 785 m^3, 0.77 SV
- medium mid-row house, 402 m^3, 48% attached, 0.95 SV
- small mid-row house, 267 m^3, 48% attached, 1.02 SV

Each archetype house was modeled five times, as follows:

1. Current ACH_{50}-Based Reference House (in NBC 2020)
2. NLR_{50}-Based Reference House (in this PCF; NLR_{50} converted to ACH_{50})
3. Proposed House Airtightness Level 1 (NLR_{50} converted to ACH_{50})
4. Proposed House Airtightness Level 2 (NLR_{50} converted to ACH_{50})
5. Proposed House Airtightness Level 3 (NLR_{50} converted to ACH_{50})

Results

Figure 1 shows the total energy consumption for each archetype house in this progression. The arrows above the bar charts (with associated Δ% values) indicate the percentage improvement directly related to improvements in airtightness for the proposed house:

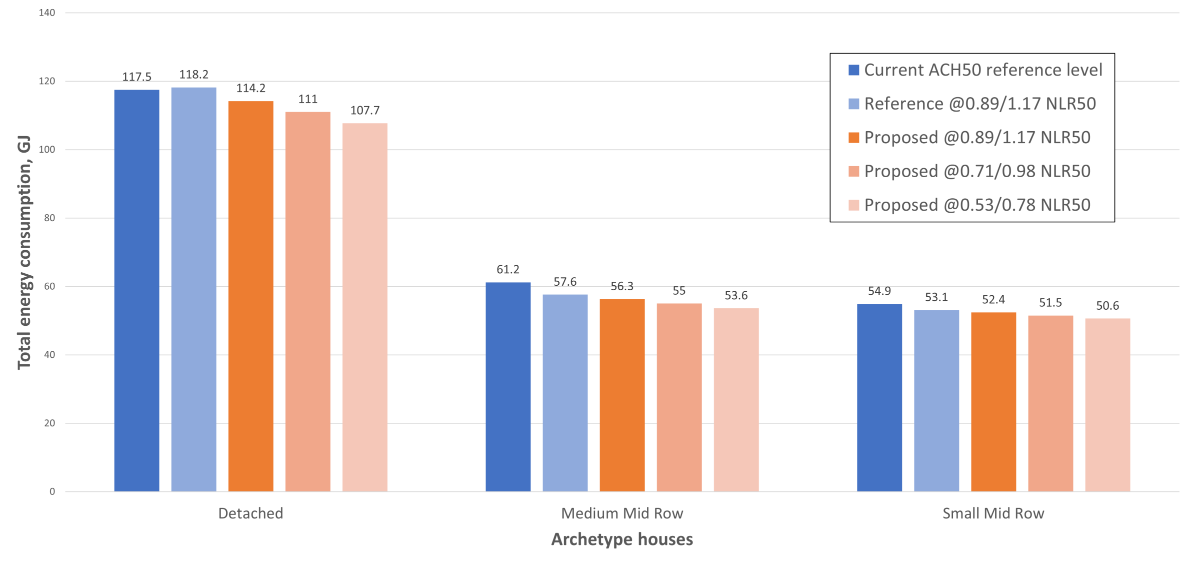


Figure 1. Comparison of impact on energy consumption using different airtightness metrics as regulating metric by archetype

The results in Figure 1 demonstrate how the contribution of airtightness to energy savings appears reasonable using this approach, reflecting less impact on houses with less exposed area.

The following observations can be made:

- Because the NLR_{50} value is converted to ACH_{50} using only the exposed area (A_e), the calculated ACH_{50} input values (for use in the model) decrease as the degree of attachment increases.
- The total energy use of the reference house for attached houses is substantially reduced, while having only minimal impact overall on detached houses of average size.

In summary, using A_e in all cases provides simplicity and consistency for Code users while reducing the overestimation of heat loss due to air leakage in the current Code.

2. Simplification of Airtightness Metrics

Since most energy modeling software uses ACH_{50} values as an input, ACH_{50} should remain in Section 9.36. as a calculated value for input to energy models. However, unless the value is the measured result of a blower door test, it would always be calculated based on the NLR_{50} values and account for the actual geometry of the house. This situation would apply to the reference house in all cases and to the proposed house where an assumed or prescriptive airtightness value is permitted to be used. The calculation required to convert NLR_{50} to ACH_{50} is simple and only requires that both the volume and total surface area of the tested zone be known; this is typically already the case, with the exception of attached houses, where an additional small calculation may be required to determine the attached surface area. This approach would allow ACH_{50} to be removed from NBC Tables 9.36.6.4.-A and 9.36.6.4.-B, greatly simplifying the requirements.

3. Alignment of Performance and Tiered Performance Paths

To further improve consistency and clarity in the Code, this proposed change also revises the tiered performance path and performance path to only reference NLR_{50} values to reconcile the current discrepancies between the two paths.

Under the current tiered performance path (see Sentence 9.36.7.3.(9)), Code users are limited to an ACH_{50} value of 3.2, even if the prescriptive requirements of Subsection 9.25.3. and Articles 9.36.2.9 and 9.36.2.10. are met, unless a blower door test is performed. In the performance path (see Sentence 9.36.5.10.(9)), compliance with the same prescriptive requirements allows the use of an ACH_{50} value of 2.5 without a blower door test. This structure disproportionately impacts houses that have limited or costly access to blower door testing, such as those in remote locations. It is also important to note that Code users are not required to use the outputs from the blower door test where one is performed. Further, both prescribed values are fixed ACH_{50} values, which are subject to many of the same concerns outlined in the Justification section.

This proposed change revises both sections as follows:

- both paths reference NLR_{50} values only,
- where prescriptive compliance is demonstrated, both paths reference one NLR_{50} value for detached houses and a different NLR_{50} value for attached houses. Since this proposed change affects only prescriptive airtightness, determination based on test method (guarded or unguarded) does not apply. The values would be aligned with the airtightness levels set out in Article 9.36.6.4., and
- both paths use the same criteria for compliance and application of the prescriptive airtightness value, without the requirement for blower door testing.

This proposed change would make consistent the application of prescriptive airtightness in Section 9.36. and the alignment with the proposed change to NLR_{50} as the governing airtightness metric in the Code.

PROPOSED CHANGE

[9.36.5.10.] 9.36.5.10. Modeling Building Envelope of Proposed House

[1] **1)** Except as provided in Sentences (2) and (3), the energy model calculations for the proposed house shall be consistent with the proposed construction specifications for that house with regard to

- [a] a) the area of the above-ground portion of *foundation* walls,
- [b] b) the effective thermal resistance of above-ground walls, ceilings below attics, roof assemblies and *rim joists*,
- [c] c) the maximum overall thermal transmittance of doors, as calculated in accordance with Sentence 9.36.2.2.(3),
- [d] d) the effective thermal resistance of below-ground walls and slabs-on-ground,
- [e] e) exterior walls, roof-ceiling assembly, doors, walls, exposed floors, and floors in contact with the ground,
- [f] f) distribution, orientation and area of fenestration and doors, as calculated in accordance with Article 9.36.2.3.,
- [g] g) solar heat gain coefficient and overall thermal transmittance of fenestration, as calculated in accordance with Sentence 9.36.2.2.(3),
- [h] h) configuration of insulation in assemblies in contact with the ground, and
- [i] i) effective thermal resistance of *foundation* walls.

[2] **2)** Except for penetrations, slab-on-ground edge insulation and assemblies with embedded heating pipes, where a *building* envelope component or assembly covers less than 2% of the total area of the assembly type to which it belongs, its thermal characteristics are not required to be calculated as belonging to a distinct assembly, provided the area of the component or assembly is included in an adjacent assembly having the same orientation (See Note A-9.36.5.10.(2).)

[3] **3)** *Building* envelope assemblies with the same thermal characteristics and orientation are not required to be calculated as distinct assemblies, provided their area is included in an adjacent assembly.

[4] **4)** *Building* envelope assemblies and components separating *conditioned space* from enclosed unconditioned space shall have a solar heat gain coefficient equal to 0.

[5] **5)** Except as stated in Sentence 9.36.5.6.(9), the energy model calculations for the proposed house shall account for the effects of exterior permanent and fixed shading devices, including fins, overhangs, and light shelves, on solar heat gain.

[6] **6)** Where thermal mass is included in the energy model calculations for the proposed house, it shall be set as

- [a] a) the specified mass up to the inside edge of insulation in exterior walls, the mass of interior walls, the mass up to the centre-line of *party walls*, and the mass of floors, as applicable,
- [b] b) the specified mass of the *building* envelope assembly, where the energy model calculations include a transient analysis of thermal transfer of the entire *building* envelope assembly, or
- [c] c) a default value of 0.060 MJ/(m^2×°C).

[7] **7)** Exterior walls, roofs and exposed floors shall have a solar absorptance of 0.4.

[8] **8)** The orientation of the *foundation* of the proposed house as constructed shall be within 22.5° of the orientation used in the energy model calculations.

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

- [a] a) where the construction complies with Section 9.25., ~~3.2 air changes per hour~~1.25 L/(s×m^2) at 50 Pa pressure differential with a pressure exponent of 0.67~~, where the construction complies with Section 9.25.~~,

[b] b) ~~2.5 air changes per hour at 50 Pa pressure differential with a pressure exponent of 0.67,~~ 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~~

  [i] --) 1.17 (L/s×m^2) at 50 Pa pressure differential with a pressure exponent of 0.67 for attached zones, and

  [ii] --) 0.89 (L/s×m^2) at 50 Pa pressure differential with a pressure exponent of 0.67 otherwise, or

[c] c) the airtightness determined in accordance with Sentence 9.36.6.3.(1) expressed as

  [i] i) the ~~number of air changes per hour~~normalized leakage rate at 50 Pa pressure differential with a pressure exponent determined through a multi-point test, and

  [ii] ii) the calculated equivalent leakage area at 50 Pa pressure differential.

(See Note A-9.36.5.10.(9) and (10).)

[10] 10) For compliance with Clause (9)(c),

[a] --) a design ~~airtightness value~~normalized leakage rate at 50 Pa pressure differential with a pressure exponent of 0.67 shall be assigned for use in the energy model until the actual airtightness is measured~~.~~, and

[b] --) where the proposed house contains attached zones and their airtightness is determined using the unguarded method, only the exposed area of the tested zone shall be used for

  [i] --) conversion between normalized leakage rate at 50 Pa pressure differential and air changes per hour at 50 Pa pressure differential, and

  [ii] --) determination of the equivalent leakage area at 50 Pa pressure differential.

(See Note A-9.36.5.10.(9) and (10).)

Note A-9.36.5.10.(9) and (10) Conversion of NLR_{50} to ACH_{50} for Use in the Energy Model.

The normalized leakage rate, also known as the normalized airflow rate, is defined as the airflow rate divided by the surface area of the tested zone. Unless otherwise specified, the surface area should include the total building envelope area of the tested zone, including below-grade areas and areas attached to conditioned space. The normalized leakage rate at 50 Pa pressure differential (NLR_{50}) is calculated in accordance with CAN/CGSB 149.10, “Determination of the airtightness of building envelopes by the fan depressurization method.”

To convert NLR_{50} to air changes per hour at 50 Pa pressure differential (ACH_{50}) for use in the energy model, the following formula can be used:

$$ACH_{50} = NLR_{50} \times \frac{A_e}{V} \times 3.6$$

where

ACH_{50} = air changes per hour at 50 Pa pressure differential,
NLR_{50} = normalized leakage rate at 50 Pa pressure differential, in L/(s×m^2),
A_e = exposed area of tested zone, measured at the interior surfaces of exterior walls, ceilings and floors, in m^2, and
V = volume of the tested zone, measured at the interior surfaces of walls, ceilings and floors, in m^3.

Where the unguarded method is used to test an attached zone, the NLR_{50} value should be calculated using the total surface area of the tested zone before determining the ACH_{50} value or the equivalent leakage area at 50 Pa pressure differential (ELA_{50}) for use in the energy model.

[9.36.5.14.] 9.36.5.14. Modeling Building Envelope of Reference House

[1] **1)** The energy model calculations for the reference house shall include the same values as those used for the proposed house with regard to

[a] a) the gross area of above-ground portion of *foundation* walls,

[b] b) *soil* conditions,

[c] c) the orientation of the *foundation*, and

[d] d) the ratio of fenestration area to opaque area of doors.

[2] **2)** The energy model calculations for the reference house shall use the following values:

[a] a) 0.060 MJ/(m^2×°C) for thermal mass,

[b] b) a solar absorptance of 0.4 for the exterior walls, roofs and exposed floors,

[c] c) 0.26 for the solar heat gain coefficient of fenestration,

[d] d) an airtightness of

[i] i) ~~3.0 air changes per hour~~1.17 L/(s×m^2) at 50 Pa pressure differential for attached zones, ~~where the airtightness used for the proposed house is determined in accordance with Sentence 9.36.6.3.(1) using the unguarded method,~~ and

[ii] ii) ~~2.5 air changes per hour~~0.89 L/(s×m^2) at 50 Pa pressure differential otherwise, and

[e] e) a pressure exponent equal to

[i] --) the pressure exponent used for the proposed house where this value is less than 0.67, and

[ii] --) 0.67 otherwise~~, 0.67~~.

(See Note A-9.36.5.10.(9) and (10).)

[3] --) For conversion between the normalized leakage rate at 50 Pa pressure differential set out in Subclause (2)(d)(i) and air changes per hour at 50 Pa pressure differential, only the exposed area of the tested zone shall be used.

[4] **3)** The effective thermal resistance and overall thermal transmittance values, as applicable, used in the energy model calculations for the reference house shall be determined for the applicable heating degree-day zone in accordance with

[a] a) Table 9.36.2.6.-A for walls, ceilings below attics, roof assemblies and *rim joists*,

[b] b) Table 9.36.2.7.-A for doors, and

[c] c) Table 9.36.2.8.-A for below-*grade* walls and slabs-on-ground.

[5] **4)** Except as provided in Sentences (5) and (6), the exterior walls, roof-ceiling assembly, doors, walls, exposed floors, and floors of the reference house that are in contact with the ground shall have the same area as those of the proposed house.

[6] **5)** The area and orientation of fenestration and doors of the reference house shall be modeled as being equally distributed on all sides of the house.

[7] **6)** The gross wall area and the area of fenestration and doors of the reference house shall be determined in accordance with Article 9.36.2.3.

[8] **7)** Windows and other glazed components in the reference house shall have a maximum overall thermal transmittance as required in Table 9.36.2.7.-A for the applicable heating degree-day category.

[9] **8)** The configuration of insulation in assemblies of the reference house that are in contact with the ground shall be modeled as conforming to Article 9.36.2.8.

[10] **9)** *Foundation* walls shall be modeled using the applicable effective thermal resistance values in Table 9.36.2.8.-A and as conforming to Sentence 9.36.2.8.(2).

[11] **10)** The fenestration and door area to gross wall area ratio (FDWR) of the reference house shall be

[a] a) for houses containing one or two *dwelling units*,

[i] i) as per the proposed house, where its FDWR is between 17% and 22%,
[ii] ii) 17%, where the FDWR of the proposed house is less than 17%, or
[iii] iii) 22%, where the FDWR of the proposed house is greater than 22%, and

[b] b) for *buildings* of *residential occupancy* containing more than two *dwelling units*,
[i] i) the FDWR determined in Clause (a) for the areas determined in accordance with Sentence 9.36.2.3.(2) and, where the FDWR determined in accordance with the calculation in Sentence 9.36.2.3.(3) only does not exceed 40%, or
[ii] ii) 40% of the gross wall area enclosing *conditioned space* where the area of fenestration and doors is greater than 40% of the gross wall area enclosing *conditioned space* determined in accordance with Sentence 9.36.2.3.(2).

(See Note A-9.36.5.14.(10).)

[9.36.6.4.] 9.36.6.4. Determination of Airtightness Level

[1] **1)** Compliance with an Airtightness Level listed in Table 9.36.6.4.-A or 9.36.6.4.-B shall be determined in accordance with this Article using the value of ~~ACH_{50},~~ NLA_{10}~~,~~ or NLR_{50} determined in accordance with Sentence 9.36.6.3.(2).

[2] **2)** For the purposes of Sentence (3) and (4), the Airtightness Level for *buildings* or *dwelling units* containing more than one zone shall be the lowest Airtightness Level achieved for the zones therein. (See Note A-9.36.6.4.(2).)

[3] **3)** Except as provided in Sentence (4), the Airtightness Level for single zones and attached zones shall be determined by complying with one of the corresponding airtightness values stipulated in Table 9.36.6.4.-A.

Table [9.36.6.4.-A] 9.36.6.4.-A
Airtightness Levels for Single Zones and Attached Zones Determined Using the Guarded Method
Forming Part of Sentences 9.36.6.3.(2), [9.36.6.4.] 9.36.6.4.([1] 1) and ([3] 3), and 9.36.8.8.(1)

Airtightness Levels	Airtightness Metrics		
	~~ACH_{50}~~	NLA_{10}, cm^2/m^2	NLR_{50}, L/(s×m^2)
	Maximum Airtightness Values		
AL-1A	~~2.5~~	1.20	0.89
AL-2A	~~2.0~~	0.96	0.71
AL-3A	~~1.5~~	0.72	0.53
AL-4A	~~1.0~~	0.48	0.35
AL-5A	~~0.6~~	0.29	0.21

[4] **4)** Where the unguarded method is used to determine the airtightness of an attached zone, the Airtightness Level shall be determined by complying with one of the corresponding airtightness values stipulated in Table 9.36.6.4.-B, provided the zone is tested independently.

Table [9.36.6.4.-B] 9.36.6.4.-B
Airtightness Levels for Attached Zones Determined Using the Unguarded Method
Forming Part of Sentences 9.36.6.3.(2), [9.36.6.4.] 9.36.6.4.([1] 1) and ([4] 4), and 9.36.8.8.(1)

Airtightness Levels	Airtightness Metrics		
	~~ACH_{50}~~	NLA_{10}, cm^2/m^2	NLR_{50}, $L/(s\times m^2)$
	Maximum Airtightness Values		
AL-1B	~~3.0~~	1.92	1.17
AL-2B	~~2.5~~	1.6	0.98
AL-3B	~~2.0~~	1.28	0.78
AL-4B	~~1.5~~	0.96	0.59
AL-5B	~~1.0~~	0.64	0.39
AL-6B	~~0.6~~	0.38	0.23

Note A-9.36.6.4.(2) Determining Airtightness Level of Buildings with Multiple Zones Having Different Airtightness Levels.

The lowest Airtightness Level determined for any zone in a building or dwelling unit with multiple zones is used to determine compliance with the tiered energy performance requirements. For example, in a building with two zones, if one zone achieves Airtightness Level AL-2A/2B ~~through the NLR_{50} metric~~, while the other zone achieves Airtightness Level AL-3A/3B ~~through the ACH_{50} metric~~, the Airtightness Level for the building as a whole would be AL-2A/2B.

[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 calculations for the proposed house shall be the airtightness value set out in Sentence 9.36.5.10.(9).

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

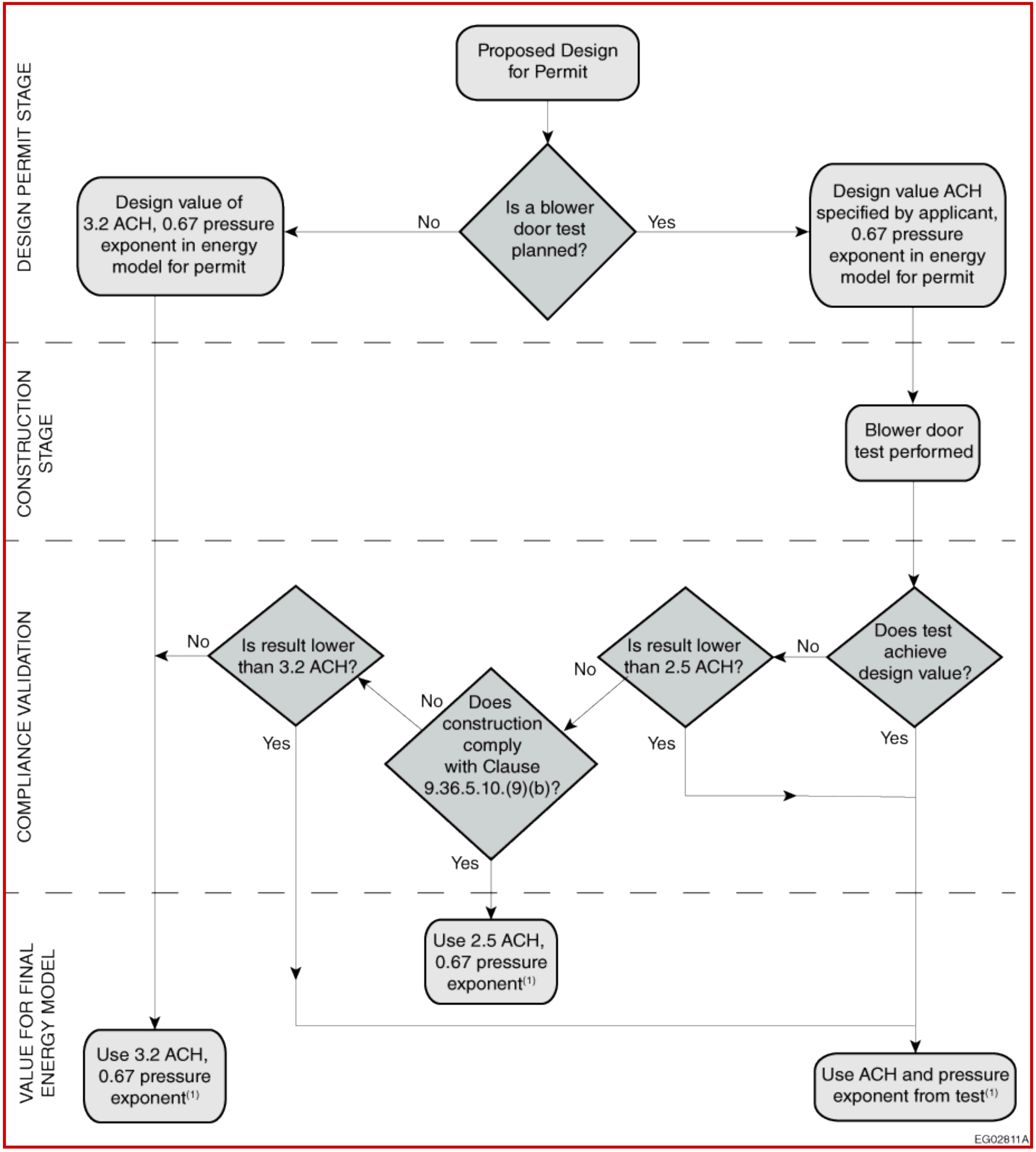
[b] b) ~~where an airtightness test is to be conducted, a design airtightness, until the airtightness has been measured in accordance with Sentence 9.36.6.3.(1)and the appropriate airtightness value set out in Sentence 9.36.5.10.(9) can be selected.~~

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

Note A-9.36.7.3.(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~~ If performed, airtightness testing provides the option of using the result instead of the prescribed airtightness value in the modeling of the proposed house. Testing the airtightness of a building will lead to more certainty regarding the building's energy performance, which is more important for compliance with higher-tier targets.

~~Figure [A-9.36.7.3.(9)] 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~~the normalized leakage rate at 50 Pa pressure differential~~ce~~ (NLR$_{50}$) 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 NLR$_{50}$ value of ~~3.2~~ ~~ACH at 50 Pa pressure difference~~1.25 L/(s×m^2) 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~~, an NLR$_{50}$ value of 0.89 L/(s×m^2) for single zones or 1.17 L/(s×m^2) for attached zones.

The airtightness value and pressure exponent to be used in the modeling of the reference house are determined in accordance with Sentence 9.36.5.14.(2).

Impact analysis

Impact on Energy Modeling

Updates to energy modeling software that allow NLR$_{50}$ values to be input directly may prove convenient for Code users, but are not a barrier to this proposed change. Energy models will still be able to use ACH$_{50}$ values: either measured directly by blower door test or by conversion from NLR$_{50}$ using the following formula, as proposed in explanatory Note A-9.36.5.10.(9)(c)(i):

$$\mathrm{ACH}_{50} = \mathrm{NLR}_{50} \times \frac{A_e}{V} \times 3.6$$

Because the conversion between ACH$_{50}$ and NLR$_{50}$ requires only the exposed area (A$_e$) and volume (V) (both known quantities when performing a blower door test or energy modeling), there would be no additional cost of implementation to builders for this proposed change.

Application of a calculated ACH$_{50}$ value (from a fixed NLR$_{50}$ value) to the reference house represents an additional step for Code users and energy advisors using the EnerGuide compliance path, as it requires modification of the reference house values in the HOT2000 energy modeling software. Energy advisors and Code users would still have the option of performance compliance using a modeled reference house and calculated ACH$_{50}$ value, which is currently common practice.

Impact on Houses with Different Forms and Geometries

In terms of impact on the form and geometry of housing, the SV of the house determines whether that particular house will achieve compliance more readily with either NLR$_{50}$ or ACH$_{50}$ metrics, when presented with targets in both metrics. When the SV is higher (typical of smaller houses), the NLR$_{50}$ target is more readily achieved. Conversely, when the SV is lower (typical of larger houses), the ACH$_{50}$ target is more readily achieved.

An analysis of the typical relationship of SV to house volume in 8 117 homes in Ontario is shown in Figure 2. The data shows that as houses grow in size, they tend to have a lower SV.

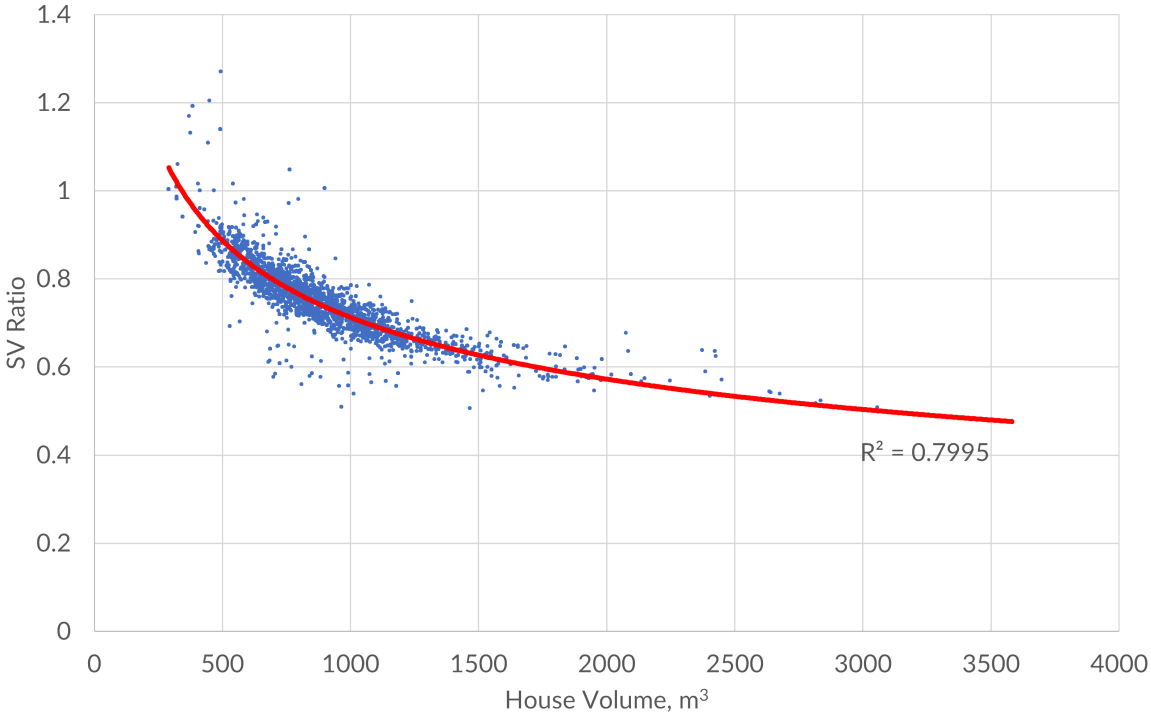


Figure 2. SV trend by house volume

Currently, larger houses (with lower SV) comply more readily with required ACH_{50} targets, so the removal of this metric would require an improvement in the airtightness of assemblies for these houses. For example, if using an NLR_{50} target of 0.89 L/(s×m^2) (i.e., AL-1A) for a 1 500 m^3 house with an SV of 0.62, the equivalent ACH_{50} target is 1.99. The reference house would also now use an ACH_{50} of 1.99 in this instance. This represents a 20.5% reduction in the targeted ACH_{50} value.

Conversely, smaller houses (with higher SV) currently comply more readily with NLR_{50} targets, so these houses would not require any improvement in the airtightness of assemblies to remain compliant. However, the impact would affect the reference house and, therefore, the relative impact of airtightness on energy performance. For example, if using the same NLR_{50} target of 0.89 L/(s×m^2) (i.e., AL-1A) for a 300 m^3 house with an SV of 1.02 (small compact house), the equivalent ACH_{50} is calculated as 3.27. In the NBC 2020, the reference house still uses the ACH_{50} value of 2.5, meaning that the compliant house is compared against a reference house that is 23.5% more airtight. This proposed change would correct this misalignment and require that the reference house also use the equivalent ACH_{50} value of 3.27 in this case.

The use of NLR_{50} as the governing airtightness metric might require houses with lower SV (typically larger houses) to demonstrate improvements in building envelope airtightness compared to current requirements, while houses with higher SV (typically smaller houses) would be compared against a more appropriate baseline reference house.

This proposed change that aligns the airtightness requirements in the tiered performance path with those of the performance path in Section 9.36. of NBC would

- make consistent and simplify Section 9.36.,
- give meaning to performing an airtightness test by using the result, and
- remove the significant cost burden associated with detached houses and moderate burden associated with attached houses of providing energy efficiency measures to compensate for the required use of the NLR_{50} value of 1.25 L/(s×m^2) instead of 0.89 L/(s×m^2) (detached houses) or 1.17 L/(s×m^2) (attached houses) where compliance with specific prescriptive requirements is demonstrated.

Enforcement implications

The proposed change could be enforced using existing Code enforcement infrastructure.

Some training and education may be required for authorities having jurisdiction as they will need to be familiar with the NLR_{50} metric if they are not using it already on a regular basis.

Who is affected

Designers, engineers, architects, building officials, manufacturers, suppliers and energy advisors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.36.5.10.] 9.36.5.10. ([1] 1) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([2] 2) no attributions

[9.36.5.10.] 9.36.5.10. ([3] 3) no attributions

[9.36.5.10.] 9.36.5.10. ([4] 4) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([5] 5) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([6] 6) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([7] 7) [F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([8] 8) no attributions

[9.36.5.10.] 9.36.5.10. ([9] 9) [F90,F91,F92,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([10] 10) [F90,F91,F92,F93,F95,F99-OE1.1]

[9.36.5.10.] 9.36.5.10. ([10] 10) [F90,F91,F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([1] 1) [F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([2] 2) [F90,F91,F92,F95,F99-OE1.1]

[9.36.5.14.] -- ([3] --) [F90,F91,F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([4] 3) [F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([5] 4) [F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([6] 5) [F92,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([7] 6) [F92,F95,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([8] 7) [F92,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([9] 8) [F92,F99-OE1.1]

[9.36.5.14.] 9.36.5.14. ([10] 9) [F92,F99,F95-OE1.1]

[9.36.5.14.] 9.36.5.14. ([11] 10) [F92,F99-OE1.1]

[9.36.6.4.] 9.36.6.4. ([1] 1) no attributions

[9.36.6.4.] 9.36.6.4. ([1] 1) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.6.4.] 9.36.6.4. ([2] 2) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.6.4.] 9.36.6.4. ([3] 3) [F90,F91,F92,F93,F95,F100-OE1.1]

[9.36.6.4.] 9.36.6.4. ([4] 4) [F90,F91,F92,F93,F95,F100-OE1.1]

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

[9.36.7.3.] 9.36.7.3. ([2] 2) [F95-OE1.1]

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

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

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

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

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

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

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

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

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

Submit a comment

Proposed Change 1890

Code Reference(s):	**NBC20 Div.B 9.36.8.2. (first printing)**
Subject:	Energy Efficiency for Houses
Title:	Energy Conservation Points for Energy Performance Tiers 3, 4 and 5
Description:	This proposed change assigns minimum sums of energy conservation points for Energy Performance Tiers 3, 4 and 5 in the prescriptive trade-off compliance path.

This change could potentially affect the following topic areas:

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

Problem

The 2020 edition of the National Building Code of Canada (NBC) introduced five energy performance tiers with increasing levels of improvement for buildings and houses, providing jurisdictions with the option to regulate the energy performance level that is most suitable for their needs.

The 2020 edition also introduced a prescriptive trade-off path in Subsection 9.36.8. as a new compliance option for Code users. Although performance modeling is commonly used in the industry, further development of the prescriptive trade-off compliance path for all energy performance tiers would make it simpler to achieve energy-efficiency compliance. However, there are no minimum sums of energy conservation points provided beyond Tier 2 of the prescriptive trade-off compliance path.

Failure to develop minimum sums of energy conservation points for Tiers 3, 4 and 5 of the prescriptive trade-off compliance path restricts Code users from demonstrating compliance with energy performance tiers above Tier 2 of the prescriptive trade-off compliance path, forcing Code users to use the performance-based compliance path that requires energy modeling to meet the energy-efficiency targets.

Justification

For the 2025 Code cycle, the provinces and territories have identified as a priority the improvement of energy provisions leading to the adoption of net-zero energy ready model codes by 2030. To achieve higher levels of energy performance by 2030, it is imperative to comprehensively develop the prescriptive trade-off compliance path to provide Code users with additional options for compliance.

The prescriptive trade-off path provides acceptable solutions using different energy conservation measures to improve total energy performance. Together with the tiered energy performance path in Subsection 9.36.7. of Division B of the NBC and the prescriptive path, the prescriptive trade-off path is one of the three compliance options that provide an acceptable means of achieving the performance goal of reducing energy consumption. Currently, Subsection 9.36.8. only provides a compliance option for the trade-off path up to Tier 2, which deprives Code users following this path of the ability to demonstrate compliance with Tiers 3, 4 and 5.

Updates to the energy conservation points for the existing as well as several new energy conservation measures are proposed for inclusion in the 2025 edition of the NBC. New measures are proposed for components and equipment such as drain-water heat recovery, heat-recovery ventilators, energy-recovery ventilators, oil-fired furnaces, gas-fired furnaces, air-source heat pumps, ceilings and slabs-on-grade. Stating the minimum sum of energy conservation points in Table 9.36.8.2.-2025 based on new and updated measures that are required for compliance with Energy Performance Tiers 3, 4 and 5 would complete the development of the prescriptive trade-off compliance path in Subsection 9.36.8.

This proposed change specifies minimum airtightness levels for Energy Performance Tiers 3, 4 and 5. This proposed change also introduces a threshold for the minimum sum of energy conservation points that must be contributed from building envelope measures. This threshold has been set considering that the majority of building archetypes can obtain the threshold building envelope points to achieve the energy performance of the corresponding tiers. This threshold also ensures a balance between the contributed points from building envelope measures and from other measures to the minimum sum of energy conservation points for the building design.

PROPOSED CHANGE

[9.36.8.2.] 9.36.8.2. Compliance

[1] 1) Compliance with this Subsection shall be achieved by designing and constructing *buildings* to which this Subsection applies in accordance with Sentences (2) to (6).

- [a] a) ~~designing and constructing *buildings* to which this Subsection applies in accordance with one or more of the energy conservation measures prescribed in Articles 9.36.8.4. to 9.36.8.10. to accumulate the minimum sum of energy conservation points required to attain Energy Performance Tier 2, 3, 4 or 5 as specified in Table 9.36.8.2., and~~
- [b] b) ~~complying with Subsections 9.36.2. to 9.36.4., except where these requirements are specifically permitted by this Subsection to be waived (see Note A-9.36.8.2.(1)(b)).~~

[2] --) The requirements of Subsections 9.36.2. to 9.36.4. shall be met, except where these requirements are specifically permitted by this Subsection to be waived. (See Note A-9.36.8.2.(2).)

[3] --) Except as provided in Sentence (4), the minimum sum of energy conservation points as specified in Table 9.36.8.2. shall be accumulated, by complying with one or more of the energy conservation measures prescribed in Articles 9.36.8.5. to 9.36.8.11., to attain the applicable energy performance tier.

[4] --) In climate zones 7B and 8, the minimum sum of energy conservation points required to attain Energy Performance Tier 5 shall be 5 energy conservation points less than that specified in Table 9.36.8.2.

[5] --) The minimum sum of energy conservation points from *building* envelope measures as specified in Table 9.36.8.2. shall be accumulated, by complying with one or more of the energy conservation measures prescribed in Articles 9.36.8.5 to 9.36.8.8. and 9.36.8.11., to attain the applicable energy performance tier.

[6] --) A minimum Airtightness Level of AL-3A or AL-4B as specified in Article 9.36.6.4. shall be achieved to attain Energy Performance Tiers 4 and 5.

~~Table [9.36.8.2.-A] 9.36.8.2.~~
~~Energy Performance Tiers~~
~~Forming Part of Clause 9.36.8.2.(1)(a)~~

~~Energy Performance Tier~~	~~Minimum Sum of Energy Conservation Points~~
~~1~~	~~(1)~~
~~2~~	~~10~~
~~3~~	~~Reserved~~
~~4~~	~~Reserved~~
~~5~~	~~Reserved~~

~~Note to Table [9.36.8.2.-A] 9.36.8.2.:~~

(1) ~~Tier 1 represents compliance with the baseline energy efficiency requirements stated in Subsections 9.36.2. to 9.36.4.; therefore, this Tier has no energy conservation points associated with it.~~

Table [9.36.8.2.-B]
Energy Performance Tiers
Forming Part of Sentences 9.36.8.2.(3), (4) and (5)

Minimum Sum	Energy Performance Tiers				
	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Energy conservation points	(1)	10	20	40	75 (2)
Energy conservation points from *building* envelope measures (3)	–	–	5	10	15

Notes to Table [9.36.8.2.-B] :

(1) Tier 1 represents compliance with the baseline energy efficiency requirements stated in Subsections 9.36.2. to 9.36.4.; therefore, this Tier has no energy conservation points associated with it.

(2) See Sentence (4).

(3) Applicable measures include *building* envelope measures described in Articles 9.36.8.5. to 9.36.8.7., airtightness measures prescribed in Article 9.36.8.8. and *building* volume measures prescribed in Article 9.36.8.11.

Note A-9.36.8.2.(~~1~~2)~~(b)~~ Compliance Options.

The prescriptive requirements presented in Subsections 9.36.2. to 9.36.4. serve as the basis for the energy conservation measures presented in Subsection 9.36.8. Builders and designers can choose to apply one or more of the measures in order to accumulate the associated energy conservation points with a view to achieving compliance with more stringent Energy Performance Tiers. Energy conservation measures are provided only for certain building elements addressed in Subsections 9.36.2. to 9.36.4.; therefore, other building elements that comply with other Code provisions cannot be credited with any energy conservation points.

Impact analysis

This proposed change comprehensively develops the prescriptive trade-off compliance path to provide Code users with an acceptable solution that uses different energy conservation measures to improve the total energy performance.

Detailed modeling data can be found in the supporting document.

Methodology

The impact analysis aims to determine all permutations of the energy conservation measure (ECM) combinations for the given building archetypes.

Constraints on the analysis:

- No interpolation was considered
- No oil-fired furnaces were included
- Only ECMs for instantaneous gas and EF = 2.35 heat pumps service hot water were considered
- Only cold climate air-source heat pumps (ccASHPs) covering 60% of load were considered. However, air-source heat pumps and equation tables were not considered.

Sources

- Envelope assembly ECMs were costed using RSMeans (2023)
    - Windows and airtightness were costed using estimates from the Housing Technology Assessment Program/Local Energy Efficiency Partnerships (HTAP/LEEP)
    - Adjusted by the Industrial Product Price Index (IPPI) (assumed to be 41%)
- Service water heating systems estimated from HTAP/LEEP
    - Adjusted by IPPI (assumed to be 41%)
- Drain-water heat-recovery costing data from Table 1 in PCF 1835
    - Installation costs estimated from HTAP/LEEP (adjusted for inflation using IPPI)
- Heat-recovery ventilator/energy-recovery ventilator (HRV/ERV) costing data from Table 4 in PCF 1838

Building Archetypes

Table 1 shows the packages from four building archetypes that were considered in the impact analysis.

Table 1. Building Archetypes Considered in the Impact Analysis

Archetype	ERS-5213	ERS-7972	ERS-4943	ERS-1605
Type	Detached	Row house end unit	Detached	Double/semi-detached
Volume, m^3	664	451	112	193
Storeys	2	2	1.5	1
Floor area, ft^2	2 400	2 370	470	580
Foundation	Full basement	Full basement	Slab-on-grade	Slab-on-grade

Incremental Costs

Tables 2 to 4 show the incremental costs for single detached archetype (> 300 m^3) packages for various tiers in different climate zones.

Table 2. Incremental Costs for Single Detached Archetype (> 300 m^3) Packages for Tier 3 by Climate Zone

Zone	Package	Ventilation ECM	Space Conditioning	Hot Water ECM	AG Walls RSI	DWHR	BG Walls RSI	Fenestration U-Value	ACH @ 50 PA	Total Points	Envelope Points	Incremental Cost
4	Lowest cost	60% SRE	NA	NG instantaneous	2.97	40%	3.46	NA	2.0	20.5	5.2	$3,700
	Lowest cost – no airtightness	60% SRE	NA	NG instantaneous	2.97	40%	3.46	NA	NA	20.5	5.2	$3,700

Table 2. Incremental Costs for Single Detached Archetype (> 300 m^3) Packages for Tier 3 by Climate Zone (Continued)

Zone	Package	Ventilation ECM	Space Conditioning	Hot Water ECM	AG Walls RSI	DWHR	BG Walls RSI	Fenestration U-Value	ACH @ 50 PA	Total Points	Envelope Points	Incremental Cost
5	Lowest cost	80% SRE	NA	NG instantaneous	NA	60%	3.09	NA	1.5	20.0	6.5	$4,560
	Lowest cost – no airtightness	60% SRE	NA	NA	NA	50%	3.09	0.94	NA	20.1	13.6	$4,760
6	Lowest cost	70% SRE	NA	NA	NA	60%	NA	1.05	2.0	20.0	12.3	$4,450
	Lowest cost – no airtightness	70% SRE	NA	NA	NA	60%	NA	0.82	NA	20.1	12.4	$4,540
7A	Lowest cost	60% SRE	NA	NA	NA	NA	NA	1.05	1.5	20.2	16.5	$4,410
	Lowest cost – no airtightness	70% SRE	NA	NA	NA	60%	NA	0.82	NA	20.3	12.6	$4,540
7B	Lowest cost	60% SRE	NA	NA	NA	60%	NA	NA	1.0	20.2	12.9	$3,800
	Lowest cost – no airtightness	80% SRE	NA	NA	3.96	60%	3.90	0.82	NA	20.0	11.6	$4,650
8	Lowest cost	60% SRE	NA	NA	NA	40%	NA	NA	1.0	20.4	14.7	$3,600
	Lowest cost – no airtightness	60% SRE	NA	NG instantaneous	3.96	60%	NA	0.82	NA	20.0	10.4	$5,320

Notes to Table:

ACH = air change per hour; AG = above-ground; BG = below-ground; DWHR = drain-water heat recovery; NG = natural gas

Table 3. Incremental Costs for Single Detached Archetype (> 300 m^3) Packages for Tier 4 by Climate Zone

Zone	Package	Ventilation ECM	Space Conditioning	Hot Water ECM	AG Walls RSI	DWHR	BG Walls RSI	Fenestration U-Value	ACH @ 50 PA	Total Points	Envelope Points	Incremental Cost
4	Lowest cost	70%	NA	NG instantaneous	2.97	60%	2.98	0.82	1.5	40	22.8	$10,210
5	Lowest cost	70%	NA	NG instantaneous	3.69	50%	3.09	0.94	1	40	27.5	$11,240
6	Lowest cost	70%	NA	NG instantaneous	3.69	60%	3.09	0.82	1	40	27.4	$10,910
7A	Lowest cost	70%	NA	NG instantaneous	3.85	60%	NA	0.82	1	40	29.2	$11,310
7B	Lowest cost	70%	NA	NG instantaneous	4.84	60%	3.90	0.82	1	40.0	25.8	$11,750
8	Lowest cost	80%	NA	NG instantaneous	4.29	50%	NA	0.82	0.6	40.1	30.9	$11,440

Notes to Table:

ACH = air change per hour; AG = above-ground; BG = below-ground; DWHR = drain-water heat recovery; NG = natural gas

Table 4. Incremental Costs for Single Detached Archetype (> 300 m^3) Packages for Tier 5 by Climate Zone

Zone	Package	Ventilation ECM	Space Conditioning	Hot Water ECM	AG Walls RSI	DWHR	BG Walls RSI	Fenestration U-Value	ACH @ 50 PA	Total Points	Envelope Points	Incremental Cost
4	Lowest cost	80%	ccASHP HSPF2 V 6.7 60% load cover	NG instantaneous	2.97	60%	3.09	0.94	1	75	23.5	$21,200
5	Lowest cost	60%	ccASHP HSPF2 V 6.7 60% load cover	NG instantaneous	3.69	50%	NA	0.82	1	75.2	29.1	$22,250

Table 4. Incremental Costs for Single Detached Archetype (> 300 m^3) Packages for Tier 5 by Climate Zone (Continued)

Zone	Package	Ventilation ECM	Space Conditioning	Hot Water ECM	AG Walls RSI	DWHR	BG Walls RSI	Fenestration U-Value	ACH @ 50 PA	Total Points	Envelope Points	Incremental Cost
6	Lowest cost	80%	ccASHP HSPF2 V 7.6 60% load cover	NG instantaneous	3.69	60%	3.9	0.82	1	75.1	28.7	$23,830
7A	Lowest cost	80%	ccASHP HSPF2 V 6.7 60% load cover	NG instantaneous	4.84	60%	3.9	0.82	1	75.1	34.2	$25,550
7B	Lowest cost	80%	ccASHP HSPF2 V 6.7 60% load cover	NG instantaneous	4.4	60%	3.9	0.82	0.6	70.3	30.3	$23,990
8	Lowest cost	80%	ccASHP HSPF2 V 9.6 60% load cover	NG instantaneous	5.45	70%	NA	0.82	0.6	70.1	35	$31,910

Notes to Table:

ACH = air change per hour; AG = above-ground; BG = below-ground; DWHR = drain-water heat recovery; NG = natural gas

Tables 5 to 7 show the incremental costs for row house end unit archetype (> 300 m^3) packages for various tiers in different climate zones.

Table 5. Incremental Costs for Row House End Unit Archetype (> 300 m^3) Packages for Tier 3 by Climate Zone

Zone	Package	Ventilation ECM	Space Conditioning	Hot Water ECM	AG Walls RSI	DWHR	BG Walls RSI	Fenestration U-Value	ACH @ 50 PA	Total Points	Envelope Points	Incremental Cost
4	Lowest cost	60% SRE	NA	NA	NA	NA	2.98	0.94	2.5	20.2	16.9	$1,690
	Lowest cost – no airtightness	60% SRE	NA	NA	NA	NA	3.09	0.82	NA	20.0	16.7	$1,710
5	Lowest cost	60% SRE	NA	NA	NA	NA	NA	0.94	2.5	20.2	16.6	$1,470
	Lowest cost – no airtightness	60% SRE	NA	NA	NA	NA	3.09	0.82	NA	20.1	16.5	$1,670
6	Lowest cost	60% SRE	NA	NA	NA	NA	3.46	1.05	2.0	20.1	16.5	$1,260
	Lowest cost – no airtightness	60% SRE	NA	NA	NA	50%	3.90	0.82	NA	20.5	13.9	$1,960
7A	Lowest cost	60% SRE	NA	NA	NA	NA	NA	1.05	2.0	20.2	16.5	$1,150
	Lowest cost – no airtightness	60% SRE	NA	NA	NA	60%	3.90	0.82	NA	20.5	13.3	$2,010
7B	Lowest cost	60% SRE	NA	NA	NA	NA	NA	0.94	2.0	20.4	16.5	$1,070
	Lowest cost – no airtightness	80% SRE	NA	NA	3.96	60%	3.90	0.82	NA	20.0	11.6	$2,420
8	Lowest cost	60% SRE	NA	NA	NA	NA	NA	0.94	2.0	21.0	17.4	$1,070
	Lowest cost – no airtightness	60% SRE	NA	NG instantaneous	3.96	60%	NA	0.82	NA	20.0	10.4	$3,330

Notes to Table:

ACH = air change per hour; AG = above-ground; BG = below-ground; DWHR = drain-water heat recovery; NG = natural gas

Table 6. Incremental Costs for Row House End Unit Archetype (> 300 m^3) Packages for Tier 4 by Climate Zone

Zone	Package	Ventilation ECM	Space Conditioning	Hot Water ECM	AG Walls RSI	DWHR	BG Walls RSI	Fenestration U-Value	ACH @ 50 PA	Total Points	Envelope Points	Incremental Cost
4	Lowest cost	60%	NA	NG instantaneous	NA	60%	3.46	0.82	1.5	40.2	23.6	$5,460
5	Lowest cost	70%	NA	NG instantaneous	3.69	NA	3.90	0.82	1.5	40	30.4	$6,140
6	Lowest cost	60%	NA	NG instantaneous	3.69	50%	3.90	0.82	1.5	40.1	28.6	$6,240
7A	Lowest cost	70%	NA	NG instantaneous	3.69	60%	3.90	0.82	1.5	40	29.2	$6,490
7B	Lowest cost	80%	NA	NA	4.84	60%	3.90	0.82	1.0	40.1	31.7	$7,550
8	Lowest cost	70%	NA	NG instantaneous	3.96	50%	NA	0.82	1.0	40.0	30.0	$7,260

Notes to Table:

ACH = air change per hour; AG = above-ground; BG = below-ground; DWHR = drain-water heat recovery; NG = natural gas

Table 7. Incremental Costs for Row House End Unit Archetype (> 300 m^3) Packages for Tier 5 by Climate Zone

Zone	Package	Ventilation ECM	Space Conditioning	Hot Water ECM	AG Walls RSI	DWHR	BG Walls RSI	Fenestration U-Value	ACH @ 50 PA	Total Points	Envelope Points	Incremental Cost
4	Lowest cost	60%	ccASHP HSPF2 V 6.7 60% load cover	NG instantaneous	2.97	50%	3.46	0.82	1.5	75.3	25.6	$15,290
5	Lowest cost	60%	ccASHP HSPF2 V 6.7 60% load cover	NG instantaneous	3.69	50%	NA	0.82	1.5	75.2	29.1	$15,780
6	Lowest cost	70%	ccASHP HSPF2 V 6.7 60% load cover	NG instantaneous	4.29	60%	3.90	0.82	1.5	75.4	31.5	$17,380
7A	Lowest cost	80%	ccASHP HSPF2 V 6.7 60% load cover	NG instantaneous	4.84	60%	3.90	0.82	1.5	75.2	34.3	$18,650
7B	Lowest cost	80%	ccASHP HSPF2 V 6.7 60% load cover	NG instantaneous	4.29	50%	3.90	0.82	1.0	70.0	30.5	$18,200
8	Lowest cost	80%	ccASHP HSPF2 V 6.7 60% load cover	NG instantaneous	5.45	60%	NA	0.82	0.6	70.1	40	$23,730

Notes to Table:

ACH = air change per hour; AG = above-ground; BG = below-ground; DWHR = drain-water heat recovery; NG = natural gas

Tables 8 to 10 show the incremental costs for single detached archetype (≤ 300 m^3) packages for various tiers in different climate zones.

Table 8. Incremental Costs for Single Detached Archetype (≤ 300 m^3) Packages for Tier 3 by Climate Zone

Zone	Package	Ventilation ECM	Space Conditioning	Hot Water ECM	AG Walls RSI	DWHR	BG Walls RSI	Fenestration U-Value	ACH @ 50 PA	Total Points	Envelope Points	Incremental Cost
4	Lowest cost	60% SRE	NA	NA	NA	NA	NA	1.22	NA	20.2	6.9	$670
	Lowest cost – no airtightness	60% SRE	NA	NA	NA	NA	NA	1.22	NA	20.2	6.9	$670
5	Lowest cost	60% SRE	NA	NA	NA	NA	NA	1.22	NA	20.6	7.0	$350
	Lowest cost – no airtightness	60% SRE	NA	NA	NA	NA	NA	1.22	NA	20.6	7.0	$350
6	Lowest cost	60% SRE	NA	NA	NA	NA	NA	1.05	NA	22.4	8.8	$610
	Lowest cost – no airtightness	60% SRE	NA	NA	NA	NA	NA	1.05	NA	22.4	8.8	$610
7A	Lowest cost	60% SRE	NA	NA	NA	NA	NA	1.05	NA	22.6	8.9	$610
	Lowest cost – no airtightness	60% SRE	NA	NA	NA	NA	NA	1.05	NA	22.6	8.9	$610
7B	Lowest cost	60% SRE	NA	NA	NA	NA	NA	1.05	NA	20.0	6.1	$420
	Lowest cost – no airtightness	60% SRE	NA	NA	NA	NA	NA	1.05	NA	20.0	6.1	$420
8	Lowest cost	60% SRE	NA	NA	NA	NA	NA	0.94	NA	21.5	7.8	$540
	Lowest cost – no airtightness	60% SRE	NA	NA	NA	NA	NA	0.94	NA	21.5	7.8	$540

Notes to Table:

ACH = air change per hour; AG = above-ground; BG = below-ground; DWHR = drain-water heat recovery; NG = natural gas

Table 9. Incremental Costs for Single Detached Archetype (≤ 300 m^3) Packages for Tier 4 by Climate Zone

Zone	Package	Ventilation ECM	Space Conditioning	Hot Water ECM	AG Walls RSI	DWHR	BG Walls RSI	Fenestration U-Value	ACH @ 50 PA	Total Points	Envelope Points	Incremental Cost
4	Lowest cost	60%	NA	NG instantaneous	NA	NA	NA	0.82	1.5	40.5	18.3	$3,320
5	Lowest cost	70%	NA	NA	3.96	NA	NA	0.82	1.5	40.0	25.8	$2,960
6	Lowest cost	60%	NA	NA	4.29	NA	NA	0.82	1.5	40.1	26.5	$3,350
7A	Lowest cost	70%	NA	NA	3.96	NA	NA	0.82	1.5	40.2	26.0	$3,090
7B	Lowest cost	70%	NA	NA	4.40	NA	NA	0.82	1.0	40.3	25.8	$3,570
8	Lowest cost	60%	NA	NA	4.29	NA	NA	0.82	1.0	40.5	26.8	$3,220

Notes to Table:

ACH = air change per hour; AG = above-ground; BG = below-ground; DWHR = drain-water heat recovery; NG = natural gas

Table 10. Incremental Costs for Single Detached Archetype (≤ 300 m^3) Packages for Tier 5 by Climate Zone

Zone	Package	Ventilation ECM	Space Conditioning	Hot Water ECM	AG Walls RSI	DWHR	Slab on grade	Fenestration U-Value	ACH @ 50 PA	Total Points	Envelope Points	Incremental Cost
4	Lowest cost	60%	ccASHP HSPF2 V 6.7 60% load cover	NG instantaneous	2.97	NA	NA	0.82	1.5	76.3	20.3	$13,210
5	Lowest cost	60%	ccASHP HSPF2 V 6.7 60% load cover	NA	3.69	NA	2.84	0.82	1.5	75.0	26.6	$12,830

Table 10. Incremental Costs for Single Detached Archetype (≤ 300 m^3) Packages for Tier 5 by Climate Zone (Continued)

Zone	Package	Ventilation ECM	Space Conditioning	Hot Water ECM	AG Walls RSI	DWHR	Slab on grade	Fenestration U-Value	ACH @ 50 PA	Total Points	Envelope Points	Incremental Cost
6	Lowest cost	60%	ccASHP HSPF2 V 7.6 60% load cover	NG instantaneous	3.85	NA	2.84	0.82	1.5	75.0	25.2	$14,010
7A	Lowest cost	60%	ccASHP HSPF2 V 6.7 60% load cover	NA	4.40	NA	NA	0.82	1.0	75.0	31.8	$14,110
7B	Lowest cost	60%	ccASHP HSPF2 V 6.7 60% load cover	NA	4.84	NA	NA	0.82	1.0	70.0	27.6	$13,470
8	Lowest cost	60%	ccASHP HSPF2 V 6.7 60% load cover	NG instantaneous	5.01	NA	NA	0.82	0.6	70.0	33.6	$17,360

Notes to Table:

ACH = air change per hour; AG = above-ground; BG = below-ground; DWHR = drain-water heat recovery; NG = natural gas

Tables 11 to 13 show the incremental costs for double/semi-detached archetype (≤ 300 m^3) packages for various tiers in different climate zones.

Table 11. Incremental Costs for Double/Semi-Detached Archetype (≤ 300 m^3) Packages for Tier 3 by Climate Zone

Zone	Package	Ventilation ECM	Space Conditioning	Hot Water ECM	AG Walls RSI	DWHR	BG Walls RSI	Fenestration U-Value	ACH @ 50 PA	Total Points	Envelope Points	Incremental Cost
4	Lowest cost	60% SRE	NA	NA	NA	NA	NA	1.22	NA	20.2	6.9	$590
	Lowest cost – no airtightness	60% SRE	NA	NA	NA	NA	NA	1.22	NA	20.2	6.9	$590
5	Lowest cost	60% SRE	NA	NA	NA	NA	NA	NA	2.0	20.0	6.4	$350
	Lowest cost – no airtightness	60% SRE	NA	NA	NA	NA	NA	1.22	NA	20.6	7.0	$590
6	Lowest cost	60% SRE	NA	NA	NA	NA	NA	NA	2.0	20.5	6.9	$350
	Lowest cost – no airtightness	60% SRE	NA	NA	NA	NA	NA	1.05	NA	22.4	8.8	$530
7A	Lowest cost	60% SRE	NA	NA	NA	NA	NA	NA	2.0	21.3	7.6	$350
	Lowest cost – no airtightness	60% SRE	NA	NA	NA	NA	NA	1.05	NA	22.6	8.9	$530
7B	Lowest cost	60% SRE	NA	NA	NA	NA	NA	NA	2.0	22.4	8.5	$350
	Lowest cost – no airtightness	60% SRE	NA	NA	NA	NA	NA	1.05	NA	20.0	6.1	$370
8	Lowest cost	60% SRE	NA	NA	NA	NA	NA	NA	2.0	23.3	9.6	$350
	Lowest cost – no airtightness	60% SRE	NA	NA	NA	NA	NA	0.94	NA	21.5	7.8	$470

Notes to Table:

ACH = air change per hour; AG = above-ground; BG = below-ground; DWHR = drain-water heat recovery; NG = natural gas

Table 12. Incremental Costs for Double/Semi-Detached Archetype (≤ 300 m^3) Packages for Tier 4 by Climate Zone

Zone	Package	Ventilation ECM	Space Conditioning	Hot Water ECM	AG Walls RSI	DWHR	BG Walls RSI	Fenestration U-Value	ACH @ 50 PA	Total Points	Envelope Points	Incremental Cost
4	Lowest cost	60%	NA	NG instantaneous	NA	NA	NA	0.82	1.5	40.0	26.7	$3,710
5	Lowest cost	70%	NA	NA	3.69	NA	NA	0.94	1.5	40.9	27.3	$3,180
6	Lowest cost	60%	NA	NA	3.69	NA	NA	0.82	1.5	40.7	27.1	$3,080
7A	Lowest cost	60%	NA	NA	3.69	NA	NA	0.94	1.5	40.3	26.6	$2,960
7B	Lowest cost	70%	NA	NA	4.40	NA	NA	0.82	1.5	40.1	25.7	$3,030
8	Lowest cost	60%	NA	NA	4.29	NA	NA	0.82	1.5	40.3	26.6	$2,680

Notes to Table:

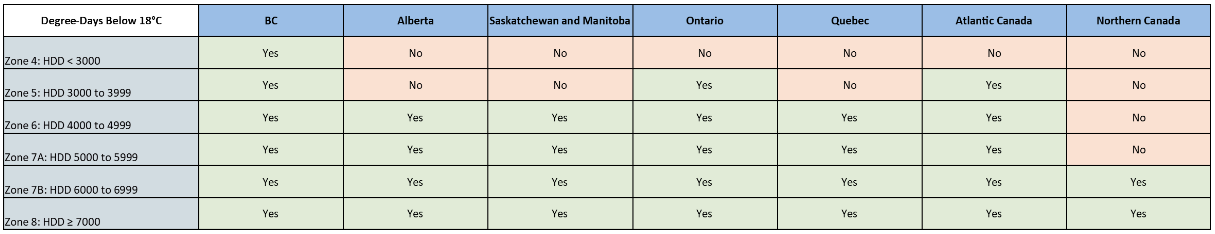
ACH = air change per hour; AG = above-ground; BG = below-ground; DWHR = drain-water heat recovery; NG = natural gas

Table 13. Incremental Costs for Double/Semi-Detached Archetype (≤ 300 m^3) Packages for Tier 5 by Climate Zone

Zone	Package	Ventilation ECM	Space Conditioning	Hot Water ECM	AG Walls RSI	DWHR	BG Walls RSI	Fenestration U-Value	ACH @ 50 PA	Total Points	Envelope Points	Incremental Cost
4	Lowest cost	60%	ccASHP HSPF2 V 6.7 60% load cover	NG instantaneous	NA	NA	NA	0.82	1.5	76.4	20.4	$13,470
5	Lowest cost	60%	ccASHP HSPF2 V 6.7 60% load cover	NA	3.69	NA	NA	0.94	1.5	75.1	27.3	$12,740
6	Lowest cost	60%	ccASHP HSPF2 V 6.7 60% load cover	NA	4.40	NA	NA	0.82	1.5	75.3	30.4	$13,620
7A	Lowest cost	60%	ccASHP HSPF2 V 6.7 60% load cover	NA	4.40	NA	NA	0.82	1.5	75.1	31.9	$13,550
7B	Lowest cost	70%	ccASHP HSPF2 V 6.7 60% load cover	NA	4.73	NA	NA	0.82	1.5	70.0	27.1	$12,980
8	Lowest cost	80%	ccASHP HSPF2 V 6.7 60% load cover	NA	5.45	NA	NA	0.82	1.0	70.0	35.8	$16,430

Table 14 shows the climate zones by region.

Table 14. Climate Zones by Region



Degree-Days Below 18°C	BC	Alberta	Saskatchewan and Manitoba	Ontario	Quebec	Atlantic Canada	Northern Canada
Zone 4: HDD < 3000	Yes	No	No	No	No	No	No
Zone 5: HDD 3000 to 3999	Yes	No	No	Yes	No	Yes	No
Zone 6: HDD 4000 to 4999	Yes	Yes	Yes	Yes	Yes	Yes	No
Zone 7A: HDD 5000 to 5999	Yes	Yes	Yes	Yes	Yes	Yes	No
Zone 7B: HDD 6000 to 6999	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zone 8: HDD ≥ 7000	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 15 shows the lowest incremental cost for single detached archetype packages by region.

Table 15. Lowest Incremental Cost for Single Detached Archetype (> 300 m^3) Packages by Region ($)

Region	Tier 3	Tier 4	Tier 5
BC	3,600–5,320	8,390–11,310	21,200–31,910
AB	3,600–5,320	8,390–11,310	22,250–31,910
SK and MB	3,600–5,320	8,390–11,310	23,830–31,910
ON	3,600–5,320	8,390–11,310	23,830–31,910
QC	3,600–5,320	8,390–11,310	23,830–31,910
Atlantic Canada	3,600–5,320	8,390–11,310	23,830–31,910
Northern Canada	3,600–5,320	8,390–11,310	23,830–31,910

Table 16 shows the lowest incremental cost for row house end unit archetype packages by region.

Table 16. Lowest Incremental Cost for Row House End Unit Archetype (> 300 m^3) Packages by Region ($)

Region	Tier 3	Tier 4	Tier 5
BC	1,070–3,330	4,900–6,490	15,290–23,730
AB	1,070–3,330	4,900–6,490	15,780–23,730
SK and MB	1,070–3,330	4,900–6,490	17,380–23,730
ON	1,070–3,330	4,900–6,490	17,380–23,730
QC	1,070–3,330	4,900–6,490	17,380–23,730
Atlantic Canada	1,070–3,330	4,900–6,490	17,380–23,730
Northern Canada	1,070–3,330	4,900–6,490	17,380–23,730

Table 17 shows the lowest incremental cost for single detached archetype packages by region.

Table 17. Lowest Incremental Cost for Single Detached Archetype (≤ 300 m^3) Packages by Region ($)

Region	Tier 3	Tier 4	Tier 5
BC	350–670	2,960–3,570	12,830–17,360
AB	420–610	3,090–3,570	13,470–17,360
SK and MB	420–610	3,090–3,570	13,470–17,360
ON	350–610	2,960–3,570	12,830–17,360
QC	420–610	3,090–3,570	13,470–17,360
Atlantic Canada	350–610	2,960–3,570	12,830–17,360
Northern Canada	420–540	3,220–3,570	13,470–17,360

Table 18 shows the lowest incremental cost for double/semi-detached archetype packages by region.

Table 18. Lowest Incremental Cost for Double/Semi-Detached Archetype (≤ 300 m^3) Packages by Region ($)

Region	Tier 3	Tier 4	Tier 5
BC	350–590	2,680–3,710	12,740–16,430
AB	350–530	2,680–3,080	12,980–16,430
SK and MB	350–530	2,680–3,080	12,980–16,430
ON	350–590	2,680–3,180	12,740–16,430
QC	350–530	2,680–3,080	12,980–16,430
Atlantic Canada	350–590	2,680–3,180	12,740–16,430
Northern Canada	350–470	2,680–3,030	12,980–16,430

Enforcement implications

This proposed change could be enforced by the existing Code enforcement infrastructure.

Who is affected

Designers, engineers, architects, builders and building officials.

Supporting Document(s)

Additional Cost Information (pcf_1890_supporting_document.pdf)

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.36.8.2.] 9.36.8.2. ([1] 1) no attributions

~~**[9.36.8.2.] 9.36.8.2. ([1] 1) [F90,F91,F92,F93,F95,F96,F98,F99,F100-OE1.1]**~~

[9.36.8.2.] 9.36.8.2. ([1] 1) no attributions

[9.36.8.2.] 9.36.8.2. ([1] 1) no attributions

[9.36.8.2.] 9.36.8.2. ([1] 1) [F95-OE1.1]

[9.36.8.2.] 9.36.8.2. ([1] 1) no attributions

[9.36.8.2.] 9.36.8.2. ([1] 1) [F90,F91,F92,F93,F95-OE1.1]

[9.36.8.2.] 9.36.8.2. ([1] 1) no attributions

[9.36.8.2.] 9.36.8.2. ([1] 1) [F90,F91,F92,F93,F95-OE1.1]

[9.36.8.2.] 9.36.8.2. ([1] 1) no attributions

[9.36.8.2.] 9.36.8.2. ([1] 1) [F90,F91,F92,F93,F95-OE1.1]

Submit a comment

Proposed Change 1838

Code Reference(s):	**NBC20 Div.B 9.36.8.5. (first printing)** **NBC20 Div.B 9.36.8.7. (first printing)** **NBC20 Div.B 9.36.8.9. (first printing)**
Subject:	Prescriptive Trade-off Path
Title:	Energy Conservation Points for HRVs/ERVs and the Building Envelope
Description:	This proposed change adjusts the points for energy conservation measures for the building envelope and for heat-recovery ventilators (HRVs) and for energy-recovery ventilators (ERVs) to align modeling with the performance path.

This change could potentially affect the following topic areas:

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

Problem

When the prescriptive trade-off path was introduced in the National Building Code of Canada (NBC), points were assigned to the energy conservation measures for ventilation systems (e.g., heat-recovery ventilators (HRVs), energy-recovery ventilators (ERVs)) by modeling the reference house using the Code's minimum performance requirements for HRVs. As a result, a smaller credit is provided for HRVs or ERVs than would be obtained using the performance path because the performance path does not require an HRV to be modeled in the reference house.

Since then, the modeling approach to calculate the points for different energy conservation measures has been updated. The new approach models 240 building archetypes in all climate zones to determine the appropriate energy conservation points and does not model an HRV in the reference house (in accordance with Sentence 9.36.5.15.(3) of Division B of the NBC). As a result, the existing points assigned to energy conservation measures for building envelopes need to be updated.

Failure to update the existing energy conservation points would create a discrepancy as the modeling rules used to determine the existing points would be different from those used to assign points to new energy conservation measures. This discrepancy would not allow Code users to benefit from obtaining appropriate energy conservation points to demonstrate compliance with the prescriptive trade-off path.

Justification

This proposed change updates the energy conservation points for HRVs/ERVs in Table 9.36.8.9. of Division B of the NBC and for the building envelope measures in Tables 9.36.8.5. and 9.36.8.7. to demonstrate compliance with the prescriptive trade-off path.

To align with the performance path and assign the appropriate number of points to the energy conservation measures for HRVs, ERVs and the building envelope, energy modeling was conducted using 240 building archetypes in all climate zones without an HRV modeled in the reference house. As a result of this modeling, this proposed change updates the energy conservation points in Tables 9.36.8.5., 9.36.8.7. and 9.36.8.9. to reflect the associated energy savings. This proposed change also updates Table 9.36.8.9. to assign points to specific sensible heat-recovery efficiency values rather than to ranges of values. Updating Table 9.36.8.9. would make this Table consistent with others in the NBC for energy conservation measures.

Furthermore, this proposed change updates the titles of Tables 9.36.8.7. and 9.36.8.9. to reflect their contents. Additionally, this proposed change adds granularity for energy conservation points provided in tabulated form for HRVs/ERVs by allowing interpolation. If this proposed change did not permit interpolation, Code users would only be able to claim the lower number of two point values when the energy conservation measure falls between two values listed in the Tables.

PROPOSED CHANGE

[9.36.8.5.] 9.36.8.5. Energy Conservation Measures for Above-Ground Opaque Building Assemblies

[1] 1) Except as permitted by Articles 9.36.2.5. and 9.36.2.11., and Sentence 9.36.2.6.(3), the effective thermal resistance of above-ground opaque *building* assemblies or portions thereof shall be not less than that shown for the applicable heating degree-days of the *building* location in Table 9.36.2.6.-~~B~~A.

[2] 2) Above-ground walls that comply with one of the energy conservation measures prescribed in Table 9.36.8.5. shall be credited with the corresponding energy conservation points stipulated therein.

[3] 3) The effective thermal resistance of *rim joists* shall be not less than that of the above-ground walls.

[4] 4) Where the top of a section of *foundation* wall is on average greater than or equal to 600 mm above the adjoining ground level, the effective thermal resistance of the above-ground portion of that section of wall shall be not less than that of the above-ground walls.

[5] 5) Except for tubular daylighting devices, the effective thermal resistance of skylight shafts shall be not less than that of the above-ground walls.

[6] 6) Except as provided in Sentence (7), where above-ground walls are constructed using two or more wall assemblies with different calculated effective thermal resistance values, the above-ground wall assembly with the lowest effective thermal resistance value shall be used to determine the applicable energy conservation points from Table 9.36.8.5.

[7] 7) The effective thermal resistance of one or more of the above-ground wall assemblies referred to in Sentence (6) is permitted to be less than that required to meet an energy conservation measure target listed in Table 9.36.8.5. for the wall or walls to be credited with the energy conservation points listed for that target, provided

[a] a) the effective thermal resistance of one or more of the other above-ground wall assemblies is increased to more than the energy conservation measure target listed in Table 9.36.8.5. to account for the wall assemblies that do not meet the target, and

[b] b) the sum of the results of each individual above-ground wall assembly area divided by its respective effective thermal resistance is less than or equal to the total area of all above-ground wall assemblies divided by the effective thermal resistance target listed in Table 9.36.8.5. that is to be credited.

(See also Note A-9.36.2.11.(2).)

Table [9.36.8.5.] 9.36.8.5.
Energy Conservation Measures and Points for Above-Ground Walls (1)
Forming Part of Sentences [9.36.8.5.] 9.36.8.5.([2] 2), ([6] 6) and ([7] 7)

Energy Conservation Measures for Above-Ground Walls – Minimum Effective RSI Values, (m^2×K)/W	**Heating Degree-Days of *Building* Location, 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**
	Energy Conservation Points					
2.97	2.0	–	–	–	–	–
3.08	~~3.2~~2.3	~~1.4~~–	~~1.6~~–	~~2.1~~–	–	–
3.69	~~7.4~~6.3	~~5.4~~4.3	~~6.2~~4.3	~~6.7~~4.4	~~5.4~~–	~~5.2~~–
3.85	~~8.2~~6.9	~~6.0~~5.0	~~6.9~~5.0	~~7.4~~5.2	~~6.2~~–	~~6.0~~–

Energy Conservation Measures for Above-Ground Walls – Minimum Effective RSI Values, (m^2×K)/W	**Heating Degree-Days of *Building* Location, 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**
	Energy Conservation Points					
3.96	~~8.9~~7.5	~~6.8~~5.6	~~7.7~~5.7	~~8.2~~5.8	~~7.0~~0.6	~~6.8~~0.6
4.29	~~10.2~~8.9	~~8.1~~7.1	~~9.2~~7.2	~~9.7~~7.4	~~8.6~~2.3	~~8.4~~2.3
4.40	~~10.8~~9.2	~~8.7~~7.5	~~9.9~~7.6	~~10.3~~7.8	~~9.3~~2.8	~~9.1~~2.7
4.57	~~11.4~~9.8	~~9.3~~8.1	~~10.6~~8.2	~~11.1~~8.4	~~10.1~~3.5	~~9.9~~3.4
4.73	~~11.9~~10.4	~~9.7~~8.8	~~11.1~~8.9	~~11.5~~9.1	~~10.6~~4.2	~~10.4~~4.1
4.84	~~12.3~~10.7	~~10.2~~9.1	~~11.6~~9.2	~~12.1~~9.5	~~11.2~~4.6	~~10.9~~4.5
5.01	~~12.9~~11.1	~~10.7~~9.6	~~12.2~~9.7	~~12.7~~10.0	~~11.8~~5.1	~~11.6~~5.0
5.45	~~14.0~~12.2	~~11.9~~10.8	~~13.6~~10.9	~~14.0~~11.2	~~13.3~~6.5	~~13.1~~6.4

Note to Table [9.36.8.5.] 9.36.8.5.:

(1) See also Subsection 9.25.5.

[9.36.8.7.] 9.36.8.7. Energy Conservation Measures for Opaque Building Assemblies Below-Grade or in Contact with the Ground

[1] **1)** Opaque *building* assemblies below-grade or in contact with the ground shall be designed and constructed in accordance with Sentences 9.36.2.8.(2) to (10) and this Article.

[2] **2)** Except as permitted by Article 9.36.2.5., the effective thermal resistance of *foundation* walls shall be not less than that shown for the applicable heating degree-days of the *building* location in Table 9.36.2.8.-~~B~~A.

[3] **3)** *Foundation* walls that comply with one of the energy conservation measures prescribed in Table 9.36.8.7. shall be credited with the corresponding energy conservation points stipulated therein.

[4] **4)** Where *foundation* walls are constructed with more than one effective thermal resistance (RSI) value, the lowest effective RSI value of any of these walls shall be used to determine the applicable energy conservation points from Table 9.36.8.7.

Table [9.36.8.7.] 9.36.8.7.
Energy Conservation Measures and Points for ~~Opaque Building Assemblies Below-Grade or In Contact with Ground~~Foundation Walls
Forming Part of Sentences [9.36.8.7.] 9.36.8.7.([3] 3) and ([4] 4)

Energy Conservation Measures for *Foundation* Walls – Minimum Effective RSI Values, (m^2×K)/W	**Heating Degree-Days of *Building* Location, 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**
	Energy Conservation Points					
2.98	~~1.7~~2.5	–	–	–	–	–
3.09	~~1.8~~2.7	0.2	0.2	~~0.2~~–	~~0.2~~–	–
3.46	~~2.2~~3.2	~~0.6~~0.7	0.8	~~0.6~~–	~~0.7~~–	–
3.90	~~2.6~~3.7	~~1.2~~1.3	~~1.4~~1.5	~~1.1~~0.7	~~1.3~~0.9	–

[9.36.8.9.] 9.36.8.9. Energy Conservation Measures for HVAC Systems

[1] **1)** HVAC systems, equipment and installations shall be designed and constructed in accordance with Articles 9.36.3.2. to 9.36.3.8. and this Article.

[2] **2)** Where HVAC systems, equipment or techniques other than those described in Articles 9.36.3.2. to 9.36.3.8. and this Article are used, the *building* shall be designed and constructed in accordance with the NECB.

[3] **3)** Ventilation systems serving *buildings* to which this Subsection applies shall be equipped with a heat-recovery ventilator conforming to Article 9.36.3.9.

[4] **4)** Heat-recovery ventilators and energy-recovery ventilators that comply with one of the energy conservation measures prescribed in Table 9.36.8.9. shall be credited with the corresponding energy conservation points stipulated therein.

Table [9.36.8.9.] 9.36.8.9.
Energy Conservation Measures and Points for ~~Ventilation Systems~~Heat-Recovery Ventilators (HRVs) and Energy-Recovery Ventilators (ERVs)
Forming Part of Sentence [9.36.8.9.] 9.36.8.9.([4] 4)

Energy Conservation Measures for ~~Ventilation Systems~~HRVs and ERVs – Sensible Heat-Recovery Efficiency, SRE (1) (2)	Heating Degree-Days of *Building* Location, 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
	Energy Conservation Points					
60% ~~≤ SRE < 65%~~	~~0.7~~3.3	~~0.7~~3.6	~~0.7~~3.6	~~0.6~~3.7	~~0.8~~3.9	~~0.4~~3.7
~~65% ≤ SRE < 75%~~70%	~~2.1~~3.9	~~2.1~~4.2	~~2.2~~4.2	~~1.7~~4.2	~~2.3~~4.4	~~1.2~~4.1
~~75% ≤ SRE < 84%~~ 80%	~~3.4~~4.4	~~3.2~~4.8	~~3.5~~4.8	~~2.7~~4.8	~~3.7~~5.0	~~1.8~~4.6
85%	4.7	5.1	5.1	5.0	5.3	4.8

Notes to Table [9.36.8.9.] 9.36.8.9.:

(1) SRE = sensible heat-recovery efficiency measured at an outside air test temperature of 0°C

(2) For intermediate values of SRE, linear interpolation of energy conservation points is permitted.

Impact analysis

This proposed change would make complying with the energy performance tiers through the prescriptive trade-off path more affordable by updating the energy conservation points for the building envelope measures and heat-recovery ventilators (HRVs) or energy-recovery ventilators (ERVs). These updates to the energy conservation points would allow Code users to obtain credit for the energy savings associated with building envelope measures that exceed the minimum energy performance of Energy Performance Tier 1 and associated with installing an HRV or ERV. Accumulating the appropriate number of energy conservation points in the prescriptive trade-off path is one of the compliance options for Code users, and the estimated incremental costs of each of the options are listed in Tables 2 to 4.

It should be noted that the costs listed in this analysis are an estimate depending on various factors. One major assumption was to obtain cost data for a specific region and adjust the data for other regions using the location factors provided by RSMeans. The location factors in Table 1 were used for the cost estimation, based on 2023 values.

Table 1. Location Factors by Region

Region	**Location Factor**
BC	0.98–1.05
AB	1.02–1.09
SK and MB	0.88–1.07
ON	1.01–1.15
QC	1.06–1.17
Atlantic Canada	0.88–1.05
Northern Canada	1.03–1.12

Building Envelope Measures

The incremental insulation costs listed in Table 2 represent the incremental material cost (expressed in $\$/\text{m}^2$). The cost gradually increases with an increase in the effective RSI value.

Table 2. Cost Analysis for Above-Ground Walls by Region (Impact of Proposed Changes to Table 9.36.8.5.)

Effective RSI(1)	**Energy Savings (%)**	**Incremental Cost of Insulation ($\$/\text{m}^2$)**						
		BC	AB	SK and MB	ON	QC	Atlantic Canada	Northern Canada
2.97	2	18.72–18.84	18.08–18.84	14.10–18.30	14.53–14.84	14.10–17.44	14.10–18.73	18.08–19.48
3.08	2.3	19.05–19.38	18.30–19.27	14.32–18.62	15.07–16.68	14.32–17.76	14.32–19.05	18.29–19.91
3.69	4.3–6.3	22.39–22.61	20.13–21.42	16.15–21.74	21.53–23.68	16.15–20.24	16.15–22.60	20.12–22.60
3.85	5.0–6.9	23.04–23.47	22.39–23.14	17.43–22.60	22.39–22.60	17.44–21.74	17.44–23.47	22.38–23.68
3.96	0.6–7.5	26.58–26.69	23.14–24.43	17.98–25.83	23.14–23.68	17.98–22.60	17.98–26.59	23.14–24.54
4.29	2.3–8.9	29.39–29.82	29.28–30.14	22.82–29.06	28.53	22.82–28.53	22.82–29.82	29.27–31.22
4.40	2.7–9.2	32.29–32.50	32.08–32.83	24.76–32.83	31.22–31.65	24.76–31.22	24.76–32.51	32.07–33.91
4.57	3.4–9.8	35.52–35.73	34.23–35.95	27.13–35.74	33.58–34.23	27.13–33.37	27.13–35.74	34.23–36.81
4.73	4.1–10.4	35.84–36.06	34.55–36.17	27.23–35.95	33.80–34.34	27.23–32.29	27.23–35.84	34.55–37.03
4.84	4.5–10.7	36.06–36.60	34.77–36.60	27.34–36.28	33.91–34.45	27.34–33.58	27.34–36.06	34.76–37.24
5.01	5.0–11.1	36.27–37.14	35.09–36.81	27.77–36.60	34.12–34.67	27.77–34.23	27.77–36.28	35.09–37.89
5.45	6.4–12.2	37.13–37.68	36.81–37.67	28.53–37.67	34.66–35.52	28.53–35.52	28.53–37.14	36.81–39.29

Source: RSMeans

Notes to Table 2:

(1) Insulation type: Blanket insulation, Kraft-faced fiberglass

The incremental insulation costs listed in Table 3 represent the incremental material cost (expressed in $\$/\text{m}^2$). The cost gradually increases with an increase in the effective RSI value.

Table 3. Cost Analysis for Foundation Walls by Region (Impact of Proposed Changes to Table 9.36.8.7.)

Effective RSI$^{(2)}$	Energy Savings (%)	Incremental Cost of Insulation$^{(1)}$ (\$/m^2)						
		BC	AB	SK and MB	ON	QC	Atlantic Canada	Northern Canada
2.98	2.5	66.70	63.67–66.82	54.82–65.61	60.88–63.79	56.64–61.61	54.82–66.22	67.19–69.86
3.09	0.2–2.7	69.07	65.93–69.20	56.76–67.94	63.04–66.06	58.65–63.80	56.76–68.57	69.57–72.34
3.46	0.7–3.2	89.85	86.01–90.19	73.47–88.05	82.73–86.01	76.74–83.30	73.47–89.52	89.85–93.65
3.90	0.7–3.7	93.70	89.70–94.06	76.61–91.82	86.28–89.70	80.03–86.87	76.61–93.35	93.71–97.74

Source: RSMeans

Notes to Table 3:

(1) Assumption: Rigid insulation, extruded polystyrene (XPS)

(2) Thickness of assumed insulation type: 3 in. for RSI 2.98, 3.5 in. for RSI 3.09, 4 in. for RSI 3.46, 4.5 in. for RSI 3.90.

HRV/ERV

This proposed change would make complying with the energy performance tiers through the prescriptive path more affordable by increasing the number of measures eligible for energy conservation points and allowing Code users to obtain credits that reflect the energy savings associated with installing an HRV or an ERV.

The incremental costs listed in Table 4 represent the incremental HRV/ERV material cost. The output fresh air for the units is between 80 ft.^{3}/min and 110 ft.^{3}/min. The incremental cost is calculated by comparing the cost of a higher performance unit with the cost of an SRE 60% HRV, which is the minimum efficiency required for an HRV in Energy Performance Tier 1 in Section 9.36. The incremental costs for SRE 60% and SRE 65% ventilators are similar, hence there is no incremental cost for an SRE 65% HRV. HRVs with efficiencies over 80% are not commonly installed, and as a result, the incremental cost is high.

Table 4. Cost Analysis for HRV/ERV by Region (Impact of Proposed Changes to Table 9.36.8.9.)

SRE$^{(1)}$	Energy Savings (%)	Incremental Costs of HRVs/ERVs (\$) by Region						
		ON	BC	QC	SK and MB	Atlantic Canada	AB	Northern Canada
65%	3.3–3.9	0	0	0	0	0	0	0
70%	3.9–4.4	200	200	200	200	200	200	200
80%	4.4–5.0	395	395	395	395	395	395	395
85%	4.7–5.3	1,305	1,305	1,305	1,305	1,305	1,305	1,305

Source: buildwithrise.ca; prices include retail markup and Canada-wide free shipping.

Notes to Table 4:

(1) Products: Honeywell Home VNT5070H1000/U (SRE ~60%)

Greentek PH 7.15 ES (SRE~65%)

Greentek PH 10.22 ES (SRE~70%)

Greentek Solace 2.0H (SRE~80%)

Greentek Solace 1.5H-EC (SRE~85%)

Enforcement implications

This proposed change could be enforced by the existing Code enforcement infrastructure.

Who is affected

Designers, engineers, architects, builders and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.36.8.5.] 9.36.8.5. ([1] 1) no attributions

[9.36.8.5.] 9.36.8.5. ([2] 2) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([3] 3) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([4] 4) no attributions

[9.36.8.5.] 9.36.8.5. ([4] 4) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([5] 5) no attributions

[9.36.8.5.] 9.36.8.5. ([5] 5) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([6] 6) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([7] 7) [F92-OE1.1]

[9.36.8.7.] 9.36.8.7. ([1] 1) no attributions

[9.36.8.7.] 9.36.8.7. ([2] 2) [F92-OE1.1]

[9.36.8.7.] 9.36.8.7. ([3] 3) [F92-OE1.1]

[9.36.8.7.] 9.36.8.7. ([4] 4) no attributions

[9.36.8.9.] 9.36.8.9. ([1] 1) no attributions

[9.36.8.9.] 9.36.8.9. ([2] 2) no attributions

[9.36.8.9.] 9.36.8.9. ([3] 3) no attributions

[9.36.8.9.] 9.36.8.9. ([3] 3) [F95,F100-OE1.1]

[9.36.8.9.] 9.36.8.9. ([4] 4) [F95-OE1.1]

Submit a comment

Proposed Change 1923

Code Reference(s):	**NBC20 Div.B 9.36.8.5. (first printing)** **NBC20 Div.B 9.36.8.7. (first printing)**
Subject:	Prescriptive Trade-off Path
Title:	Energy Conservation Points for the Building Envelope
Description:	This proposed change assigns energy conservation points for new building envelope measures.

This change could potentially affect the following topic areas:

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

Problem

The National Building Code of Canada (NBC) does not currently assign energy conservation points to ceilings below attics, cathedral ceilings or flat roofs, exposed floors or slabs-on-grade that exceed the minimum Code requirements.

Failure to assign energy conservation points to new conservation measures will not allow Code users to benefit from obtaining the associated energy savings when performance levels for these components exceed the minimum performance required by Energy Performance Tier 1, for the purposes of demonstrating compliance with the prescriptive trade-off path. These Code users would then need to demonstrate compliance using the energy performance path, which might necessitate hiring a professional energy advisor.

In order to accumulate the total energy conservation points required for compliance with higher tiers in the prescriptive trade-off path, Code users should have additional options for energy conservation measures than those currently provided in the Code.

Justification

This proposed change assigns energy conservation points for ceilings below attics, cathedral ceilings and flat roofs, exposed floors and slabs-on-grade for the purposes of compliance with the prescriptive trade-off path.

If energy conservation points are assigned to these building envelope measures that exceed the minimum energy performance required by Tier 1, the Code users who choose to install these measures will benefit from the additional options for demonstrating compliance with a higher energy performance tier.

This proposed change also assigns energy conservation points for combined roof systems consisting of ceilings below attics and cathedral ceilings or flat roofs to provide Code users with more options to receive a representative number of points based on roof design. For combined roof types, an average RSI of 5.80 is assumed for flat roofs, which is higher than the minimum for all climate zones. The thermal insulation of flat roofs becomes significantly cost inefficient beyond 5.80 RSI. Assigned energy conservation points gradually decrease as the climate zone becomes colder because the building envelope is required to meet a higher insulation baseline, which reduces the significance of the energy savings.

Additionally, this proposed change adds granularity for energy conservation points provided in tabulated form for ceilings below attics, cathedral ceilings and flat roofs, exposed floors and slabs-on-grade by allowing interpolation. If this proposed change did not permit interpolation, Code users would only be able to claim the lower of two point values when the energy conservation measure falls between two values listed in proposed Tables 9.36.8.5.-B to -E and 9.36.8.7.-B.

Failure to add additional energy conservation measures might prevent Code users from accumulating sufficient points to comply with higher tiers, as required by their respective jurisdictions.

PROPOSED CHANGE

[9.36.8.5.] 9.36.8.5. Energy Conservation Measures for Above-Ground Opaque Building Assemblies

[1] **1)** Except as permitted by Articles 9.36.2.5. and 9.36.2.11., and Sentence 9.36.2.6.(3), the effective thermal resistance of above-ground opaque *building* assemblies or portions thereof shall be not less than that shown for the applicable heating degree-days of the *building* location in Table 9.36.2.6.-B.

[2] **2)** Above-ground walls that comply with one of the energy conservation measures prescribed in Table 9.36.8.5. shall be credited with the corresponding energy conservation points stipulated therein.

[3] **3)** The effective thermal resistance of *rim joists* shall be not less than that of the above-ground walls.

[4] **4)** Where the top of a section of *foundation* wall is on average greater than or equal to 600 mm above the adjoining ground level, the effective thermal resistance of the above-ground portion of that section of wall shall be not less than that of the above-ground walls.

[5] **5)** Except for tubular daylighting devices, the effective thermal resistance of skylight shafts shall be not less than that of the above-ground walls.

[6] **6)** Except as provided in Sentence (7), where above-ground walls are constructed using two or more wall assemblies with different calculated effective thermal resistance values, the above-ground wall assembly with the lowest effective thermal resistance value shall be used to determine the applicable energy conservation points from Table 9.36.8.5.

[7] **7)** The effective thermal resistance of one or more of the above-ground wall assemblies referred to in Sentence (6) is permitted to be less than that required to meet an energy conservation measure target listed in Table 9.36.8.5. for the wall or walls to be credited with the energy conservation points listed for that target, provided

[a] a) the effective thermal resistance of one or more of the other above-ground wall assemblies is increased to more than the energy conservation measure target listed in Table 9.36.8.5. to account for the wall assemblies that do not meet the target, and

[b] b) the sum of the results of each individual above-ground wall assembly area divided by its respective effective thermal resistance is less than or equal to the total area of all above-ground wall assemblies divided by the effective thermal resistance target listed in Table 9.36.8.5. that is to be credited.

(See also Note A-9.36.2.11.(2).)

Table [9.36.8.5.-A] 9.36.8.5.
Energy Conservation Measures and Points for Above-Ground Walls (1)
Forming Part of Sentences [9.36.8.5.] 9.36.8.5.([2] 2), ([6] 6) and ([7] 7)

Energy Conservation Measures for Above-Ground Walls – Minimum Effective RSI Values, $(m^2 \times K)/W$	**Heating Degree-Days of *Building* Location, 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**
	Energy Conservation Points					
2.97	2.0	–	–	–	–	–
3.08	3.2	1.4	1.6	2.1	–	–
3.69	7.4	5.4	6.2	6.7	5.4	5.2
3.85	8.2	6.0	6.9	7.4	6.2	6.0
3.96	8.9	6.8	7.7	8.2	7.0	6.8
4.29	10.2	8.1	9.2	9.7	8.6	8.4
4.40	10.8	8.7	9.9	10.3	9.3	9.1
4.57	11.4	9.3	10.6	11.1	10.1	9.9
4.73	11.9	9.7	11.1	11.5	10.6	10.4
4.84	12.3	10.2	11.6	12.1	11.2	10.9
5.01	12.9	10.7	12.2	12.7	11.8	11.6
5.45	14.0	11.9	13.6	14.0	13.3	13.1

Note to Table [9.36.8.5.-A] 9.36.8.5.:

(1) See also Subsection 9.25.5.

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[8] --) Roof systems consisting solely of ceilings below attics that comply with one of the energy conservation measures prescribed in Table 9.36.8.5.-B shall be credited with the corresponding energy conservation points stipulated therein.

Table [9.36.8.5.-B]
Energy Conservation Measures and Points for Ceilings Below Attics
Forming Part of Sentence 9.36.8.5.(9)

Energy Conservation Measures for Ceilings Below Attics – Minimum Effective RSI Values, (m²×K)/W [(1)]	Heating Degree-Days of *Building* Location, 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
	Energy Conservation Points					
8.67	1.2	–	–	–	–	–
10.43	2.1	0.9	0.9	–	–	–
12.19	2.7	1.6	1.6	0.7	0.8	0.8
13.96	3.1	2.1	2.1	1.2	1.4	1.3

Note to Table [9.36.8.5.-B] :

(1) For intermediate values of minimum effective RSI, linear interpolation of energy conservation points is permitted.

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[9] --) Roof systems consisting solely of cathedral ceilings and flat roofs that comply with one of the energy conservation measures prescribed in Table 9.36.8.5.-C shall be credited with the corresponding energy conservation points stipulated therein.

Table [9.36.8.5.-C]
Energy Conservation Measures and Points for Cathedral Ceilings and Flat Roofs
Forming Part of Sentence 9.36.8.5.(10)

Energy Conservation Measures for Cathedral Ceilings and Flat Roofs – Minimum Effective RSI Values, (m²×K)/W [(1)]	Heating Degree-Days of *Building* Location, 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
	Energy Conservation Points					
5.02	0.5	0.5	0.5	–	–	–
5.80	1.4	1.5	1.6	1.0	1.1	1.1
6.49	2.0	2.2	2.3	1.8	1.9	1.9

Note to Table [9.36.8.5.-C] :

(1) For intermediate values of minimum effective RSI, linear interpolation of energy conservation points is permitted.

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[10] --) Roof systems consisting of a combination of ceilings below attics and cathedral ceilings or flat roofs that comply with one of the energy conservation measures prescribed in Table 9.36.8.5.-D shall be credited with the corresponding energy conservation points stipulated therein.

Table [9.36.8.5.-D]
Energy Conservation Measures and Points for Combined Ceilings Below Attics and Cathedral Ceilings or Flat Roofs
Forming Part of Sentence 9.36.8.5.(11)

Energy Conservation Measures for Ceilings Below Attics– Minimum Effective RSI Values, (m²×K)/W [(1)]	Energy Conservation Measures for Cathedral Ceilings and Flat Roofs– Minimum Effective RSI Values, (m²×K)/W[(1)]	Heating Degree-Days of *Building* Location, 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
		Energy Conservation Points					
8.67	5.80	1.3	–	–	–	–	–
10.43	5.80	1.8	1.1	1.1	–	–	–
12.19	5.80	2.2	1.5	1.5	0.8	0.8	0.8
13.96	5.80	2.5	1.8	1.8	1.1	1.2	1.1

Note to Table [9.36.8.5.-D] :

(1) For intermediate values of minimum effective RSI, linear interpolation of energy conservation points is permitted.

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[11] --) Exposed floors not less than 30 m² in total area that comply with one of the energy conservation measures prescribed in Table 9.36.8.5.-E shall be credited with the corresponding energy conservation points stipulated therein.

Table [9.36.8.5.-E]
Energy Conservation Measures and Points for Exposed Floors (≥ 30 m²)
Forming Part of Sentence 9.36.8.5.(12)

Energy Conservation Measures for Exposed Floors – Minimum Effective RSI Values, (m²×K)/W [(1)]	Heating Degree-Days of *Building* Location, 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
	Energy Conservation Points					
5.02	0.2	0.2	0.2	–	–	–
5.42	0.5	0.5	0.5	0.2	0.3	0.3
6.77	1.1	1.1	1.1	0.9	1.0	0.9

Note to Table [9.36.8.5.-E] :

(1) For intermediate values of minimum effective RSI, linear interpolation of energy conservation points is permitted.

[9.36.8.7.] 9.36.8.7. Energy Conservation Measures for Opaque Building Assemblies Below-Grade or in Contact with the Ground

[1] 1) Opaque *building* assemblies below-grade or in contact with the ground shall be designed and constructed in accordance with Sentences 9.36.2.8.(2) to (10) and this Article.

[2] 2) Except as permitted by Article 9.36.2.5., the effective thermal resistance of *foundation* walls shall be not less than that shown for the applicable heating degree-days of the *building* location in Table 9.36.2.8.-B.

[3] 3) *Foundation* walls that comply with one of the energy conservation measures prescribed in Table 9.36.8.7. shall be credited with the corresponding energy conservation points stipulated therein.

[4] 4) Where *foundation* walls are constructed with more than one effective thermal resistance (RSI) value, the lowest effective RSI value of any of these walls shall be used to determine the applicable energy conservation points from Table 9.36.8.7.

Table [9.36.8.7.-A] 9.36.8.7.
Energy Conservation Measures and Points for Opaque Building Assemblies Below-Grade or In Contact with Ground
Forming Part of Sentences [9.36.8.7.] 9.36.8.7.([3] 3) and ([4] 4)

Energy Conservation Measures for *Foundation* Walls – Minimum Effective RSI Values, (m^2×K)/W	Heating Degree-Days of *Building* Location, 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
	Energy Conservation Points					
2.98	1.7	–	–	–	–	–
3.09	1.8	0.2	0.2	0.2	0.2	–
3.46	2.2	0.6	0.8	0.6	0.7	–
3.90	2.6	1.2	1.4	1.1	1.3	–

[5] --) Slabs-on-grade that comply with one of the energy conservation measures prescribed in Table 9.36.8.7.-B shall be credited with the corresponding energy conservation points stipulated therein.

Table [9.36.8.7.-B] 9.36.8.7.
Energy Conservation Measures and Points for Slabs-on-Grade
Forming Part of Sentence 9.36.8.7.(5)

Energy Conservation Measures for Slabs-on-Grade – Minimum Effective RSI Values, (m^2×K)/W (1)	Heating Degree-Days of *Building* Location, 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
	Energy Conservation Points					
2.84	1.0	0.8	0.9	–	–	–
3.72	1.6	1.3	1.4	–	–	–
4.62	2.0	1.7	1.8	0.5	0.5	–

Note to Table [9.36.8.7.-B] 9.36.8.7.:

(1) For intermediate values of minimum effective RSI, linear interpolation of energy conservation points is permitted.

Impact analysis

This proposed change would improve the affordability of complying with the energy performance tiers through the prescriptive trade-off path by providing additional options for energy conservation measures, which are eligible for energy conservation points. These additional measures included in the proposed change allow Code users to obtain credit for the energy savings associated with building envelope measures that exceed the minimum energy performance of tier 1. Accumulating the appropriate number of energy conservation points in the prescriptive trade-off path is one of the compliance options for Code users. The estimated costs of each option are listed below.

It should be noted that the costs listed in the analysis are estimates that depend on various factors. One method used to conduct the analysis was obtaining cost data for a specific region and adjusting for other regions using the location factors provided by RSMeans. The location factors in Table 1 were used for cost estimation based on 2023 values.

Table 1. Location Factors by Region

Region	Location Factor
BC	0.98–1.05
AB	1.02–1.09
SK and MB	0.88–1.07
ON	1.01–1.15
QC	1.06–1.17
Atlantic Canada	0.88–1.05
Northern Canada	1.03–1.12

Table 2. Cost Analysis for Ceilings Below Attics (Impact of Proposed Table 9.36.8.5-B)

Effective RSI	Energy Savings (%)	Incremental Costs of Insulation(1) ($/m^2)						
		BC	AB	SK and MB	ON	QC	Atlantic Canada	Northern Canada
8.67	1.2	1.93–2.05	2.04–2.15	1.72–2.15	2.05–2.26	2.15–2.37	1.72–2.05	2.05–2.26
10.43	0.9–2.1	1.93–2.05	2.04–2.15	1.72–2.15	2.05–2.26	2.15–2.37	1.72–2.05	2.05–2.26
12.19	0.7–2.7	2.90–3.12	3.01–3.23	2.58–3.23	3.01–3.44	3.12–3.55	2.58–3.12	3.12–3.34
13.96	1.2–3.1	2.90–3.12	3.01–3.23	2.58–3.23	3.01–3.44	3.12–3.55	2.58–3.12	3.12–3.34

Source: Task Group on Prescriptive Trade-off Path in Section 9.36.

Note to Table 2:

(1) Insulation type: blown cellulose.

The incremental insulation costs listed in Table 2 represent incremental material costs. The costs obtained from a reputed builder in Ontario are for that province. Costs for other regions are calculated by adjusting the Ontario cost using the location factors provided. The costs gradually increase with an increase in effective RSI values.

Table 3. Cost Analysis for Cathedral Ceilings and Flat Roofs (Impact of Proposed Table 9.36.8.5-C)

Effective RSI(2)	Energy Savings (%)	Incremental Costs of Insulation(1) ($/m^2)						
		BC	AB	SK and MB	ON	QC	Atlantic Canada	Northern Canada
5.02	0.5	7.75–7.86	7.42–7.75	6.57–7.86	6.99–7.43	4.84–6.57	6.03–7.64	8.07–8.29
5.80	1.0–1.6	15.71–15.82	14.74–15.61	13.13–15.61	13.89–14.96	13.13–14.21	12.16–15.29	16.14–16.58
6.49	1.8–2.3	23.57–23.68	22.17–23.36	19.59–23.36	20.88–22.39	19.59–21.42	18.19–23.04	24.21–24.87

Source: RSMeans

Notes to Table 3:

(1) Insulation type: closed cell, spray polyurethane foam.

(2) Insulation thickness: 4.5 in. for RSI 5.02, 5 in. for RSI 5.8, 5.5 in. for RSI 6.49.

The incremental insulation costs listed in Table 3 represent incremental material costs. The costs gradually increase with an increase in effective RSI values.

Table 4. Cost Analysis for Combined Ceiling Below Attics and Cathedral Ceilings or Flat Roofs (Impact of Proposed Table 9.36.8.5-D)

Effective RSI		Energy Savings (%)	Incremental Costs of Insulation$^{(1)}$ $(\$/\mathrm{m}^2)$						
Attics	Cathedral Ceilings or Flat Roofs		BC	AB	SK and MB	ON	QC	Atlantic Canada	Northern Canada
8.67	5.80	1.3	8.88	8.63	8.10	8.26	7.98	7.78	9.23
10.43	5.80	1.1–1.8	8.88	8.63	8.10	8.26	7.98	7.78	9.23
12.19	5.80	0.8–2.2	9.38	9.13	8.55	8.81	8.50	8.25	9.76
13.96	5.80	1.1–2.5	9.38	9.13	8.55	8.81	8.50	8.25	9.76

Source: RSMeans

Note to Table 4:

(1) Insulation type: blown cellulose (for ceilings below attic); closed cell, spray polyurethane foam (for cathedral ceilings and flat roofs).

The tabulated cost is an approximation for combined roof types assuming an area comprised of 50% ceiling below attic and 50% cathedral ceiling or flat roof. The incremental insulation costs listed in Table 4 represent incremental material costs. The costs gradually increase with an increase in effective RSI values.

Table 5. Cost Analysis for Exposed Floors (Impact of Proposed Table 9.36.8.5-E)

Effective RSI$^{(2)}$	Energy Savings (%)	Incremental Cost of Insulation$^{(1)}$ $(\$/\mathrm{m}^2)$						
		BC	AB	SK and MB	ON	QC	Atlantic Canada	Northern Canada
5.02	0.2	7.75–7.86	7.42–7.75	6.57–7.86	6.99–7.43	4.84–6.57	6.03–7.64	8.07–8.29
5.42	0.2–0.5	15.71–15.82	14.74–15.61	13.13–15.61	13.88–14.96	13.13–14.21	12.16–15.29	16.14–16.58
6.77	0.9–1.1	31.86–32.08	30.14–31.75	26.59–31.75	28.31–30.36	26.59–29.06	24.75–31.22	32.83–33.69

Source: RSMeans

Notes to Table 5:

(1) Insulation type: closed cell, spray polyurethane foam.

(2) Insulation thickness: 4.5 in. for RSI 5.02, 5 in. for RSI 5.42, 6 in. for RSI 6.77.

The incremental insulation costs listed in Table 5 represent incremental material costs. The costs gradually increase with an increase in effective RSI values.

Table 6. Cost Analysis for Slabs-on-Grade (Impact of Proposed Table 9.36.8.7-B)

Effective RSI$^{(2)}$	Energy Savings (%)	Incremental Cost of Insulation$^{(1)}$ $(\$/\mathrm{m}^2)$						
		BC	AB	SK and MB	ON	QC	Atlantic Canada	Northern Canada
2.84	0.8–1.0	20.77–20.88	19.69–20.67	17.33–20.67	18.40–18.62	17.33–18.95	16.14–20.34	21.42–21.96
3.72	1.3–1.6	43.70–43.92	41.87–43.49	36.49–43.49	38.85–39.19	36.49–39.94	34.01–42.84	45.10–46.18
4.62	0.5–2.0	55.54–55.87	52.63–54.25	46.28–55.22	49.40–49.84	46.28–50.70	43.16–54.47	57.26–58.77

Source: RSMeans

Notes to Table 6:

(1) Assumption: rigid insulation, extruded polystyrene (XPS).
(2) Thickness of assumed insulation: 3 in. for RSI 2.84, 4 in. for RSI 3.72, 5 in. for RSI 4.62.

The incremental insulation costs listed in Table 6 represent incremental material costs. The costs gradually increase with an increase in effective RSI values.

Enforcement implications

This proposed change could be enforced by the existing Code enforcement infrastructure.

Who is affected

Designers, engineers, architects, builders and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.36.8.5.] 9.36.8.5. ([1] 1) no attributions

[9.36.8.5.] 9.36.8.5. ([2] 2) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([3] 3) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([4] 4) no attributions

[9.36.8.5.] 9.36.8.5. ([4] 4) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([5] 5) no attributions

[9.36.8.5.] 9.36.8.5. ([5] 5) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([6] 6) [F92-OE1.1]

[9.36.8.5.] 9.36.8.5. ([7] 7) [F92-OE1.1]

[9.36.8.5.] -- ([8] --) [F92-OE1.1]

[9.36.8.5.] -- ([9] --) [F92-OE1.1]

[9.36.8.5.] -- ([10] --) [F92-OE1.1]

[9.36.8.5.] -- ([11] --) [F92-OE1.1]

[9.36.8.7.] 9.36.8.7. ([1] 1) no attributions

[9.36.8.7.] 9.36.8.7. ([2] 2) [F92-OE1.1]

[9.36.8.7.] 9.36.8.7. ([3] 3) [F92-OE1.1]

[9.36.8.7.] 9.36.8.7. ([4] 4) no attributions

[9.36.8.7.] -- ([5] --) [F92-OE1.1]

Submit a comment

Proposed Change 2000

Code Reference(s):	**NBC20 Div.B 9.36.8.9. (first printing)**
Subject:	Prescriptive Trade-off Path
Title:	Energy Conservation Points for Oil-fired Furnaces
Description:	This proposed change assigns energy conservation points to oil-fired furnaces for compliance with the prescriptive trade-off path in Section 9.36.

This change could potentially affect the following topic areas:

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

Problem

The National Building Code of Canada (NBC) does not currently assign energy conservation points to oil-fired furnaces in the prescriptive trade-off path in Section 9.36. This proposed change would establish the number of energy conservation points assigned to oil-fired furnaces with performance levels that exceed the minimum performance required by Energy Performance Tier 1.

A failure to assign energy conservation points to oil-fired furnaces would not allow Code users to obtain the energy conservation points associated with the energy savings from installing a high-efficiency oil-fired furnace unless they used the performance compliance path.

In order to accumulate the total number of energy conservation points required to demonstrate compliance with higher tiers, Code users should have additional options in terms of energy conservation measures than those currently provided in the Code.

Justification

The choice of oil-fired furnace contributes to energy savings in a building. Code users who choose to install a high-efficiency oil-fired furnace should benefit from the additional energy savings provided by the equipment when complying with the prescriptive trade-off path in Section 9.36.

If energy conservation points are assigned to oil-fired furnaces that exceed the minimum performance required by Energy Performance Tier 1 in the NBC, Code users would benefit from this additional option for demonstrating compliance with a higher energy performance tier in the prescriptive trade-off path.

Additionally, this proposed change adds granularity for energy conservation points provided in tabulated form for oil-fired furnaces by allowing interpolation. If this proposed change did not permit interpolation, Code users would only be able to claim the lower of two point values when the energy conservation measure falls between two values listed in proposed Table 9.36.8.9.-B.

Failure to add additional energy conservation measures to the Code might prevent Code users from accumulating sufficient points to comply with higher tiers, as required by their respective jurisdictions.

PROPOSED CHANGE

[9.36.8.9.] 9.36.8.9. Energy Conservation Measures for HVAC Systems

[1] **1)** HVAC systems, equipment and installations shall be designed and constructed in accordance with Articles 9.36.3.2. to 9.36.3.8. and this Article.

[2] **2)** Where HVAC systems, equipment or techniques other than those described in Articles 9.36.3.2. to 9.36.3.8. and this Article are used, the *building* shall be designed and constructed in accordance with the NECB.

[3] **3)** Ventilation systems serving *buildings* to which this Subsection applies shall be equipped with a heat-recovery ventilator conforming to Article 9.36.3.9.

[4] **4)** Heat-recovery ventilators that comply with one of the energy conservation measures prescribed in Table 9.36.8.9. shall be credited with the corresponding energy conservation points stipulated therein.

Table [9.36.8.9.-A] 9.36.8.9.
Energy Conservation Measures and Points for Ventilation Systems
Forming Part of Sentence [9.36.8.9. 9.36.8.9.] 9.36.8.9.([4 5] 4)

Energy Conservation Measures for Ventilation Systems – Sensible Heat-Recovery Efficiency, SRE [1]	Heating Degree-Days of *Building* Location, 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
	Energy Conservation Points					
60% ≤ SRE < 65%	0.7	0.7	0.7	0.6	0.8	0.4
65% ≤ SRE < 75%	2.1	2.1	2.2	1.7	2.3	1.2
75% ≤ SRE < 84%	3.4	3.2	3.5	2.7	3.7	1.8

Note to Table [9.36.8.9.-A] 9.36.8.9.:

(1) SRE = sensible heat-recovery efficiency measured at an outside air test temperature of 0°C

[5] 4) Oil-fired *furnaces* that comply with one of the energy conservation measures prescribed in Table 9.36.8.9.-B shall be credited with the corresponding energy conservation points stipulated therein.

Table [9.36.8.9.-B]
Energy Conservation Measures and Points for Space Heating Equipment
Forming Part of Sentence 9.36.8.9.(5)

Type of Equipment	Energy Conservation Measures for Space Heating Equipment – Minimum Annual Fuel Utilization Efficiency, AFUE (1) (2)	Heating Degree-Days of *Building* Location, 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
		Energy Conservation Points					
Oil-fired warm-air *furnaces*	87%	1.2	1.4	1.4	1.5	1.6	1.7
	92%	4.1	4.9	5.0	5.4	5.5	5.9

Notes to Table [9.36.8.9.-B] :

(1) For intermediate values of minimum AFUE, linear interpolation of energy conservation points is permitted.

(2) The oil-fired *furnace* must be equipped with a high-efficiency constant torque or constant airflow fan motor.

Impact analysis

This proposed change would make complying with the energy performance tiers through the prescriptive path more affordable by increasing the number of measures eligible for accumulating points and allowing Code users to obtain credit for the energy savings associated with installing a high-efficiency oil-fired furnace.

In Table 1, the incremental cost includes only the material cost and excludes other costs (e.g., oil tank, installation). Upgrading to a higher efficiency oil-fired furnace does not result in a substantial increase in energy savings relative to the increase in the incremental cost of the equipment. When choosing to install a higher efficiency oil-fired furnace, the Code user would benefit from receiving the assigned energy conservation points for that equipment to demonstrate compliance with a higher energy tier of the prescriptive trade-off path. With this proposed change, Code users who choose to install higher efficiency oil-fired furnaces would be credited with between 1.2 and 5.9 energy conservation points, which represents the percentage energy savings, and would incur a cost of between $2,224 and $4,124.

Table 1. Incremental Cost Compared to an 86% AFUE Furnace by Region

AFUE(1)	Energy Savings (%)	Incremental Cost Compared to an 86% AFUE Furnace						
		BC	AB	SK and MB	ON	QC	Atlantic Canada	Northern Canada
87%(2)	1.2–1.7	$2,224	$2,224	$2,224	$2,224	$2,224	$2,224	$2,224
92%(3)	5.4–5.9	$4,124	$4,124	$4,124	$4,124	$4,124	$4,124	$4,124

Source: Task Group on Prescriptive Trade-off Path in Section 9.36.

Notes to Table:

(1) AFUE = annual fuel utilization efficiency

(2) Equipment: Granby-Conforto oil-fired furnace, models KLR, KLF and KHM

(3) Equipment: Granby-Conforto oil-fired furnace, model KLC

Enforcement implications

This proposed change could be enforced by the existing Code enforcement infrastructure.

Who is affected

Designers, engineers, architects, builders and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.36.8.9.] 9.36.8.9. ([1] 1) no attributions

[9.36.8.9.] 9.36.8.9. ([2] 2) no attributions

[9.36.8.9.] 9.36.8.9. ([3] 3) no attributions

[9.36.8.9.] 9.36.8.9. ([3] 3) [F95,F100-OE1.1]

[9.36.8.9. 9.36.8.9.] 9.36.8.9. ([4 5] 4) [F95-OE1.1]

[9.36.8.9. 9.36.8.9.] 9.36.8.9. ([4 5] 4) [F95-OE1.1]

Submit a comment

Proposed Change 2001

Code Reference(s):	**NBC20 Div.B 9.36.8.9. (first printing)**
Subject:	Prescriptive Trade-off Path
Title:	Energy Conservation Points for Air-Source Heat Pumps
Description:	This proposed change assigns energy conservation points to air-source heat pumps for compliance with the Prescriptive Trade-off Path in Section 9.36.

This change could potentially affect the following topic areas:

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

Problem

The National Building Code of Canada (NBC) does not currently assign energy conservation points to air-source heat pumps in the prescriptive trade-off path of Section 9.36. This proposed change would establish the number of energy conservation points assigned to air-source heat pumps for various heating load capacity and equipment efficiencies.

Failure to assign energy conservation points to air-source heat pumps would not allow Code users to obtain energy conservation points associated with the energy savings from installing a high-efficiency air-source heat pump unless they use the performance compliance path.

In order to accumulate the total number of energy conservation points required to demonstrate compliance with higher tiers, Code users should have additional options for energy conservation measures than those currently provided in the Code.

Justification

Choice of an air-source heat pump contributes to energy savings in a building. Code users who choose to install a high-efficiency air-source heat pump will benefit from the additional energy savings provided by the equipment when complying with the prescriptive trade-off path in Section 9.36.

If energy conservation points are assigned to air-source heat pumps, Code users will benefit from this additional option for demonstrating compliance with a higher energy performance tier in the prescriptive trade-off path.

Failure to add additional energy conservation measures might prevent Code users from accumulating sufficient points to comply with higher tiers, as required by their respective jurisdictions.

PROPOSED CHANGE

[9.36.8.9.] 9.36.8.9. Energy Conservation Measures for HVAC Systems

[1] 1) HVAC systems, equipment and installations shall be designed and constructed in accordance with Articles 9.36.3.2. to 9.36.3.8. and this Article.

[2] 2) Where HVAC systems, equipment or techniques other than those described in Articles 9.36.3.2. to 9.36.3.8. and this Article are used, the *building* shall be designed and constructed in accordance with the NECB.

[3] 3) Ventilation systems serving *buildings* to which this Subsection applies shall be equipped with a heat-recovery ventilator conforming to Article 9.36.3.9.

[4] 4) Heat-recovery ventilators that comply with one of the energy conservation measures prescribed in Table 9.36.8.9. shall be credited with the corresponding energy conservation points stipulated therein.

Table [9.36.8.9.-A] 9.36.8.9.
Energy Conservation Measures and Points for Ventilation Systems
Forming Part of Sentence [9.36.8.9.] 9.36.8.9.([4] 4)

Energy Conservation Measures for Ventilation Systems – Sensible Heat-Recovery Efficiency, SRE (1)	Heating Degree-Days of *Building* Location, 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

	Energy Conservation Points					
60% ≤ SRE < 65%	0.7	0.7	0.7	0.6	0.8	0.4
65% ≤ SRE < 75%	2.1	2.1	2.2	1.7	2.3	1.2
75% ≤ SRE < 84%	3.4	3.2	3.5	2.7	3.7	1.8

Note to Table [9.36.8.9.-A] 9.36.8.9.:

(1) SRE = sensible recovery efficiency measured at an outside air test temperature of 0°C

[5] --) Except as provided in Sentence (6), air-source heat pumps shall be credited with

- [a] --) where the air-source heat pump complies with one of the energy conservation measures prescribed therein, the corresponding energy conservation points stipulated in Table 9.36.8.9.-B, or
- [b] --) the energy conservation points calculated using the appropriate equation set out in Table 9.36.8.9.-C, provided the air-source heat pump has
  - [i] --) a fraction of rated capacity at 8.3°C to required capacity of heating appliances determined in accordance with Sentence 9.33.5.1.(1) that is greater than or equal to 60% and less than or equal to 100%, and
  - [ii] --) a heating seasonal performance factor for region V of greater than or equal to 5.2 (Btu/h)/W.

Table [9.36.8.9.-B]
Energy Conservation Measures and Points for Air-Source Heat Pumps Described in Clause 9.36.8.9.(5)(a)
Forming Part of Clause 9.36.8.9.(5)(a)

Energy Conservation Measures for Air Source Heat Pumps – Heating Seasonal Performance Factor 2 for Region V, HSPF2 V (1)	Minimum Air Source Heat Pump Capacity/Load Fraction (2)	Heating Degree-Days of *Building* Location, 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
		Energy Conservation Points					
5.2	60%	28.6	22.9	20.5	18.4	19.9	10.7
6.7		30.8	25.3	22.9	20.6	22.2	12.3

7.6		32.1	26.8	24.4	22.0	23.6	13.3
8.3		33.1	28.0	25.6	23.0	24.7	14.0
9.6		35.0	30.1	27.7	24.9	26.7	15.4

Notes to Table [9.36.8.9.-B] :

(1) HSPF2 V = heating seasonal performance factor 2 for region V (see map in DOE 10 CFR, Part 430, Subpart B, Appendix M1), in (Btu/h)/W

(2) “Air-source heat pump capacity/load fraction” means the rated capacity of air-source heat pump at 8.3°C divided by required capacity of heating appliances determined in accordance with Sentence 9.33.5.1.(1)

Table [9.36.8.9.-C]
Calculation of Energy Conservation Points for Air-Source Heat Pumps in Accordance with Clause 9.36.8.9.(5)(b)
Forming Part of Clause 9.36.8.9.(5)(b)

Heating Degree-Days of *Building* Location, 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
Energy Conservation Points [(1)]					
17.7 + (0.0647 F) + (1.46 HSPF2 V)	2.4+(0.198 F) + (1.65 HSPF2 V)	(0.198 F) + (1.65 HSPF2 V)	(0.180 F) + (1.47 HSPF2 V)	3.0+(0.147 F) + (1.55 HSPF2 V)	−4.7 + (0.165 F) + (1.06 HSPF2 V)

Note to Table [9.36.8.9.-C] :

(1) F = rated capacity of air-source heat pump at 8.3°C divided by required capacity of heating appliances determined in accordance with Sentence 9.33.5.1.(1), in %
HSPF2 V = heating seasonal performance factor 2 for region V, in (Btu/h)/W

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[6] --) Air-source heat pumps shall be credited with energy conservation points in accordance with Sentence (7), provided the air-source heat pump has

[a] --) a rated coefficient of performance greater than or equal to 1.8 at

−15°C, and

[b] --) a rated capacity at −15°C that is greater than or equal to 70% of its rated capacity at 8.3°C.

[7] --) Air-source heat pumps described in Sentence (6) shall be credited with the corresponding energy conservation points

[a] --) prescribed in Table 9.36.8.9.-D, provided the air-source heat pump complies with one of the energy conservation measures, or

[b] --) calculated using the equations in Table 9.36.8.9.-E, provided the air-source heat pump has

[i] --) a fraction of rated capacity at 8.3°C to required capacity of heating appliances determined in accordance with Sentence 9.33.5.1.(1) greater than or equal to 60% and less than or equal to 120%, and

[ii] --) a HPSF V of greater than or equal to 6.7 (Btu/h)/W.

Table [9.36.8.9.-D]
Energy Conservation Measures and Points for Air-Source Heat Pumps Described in Clause 9.36.8.9.(7)(b)
Forming Part of Clause 9.36.8.9.(7)(b)

Energy Conservation Measures for Air Source Heat Pumps – Heating Seasonal Performance Factor 2 for Region V, HSPF2 V (1)	Minimum Air Source Heat Pump Capacity/Load Fraction (2)	Heating Degree-Days of *Building* Location, 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
		Energy Conservation Points					
6.7	60%	33.8	34.2	31.3	29.5	28.5	19.6
7.6		35.2	36.2	33.2	31.4	30.3	21.0
8.3		36.3	37.7	34.8	32.9	31.6	22.1
9.6		38.3	40.5	37.6	35.5	34.2	24.2

Notes to Table [9.36.8.9.-D] :

(1) HSPF2 V = heating seasonal performance factor 2 for region V (see map in DOE 10 CFR, Part 430, Subpart B, Appendix M1), in (Btu/h)/W

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(2) Air-Source Heat Pump Capacity/Load Fraction = rated capacity of air-source heat pump at 8.3°C divided by required capacity of heating appliances determined in accordance with Sentence 9.33.5.1.(1)

Table [9.36.8.9.-E]
Calculation of Energy Conservation Points for Air-Source Heat Pumps in Accordance with Clause 9.36.8.9.(7)(b)
Forming Part of Clause 9.36.8.9.(7)(b)

Heating Degree-Days of *Building* Location, 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
Energy Conservation Points (1)					
22.5 + (0.0112 F) + (1.58 HSPF2 V)	16.6 + (0.0523 F) + (2.16 HSPF2 V)	12.8 + (0.0657 F) + (2.17 HSPF2 V)	12.4 + (0.0546 F) + (2.07 HSPF2 V)	13.1 + (0.0338 F) + (1.99 HSPF2 V)	6.8 + (0.0397 F) + (1.56 HSPF2 V)

Note to Table [9.36.8.9.-E] :

(1) F = rated capacity of air source heat pump at 8.3 °C divided by required capacity of heating appliances determined in accordance with Sentence 9.33.5.1.(1), in %
HSPF2 V = heating seasonal performance factor 2 for region V (see map in DOE 10 CFR, Part 430, Subpart B, Appendix M1), in (Btu/h)/W

Impact analysis

This proposed change would improve the affordability of complying with the energy performance tiers through the prescriptive path by increasing the number of measures eligible for points and allowing Code users to obtain credit for the energy savings associated with installing a high-efficiency air-source heat pump.

Installing higher efficiency air-source heat pump results in substantial increase in energy savings relative to the increase in equipment cost, as shown in Tables 1 and 2. When choosing to install a higher efficiency air-source heat pump, Code users would benefit from receiving the assigned energy conservation points for that equipment to contribute to demonstrating compliance with a higher energy tier of the prescriptive trade-off path.

Table 1. Cost of Regular Air-Source Heat Pumps

HSPF2(1)(2)	**Energy Savings (%)**	**Cost of Air-Source Heat Pumps ($)**						
		BC	**AB**	**SK and MB**	**ON**	**QC**	**Atlantic Canada**	**Northern Canada**
5.2(a)	10.7–28.6	5,200	5,200	5,200	5,200	5,200	5,200	5,200
6.7(b)	12.3–30.8	5,800	5,800	5,800	5,800	5,800	5,800	5,800
7.6(c)	13.3–32.1	6,806	6,806	6,806	6,806	6,806	6,806	6,806
8.3(d)	14.0–33.1	10,268	10,268	10,268	10,268	10,268	10,268	10,268
9.6(e)	15.4–35.0	12,738	12,738	12,738	12,738	12,738	12,738	12,738

Sources: www.rsl.ca (a), www.hvactrust.ca (d) and (e), www.pickhvac.com/heat-pump/ (b) and (c); prices listed were in effect on July 31, 2023, and do not include installation, taxes or fees.

Notes to Table 1:
(1) HSPF2 = heating seasonal performance factor 2
(2) Equipment:
(a) Ducane 1.5 ton, single stage, 4HP14B
(b) Carrier Comfort 25HCD3, single-stage
(c) Bryant Legacy 213C, single-stage
(d) Lennox EL22XPV, 2 ton, 24000 BTU
(e) Lennox EL22XPV, 4 ton, 48000 BTU

Table 2. Cost of Cold Climate Air-Source Heat Pumps

HSPF2(1)(2)	**Energy Savings (%)**	**Cost of Air-Source Heat Pumps ($)**						
		BC	**AB**	**SK and MB**	**ON**	**QC**	**Atlantic Canada**	**Northern Canada**
6.7(a)	19.6–34.2	7,000	7,000	7,000	7,000	7,000	7,000	7,000
7.6(b)	21.0–36.2	17,946	17,946	17,946	17,946	17,946	17,946	17,946
8.3(c)	22.1–37.7	24,008	24,008	24,008	24,008	24,008	24,008	24,008
9.6(d)	24.2–40.5	24,008	24,008	24,008	24,008	24,008	24,008	24,008

Sources: www.rsl.ca (a) and www.1clickheat.com (b), (c) and (d). The prices were in effect on July 31, 2023, and do not include installation, taxes or fees.

Notes to Table 2:
(1) HSPF2 = heating seasonal performance factor 2
(2) Equipment:

(a) Ducane 2.5 ton - 4HP15L
(b) Tosot Apex Central Heat Pumps, TU60-48WADU - TUD48-24AH2ADU – 48000 BTU capacity
(c) and (d) Mitsubishi Zuba Central Hyper Heat Ducted Heat Pump, 24000 BTU capacity

Cold climate air-source heat pumps are generally more expensive than regular air-source heat pumps as they have been technologically improved for application in challenging and harsh climates.

Code users who choose to install regular air-source heat pump would be credited with between 10.7 and 37 energy conservation points, which represents percentage energy savings and would cost between $5,200 and $12,738. Similarly, Code users who choose to install cold climate air-source heat pumps would be credited with between 19.6 and 40.5 energy conservation points for an expense of between $7,000 and $24,000.

Enforcement implications

This proposed change could be enforced using the existing Code enforcement infrastructure.

Who is affected

Designers, engineers, architects, builders and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[9.36.8.9.] **9.36.8.9. ([1] 1) no attributions**

[9.36.8.9.] **9.36.8.9. ([2] 2) no attributions**

[9.36.8.9.] **9.36.8.9. ([3] 3) no attributions**

[9.36.8.9.] **9.36.8.9. ([3] 3) [F95,F100-OE1.1]**

[9.36.8.9.] **9.36.8.9. ([4] 4) [F95-OE1.1]**

[9.36.8.9.] -- ([5] --) [F95-OE1.1]

[9.36.8.9.] -- ([6] --) [F95-OE1.1]

[9.36.8.9.] -- ([7] --) [F95-OE1.1]

Submit a comment

Proposed Change 1825

Code Reference(s):	**NBC20 Div.B 10.9.36. (first printing)**
Subject:	Alteration of Existing Buildings
Title:	Alteration of Service Water Heating Systems
Description:	This proposed change introduces requirements for service water heating systems subjected to alteration.
Related Proposed Change(s):	PCF 1827, PCF 1828, PCF 2032, PCF 2033, PCF 2051

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Alteration of Existing Buildings.

Problem

See the "Problem" section of the summary for the subject Alteration of Existing Buildings.

The energy performance requirements for the service water heating systems described in Subsection 9.36.4. of Division B of the National Building Code of Canada (NBC) already apply to the alteration of existing buildings. However, the enforcement of the application of these requirements depends on the interpretation of the relative importance, by the authority having jurisdiction, of achieving the environment objective of the Code when balanced against the cost of implementation.

Indiscriminately applying the energy performance requirements for service water heating systems to all voluntary alterations could result in alterations that go far beyond their original scope.

If voluntary alterations include upgrades to existing service water heating systems, not upgrading these systems to reasonable performance levels of energy efficiency might waste an opportunity for future energy benefits and cost savings through reduced energy bills and reduced construction costs.

Justification

The voluntary alteration of a service water heating system in an existing building represents an opportunity to upgrade the energy performance of the system.

To address the alteration of existing buildings, a guiding principle of the development of provisions is that the provisions should be reasonable, pragmatic and avoid placing an undue burden on building owners. Providing exemptions for cases of maintenance, repair or replacement with similar parts or components allows the flexible continued use of existing functional equipment by extending its service life and deferring system replacement costs.

This proposed change attempts to minimize the misinterpretation of requirements for the application of exemptions for maintenance or repair and ensures that alterations are not required to go far beyond the scope of the original alteration, causing an undue burden.

PROPOSED CHANGE

[10.9.36.] -- Energy Efficiency

[10.9.36.1.] --- Service Water Heating Systems

(See Note A-10.9.36.1.)

[1] --) Except for maintenance and repair, replacement service water heating equipment shall conform to the performance requirements stated in Article 9.36.4.2.

[2] --) Where piping forming part of a service water heating system is replaced or exposed, the exposed portion of the piping shall be insulated in accordance with Article 9.36.4.4.

[3] --) Where service water heating systems with storage tanks are replaced, the installation of automatic temperature controls shall conform to applicable provincial or territorial regulations or, in the absence of such regulations, to Sentence 9.36.4.5.(1).

Note A-10.9.36.1. Abandoned Inlets.

If the replacement of the HVAC or service water heating system or its components results in an abandoned inlet opening in a chimney or vent, the opening should be closed by an approved method to make the chimney or vent safe (see Clause 2.6.1.4.(3)(b) of Division B of the NFC). Consideration should also be given to removing and sealing a dedicated make-up air vent if the provision of make-up air is no longer required for the replacement service water heating system or component or for any other equipment identified in Article 9.32.3.8.

Impact analysis

No cost increase is associated with the replacement of equipment since any new service water heating equipment on the market meets the minimum Code requirements. Costs associated with pipe and thermal insulation forming part of the service water heating system (SWHS) is expected to be minimal. However, an assessment of costs is provided below for general information.

Average Cost of SWHS Equipment by Energy Source and Capacity

The average cost of SWHS equipment per energy source is provided based on a market price survey conducted on widely available models for different heating capacities. According to the National Resources Canada guide [1], each Canadian uses an average of 75 L of hot water per day. As such, between 75 L and 150 L for storage-based SWHS equipment is expected to meet the average hot service water demand. For tankless heaters, a hot service water capacity of 20 L/min to 40 L/min is sufficient to meet the demand.

The average cost of these heaters is between $1 000 and $3 000, based on the market survey conducted in Central Ontario for guidance purposes. The average cost of domestic water heaters by capacity is summarized in the Tables 1 to 3. The most common capacities of service water heating equipment available in Canada were converted to metric units (L) from U.S. gallons using soft conversion (see explanatory Note A-2.2.7.6. of Division C of the NBC).

Table 1. Average Cost of Gas- and Oil-fired Storage-type Service Water Heaters

Capacity, L	**Average Cost, $**	
	Gas-fired	**Oil-fired**
≥ 115 and < 150	1 400	–(1)
150	–	1 850
190	1 765	1 870
230	2 215	2 790
≥ 230 and < 265	–	4 875
> 265	4 050	–

Note to Table 1:
(1) A dash appears where pricing data was not applicable or available for the energy source at the specified capacity.

Table 2. Average Cost of Electric Tankless Service Water Heaters

Capacity, L/min	**Average Cost, $**
	Electric (Tankless)
0–15	550
20–40	1 160

Table 3. Average Cost of Electric Storage-type Service Water Heaters

Capacity, L	**Average Cost, $**
	Electric (Storage)
75	1 280
150	1 010
190	1 905
230	1 135
> 230	2 320

Average Cost of Thermal Insulation and Pipe by Size

Typical pipe size used for SWHS in residential buildings is less than 25 mm. The required length of pipe connected to SWHS equipment, which is directly affected and required to be replaced, is expected to be less than 1.8 m according to general installation practices. Thermal insulation can be newly applied to meet the requirements of Article 9.36.4.4. of Division B of the NBC. The required length of thermal insulation is identical to that of the pipe connected to SWHS equipment, which is directly affected and required to be replaced. Overall material costs including both pipe and pipe insulation is between about $10 and $40.

Table 4. Average Costs of Piping

Material	Size (for a 1.8 m length)	Average Cost, $
Pipe (e.g., PEX, Copper, CPVC)	Up to 25 mm pipe size	~3–30
Thermal insulation	Up to 25 mm pipe size and up to 25 mm thickness	~5–10

Total Cost of Replacement SWHS

The estimated total cost of a replacement SWHS is between $1 000 and $3 000, if the installation is conducted by the building owner, and between $1 400 and $3 600, if conducted by professionals. Note that when installation of the SWHS is conducted by professionals, costs associated with materials such as pipe and thermal insulation for pipe are included in the cost of installation.

Assessment of Benefits

The benefits are measurable due to the direct energy savings associated with using higher energy-efficiency SHWS equipment. The energy savings that result from applying a small section of thermal insulation to pipe is considered as negligible for this particular installation.

According to the National Resources Canada guide [1], Canadians use an average of 75 L of hot water daily and the average Canadian household uses 225 L daily for washing dishes and clothing, cleaning and showering or bathing. Water heaters account for 17.2% of the energy used by the average Canadian house. This statistic makes water heaters the second highest energy consumer in the house after heating.

According to the ENERGY STAR guide [2], replacing lower efficiency SWHS equipment with an ENERGY STAR certified super-efficient electric water heater and can save a household of four or more approximately $470 per year on electric bills. This could represent the base case scenario.

Applying thermal insulation to piping connected to SWHS equipment may minimize thermal transfer from the piping to the surrounding environment and reduce consumption of energy for service water heating.

References

[1] National Resources Canada. Water heaters. https://natural-resources.canada.ca/energy-efficiency/products/water-heaters/13735.
[2] ENERGY STAR. Super-Efficient Water Heater. https://www.energystar.gov/products/energy_star_home_upgrade/super_efficient_water_heater.

Enforcement implications

It is expected that a consistent set of provisions that apply to the alteration of existing buildings would help reduce the administrative and enforcement work of assessing the degree to which any particular requirement could be relaxed without affecting the level of performance of the building with respect to the Code objectives.

The proposed change would aid enforcement by identifying the work necessary to improve energy performance in the unaltered portion of the building.

Who is affected

Designers, engineers, architects, building officials, manufacturers, suppliers and energy advisors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[10.9.36.1.] -- ([1] --) no attributions

[10.9.36.1.] -- ([2] --) no attributions

[10.9.36.1.] -- ([3] --) no attributions

Submit a comment

Proposed Change 1826

Code Reference(s):	**NBC20 Div.B 10.9.36. (first printing)**
Subject:	Alteration of Existing Buildings
Title:	Replacement of Fenestration, Doors and Skylights
Description:	This proposed change introduces requirements for the replacement of fenestration, doors and skylights.
Related Proposed Change(s):	PCF 1812, PCF 1813, PCF 1824, PCF 1829, PCF 1839, PCF 1850

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Alteration of Existing Buildings.

Problem

See the "Problem" section of the summary for the subject Alteration of Existing Buildings.

The requirements for the energy performance of fenestration, doors or skylights described in Subsection 9.36.2. of Division B of the National Building Code of Canada (NBC) theoretically already apply to the alteration of existing buildings, but the enforcement of the application of Code requirements to alterations and any relaxations depends on the interpretation of the authority having jurisdiction that balances the cost of complying with the Code against the benefits of achieving the Code’s environment objective.

Applying all requirements for the minimum energy performance of fenestration, doors and skylights in Section 9.36. to an alteration, as if the building were newly constructed, could result in alterations that go far beyond their original scope.

However, if voluntary upgrades to fenestration, doors and skylights are not required to achieve at least a reasonable level of energy-efficient performance, an opportunity may be lost to reduce energy use in the existing building (and gain the related cost savings in energy billing).

This proposed change would also potentially save installation costs compared to later upgrades to better products, which would involve reconstructing wall openings and flashing.

Justification

This proposed change clarifies the application of the requirements for the energy performance of fenestration, doors and skylights in Article 9.36.2.7. to existing buildings. This proposed change would also facilitate a consistent interpretation of the Code when the costs of compliance are balanced against the benefits of achieving the Code's environment objective.

This proposed change allows for some relaxation of the requirements when they are applied to existing buildings, which prevents an alteration from going far beyond its original extent. This proposed change also contains sufficient detail for the voluntary alteration of fenestration, doors and skylights.

PROPOSED CHANGE

[10.9.36.] -- Energy Efficiency

[10.9.36.1.] --- Replacement Fenestration, Doors and Skylights

[1] --) Except for maintenance and repair, and except as provided in Sentences (2) and (3), the energy performance of replacement fenestration, doors or skylights shall comply with Article 9.36.2.7. (See Note A-10.9.36.1.(1).)

[2] --) Where only a glazing unit is replaced, the replacement glazing unit shall conform to Table 9.36.2.7.-C or have a level of energy performance equivalent to that of the existing glazing unit, whichever provides the higher level of energy performance.

[3] --) Where fenestration, doors or skylights are replaced, the interfaces between wall/ceiling assemblies and the replacement fenestration, doors or skylights shall conform to Sentence 9.36.2.10.(10).

Note A-10.9.36.1.(1) Energy Performance of Replacement Fenestration, Doors and Skylights.

Generally, replacing old fenestration products in an existing building with new products conforming to Article 9.36.2.7. will sufficiently improve energy performance. However, some recently constructed Part 9 buildings may have been designed and constructed to exceed the Code requirements for energy performance. Where making alterations to these buildings with the intent of replacing existing fenestration, doors or skylights, Sentence 10.1.1.5.(1)-2025 (PCF 1824) requires that the energy performance level of the replacement building component not be less than that of the replaced component. For these buildings in particular, the selection of the appropriate fenestration products needs to take into account the design of the existing fenestration products. For example, if an existing building has triple-glazed, vinyl-framed windows, the replacement windows should have these same overall characteristics, even though these characteristics may exceed the minimum requirements set out in Article 9.36.2.7.

Given that glazing can only be replaced and not repaired, it is important to use replacement glazing that provides a level of energy performance similar to that of the existing glazing. In order to provide adequate replacement glazing, the supplier will typically be able to determine the energy-performance characteristics of the existing glazing by performing a simple visual inspection or by considering the technical description of the existing glazing components and construction details.

For a building designed to a specific energy performance tier as specified in Section 9.36., the energy performance characteristics of the existing fenestration should ideally be identified in the documentation retained by the authority having jurisdiction and any replacement fenestration product should meet or exceed these energy performance characteristics.

Solar heat gain through windows in the summer is an important aspect that is often not considered in the design of fenestration for energy efficiency, which may focus on design for the winter (i.e., limiting thermal transmittance to the exterior).

Impact analysis

The costs associated with the replacement of existing windows, doors and skylights with products having higher thermal-resistive characteristics, such as lower U-values and/or higher energy ratings, and related installation were assessed. Using the widely recognized energy-savings estimation software program, RESFEN[1], input parameters were used to calculate the impact of windows on heating and cooling costs for residential houses in different locations (93 U.S. cities), house type (one- or two-storey, new or existing wood-frame or masonry), size (1 700 ft.^{2} for one-storey and 2 600 ft.^{2} for two-storey), foundation type (basement, crawlspace or slab-on-grade) and HVAC system type (gas furnace/electric air conditioning or electric heat pump). The total window area was assumed to be equal to 15% of the total floor area of the house, and the windows were equally distributed in the ordinal directions.

RESFEN allows the type of window to be selected, which was predetermined by the climate zone of the designated city. The annual energy saving cost was calculated for whole-house replacements for the existing types of window to be replaced by windows with a higher energy rating. Types of existing window can be selected from the window library as a built-in pull-down list. The prices for natural gas and electricity were based on the average price in each State in 2013–2014 and 2012–2013, respectively.

This impact analysis assesses the costs and benefits, as applicable, without providing user-specific information, which may differ greatly and add complexity (e.g., opaque/glazed doors, separate consideration on skylights with solar heat gain coefficient, energy rating contribution to heating vs. cooling, heating and cooling degree-days, percentage of fenestration areas to gross wall area ratio).

Calculation Basis

According to National Resources Canada, space heating accounts for 64% of the energy used in the average Canadian house as a result of Canada’s cold climate. Annual average energy use is 130 GJ, which implies 83 GJ is used for annual space heating. Average cooling accounts for 1.6% of the energy used in the average Canadian house. Annual average energy use is 130 GJ, which implies 2 GJ is used for space cooling.

According to the ENERGY STAR guide[2], typical annual energy savings of around 10% and around 30% are expected where replacing double-pane and single-pane windows, respectively, with ENERGY STAR-rated windows, which are typically available for purchase in most climate zones.

It follows that annual average energy savings of 10% represents 8.3 GJ and 0.2 GJ of energy savings in space heating and cooling, respectively, when double-pane windows are replaced with ENERGY STAR-rated windows. The average energy cost in Canada is around $0.179/kWh (1 GJ is 277.79 kWh). With the specified replacement windows, the annual average energy cost savings is expected to be around $412 and $10, respectively. Therefore, the combined total of annual energy cost savings is $422.

It also follows that annual average energy savings of 30% represents 25.5 GJ and 0.6 GJ of energy savings in space heating and cooling, respectively, when single-pane windows are replaced with ENERGY STAR-rated windows. With the specified replacement windows, annual average energy cost savings is expected to be around $1 267 and $30, respectively. Therefore, the combined total of annual energy cost savings is $1 297.

This information is summarized in Table 1.

Table 1. Calculation of Possible Energy Savings with ENERGY STAR-rated Replacement Windows

Type of Energy Use or Savings	Amount
Total average energy use for average Canadian house[3]	130 GJ
Annual average energy use for space heating[3]	130 × 64% = 83 GJ
Annual average energy use for cooling[3]	130 × 1.6% = 2 GJ
Total average energy use for space heating and cooling	83 + 2 = 85 GJ

Average percentage energy savings from window replacement[2]	10%–30%
Average energy savings from window replacement	8.5 (85 × 10%) − 25.5 (85 × 30%) GJ
Average energy cost in Canada[4, *see Table 1.*]	$/kWh
Average energy cost in Canada	$49.7 (0.179/kWh × 1 GJ/277.79 kWh)/GJ
Average energy cost savings from 10% window replacement	$422 (8.5 GJ × $49.7/GJ)
Average energy cost savings from 30% window replacement	$1 297 (26.1 GJ × $49.7/GJ)

The average lifespan of residential windows is expected to be more than 20 years. The average cost of 20 new windows, including installation, that are ENERGY STAR-rated and widely available in the market, is around $20 000.

Benefits

This proposed change, linked to the energy objective of the Code, would have benefits that should be expressed in quantitative terms as monetary savings or as incremental annual energy savings.
For this impact analysis, benefits are measurable based on the reduction of both energy costs and total energy consumption associated with replacement windows having higher energy ratings.

References

(1) RESFEN Software, Windows and Daylighting (lbl.gov). https://windows.lbl.gov/resfen-documentation. Note: RESFEN software is free to download; the user's manual contains complete details on archetypical houses used and other conditions applied when using RESFEN.

(2) National Fenestration Rating Council. Window Savings Estimates. https://www.nfrc.org/windows-doors-skylights/window-savings-estimates/

(3) National Resources Canada. Water heaters. https://natural-resources.canada.ca/energy-efficiency/products/water-heaters/13735

(4) Home Depot. Cost for Replacement Window Installation. https://www.homedepot.ca/en/home/ideas-how-to/windows-doors/window-replacement-cost.html

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Enforcement implications

It is expected that a consistent set of provisions that apply to the alteration of existing buildings would help reduce the administrative and enforcement work of assessing the degree to which any particular requirement could be relaxed without affecting the level of performance of the building with respect to the Code objectives.

This proposed change would aid enforcement by identifying the work necessary to improve the energy performance of an alteration.

Who is affected

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

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[10.9.36.1.] -- ([1] --) no attributions

[10.9.36.1.] -- ([1] --) no attributions

[10.9.36.1.] -- ([2] --) [F92,F95-OE1.1]

[10.9.36.1.] -- ([3] --) no attributions

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Proposed Change 1827

Code Reference(s):	**NBC20 Div.B 10.9.36. (first printing)**
Subject:	Alteration of Existing Buildings
Title:	Airtightness of Altered Air Barrier Systems
Description:	This proposed change introduces requirements for the airtightness of air barriers in existing subjected to alteration.
Related Proposed Change(s):	PCF 1825, PCF 1828, PCF 2032, PCF 2033, PCF 2051

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Alteration of Existing Buildings.

Problem

See the "Problem" section of the summary for the subject Alteration of Existing Buildings.

If the continuity of the air barrier system is not maintained or repaired when significant repairs or alterations are made to the building envelope of an existing building, excessive heat loss or gain, drafts, high indoor relative humidity, or water accumulation could result. Failure to maintain the continuity of the air barrier system in an alteration may also lead to a decrease in the energy performance of the building and result in excessive use of energy.

However, if all the requirements for air barriers in Section 9.36. of Division B of the National Building Code of Canada (NBC) are applied to an alteration as if the building were newly constructed, the alteration could go far beyond its original scope.

If voluntary upgrades to assemblies that are required to include an air barrier are upgraded to at least a reasonable airtightness, an opportunity exists to reduce energy use in the existing building (and gain the related cost savings in energy billing).

This proposed change would also potentially save installation costs compared to later upgrades to a higher level of airtightness, which would involve reconstructing walls and ceilings.

Justification

When the air barrier system is added or upgraded to improve continuity or airtightness concurrently with other alteration work in an existing building, the energy performance of the building will improve, thereby reducing the incremental cost of the upgrade.

This proposed change not only clarifies the Code requirements for buildings subjected to alteration, but also safeguards against potential misinterpretation by various stakeholders, including authorities having jurisdiction, designers and other professionals. This enhanced clarity would ensure that the improvement of energy performance achieved through concurrent upgrading of the air barrier's continuity or airtightness instead during alteration work is both effective and correctly implemented, reducing the risk of non-compliance and suboptimal results.

PROPOSED CHANGE

[10.9.36.] -- Energy Efficiency

[10.9.36.1.] --- Airtightness of an Existing Building Subjected to Alteration
(See Note A-10.9.36.1.)

[1] --) Where the continuity of the *air barrier system* is adversely affected by an *alteration*, or where a continuous *air barrier system* does not exist throughout the extent of the *alteration*

- [a] --) discontinuous areas of the *air barrier system* shall be constructed in conformance with Sentence 9.36.2.9.(1), or
- [b] --) the *air barrier system* shall be tested in accordance with Subsection 9.36.6. and achieve an Airtightness Level of at least AL-1A or AL-1B as specified in Article 9.36.6.4. based on *building* type. (See Tables 9.36.6.4.-A and 9.36.6.4.-B.)

Note A-10.9.36.1. Airtightness of an Existing Building Subjected to Alteration.

Effect of Airtightness on the Building Envelope

The building envelope is required to effectively minimize heat transfer, air leakage, vapour diffusion, and precipitation ingress. The systems performing these functions are interdependent, and a material in one of these systems may have multiple functions. To ensure that alterations affecting airtightness do not adversely affect the overall performance of the building envelope, it is critical to understand that the air barrier system is one of several systems within the building envelope (see Note A-9.25.3.1.(1)).

For materials that are used to fulfill the air barrier function, changing the location of the materials or selecting materials with different performance characteristics may affect the performance of other systems within the building envelope. For example, where rigid foam board is used as thermal insulation, it may also act as a component of an air barrier system; replacing the foam board with a material that offers thermal resistance, but does not provide acceptable air leakage resistance would compromise the performance of the air barrier system. (See also Notes A-5.1.4.1.(2), A-9.25.4.2.(6) and A-9.25.5.1.) To avoid unintended consequences of alterations, it is important to consider the house or building as one system required to perform multiple functions (building-as-a-system concept).

The intent of Article 10.9.36.1. is to improve the energy efficiency of buildings subjected to alteration by increasing their airtightness, which may be achieved in different ways depending on the broader scope of the alteration project and its impact on the building as a system. The follow examples demonstrate simple and complex cases where the air barrier system may be upgraded within the scope of an alteration to an existing building:

- In a simple case of a single-room or -space renovation where the air barrier system is not the main focus, the goal might simply be to maintain, restore or improve the continuity of the existing air barrier system with minimal intervention.

- Another example of a simple case, but on a larger scale and with significant intervention, is a deep energy retrofit. The improvement of the entire building envelope, including the air barrier system, is the main focus of the project, particularly where the entire air barrier system is exposed and accessible. This case is similar to new construction, and it may be relatively easy to adhere to the building-as-a-system concept.
- More complex cases are renovation projects where as significant portion of the building is subjected to alteration, including cases where substantial upgrades are made to the building envelope, or where an extension is added to an existing building. In such cases, it is important to carefully apply the building-as-a-system concept to evaluate the risk of condensation in the parts of the building envelope that are unaltered. The risk of condensation may be lower where the thermal performance and airtightness of the new and existing parts of the building are relatively similar, while the risk of condensation may be higher where the new and existing parts of the building perform significantly differently.

Further information on airtightness and condensation control can be found in the Canadian Home Builders' Association (CHBA):2021, Renovators' Manual.

Effect of Airtightness on Other Building Systems

Improving the airtightness of a building not only improves the building's energy efficiency, but also affects the building's mechanical systems (e.g., ventilation, space heating, and cooling). Improved airtightness reduces the stack effect across the height of the building, which has the desirable effect of reducing unintended air infiltration through the building envelope assemblies.

However, indoor air quality may be adversely affected by the (unintentional) reduction of air flow, which reduces the dilution of contaminants. The performance of ventilation systems (and possibly forced-air heating systems) should be reviewed and adjusted, especially in partially renovated buildings where the unaltered part of the building may receive more of the unintended infiltration (and, with it, potentially moisture and other contaminants such as soil gases). One particular concern associated with increasing the airtightness of buildings is that the indoor radon concentration could also increase (see Note A-9.13.4.).

Impact analysis

According to Statistics Canada, the greatest number of permits were issued for single-family houses in the late 1980s, peaking at around 130 000 permits annually [1]. For the purpose of providing a simplified calculation for estimating the cost-benefit of alterations, a demonstrative house (circa 1984–1995, two-storey, single detached, 2 000 ft.^{2} to 2 500 ft.^{2} of heated floor area and natural gas-fired furnace) in London, Ontario, (Zone 6) was used from a study conducted by CanmetEnergy [2].

Note that it is impossible to explore all permutations of alterations occurring in Canada. As such, this representative case has been selected to provide an illustrative example. The actual energy savings would greatly differ (i.e., may be understated or overstated), as they are based on the current airtightness of the building envelope being altered.

Where the building envelope is improved by this proposed change (and not have been improved otherwise), the amount of energy required to heat the building is typically expected to be nearly 30% less than that of the existing building with the original building envelope. The potential energy savings from improved enclosure airtightness could help meet energy-efficiency requirements and save utility costs [3]. Given this, up to 25% of energy savings could be contributed from alterations to improve airtightness. This implies that potential annual average energy savings would be around $75 per year (i.e., 25% of 30% of $995, which is the annual average natural gas bill for Canadian residences [4]).

Code users may comply with the requirements by applying certain sealing measures and conducting an airtightness test. A survey conducted in spring 2023 on the availability and cost of airtightness testing in Canada supports the rationale that airtightness testing is available at a fairly low cost ($150 to $3 250, see Table 1 below), and the increase related to travel costs for long distances is reasonable.

Table 1. Cost of an Airtightness Test by Geographic Region

	ON	BC	AB	Prairies	QC	Maritimes	Northern
Cost of blower door test(1)	\$200–\$3 000 \$575 median	\$150–\$2 000 \$475 median	\$150–\$2 000 \$425 median	\$250–\$2 000 \$500 median	\$250–\$1 200 \$500 median	\$250–\$1 250 \$750 median	\$3 250(2)

Notes to Table 1:
(1) Costing data was collected from the survey on airtightness testing by Codes Canada.
(2) Costing includes estimated travel costs.

References

(1) Statistics Canada. Housing permit statistics.
(2) Clean Air Partnership. Archetyping-Guide-For-Energy-Efficiency-Programs-1.pdf, www.cleanairpartnership.org
(3) BC Housing. Illustrated Guide Achieving Airtight Buildings, www.bchousing.org
(4) Canadian Gas Association. Natural Gas Facts, www.cga.ca

Enforcement implications

It is expected that a consistent set of provisions that apply to the alteration of existing buildings would help reduce the administrative and enforcement work of assessing the degree to which any particular requirement could be relaxed without affecting the level of performance of the building with respect to the Code objectives.

This proposed change would aid enforcement by identifying the work necessary to improve the energy performance of an alteration.

Who is affected

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

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[10.9.36.1.] -- ([1] --) (a)

[10.9.36.1.] -- ([1] --) (b)

[10.9.36.1.] -- ([1] --) (b) [F90,F92,F95-OE1.1]

Submit a comment

Proposed Change 1828

Code Reference(s):	**NBC20 Div.B 10.9.36. (first printing)**
Subject:	Alteration of Existing Buildings
Title:	Alteration of HVAC Systems
Description:	This proposed change introduces requirements for HVAC systems subjected to alteration.
Related Proposed Change(s):	PCF 1825, PCF 1827, PCF 2032, PCF 2033, PCF 2051

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Alteration of Existing Buildings.

Problem

See the "Problem" section of the summary for the subject Alteration of Existing Buildings.

The energy performance requirements for the HVAC systems described in Subsection 9.36.3. of Division B of the National Building Code of Canada (NBC) theoretically already apply to the alteration of existing buildings. However, the enforcement of the application of these requirements depends on the interpretation of the authority having jurisdiction, which balances the implementation costs against the relative importance of achieving the Code’s environment objective.

Applying the requirements for the minimum energy performance of HVAC systems to all voluntary alterations could result in alterations that exceed their original scope.

If voluntary alterations include upgrades to existing HVAC systems, not upgrading these systems to reasonable performance levels of energy efficiency might waste an opportunity for future energy benefits and cost savings through reduced energy bills and reduced construction costs.

Justification

The voluntary alteration of an HVAC system in an existing building represents an opportunity to upgrade the energy performance of the system.

To address the alteration of existing buildings, a guiding principle of the development of provisions is that the provision should be reasonable, pragmatic and avoid placing an undue burden on building owners. Providing exemptions for cases of maintenance, repair or replacement with similar parts or components allows the flexible continued use of existing functional equipment by extending its service life and deferring system replacement costs.

This proposed change aims to clarify the requirements for authorities having jurisdiction, designers and building professionals. The enhanced clarity would ensure that building owners could benefit from energy performance upgrades while avoiding an undue burden, ultimately promoting energy efficiency and reducing the incremental cost of the upgrade.

PROPOSED CHANGE

[10.9.36.] -- Energy Efficiency

[10.9.36.1.] --- Alteration of HVAC Systems
(See Note A-10.9.36.1. (PCF 1825))

[1] --) Except for maintenance and repair, and except as provided in Sentences (2) to (5), HVAC systems and equipment shall conform to Subsection 9.36.3.

[2] --) Where the *alteration* is an addition, newly installed ducts and *plenums* shall conform to Article 9.36.3.2.

[3] --) Where portions of existing HVAC ducts or *plenums* are exposed within the extent of the *alteration*, the joints of those portions of ducts or *plenums* shall be sealed in conformance with Sentence 9.32.3.11.(8) and Articles 9.33.6.2. and 9.33.6.3., as applicable.

[4] --) Except as provided in Sentence (5), where a previously unconditioned space in a residential *building* is converted to a habitable, *conditioned space*, HVAC systems serving the space shall comply with Sections 9.32.

and 9.33.

[5] --) Where the capacity of existing HVAC equipment is determined to be adequate to serve the existing *building* and addition, the HVAC equipment need not comply with Table 9.36.3.10.

Impact analysis

There is no associated cost increase with the replacement of heating or air-conditioning equipment, since any new equipment on the market meets the minimum Code requirements. The cost associated with sealing the existing portions of ducts or plenums that can be accessed is expected to be minimal. However, an assessment of costs is provided below for general information.

Assessment of Costs

The following representative conditions were selected for assessment purposes.

- Household size: four occupants (energy use: ~130 GJ/year)
- House: 2 000 ft.^{2} detached, built prior to 1980 (HVAC system demand: 65 000 BTU/h heating capacity, 2.5-ton cooling capacity). (See Table 1.)

Table 1. Size of Furnace and Air Conditioner for a Detached, Two-Storey House

Detached House, ft.$^{2(1)}$	**Furnace Output, BTU/hr**		**Air Conditioner Size, ton**	
	Built after 1980	**Built before 1980**	**Built after 1980**	**Built before 1980**
< 1 300	40 000	50 000	1.5	< 2
1 300 to 1 700	45 000	< 55 000	1.5	2
1 700 to 2 500	55 000	**< 65 000**	2 to 2.5	**2.5**
2 500 to 3 500	< 65 000	< 80 000	2.5 to 3	3 to 3.5
3 500 to 4 500	< 80 000	< 100 000	3.5 to 4	4 to 5

Note to Table 1:

(1) The above square footages do not include the area of the basement.

Different energy sources are available for both heating and cooling equipment, e.g., gas, electric, oil, air-source and geothermal (for heat pumps) or a combination of these energy sources. This analysis determines the associated costs and benefits of replacing existing equipment while maintaining the existing energy source. Therefore, the associated costs and benefits of replacing existing equipment with higher energy-efficiency HVAC equipment are also captured. Gas-fired heating equipment and electric cooling equipment are selected as representative energy sources. Note that energy cost savings based on different energy sources is assumed to be similar to that of the representative energy source.

The typical cost of heating equipment with a capacity of up to 65 000 BTU/h that is available at big box stores, such as Home Depot, is around $3 500 to $5 000. The typical cost of cooling equipment with a capacity of up to 2.5 tons that is available at big box stores is around $2 000 to $3 000.

Typically, the installation of new HVAC equipment is provided by professionals, and the costs associated with such service include labour and materials (required to replace the accessible portions of ducts or plenums that form part of the HVAC system to be insulated). According to the resources available for Canadian consumers, the average cost of labour for the installation of an HVAC system is between $2 000 and $3 000. The estimated total cost of the replacement of heating equipment is between $3 500 and $8 000 including installation or between $2 000 and $6 000 without installation. [3]

Assessment of Benefits

The benefits of this proposed change are measurable due to the direct energy savings associated with using higher energy-efficiency HVAC equipment. Energy savings that result from applying a small section of thermal insulation to supply and return plenums are considered negligible for this particular installation.

According to Natural Resources Canada, space heating accounts for 64% of the energy used in the average Canadian house as a result of Canada’s cold climate [1]. Annual average energy use is 130 GJ, which implies 83 GJ is used for annual space heating. Average cooling accounts for 1.6% of the energy used in the average Canadian home. Annual average energy use is 130 GJ, which implies 2 GJ is used for space cooling.

According to the ENERGY STAR guide, typical annual energy savings of around 10% to around 30% are expected where higher efficiency HVAC equipment is properly installed. It follows that annual average energy savings of 20% delivers 17 GJ and 0.4 GJ would result with the use of higher efficiency heating and cooling, respectively. Average energy cost in Canada is around $0.179/kWh (1 GJ is 277.79 kWh) [3]. Annual average energy cost savings generated upon installation of higher efficiency heating and cooling equipment is expected to be around $845 and $20, respectively.

Applying thermal insulation to ducts and plenums in the HVAC system may minimize thermal transfer from the ducts and plenums to the surrounding environment and reduce the extra consumption of energy required for HVAC equipment.

References

(1) Natural Resources Canada guide, https://natural-resources.canada.ca/energy-efficiency/products/water-heaters/13735

(2) Statistics Canada (2011). Average energy use data.

(3) National average pricing for HVAC equipment from big box stores such as Home Depot.

(4) Energy Rates Canada, accessed in July 2023.

Enforcement implications

It is expected that a consistent set of provisions that apply to the alteration of existing buildings would help reduce the administrative and enforcement work of assessing the degree to which any particular requirement could be relaxed without affecting the level of performance of the building with respect to the Code objectives.

This proposed change would aid enforcement by identifying the work necessary to improve the energy performance of an alteration.

Who is affected

Designers, engineers, architects, building officials, manufacturers, suppliers and energy advisors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[10.9.36.1.] -- ([1] --) no attributions

[10.9.36.1.] -- ([2] --) no attributions

[10.9.36.1.] -- ([3] --) no attributions

[10.9.36.1.] -- ([4] --) no attributions

[10.9.36.1.] -- ([5] --) no attributions

Submit a comment

Proposed Change 1829

Code Reference(s):	**NBC20 Div.B 10.9.36. (first printing)**
Subject:	Alteration of Existing Buildings
Title:	Thermal Characteristics of Above-Ground Opaque Building Assemblies
Description:	This proposed change introduces requirements for the thermal characteristics of above-ground opaque building assemblies in existing buildings subjected to alteration.
Related Proposed Change(s):	PCF 1812, PCF 1813, PCF 1824, PCF 1826, PCF 1839, PCF 1850

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Alteration of Existing Buildings.

Problem

See the "Problem" section of the summary for the subject Alteration of Existing Buildings.

When a voluntary alteration is made to above-ground opaque building assemblies in an existing building, there is an opportunity to improve the energy performance of the building assembly. This proposed change provides the requirements for the thermal characteristics of above-ground opaque walls subjected to alteration.

If the thermal characteristics of the above-ground opaque building assemblies do not achieve the required performance after an alteration, excessive energy would be consumed.

Justification

When alterations are made to above-ground opaque building assemblies in an existing building, there is an opportunity to upgrade the performance level of the building assembly to increase the overall energy performance of the building, thereby minimizing the incremental cost of the upgrade.

This proposed change aims to clarify the requirements for authorities having jurisdiction, designers and building professionals. The enhanced clarity would ensure that building owners could benefit from energy performance upgrades while avoiding an undue burden, ultimately promoting energy efficiency and reducing the incremental cost of the upgrade.

PROPOSED CHANGE

[10.9.36.] -- Energy Efficiency

[10.9.36.1.] --- Thermal Characteristics of Above-Ground Opaque Building Assemblies

(See Note A-10.9.36.1. and 10.9.36.2.-2025.) (See also Note A-10.1.1.1.(1)-2025 (PCF 1824).)

[1] --) Except for maintenance and repair, and except as provided in Sentence (7), where above-ground opaque *building* assemblies are subjected to *alteration*, the effective thermal resistance of the *building* assembly shall conform to Sentences (3) to (6).

[2] --) Where insulation is installed to meet the requirements of Sentence (1), all applicable requirements in Part 9 shall be met. (See Note A-10.9.36.1.(2).)

[3] --) Except as provided in Sentence (7), where the stud cavity of an exterior wall or the interior unfinished surface of an exterior mass wall is exposed or made accessible by the *alteration* or is within the extent of the *alteration*, the effective thermal resistance of the wall shall

[a] --) be assessed in accordance with Article 9.36.2.2., and

[b] --) conform to Article 9.36.2.6.

[4] --) Except as provided in Sentence (7), where the space above a ceiling below attic is exposed or made accessible by the *alteration* or is within the extent of the *alteration*, the effective thermal resistance of the ceiling shall

[a] --) be assessed in accordance with to Article 9.36.2.2., and

[b] --) conform to Article 9.36.2.6.

[5] --) Except as provided in Sentence (7), where the joist cavity of a cathedral ceiling or flat roof is exposed or made accessible by the *alteration* or is within the extent of the *alteration*, the effective thermal resistance of the ceiling or roof shall

[a] --) be assessed in accordance with Article 9.36.2.2., and

[b] --) conform to Article 9.36.2.6.

[6] --) Except as provided in Sentence (7), where the joist cavity of a floor over unheated space is exposed or made accessible by the *alteration* or is within the extent of the *alteration*, the effective thermal resistance of the floor shall

[a] --) be assessed in accordance with Article 9.36.2.2., and

[b] --) conform to Article 9.36.2.6.

[7] --) Except as provided in Sentence (8), where the effective thermal resistance of the *building* assembly cannot be improved to meet the requirements of Sentences (2) to (6) due to construction limitations, structural constraints or loss of functionality of the space, the effective thermal resistance shall be improved to the extent possible. (See Note A-10.9.36.1.(7) and 10.9.36.2.(7)-2025.)

[8] --) Where the effective thermal resistance of the *building* assembly cannot be improved in accordance with Sentence (7), another above-ground opaque *building* assembly within the extent of the *alteration* is permitted to be upgraded in accordance with Sentence 9.36.2.11.(2).

Note A-10.9.36.1. and 10.9.36.2.-2025 (PCF 1850) Thermal Characteristics of Building Assemblies.

If the thermal performance of an area of existing insulation is compromised, the existing insulation should be replaced. The three main issues that affect the thermal performance of cavity insulation are as follows:

1. Improper installation: This condition results from insufficient quality assurance and quality control during the original construction of the wall. The most common problems related to improper installation include
    - missing sections of insulation,
    - overly compressed insulation, and
    - gaps between the insulation and the surrounding construction element (e.g., studs, plates, exterior sheathing).

   All of these issues reduce the thermal resistance of the insulation and/or allow heat energy to bypass the insulation.
2. Settlement over time: Certain types of loose-fill insulation will slowly settle or compress over time after installation. This settlement may occur more frequently with “blown-in” insulation, as the original loft of the installation can be decreased by gravity. As a result, the insulation has an increased density and a lower thermal resistance; thus, the original thermal performance of the design is compromised.

3. Deterioration of the cavity environment: Air and moisture movement within the cavity may result in dirt, moisture and/or mould accumulation within the insulation and cavity. These accumulations affect the thermal performance of the insulation by reducing the volume of still air captured by the insulation, which reduces the thermal resistance.

Further information on best practices for the installation of insulation can be found in the following:

- Canadian Home Builders' Association (CHBA) (2021), "Renovators' Manual,"
- ASTM C1015-17, "Standard Practice for Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation,"
- ASTM C1320-20, "Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction,"
- ASTM C1848-17a, "Standard Practice for Installation of High-Pressure Spray Polyurethane Foam Insulation for the Building Enclosure Significance and Use Achieving Quality Insulation Installation. Online at Insulation Installation,"
- North American Insulation Manufacturers Association (NAIMA) website (www.insulationinstitute.org),
- NAIMA B1402-12, "Recommendations for Installing Mineral Fiber Insulation in Residential and Other Light-Frame Construction," and
- ANSI/RESNET/ICC 301-2019, "Standard for the Calculation and Labeling of the Energy Performance of Dwelling and Sleeping Units using an Energy Rating Index."

Note A-10.9.36.1.(2) Applicable Part 9 Requirements.

When increasing the effective thermal resistance of walls, ceilings below attics, floors over unheated spaces, cathedral ceilings, or flat roofs, it is important to review Part 9 to confirm that all relevant requirements are met. As a result of Sentence 10.9.36.1.(2), the desired design approach may be constrained by the following Part 9 requirements, for example:

- Subsection 9.10.3., Ratings,
- Subsection 9.10.14., Spatial Separation Between Buildings,
- Subsection 9.10.15., Spatial Separation Between Houses,
- Article 9.10.17.10., Protection of Foamed Plastics,
- Section 9.19., Roof Spaces,
- Section 9.25., Heat Transfer, Air Leakage and Condensation Control,
- Subsection 9.25.5., Properties and Position of Materials in the Building Envelope,
- Article 9.27.3.8., Flashing Installation, or
- Section 9.29., Interior Wall and Ceiling Finishes

Note A-10.9.36.1.(7) and 10.9.36.2.(7)-2025 (PCF 1850) Improvement of Effective Thermal Resistance.

The term "to the extent possible" is used to provide flexibility in response to the conditions encountered in the alteration of an existing building. In some instances and in certain locations, achieving the required effective thermal resistance will not be feasible in the alteration of an existing building. For example, the installation of insulation may be prevented or made difficult by the following:

- existing mechanical and electrical elements that are not intended to be changed in the alteration,
- existing structural components (e.g., walls, columns or beams) that obstruct the installation of insulation,
- stairwells located against an existing exterior wall, since Part 9 requirements might not permit the addition of insulation or since reconstructing or relocating the stairwell might require significant effort and cost,
- existing doors framed close to the existing wall that are not being changed as part of the alteration,
- a small room in a very old house, where adding 100 mm (4 in.) of insulation on the interior of exterior walls would make the room unusable (e.g., as a small bedroom or washroom) without rerouting building services or substantially reconstructing walls or structural supports.

"To the extent possible" is intended to encourage increasing thermal resistance as much as possible within these limitations. It is important to understand that there will be instances where upgrading, for example, the installation of additional insulation, will not be possible and that this is an acceptable outcome for specific locations.

The installation of any insulating materials should be implemented in a manner that manages the risk of undesirable consequences, such as condensation, especially where parts of the building envelope are insulated to a lower thermal resistance level than required or where insulation is added on the inside of a masonry wall, which may exacerbate the degradation of the masonry.

Impact analysis

According to Statistics Canada, the greatest number of permits were issued for single-family houses in the late 1980s, peaking at around 130 000 permits annually [1]. For the purpose of providing a simplified calculation for estimating the cost-benefit of alterations, a demonstrative house (circa 1984–1995, two-storey, single detached, 2 000 ft.^{2} to 2 500 ft.^{2} of heated floor area and natural gas-fired furnace) in London, Ontario, (Zone 6) was used from a study conducted by CanmetEnergy [2].

Note that it is impossible to explore all permutations of alterations occurring in the country. As such, this representative case has been selected to provide an illustrative example. The actual energy savings would greatly differ (i.e., may be understated or overstated), as they are based on the current thermal resistance value of the above-ground opaque building assemblies being subjected to alteration.

Where the building envelope is improved by this proposed change (and where additional insulation would not have been added otherwise), the amount of energy required to heat the building is typically expected to be nearly 30% less than that of the original building envelope. Up to 12% of energy savings can be contributed from the improved thermal resistance of above-ground building assemblies. This statement implies that the potential annual average energy savings would be around $36 per year (i.e., 12% of 30% of $995, which is the annual average natural gas bill for Canadian residences [3]).

The incremental cost of the installation of blown-in glass fibre insulation in a ceiling below attic to an RSI value of 8.67, assuming an initial RSI value of 5.28, would be \$8.39/m^2, for a total cost of up to $780 for the archetype house.

The incremental cost of the installation of additional batt insulation to the exterior above-ground walls to an RSI value of 2.97, assuming an initial RSI value of 1.94, is \$2.47/m^2, for a total cost of up to $456 for the entire archetype house.

References

(1) Statistics Canada. Housing Permit.

(2) Clean Air Partnership. Archetyping Guide for Energy-Efficiency Programs, www.cleanairpartnership.org

(3) Canadian Gas Association. Natural Gas Facts, www.cga.ca

Enforcement implications

It is expected that a consistent set of provisions that apply to the alteration of existing buildings would help reduce the administrative and enforcement work of assessing the degree to which any particular requirement could be relaxed without affecting the level of performance of the building with respect to the Code objectives.

This proposed change would aid enforcement by identifying the work necessary to improve the energy performance of an alteration.

Who is affected

Designers, engineers, architects, building officials, manufacturers, suppliers and energy advisors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[10.9.36.1.] -- ([1] --) no attributions

[10.9.36.1.] -- ([2] --) no attributions

[10.9.36.1.] -- ([3] --)

[10.9.36.1.] -- ([3] --) [F92-OE1.1]

[10.9.36.1.] -- ([4] --) no attributions

[10.9.36.1.] -- ([4] --) [F92-OE1.1]

[10.9.36.1.] -- ([5] --) no attributions

[10.9.36.1.] -- ([5] --) [F92-OE1.1]

[10.9.36.1.] -- ([6] --) no attributions

[10.9.36.1.] -- ([6] --) [F92-OE1.1]

[10.9.36.1.] -- ([7] --) no attributions

[10.9.36.1.] -- ([8] --) [F92-OE1.1]

Submit a comment

Proposed Change 1850

Code Reference(s):	**NBC20 Div.B 10.9.36. (first printing)**
Subject:	Alteration of Existing Buildings
Title:	Thermal Characteristics of Building Assemblies Below-Grade or in Contact with the Ground
Description:	This proposed change introduces requirements for the thermal characteristics of building assemblies that are below-grade or in contact with the ground in existing buildings subjected to alteration.
Related Proposed Change(s):	PCF 1812, PCF 1813, PCF 1824, PCF 1826, PCF 1829, PCF 1839

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Alteration of Existing Buildings.

Problem

See the "Problem" section of the summary for the subject Alteration of Existing Buildings.

When a voluntary alteration is made to below-grade or in contact with the ground building assemblies in an existing building, there is an opportunity to improve the energy performance of the building assembly. This proposed change provides the requirements for the thermal characteristics of building assemblies below-grade or in contact with the ground that are subjected to alteration.

If the thermal characteristics of the building assembly do not achieve the required performance after an alteration, excessive energy would be consumed.

Justification

When alterations are made to building assemblies that are below-grade or in contact with the ground in an existing building, there is an opportunity to upgrade the performance level of the assembly to increase the overall energy performance of the building, thereby minimizing the incremental cost of the upgrade.

This proposed change aims to clarify the requirements for authorities having jurisdiction, designers and building professionals. The enhanced clarity would ensure that building owners could benefit from energy performance upgrades while avoiding an undue burden, ultimately promoting energy efficiency and reducing the incremental cost of the upgrade.

PROPOSED CHANGE

[10.9.36.] -- Energy Efficiency

[10.9.36.1.] ---

[10.9.36.2.] --- Thermal Characteristics of Building Assemblies Below-Grade or in Contact with the Ground

(See Note A-10.9.36.1. and 10.9.36.2.-2025 (PCF 1829).) (See also Note A-10.1.1.1.(1)-2025 (PCF 1824).)

[1] --) Except for maintenance and repair, and except as provided in Sentence (7), where *building* assemblies that are below-grade or in contact with the ground are subjected to *alteration*, the effective thermal resistance of the *building* assembly shall conform to Sentences (3) to (6).

[2] --) Where insulation is installed to meet the requirements of Sentence (1), all applicable requirements of Part 9 shall be met.

[3] --) Except as provided in Sentence (7), where the stud cavity of an exterior *foundation* wall or interior surface of an exterior mass *foundation* wall is exposed or made accessible by the *alteration* or is within the extent of the *alteration*, the effective thermal resistance of the wall shall

[a] --) be assessed in accordance with Article 9.36.2.2., and

[b] --) conform to Article 9.36.2.8.

[4] --) Except as provided in Sentence (7), where a floor-on-ground is replaced within the extent of the *alteration*, effective thermal resistance of the floor-on-ground shall conform to Article 9.36.2.8. (See Note A-10.9.36.1.(4).)

[5] --) Except as provided in Sentence (7), where a heated floor or an unheated floor above the frost line is exposed or made accessible by the *alteration* or is within the extent of the *alteration* and has accessible space below it, the effective thermal resistance of the floor shall

[a] --) be assessed in accordance with Article 9.36.2.2., and

[b] --) conform to Article 9.36.2.8.

[6] --) Except as provided in Sentence (7), where the exterior perimeter of a slab-on-grade with an integral footing or a heated or unheated floor on permafrost is exposed or made accessible by the *alteration* or within the extent of the *alteration*, the effective thermal resistance of the slab-on-grade or floor shall

[a] --) be assessed in accordance with Article 9.36.2.2., and

[b] --) conform to Article 9.36.2.8.

[7] --) Where the effective thermal resistance of the *building* assembly cannot be improved to meet the requirements of Sentences (2) to (6) due to construction limitations, structural constraints or loss of functionality of the space, the effective thermal resistance shall be improved to the extent possible. (See Note A-10.9.36.1.(7) and 10.9.36.2.(7)-2025 (PCF 1829).)

Note A-10.9.36.1.(4) Alteration of Unheated Floors-on-Ground Below the Frost Line.

Table 9.36.2.8.-A does not require insulation below unheated floors-on-ground that are below the frost line (i.e., typical basement slabs). If, within the extent of an alteration, a basement slab or a portion thereof is replaced or newly installed, additional insulation above or below this floor and further sealing of the air barrier to reduce the ingress of soil gases will offer additional benefits to occupants.

Impact analysis

According to Statistics Canada, the greatest number of permits were issued for single-family houses in the late 1980s, peaking at around 130 000 permits annually [1]. For the purpose of providing a simplified calculation for estimating the cost-benefit of alterations, a demonstrative house (circa 1984–1995, two-storey, single detached, 2 000 ft.^{2} to 2 500 ft.^{2} of heated floor area and natural gas-fired furnace) in London, Ontario, (Zone 6) was used from a study conducted by CanmetEnergy [2].

Note that it is impossible to explore all permutations of alterations occurring in the country. As such, this representative case has been selected to provide an illustrative example. The actual energy savings would greatly differ (i.e., may be understated or overstated), as they are based on the current thermal resistance value of the below-grade assembly being altered.

Where the building envelope is improved by this proposed change, the amount of energy required to heat the building is typically expected to be nearly 30% less than that of the original building envelope. Up to 3% of this energy savings results from the improved thermal resistance of below-grade assemblies. This statement implies that potential annual average energy savings would be around $9 per year (i.e., 3% of 30% of $995, which is the annual average natural gas bill for Canadian residences [3]).

The incremental cost of the installation of batt insulation in a frost wall to an RSI value of 2.97, assuming there was no insulation in the original framed wall, is $2.47/m^2, for a total cost of up to $1 636 for the entire basement of the archetype.

References

(1) Statistics Canada. Housing Permit.

(2) Clean Air Partnership. Archetyping Guide for Energy-Efficiency Programs, www.cleanairpartnership.org

(3) Canadian Gas Association. Natural Gas Facts, www.cga.ca

Enforcement implications

It is expected that a consistent set of provisions that apply to the alteration of existing buildings would help reduce the administrative and enforcement work of assessing the degree to which any particular requirement could be relaxed without affecting the level of performance of the building with respect to the Code objectives.

This proposed change would aid enforcement by identifying the work necessary to improve the energy performance of an alteration.

Who is affected

Designers, engineers, architects, building officials, manufacturers, suppliers and energy advisors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[10.9.36.2.] -- ([1] --) no attributions

[10.9.36.2.] -- ([2] --) no attributions

[10.9.36.2.] -- ([3] --) no attributions

[10.9.36.2.] -- ([3] --) [F92-OE1.1]

[10.9.36.2.] -- ([4] --) no attributions

[10.9.36.2.] -- ([4] --) [F92-OE1.1]

[10.9.36.2.] -- ([5] --) no attributions

[10.9.36.2.] -- ([5] --) [F92-OE1.1]

[10.9.36.2.] -- ([6] --) no attributions

[10.9.36.2.] -- ([6] --) [F92-OE1.1]

[10.9.36.2.] -- ([7] --) no attributions

Submit a comment

Proposed Change 1846

Code Reference(s):	**NBC20 Div.B Appendix D (first printing)**
Subject:	Other — Fire Protection
Title:	Introduction of References to Standards Related to Gypsum Board to Sentence D-1.5.1.(2)
Description:	This proposed change introduces references to three standards that are already referenced elsewhere in the NBC to Sentence D-1.5.1.(2), ASTM C1177/C1177M, "Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing," ASTM C1178/C1178M, "Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel," and ASTM C1658/C1658M, "Standard Specification for Glass Mat Gypsum Panels."
Related Code Change Request(s):	CCR 1801
Related Proposed Change(s):	PCF 1845

This change could potentially affect the following topic areas:

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

Problem

Several common Type X gypsum board products are available on the market and used across Canada. However, Sentence D-1.5.1.(2) of Division B of the NBC currently references only two standards for Type X gypsum board. This results in a limited selection of Type X gypsum board products that can be used to comply with the requirements of Appendix D. If the list of gypsum board standards referenced in Sentence D-1.5.1.(2) is not updated, it will continue to limit the flexibility of design and construction.

The current edition of the NBC needs to be updated to reflect the standardized industry language and gypsum products that are currently used in Canada.

Justification

This proposed change would introduce references to three Type X gypsum board standards to Sentence D-1.5.1.(2), ASTM C1177/C1177M, “Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing,” ASTM C1178/C1178M, “Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel,” and ASTM C1658/C1658M, “Standard Specification for Glass Mat Gypsum Panels”. These three standards are already referenced elsewhere in the NBC 2020, and referencing them in Sentence D-1.5.1.(2) is not expected to result in any conflicts.

This proposed change would permit Type X gypsum board with glass mat facer to be used in high moisture environments where paper-faced products are not appropriate. This proposed change would also improve flexibility in the design and construction of buildings since more options would be available to Code users.

PROPOSED CHANGE

Appendix D Fire-Performance Ratings

> Footnote: This information is included for explanatory purposes only and does not form part of the requirements. The bold face reference numbers that introduce each item do not relate to specific requirements in this Division.

[D-1.] D-1. General

The content of this Appendix was prepared on the recommendations of the Standing Committee on Fire Protection, which was established by the Canadian Commission on Building and Fire Codes (CCBFC) for this purpose.

[D-1.5.] D-1.5. Gypsum Board

[D-1.5.1.] D-1.5.1. Types of Gypsum Board

[1]

1) Where the term “gypsum board” is used in this Appendix, it is intended to include—in addition to gypsum board—gypsum backing board and gypsum base for veneer plaster as described in

a) CAN/CSA A82.27-M, "Gypsum Board", or

b) ASTM C1396/C1396M, "Standard Specification for Gypsum Board".

[2]

2) Where the term “Type X gypsum board” is used in this Appendix, it applies to special fire-resistant board as described in

a) CAN/CSA A82.27-M, "Gypsum Board", ~~or~~

b) ASTM C1396/C1396M, "Standard Specification for Gypsum Board".,

c) ASTM C1177/C1177M, “Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing,”

d) ASTM C1178/C1178M, “Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel,” or

e) ASTM C1658/C1658M, “Standard Specification for Glass Mat Gypsum Panels.”

[D-2.] D-2. Fire-Resistance Ratings

[D-3.] D-3. Flame-Spread Ratings and Smoke Developed Classifications

[D-4.] D-4. Noncombustibility

[D-5.] D-5. Protection of Openings in Fire-Rated Assemblies

[D-6.] D-6. Fire Performance of Exterior Wall Assemblies

[D-7.] D-7. Background Information

Impact analysis

No additional cost are expected to be incurred as a result of adding references to these three standards to Sentence D-1.5.1.(2). The proposed change would simply add more options. Formally including more gypsum board products as desired by the construction industry will simplify enforcement and allow the use of gypsum board products that are more appropriate to the end use.

Enforcement implications

This proposed change can be enforced by the existing infrastructure. Since the three additional standards are already referenced in the NBC 2020, the industry and regulators are familiar with the products conforming to these standards. As such, no additional training is anticipated to be necessary for Code users. Formally including more gypsum board products as desired by the construction industry will simplify enforcement of the Code.

Who is affected

Builders, consumers, manufacturers, regulators, designers, contractors and building owners.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

N/A

Submit a comment

Proposed Change 1954

Code Reference(s):	**NBC20 Div.C 2.2.8.2.(1) (first printing)**
Subject:	Airtightness
Title:	Using NLR_{50} in Administrative Documents
Description:	This proposed change modifies the airtightness metric required on drawings and specifications for the proposed house.
Related Proposed Change(s):	PCF 1819

This change could potentially affect the following topic areas:

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

Problem

Where an airtightness test is used to determine the airtightness of a proposed house, the measured airtightness of the building envelope must be reported in ACH_{50} (air changes per hour at 50 Pa pressure differential) on the drawings and specifications for the proposed house as required by the National Building Code of Canada (NBC) 2020. A related proposed change (PCF 1819) uses NLR_{50} (normalized leakage rate at 50 Pa pressure differential) as the regulated airtightness metric in the NBC.

To prevent confusion and enforcement issues associated with PCF 1819, the administrative provisions of the Code should also be revised to require the NLR_{50} metric to be provided on the drawings and specifications for the proposed house.

Justification

NLR_{50} (in L/(s×m^2)) is an airtightness metric that is based on the airtightness of assemblies and surfaces, which is in turn directly aligned with the materials used and the assemblies built by the builders during construction. The prescriptive requirements in Subsection 9.25.3. address the airtightness of materials and assemblies as a means of achieving a continuous air barrier system that is a part of the building envelope. The required airtightness of this system should not vary with the size or geometry of the house being constructed, yet relying on a volumetric target such as ACH_{50} effectively does just that. ACH_{50} is a volumetric measurement that is calculated as an output of the measured effectiveness of the air barrier assemblies and varies by house size, even where assembly airtightness is consistent. Conversely, NLR_{50} is a normalized metric, meaning that it is more consistently applicable to a wide variety of housing geometries.

PCF 1819 proposes maintaining the use of ACH_{50} in Section 9.36. as a calculated value for input into energy models, but ACH_{50} would be calculated as an output value based on an NLR_{50} input value and building geometry rather than an assumed value. PCF 1819 would also remove ACH_{50} from all tables in Section 9.36., which would simplify the requirements.

Using NLR_{50} instead of ACH_{50} as the metric to report the measured airtightness on the drawings and specifications for the proposed house would align the administrative requirements with the proposed revision to the technical requirements found in PCF 1819.

PROPOSED CHANGE

[2.2.8.2.] 2.2.8.2. Information Required on Drawings and Specifications

[1] **1)** Except as provided in Sentences (2) to (4), the drawings and specifications for the proposed house shall include

[a] a) the effective thermal resistance values and respective areas of all opaque *building* envelope assemblies, including all above-ground and below-ground roof/ceiling, wall, and floor assemblies,

[b] b) the overall thermal transmittance (U-value), solar heat gain coefficient and respective areas of all fenestration and door components,

[c] c) the ratio of total vertical fenestration and door area to gross wall area,

[d] d) the performance rating, energy source, and types of all equipment required for space-heating and -cooling and service water heating,

[e] e) the design basis for the ventilation rates,

[f] f) the design normalized leakage rate of the *building* envelope at 50 Pa pressure differential (NLR_{50}) in L/(s×m^2), with a pressure exponent of 0.67, where a test is to be used to determine the airtightness of ~~a~~the house, ~~the measured airtightness of the~~

~~*building* envelope in air changes per hour,~~ and

[g] g) any additional features used in the energy model calculations that account for a significant difference in house energy performance.

Impact analysis

PCF 1819 revises Section 9.36. to use NLR$_{50}$ as the regulated airtightness metric, which provides a more representative assessment of the performance of the air barrier system. Making this change (PCF 1954) would align the requirements for drawings and specifications with airtightness testing practices. Since the Code requires builders to construct assemblies that are airtight, it makes sense to measure the airtightness of these assemblies, aligning technical requirements and enforcement requirements through the use of the NLR$_{50}$ metric.

Because the conversion between ACH$_{50}$ and NLR$_{50}$ requires only the exposed area and volume as inputs (both known quantities when performing a blower door test), and the NLR$_{50}$ metric is already specified in existing Code requirements, this proposed change would have no additional implementation costs for Code users. The authority having jurisdiction would need to be familiar with the airtightness requirements using the NLR$_{50}$ metric (i.e., the targeted NLR$_{50}$ values for different airtightness levels) when reviewing the drawings and specifications for proposed projects.

Using the NLR$_{50}$ metric instead of the ACH$_{50}$ metric as a measure of airtightness performance on the drawings and specifications for a proposed house would align the administrative requirements in Division C of the NBC with the revised technical requirements (as proposed in PCF 1819) in Division B.

Enforcement implications

This proposed change could be enforced using existing Code enforcement infrastructure.

Authorities having jurisdiction would need to become familiar with the NLR$_{50}$ metric if they are not already using it regularly.

Who is affected

Designers, engineers, architects, building officials, manufacturers, suppliers and energy advisors.

Submit a comment

Proposed Change 1989

Code Reference(s):	**NECB20 Div.A 1.3.3.1. (first printing)**
Subject:	Greenhouse Gas Emissions
Title:	Application of a New Part on Operational Greenhouse Gas Emissions
Description:	This proposed change adds the application of a new Part proposed to be introduced to the NECB to address operational greenhouse gas emissions.
Related Code Change Request(s):	CCR 1805
Related Proposed Change(s):	PCF 1820, PCF 1843, PCF 2003, PCF 2004, PCF 2016, PCF 2026

This change could potentially affect the following topic areas:

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

Problem

In 2022, on advice from the provinces and territories, the Canadian Commission on Building and Fire Codes (CCBFC) agreed to add an objective to the National Model Codes that relates to limiting greenhouse gas (GHG) emissions. This direction was adopted by the newly formed Canadian Board for Harmonized Construction Codes (CBHCC) in November 2022.

Proposed Part 11 of the NECB will contain the technical requirements for GHG emissions that apply to buildings. The application of Part 11 must be stated in Division A of the NECB.

Failure to state the application of these requirements may lead to a risk that the requirements will not be enforceable.

Justification

In order to meet provincial, territorial and federal GHG emissions reduction targets and climate action plans, including the goals to reduce Canada's total GHG emissions to 40–45% below the 2005 levels by 2030 and to reach net-zero GHG emissions by 2050, Code requirements are needed to mitigate the GHG emissions of new buildings.

In the 2020 edition of the NECB, energy efficiency tiers were introduced with measures that progressively increase energy efficiency in new buildings. While these requirements go a long way towards reducing the amount of energy used to operate a building, operational GHG emissions have not yet been addressed.

Excessive GHG emissions result in increased concentrations of GHGs in the atmosphere, which in turn can lead to climate change and a risk to the environment. Technical requirements for the design and construction of buildings that limit the excessive emissions of operational GHGs are needed to address climate change mitigation.

PROPOSED CHANGE

[1.3.3.1.] 1.3.3.1. Application of Parts 1, 3 to 8, 10 and 1~~0~~1

[1] 1) Parts 1, 3 to 8, 10 and 1~~0~~1 of Division B apply to all *buildings* covered in this Code. (See Article 1.1.1.1.)

Impact analysis

The impact analysis for proposed measures to limit GHG emissions will be provided in each of the respective proposed change forms that address the specific technical changes proposed for Division B of the NECB.

It is expected that new proposed changes to Code requirements that limit excessive emissions of operational GHGs will provide a benefit to society by mitigating the effect of climate change on the environment.

Enforcement implications

Enforcement of technical requirements to minimize excessive emissions of operational GHGs will require additional effort by the authorities having jurisdiction. Training material will be required to assist enforcement officials.

A consistent set of technical requirements to minimize the excessive emission of operational GHGs across Canada will contribute to meeting provincial, territorial and federal GHG emissions reduction targets and climate action plans, including the goals to reduce Canada's total GHG emissions to 40−45% below the 2005 levels by 2030 and to reach net-zero GHG emissions by 2050.

Who is affected

Designers, manufacturers, building officials, builders, building owners and specification writers.

Submit a comment

Proposed Change 1990

Code Reference(s): **NECB20 Div.A 1.4.1.2. (first printing)**

Subject: Defined Terms

Title: Addition of the Defined Term "Alteration"

Description: This proposed change introduces the defined term "alteration" from the NBC to the NECB.

This change could potentially affect the following topic areas:

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

Problem

"Alteration" is a defined term in the National Building Code of Canada (NBC) 2020 but is not currently a defined term in the National Energy Code of Canada for Buildings (NECB) 2020. The proposed changes regarding the alteration of existing buildings will use the term alteration both for the NECB and for Section 9.36. of Division B of the NBC.

If the term "alteration" were defined differently by the National Model Codes, then the Codes would be inconsistent, which could lead to misinterpretation and incorrect application of Code requirements.

Justification

This proposed change introduces "alteration" as a defined term and replicates the NBC's definition of the term in the NECB without modification. This proposed change would eliminate inconsistency and potential misinterpretation and incorrect application of the requirements for the alteration of existing buildings.

PROPOSED CHANGE

[1.4.1.2.] 1.4.1.2. Defined Terms

[1] 1) The words and terms in italics in this Code shall have the following meanings:

Alteration means a change or extension to any matter or thing or to any *occupancy* regulated by this Code.

Impact analysis

Defining the term "alteration" in the NECB would provide clarification, harmonize the NECB with the NBC and reduce confusion when applying the proposed requirements applicable to the alteration of existing buildings.

Enforcement implications

Replicating the NBC's definition of the term "alteration" without modification in the NECB would facilitate the enforcement of the proposed requirements that apply to the alteration of existing buildings.

Who is affected

Designers, specification writers, manufacturers, contractors, building owners and building officials.

Submit a comment

Proposed Change 2016

Code Reference(s):	**NECB20 Div.A 1.4.2.1.(1) (first printing)** **NBC20 Div.A 1.4.2.1.(1) (first printing)**
Subject:	Greenhouse Gas Emissions
Title:	New Abbreviations Related to Operational GHG Emissions
Description:	This proposed change updates the list of symbols and abbreviations in the NBC and NECB.
Related Proposed Change(s):	PCF 1820, PCF 1843, PCF 1989, PCF 2003, PCF 2004, PCF 2026

This change could potentially affect the following topic areas:

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

Problem

Proposed changes developed for the 2025 edition of the National Building Code of Canada (NBC) and National Energy Code of Canada for Buildings (NECB) introduce new abbreviated terms to quantify operational greenhouse gas (GHG) emissions. While these abbreviations, such as “CO2e”, “GHG”, “GJ” and “kWh”, are commonly used in the industry, they are not assigned meaning in the NBC and NECB, which could result in confusion leading to improper application of Code provisions.

Justification

Providing the meaning of new abbreviated terms used in the technical requirements of the NBC and NECB to quantify operational GHG emissions would

- standardize terminology,

- enhance clarity,
- facilitate interpretation of, and compliance with, the requirements,
- ensure consistency,
- reduce confusion, and
- foster streamlined communication among Code users.

PROPOSED CHANGE

NECB20 Div.A 1.4.2.1.(1) (first printing)

[1.4.2.1.] 1.4.2.1. Symbols and Other Abbreviations

[1] **1)** The symbols and other abbreviations in this Code shall have the meanings assigned to them in this Article and Article 1.3.2.1. of Division B.

A	ampere(s)
a	annum (year)
Btu	British thermal unit(s)
cfm	cubic feet per minute
CH	*ceiling height*
CO_2e	carbon dioxide equivalent
COP	*coefficient of performance*
°	degree(s) (of an angle)
°C	degree(s) Celsius
°F	degree(s) Farenheit
db	dry bulb (temperature)
E_c	*combustion efficiency*
E_t	*thermal efficiency*
EER	*energy-efficiency ratio*
EF	*energy factor*
ft.	foot (feet)
g	gram(s)

GHG	greenhouse gas
GJ	gigajoule(s)
gpm	gallon(s) per minute
>	greater than
≥	greater than or equal to
h	hour(s)
HVAC	heating, ventilating and air-conditioning
IEER	*integrated energy-efficiency ratio*
IPLV	*integrated part-load value*
K	Kelvin
kg	kilogram(s)
kJ	kilojoule(s)
kVA	kilovolt ampere(s)
kW	kilowatt(s)
kWh	kilowatt-hour(s)
<	less than
≤	less than or equal to
L	litre(s)
lb.	pound(s)
LPD	lighting power density
lx	lux
m	metre(s)
max.	maximum
MBH	mega Btu/h
min.	minimum
min	minute(s)
mm	millimetre(s)
No.	number

o.c.	on centre
Pa	pascal(s)
%	per cent
R	thermal resistance value (imperial unit)
RSI	thermal resistance value (metric unit)
s	second(s)
SCOP	seasonal *coefficient of performance*
SEER	*seasonal energy-efficiency ratio*
SL	*standby losses*
Δt	temperature difference
US gal.	US gallon(s)
U-value	*overall thermal transmittance*
V	volt(s)
V_t	storage volume
W	watt(s)
wb	wet bulb (temperature)

NBC20 Div.A 1.4.2.1.(1) (first printing)

[1.4.2.1.] 1.4.2.1. Symbols and Other Abbreviations

[1] **1)** The symbols and other abbreviations in this Code shall have the meanings assigned to them in this Article and Article 1.3.2.1. of Division B.

1 in 2	slope of 1 vertical to 2 horizontal
cm	centimetre(s)
CO_2e	carbon dioxide equivalent
°	degree(s)
°C	degree(s) Celsius
dBA	A-weighted sound level
diam	diameter

g	gram(s)
GHG	greenhouse gas
GJ	gigajoule(s)
h	hour(s)
HDD	heating degree-day(s)
HVAC	heating, ventilating and air-conditioning
Hz	hertz
J	joule(s)
K	degree(s) Kelvin
kg	kilogram(s)
kN	kilonewton(s)
kPa	kilopascal(s)
kW	kilowatt(s)
kWh	kilowatt-hour(s)
L	litre(s)
lx	lux
m	metre(s)
M	metric nomenclature for reinforcing bars
max.	maximum
min.	minimum
min	minute(s)
MJ	megajoule(s)
mm	millimetre(s)
MPa	megapascal(s)
N	newton
n/a	not applicable
ng	nanogram(s)
No.	number(s)

o.c.	on centre
OSB	oriented strandboard
PM	particulate matter
ppb	part(s) per billion
ppm	part(s) per million
R	thermal resistance value (imperial unit)
RSI	thermal resistance value (metric unit)
s	second(s)
W	watt(s)
%	percent
µg	microgram(s)
µm	micrometre(s)
U-value	overall thermal transmittance

Impact analysis

This proposed change would add consistency and eliminate any potential ambiguity in the interpretation of various NBC and NECB requirements containing the abbreviations.

Providing the meaning of the abbreviations would not have a negative impact on building design; and, therefore, should not result in any additional costs in the design of a particular project.

Enforcement implications

This proposed change increases clarity and consistency, thereby reducing ambiguity in Code interpretation. There should not be any resulting enforcement implications.

Who is affected

Designers, engineers, architects, builders and building officials.

Submit a comment

Proposed Change 1868

Code Reference(s): **NECB20 Div.B 1.1.2.1. (first printing)**
NECB20 Div.B 8.4. (first printing)

Subject: Energy Use Intensity

Title: Energy Use Intensity Compliance Path

Description: This proposed change introduces an energy performance compliance path based on the energy use intensity target of the building.

Related Proposed Change(s): PCF 1869

This change could potentially affect the following topic areas:

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

Problem

The current energy performance path in the National Energy Code of Canada for Buildings (NECB) uses a “proposed versus reference” approach to demonstrate compliance with the Code. In this approach, an energy model for the entire building that represents the proposed building design is created following the requirements of Part 8 of Division B of the NECB. An energy model for the reference building is then created in a similar fashion, but using the appropriate prescriptive requirements in Parts 3 to 7 of the NECB instead of the proposed design parameters. A building is deemed compliant with Part 8 if the modeled proposed building uses no more energy than the reference building. This approach is commonly used by many energy codes.

As the NECB becomes more stringent and aspires to a net-zero energy level of performance, the "proposed versus reference" approach in the performance path becomes less efficient in its ability to reduce energy use in buildings. The following are some of the flaws of this compliance approach.

1. The prescriptive requirements of the NECB are used to set the minimum performance level of the proposed building and the NECB is also used in the modeling of the reference building. As the required performance level of the proposed building increases, specific prescriptive energy conservation measures could be favoured while invalidating others, limiting the design options to which building designers have access and pushing the market toward more uniform design solutions and a limited set of technologies that may prove to be unsuitable for some categories of building archetypes or in the future.

2. The NECB performance path was not designed to accommodate increasing levels of "percent better than" comparison; rather, it was designed as a binary pass/fail test. This is evidenced by the following.

    a. Different design paths leading to different applicable prescriptive requirements. In the current prescriptive requirements and reference building modeling rulesets, the energy consumption of the reference building can change significantly as a result of proposed design choices, even if those choices have only marginal impact on the energy consumption of the proposed design. For example, switching heating systems from heat pump to boiler results in a similar change in the reference building and thus increases the reference energy consumption.

    b. Aligning modeling procedures across jurisdictions. Many authorities having jurisdiction express their requirements as "percent better than" Code values. However, due to the limitations noted here, authorities having jurisdiction have implemented various modifications to the current performance path rules to allow projects to demonstrate higher savings. These modifications create a patchwork of energy modeling procedures that vary across Canada. This issue is avoided with an energy use intensity approach, where it presents an opportunity to streamline or eliminate local modeling variations, that is independent of the energy performance tier or "percent better than" targets set by each jurisdiction.

3. The NECB performance path may be limited in its ability to meet its intended objective, i.e., reducing excessive use of energy. Due to the effect of different design paths leading to different prescriptive requirements (2(a) above), potential energy savings under the current performance path may be constrained by the ruleset that determines the energy consumption of the reference building and have less effect on energy reduction in the proposed building.

4. Additional effort is required and potential to introduce errors exists when creating a reference building model. Creating an energy model to represent the energy performance of a proposed design (based on drawings and specifications) depends on the interpretation of the energy modeler. The rulesets for creating the reference building, while sometimes clear and precise, can at other times be ambiguous and open to interpretation as well.

Failure to provide Code users with an alternative energy performance path to the "proposed versus reference" approach to demonstrate compliance with the performance path of the NECB would limit the options available for Code users to improve building energy performance to meet the objective of minimizing excessive use of energy.

Justification

Introducing absolute energy targets in the NECB would allow designers to directly measure the intended impact of design choices, specifically in terms of energy consumption. Design decisions that impact these metrics would be reflected in the energy performance of the energy model.

The proposed absolute energy targets take into account climate zones and building size and typology. As not all building typologies can be represented, the most significant archetypes in terms of annual construction in Canada would be targeted.

This proposed change would enable the NECB to facilitate the design of net-zero energy ready buildings by setting absolute energy targets that represent the minimum energy consumption that can reasonably be achieved for the given building typology and climate zone. This proposed change would also streamline performance path compliance by reducing energy modeling effort and removing the need to interpret the reference building ruleset.

The proposed compliance path based on absolute energy targets would make it more cost-effective for Code users to comply with Code requirements when using designs that minimize the building envelope to floor area ratios or optimize ventilation air. The proposed change would permit Code users to use lower insulation levels in more compact building designs, due to the fact that these buildings naturally consume less energy due to their smaller building envelope area. Finally, this proposed compliance path would enable flexibility in the choice of heating, ventilation and air-conditioning systems by allowing any type of system to be selected.

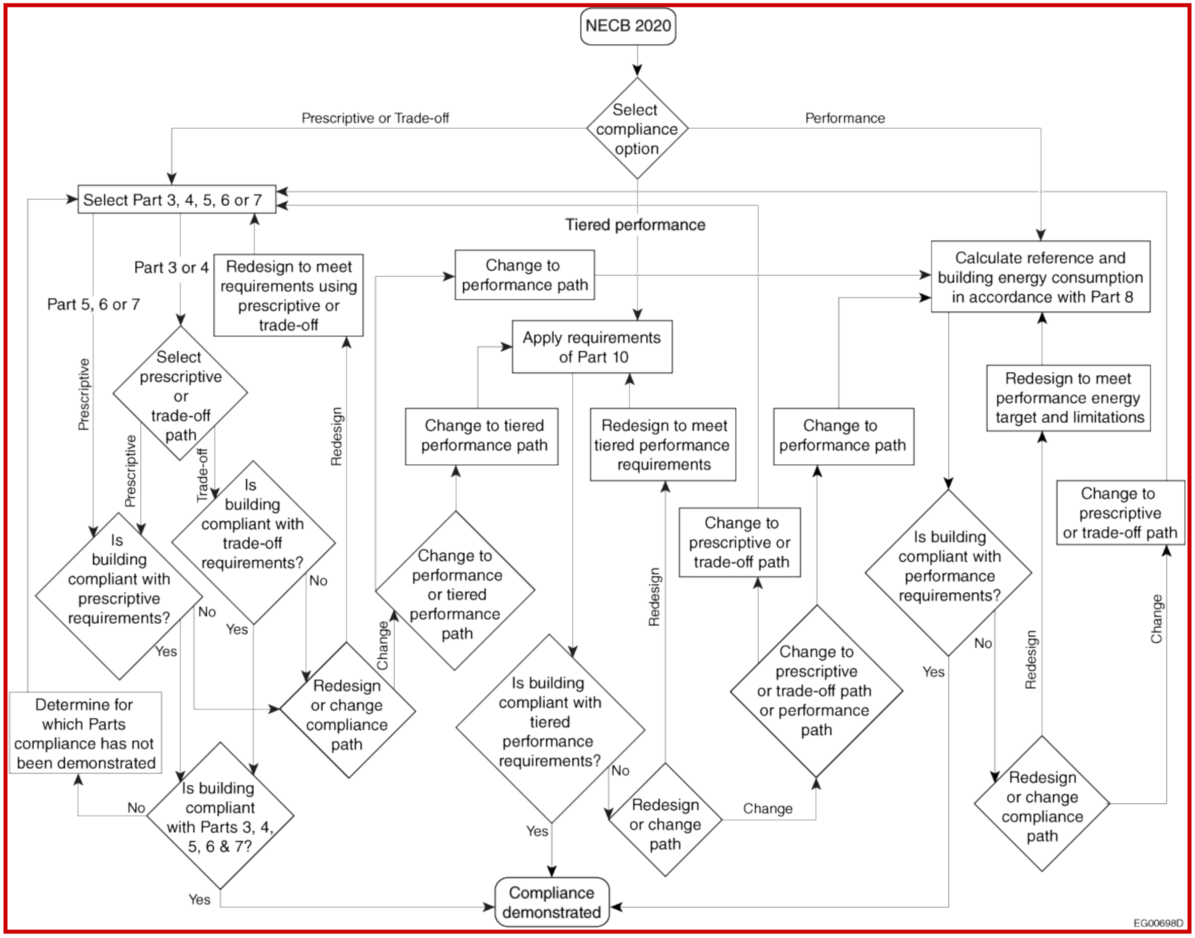
PROPOSED CHANGE

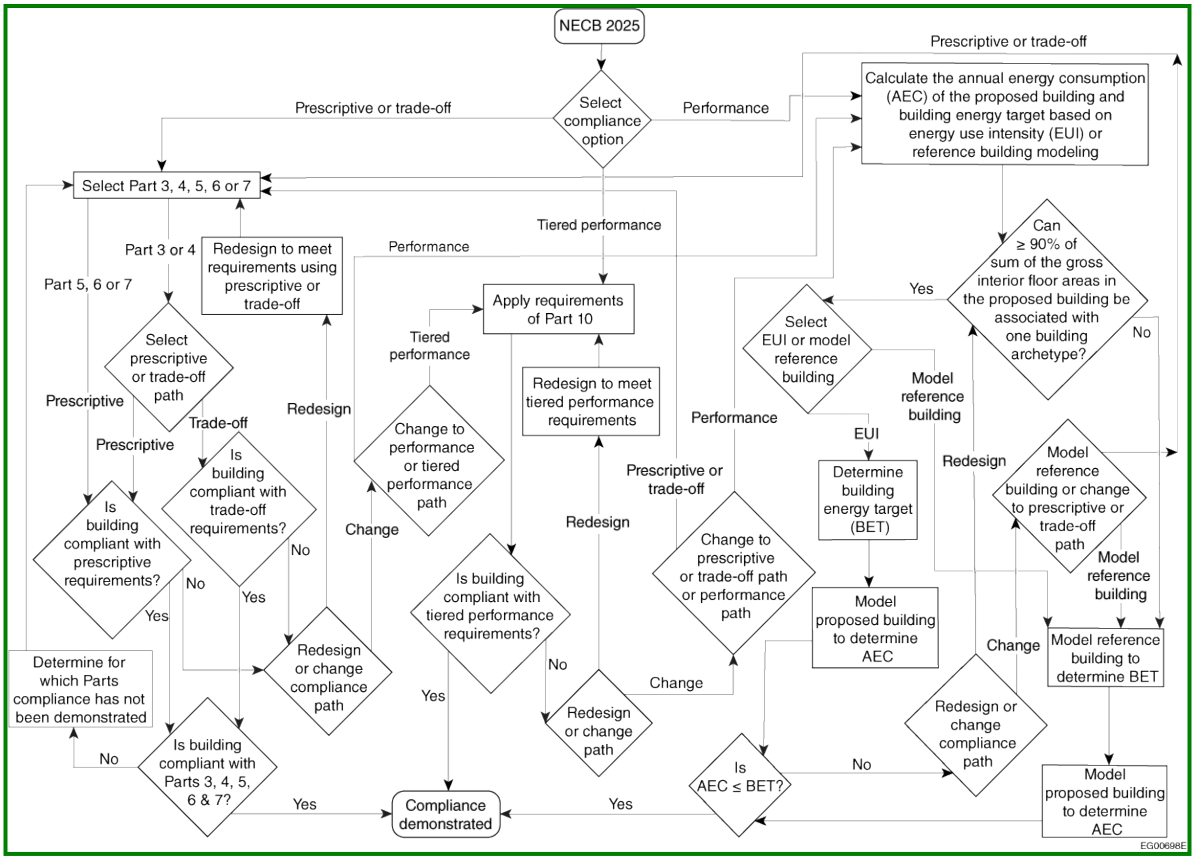
[1.1.2.1.] 1.1.2.1. Prescriptive, Trade-off or Performance Compliance

Note A-1.1.2.1. NECB Compliance Options.

Figure A-1.1.2.1. shows the three compliance options available in Division B.

Figure [A-1.1.2.1.] A-1.1.2.1.
Decision flow chart for Code compliance





[8.4.] 8.4. Performance Path

[8.4.1.] 8.4.1. Compliance

[8.4.1.1.] 8.4.1.1. General

[8.4.1.2.] 8.4.1.2. Determination of Compliance

[1] 1) Subject to the limitations stated in Article 8.4.1.3., compliance with this Part shall be determined based on Sentences (2) to (5).

[2] 2) The *annual energy consumption* of the proposed *building*, in kWh per year, as determined in accordance with this Part, shall not exceed the *building energy target* of the reference *building*, in kWh per year, as determined in accordance with~~.~~

[a] a) Subsection 8.4.4.-2025, or

[b] a) Subsection 8.4.5.-2025.

[3] 3) The number of hours during which the heating loads for each *thermal block* are not met shall not exceed 100 hours in a simulated year for ~~both~~ the proposed *building* and, where applicable, for the reference *building*~~s~~.

[4] 4) The number of hours during which the cooling loads for each *thermal block* of the proposed *building* for which mechanical cooling is provided are not met shall

[a] a) not exceed 100 hours in a simulated year for the proposed *building* when complying with Subsection 8.4.4.-2025, or

[b] a) not differ by more than ±10% or 20 hours, whichever is greater, from the number of hours in a simulated year ~~that~~during which the cooling loads for each *thermal block* of the reference *building* are not met when complying with Subsection 8.4.5.-2025.

[5] **5)** Where the requirements of Sentences (3) and (4) are not met, the capacities of the *primary* and *secondary systems* of the proposed *building* or the reference *building*, where applicable, shall be incrementally increased until those loads are met.

[8.4.1.3.] 8.4.1.3. Limitations

[8.4.1.4.] 8.4.1.4. Treatment of Additions

[8.4.1.5.] --- Treatment of Process Loads

[1] --) Except as provided in Sentence (2), the energy consumed by process loads need not be included in the energy model of the proposed *building*.

[2] --) Where the effects of process loads are included to reduce the *annual energy consumption* of the proposed *building*, the energy consumed by the process loads shall be accounted for in the modeling of the proposed *building* and in the calculation of the *building energy target*. (See also Note A-8.4.2.7.(1).)

[8.4.2.] 8.4.2. Compliance Calculations

[8.4.2.1.] 8.4.2.1. General

[8.4.2.2.] 8.4.2.2. Calculation Methods

[1] **1)** Except as provided in Sentence (5), the energy model calculations shall account for the ~~*annual energy consumption*~~annual energy use of

[a] a) space-heating equipment,

[b] b) space-cooling equipment,

[c] c) fans,

[d] d) *interior* and *exterior lighting* devices,

[e] e) *service water* heating equipment,

[f] f) pumps,

[g] g) auxiliary HVAC equipment (see Note A-8.4.2.2.(1)(g)),

[h] h) receptacle loads and miscellaneous equipment as per Article 8.4.2.7.,

[i] i) appliances, and

[j] j) elevators and escalators.

[2] **2)** The energy model calculations shall be performed for a one-year period

(8 760 hours) using time intervals no greater than one hour.

[3] **3)** Operating schedules and climatic data input in the energy model shall use a time interval no greater than one hour.

[4] **4)** 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) ANSI/ASHRAE 140, "Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs", or

[b] b) an equivalent test method.

[5] **5)** Redundant or back-up equipment is permitted to be excluded from the energy model, provided it is equipped with controls that operate the equipment only when the primary equipment is not operating.

[8.4.2.3.] 8.4.2.3. Climatic Data

[8.4.2.4.] 8.4.2.4. Thermal Mass

[8.4.2.5.] 8.4.2.5. Space Temperature

[8.4.2.6.] 8.4.2.6. Heat Transfer Between Thermal Blocks

[8.4.2.7.] 8.4.2.7. Internal and Service Water Heating Loads

[8.4.2.8.] 8.4.2.8. Building Envelope

[8.4.2.9.] 8.4.2.9. Air Leakage

[8.4.2.10.] 8.4.2.10. HVAC Systems Calculations

[1] **1)** For the purpose of compliance calculations in accordance with the requirements of Subsection 8.4.5.-2025, the reference *building*'s HVAC systems determined in accordance with Article 8.4.5.7.-2025~~Article 8.4.4.7.~~ shall be modeled without substituting their components with thermodynamically similar components or using approximated calculations.

[2] **2)** The energy model calculations shall account for the effect of terminal devices, *primary systems* and *secondary systems* having limited capacities on space temperature and energy use.

[3] **3)** Where applicable, the energy modeling of *secondary systems* shall account for

[a] a) temperature rise of supply air due to heat from supply fan,

[b] b) temperature rise of return air due to heat from return fan,

[c] c) temperature rise of return air due to heat gain from lights,

[d] d) fan power as a function of supply airflow,

[e] e) temperature and humidity rise or drop of supply or return air due to heat (sensible and latent energy) transferred from a heat-recovery device, and

[f] f) temperature rise of the outside air due to preheaters.

[4] **4)** The energy model calculations shall determine how many hours the *primary system*, *secondary system* and terminal device loads are not met.

[5] **5)** The energy model calculations shall account for the efficiency and capacity of the HVAC equipment as a function of part load and parameters such as, but not limited to, the temperatures of entering fluids and climatic conditions.

[8.4.3.] 8.4.3. Annual Energy Consumption of Proposed Building

[8.4.3.1.] 8.4.3.1. General

[1] **1)** The *annual energy consumption* of the proposed *building* shall be calculated as described in this Subsection.

[2] **2)** Except as stated otherwise in this Subsection, the energy model shall be consistent with the proposed *building*'s specifications including proper accounting of

- [a] a) *fenestration*, doors and *opaque building assembly* types and areas,
- [b] b) lighting systems and controls,
- [c] c) HVAC system types, capacities and controls,
- [d] d) *service water* heating system types, capacities and controls, and
- [e] e) electrical systems.

[3] **3)** The energy model calculations shall include

- [a] --) all the energy use addressed in Sections 3.2., 4.2., 5.2., 6.2. and 7.2., and
- [b] --) all spaces within the *building*.

[4] **4)** Each conditioned *thermal block* in the proposed *building* shall be modeled as being

- [a] a) heated, if only heating systems are provided,
- [b] b) cooled, if only cooling systems are provided, and
- [c] c) heated and cooled, if complete heating and cooling systems or only rough-ins are provided.

[5] **5)** For the purpose of compliance calculations, where a *building* system or part of a *building* system has not been fully specified, it shall be assumed that it complies with the prescriptive requirements.

[6] **6)** Where a *building envelope* assembly covers less than 5% of the total area of that assembly type, it is permitted to be excluded from the energy model, provided its area is included in an adjacent assembly having a similar U-value and the same orientation.

[7] **7)** The energy model calculations shall not include manually operated *fenestration* shading devices, such as blinds or shades.

[8] **8)** The energy model calculations shall include permanent *fenestration* shading devices, such as fins, overhangs, and light shelves.

[8.4.3.2.] 8.4.3.2. Operating Schedules, Internal Loads, Service Water Heating Loads and Set-point Temperature

[1] **1)** The operating schedules relating to the presence of occupants and of loads due to the operation of lighting, receptacle equipment, and heating, cooling and *service water* heating systems shall be ~~representative of the proposed *building*'s type or space functions. (See Note A-8.4.3.2.(1).)~~set in accordance with

- [a] --) Article 8.4.4.2.-2025, when complying with Subsection 8.4.4.-2025, or
- [b] --) Sentences (2) and (3), when complying with Subsection 8.4.5.-2025. (See Note A-8.4.3.2.(1)(b).)

[2] **2)** Internal loads, *service water* heating loads, and illuminance levels used in the energy compliance calculations shall be representative of the proposed *building*'s type or space functions. (See Note A-8.4.3.2.(2).)

[3] **3)** For semi-heated *buildings*, as defined in Sentence 1.2.1.2.(2), the set-point temperature of the proposed *building* shall be that shown in the specifications.

[8.4.3.3.] 8.4.3.3. Building Envelope Components

[8.4.3.4.] 8.4.3.4. Interior Lighting

[8.4.3.5.] 8.4.3.5. Purchased Energy

[8.4.3.6.] 8.4.3.6. Outdoor Air

[1] **1)** For the purpose of compliance calculations, the peak outdoor air ventilation rates shall be set

- [a] --) in accordance with Article 8.4.4.2., when complying with Subsection 8.4.4.-2025, or
- [b] --) to the minimum rates required by the applicable ventilation standard, based on the proposed *building*'s specifications, when complying with Subsection 8.4.5.-2025. (See Note A-8.4.3.6.(1).) (See also Note A-5.2.3.4.(1).)

[8.4.3.7.] 8.4.3.7. Space Temperature Control

[8.4.3.8.] 8.4.3.8. Part-Load Performance Curves

[8.4.3.9.] 8.4.3.9. Ice Plants

[8.4.4.] -- Energy Use Intensity

[8.4.4.1.] --- General

[1] --) This Subsection shall only be used to demonstrate compliance where 90% or more of the sum of the gross interior floor areas for each known space use of the proposed *building*, as calculated in accordance with Sentence

(3), is associated with one of the *building* archetypes listed in Table 8.4.4.1.-2025. (See Note A-8.4.4.1.(1)-2025.)

Table [8.4.4.1.]
Energy Use Intensities for Building Archetypes
Forming Part of Sentence 8.4.4.1.(1)

***Building* Archetype** [(1)]	**Energy Use Intensity,** [(2)] [(3)] **kWh/m² per year**
School (K-12)	125
Multi-unit residential *building*, not more than 6 *storeys*	225
Multi-unit residential *building*, more than 6 *storeys*	175
Office	175

Notes to Table [8.4.4.1.] :

(1) For heating degree-days of *building* location (HDD) < 9000 Celsius degree-days.

(2) See Note A-Table 8.4.4.1.-2025.

(3) For all heating energy types.

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[2] --) For the purpose of compliance with this Subsection, the *building energy target* (BET), in kWh per year, of the reference *building* shall be calculated as follows:

$$\mathrm{BET} = \sum_{i=1}^{n} \left(A_i \times \mathrm{EUI}_i \right) + \mathrm{PL}$$

where

i = identifier of a *building* archetype listed in Table 8.4.4.1.-2025 that is associated with a space use of the *building*,

n = total number of *building* archetypes listed in Table 8.4.4.1.-2025 that are associated with the *building*,

A_i = gross interior floor area of the *building* archetype i, in m², calculated in accordance with Sentence 8.4.4.1.(3)-2025,

EUI_i = energy use intensity, in kWh/m² per year, listed in Table 8.4.4.1.-2025 for *building* archetype i, and

PL = annual energy use of the process loads accounted for in the calculation of the *annual energy consumption* of the proposed *building*, in excess of the default peak receptacle loads set in Table 8.4.4.2.-2025, in kWh per year.

[3] --) The gross interior floor area of a *building* archetype shall be the sum of the interior floor areas of all *conditioned spaces* that are associated with this *building* archetype, as modeled in the proposed *building*, measured from the inside of exterior walls or the middle line of *partitions* separating a space use represented by this *building* archetype from a space use represented by another *building* archetype. (See Note A-8.4.4.1.(3)-2025.)

[4] --) Space functions not associated with a *building* archetype listed in Table 8.4.4.1.-2025 shall be distributed proportionally among the listed *building* archetypes so that the sum of the gross interior floor areas used in Sentence (2)-2025 is equal to the total floor area defined in the proposed *building* energy model.

[5] --) Where the *exterior lighting* devices of the proposed *building* do not comply with the prescriptive requirements of Part 4, their annual energy use shall be accounted for in the calculations as part of

[a] --) the *annual energy consumption* of the proposed *building*, and

[b] --) the process loads used in Sentence (2)-2025, where the *exterior lighting* devices are

  [i] --) set to comply with the prescriptive requirements of Section 4.2, and

  [ii] --) modeled using the operating schedules referred to in Article 8.4.4.2.-2025.

[8.4.4.2.] --- Operating Schedules and Internal and Service Water Heating Loads

[1] --) For the purpose of compliance with this Subsection, the proposed *building*'s operating schedules and internal and *service water* heating loads shall be set to the schedules and values indicated in Table 8.4.4.2.-2025 for the applicable *building* archetype. (See Note A-8.4.4.2.(1)-2025.)

Table [8.4.4.2.]
Modeling Inputs for the Proposed Building
Forming Part of Sentence 8.4.4.2.(1)

Building Archetype	Occupant Density, m^2/occupant	Peak Receptacle Load (1), W/m²	Peak Service Water Heating Load, L/h/occupant	Operating Schedule in Note A-8.4.3.2.(1)
School (K-12)	8	5	1.2	D
Multi-unit residential *building*	25	5	9.8	G
Office	25	7.5	1.8	A

Note to Table [8.4.4.2.] :

(1) Receptacle loads include loads due to plug-in and other miscellaneous equipment typically present in the *building* archetype, but exclude loads due to appliances, elevators or escalators, which can be accounted for as process loads.

---

[2] --) For the purpose of compliance with this Subsection, the peak outdoor air ventilation rates defined in the proposed *building* model shall be set to the rates indicated in the proposed *building*'s specifications.

[8.4.5.] 8.4.4. ~~Building Energy Target of the~~Modeled Reference Building

[8.4.5.1.] 8.4.4.1. General

[1] 1) For the purpose of compliance with this Subsection, ~~T~~the *building energy target* of the reference *building*, in kWh per year, shall be calculated based on the ~~parameters described~~ requirements in this Subsection.

[2] 2) The *building* components and systems of the reference *building* shall meet the prescriptive requirements of Sections 3.2., 4.2., 5.2., 6.2. and 7.2. for the climate zone under consideration.

[3] 3) The energy model calculations shall include all the energy uses addressed in Sections 3.2., 4.2., 5.2., 6.2. and 7.2.

[4] 4) Except as noted otherwise in this Subsection, the following characteristics of the reference *building* shall be modeled as being identical to those of the proposed *building*:

[a] a) total floor area of *conditioned* and unconditioned spaces,

- [b] b) use of *building* spaces,
- [c] c) number, type and conditioning of *thermal blocks*,
- [d] d) shape and exterior dimensions, and
- [e] e) orientation.

[5] **5)** The presence or absence of heating and/or cooling systems in each conditioned *thermal block* of the reference *building* shall be modeled as being identical to those in the proposed *building*.

[6] **6)** Climatic data used in the compliance calculations for the proposed *building* shall be applied.

[7] **7)** The simulation shall account for the effect of part-load operation on equipment performance.

[8.4.5.2.] 8.4.4.2. Operating Schedules, Internal Loads, Service Water Heating Loads and Set-point Temperature

[8.4.5.3.] 8.4.4.3. Building Envelope Components

[8.4.5.4.] 8.4.4.4. Thermal Mass

[8.4.5.5.] 8.4.4.5. Lighting

[8.4.5.6.] 8.4.4.6. Purchased Energy

[8.4.5.7.] 8.4.4.7. HVAC System Selection

[8.4.5.8.] 8.4.4.8. Equipment Oversizing

[8.4.5.9.] 8.4.4.9. Heating System

[8.4.5.10.] 8.4.4.10. Cooling Systems

[8.4.5.11.] 8.4.4.11. Cooling Tower Systems

[8.4.5.12.] 8.4.4.12. Cooling with Outside Air

[8.4.5.13.] 8.4.4.13. Heat Pumps

[8.4.5.14.] 8.4.4.14. Hydronic Pumps

[8.4.5.15.] 8.4.4.15. Outdoor Air

[8.4.5.16.] 8.4.4.16. Space Temperature Control

[8.4.5.17.] 8.4.4.17. Fans

[8.4.5.18.] 8.4.4.18. Supply Air Systems

[8.4.5.19.] 8.4.4.19. Energy Recovery Systems

[8.4.5.20.] 8.4.4.20. Service Water Heating Systems

[8.4.6.] 8.4.5. Part-Load Performance Characteristics

[8.4.6.1.] 8.4.5.1. General

[8.4.6.2.] 8.4.5.2. Boiler

[8.4.6.3.] 8.4.5.3. Furnace

[8.4.6.4.] 8.4.5.4. Direct-Expansion Cooling Equipment

[8.4.6.5.] 8.4.5.5. Electric Chiller

[8.4.6.6.] 8.4.5.6. Cooling Tower

[8.4.6.7.] 8.4.5.7. Electric Air-Source Heat Pump

[8.4.6.8.] 8.4.5.8. Absorption Chiller

[8.4.6.9.] 8.4.5.9. Fuel-Fired Service Water Heater

Note A-8.4.3.6.(1)(b) Outdoor Air.

The basic ventilation rates for the proposed building must be set to the minimum rates required by the applicable standards. If the HVAC system includes demand control ventilation strategies, the basic rates can then be adjusted in the energy model calculations to reflect their operation.

While the Code does not restrict modeling of any demand control ventilation strategies implemented in the proposed building, their effectiveness varies significantly from one application to another. As such, only demand control ventilation strategies that are known to reliably generate energy savings should be modeled, and this, in such a way as to avoid overestimating those savings.

Note A-8.4.4.1.(1)-2025 Space Uses Associated with a Building Archetype.

A building archetype includes all space uses directly represented by that archetype. The building archetype also includes the common and ancillary spaces normally associated with that archetype and needed for its operation. For example, the office building archetype typically includes offices, conference rooms, employee lounges or break rooms, corridors, lobbies, stairways, washrooms and service rooms.

However, a heated parking garage located on the office building site and included within the building envelope would be associated with a different building archetype since the office building is able to serve its purpose without the parking garage. In this example, the parking garage and its common and ancillary spaces would not be permitted to be included in the energy model of the proposed building or in the calculation of the building energy target.

Note A-Table 8.4.4.1.-2025 Energy Use Intensity in the Coldest Climates.

Statistical analysis of the results of modeling multiple permutations of each building archetype in different locations across Canada indicates that the average and range of energy use intensities (EUIs) for each building archetype remain relatively similar across climate zones.

This is largely due to the fact that the applicable prescriptive requirements in Sections 3.2, 4.2 and 7.2 become increasingly stringent as the heating-degree-days (HDD) of the climate zone increase (generally, in steps of 1000 HDD). However, climate zone 8 (HDD ≥ 7000) encompasses a large range of locations, some with HDD ≥ 11 000, which are covered by a single set of prescriptive requirements. It has been observed that the EUIs for building archetypes in locations with HDD ≥ 9000 diverge from those for building archetypes in other locations. Consequently, for these locations, compliance using Subsection 8.4.4.-2025 is not recommended.

Note A-8.4.4.1.(3)-2025 Calculation of the Gross Interior Floor Area.

The gross interior floor area generally includes all floor areas enclosed by the building envelope. It excludes exterior lighted areas and heated or unheated parking garages. It also excludes floor areas with space uses not associated with the building archetypes listed in Table 8.4.4.1.-2025 (e.g., retail facilities). As used in the NECB, this term is not intended to mean gross floor area as defined by some authorities having jurisdiction or their bylaws.

Note A-8.4.4.2.(1)-2025 Operating Schedules and Load Values for Modeling the Proposed Building.

Because the energy consumption of a building is greatly influenced by internal loads and their demand profiles and by equipment operating schedules, it is important that the model of the proposed building use the schedules and values indicated in Table 8.4.4.2. Since these schedules and values were used to establish the energy use intensity for each building archetype, they must be used in the model even if they are deemed non-representative of the actual expected operation of the proposed building. Using different schedules and values could result in an unsuitable comparison between the annual energy consumption and the building energy target, which could potentially be unjustly advantageous or penalizing to the proposed building. The energy modeler may distribute these schedules and load values across the thermal zones of the energy model, as appropriate for the space functions modeled, as long as the building's average matches the schedules and values indicated for the associated archetype.

Impact analysis

This proposed change provides an additional compliance path for meeting the energy conservation requirements of Part 8 of the NECB. This proposed change does not limit or restrict the continued use of the existing compliance path provided in Part 8. Code users who deem the energy use intensity (EUI) compliance path to be less attractive than the existing prescriptive or performance paths available in the NECB may continue to comply via those other paths. Accordingly, this proposed change is not expected to increase the cost or effort required to comply with the NECB.

However, many builders will likely find that complying via the EUI compliance path is simpler and less expensive than compliance via the existing prescriptive or performance paths. This outcome is expected because the EUI path recognizes the energy savings inherent in more compact building designs. Where the NECB’s “proposed versus reference” approach limits compliance measures to improved building envelopes and enhanced efficiency, the proposed EUI compliance path would offer Code users another tool (i.e., reducing building envelope area and HVAC system type selection) to achieve the same objective.

Research conducted by the National Research Council Canada (NRC) supports this conclusion. NRC analyzed the various compliance paths using various building archetypes (i.e., office, school and multi-unit residential buildings) in different locations across Canada. Each of these building architypes was evaluated by floorplate (e.g., rectangular, T-shape and L-shape), number of storeys and width-to-depth aspect ratio. All models were configured to reflect the reference building design of Part 8.

When the compliance of these same building archetypes was assessed via the proposed EUI compliance path, NRC found that approximately 70% of the building archetypes achieved at least Energy Performance Tier 1 without further modification.

In practice, this result means that builders of compact buildings would face lower costs to achieve Code compliance. Builders of highly compact and attached buildings could achieve higher energy performance tiers with zero cost increase. And all builders would have a new tool (architectural form) available to reduce the cost of achieving higher energy performance tiers. As a result of this proposed change, the massing and, therefore, architectural compactness of some commercial buildings under the NECB may be restricted in practice by the proposed site plan requirements. However, these projects would have the choice of using the existing "proposed versus reference" compliance path.

Enforcement implications

Projects currently using the performance path that elect to use this proposed compliance path based on absolute energy targets would not require any additional enforcement resources.

The proposed design energy model is largely the same as the existing model being submitted, and the reference model would not need to be submitted.

As a result, this proposed change reduces the effort involved in reviewing submissions. The authority having jurisdiction need only review the proposed design model submission against the performance target.

Who is affected

This proposed change would affect designers, engineers, architects, builders and energy consultants who choose to use the proposed compliance path when demonstrating Code compliance. Building officials would also be affected.

Code users who opt to use the proposed compliance path may find that the administration of performance compliance is somewhat easier, as they would only be required to submit one building model instead of two.

Builders would be able to use changes in architectural form as a means to meet energy conservation requirements as well as choose HVAC systems with lower energy consumption.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

N/A

[8.4.1.1.] 8.4.1.1. ([1] 1) [F99-OE1.1]

[8.4.1.1.] 8.4.1.1. ([2] 2) [F92,F93,F94,F95,F96,F97,F98,F99,F100-OE1.1]

[8.4.1.1.] 8.4.1.1. ([3] 3) no attributions

[8.4.1.2.] 8.4.1.2. ([1] 1) no attributions

[8.4.1.2.] 8.4.1.2. ([2] 2) no attributions

[8.4.1.2.] 8.4.1.2. ([2] 2) [~~F92~~,~~F93~~,F94,F95,F96,F97,~~F98~~,~~F99~~,~~F100~~-OE1.1]

[8.4.1.2.] 8.4.1.2. ([3] 3) [F99-OE1.1]

[8.4.1.2.] 8.4.1.2. ([4] 4) [F99-OE1.1]

[8.4.1.2.] 8.4.1.2. ([5] 5) [F99-OE1.1]

[8.4.1.3.] 8.4.1.3. ([1] 1) no attributions

[8.4.1.4.] 8.4.1.4. ([1] 1) [F99-OE1.1]

[8.4.1.4.] 8.4.1.4. ([2] 2) [F99-OE1.1]

[8.4.1.4.] 8.4.1.4. ([3] 3) [F99-OE1.1]

[8.4.1.5.] -- ([1] --) no attributions

[8.4.1.5.] -- ([2] --) [F99-OE1.1]

[8.4.2.1.] 8.4.2.1. ([1] 1) [F99-OE1.1]

[8.4.2.2.] 8.4.2.2. ([1] 1) [F99-OE1.1]

[8.4.2.2.] 8.4.2.2. ([2] 2) [F99-OE1.1]

[8.4.2.2.] 8.4.2.2. ([3] 3) [F99-OE1.1]

[8.4.2.2.] 8.4.2.2. ([4] 4) [F99-OE1.1]

[8.4.2.2.] 8.4.2.2. ([5] 5) no attributions

[8.4.2.3.] 8.4.2.3. ([1] 1) [F99-OE1.1]

[8.4.2.3.] 8.4.2.3. ([2] 2) [F99-OE1.1]

[8.4.2.4.] 8.4.2.4. ([1] 1) [F99-OE1.1]

[8.4.2.5.] 8.4.2.5. ([1] 1) [F99-OE1.1]

[8.4.2.6.] 8.4.2.6. ([1] 1) [F99-OE1.1]

[8.4.2.6.] 8.4.2.6. ([2] 2) [F99-OE1.1]

[8.4.2.7.] 8.4.2.7. ([1] 1) [F99-OE1.1]

[8.4.2.7.] 8.4.2.7. ([2] 2) [F99-OE1.1]

[8.4.2.7.] 8.4.2.7. ([3] 3) [F99-OE1.1]

[8.4.2.7.] 8.4.2.7. ([4] 4) [F99-OE1.1]

[8.4.2.7.] 8.4.2.7. ([5] 5) [F99-OE1.1]

[8.4.2.8.] 8.4.2.8. ([1] 1) [F99-OE1.1]

[8.4.2.8.] 8.4.2.8. ([2] 2) [F99-OE1.1]

[8.4.2.8.] 8.4.2.8. ([3] 3) [F99-OE1.1]

[8.4.2.8.] 8.4.2.8. ([4] 4) [F99-OE1.1]

[8.4.2.8.] 8.4.2.8. ([5] 5) [F99-OE1.1]

[8.4.2.8.] 8.4.2.8. ([6] 6) [F99-OE1.1]

[8.4.2.8.] 8.4.2.8. ([7] 7) [F99-OE1.1]

[8.4.2.8.] 8.4.2.8. ([8] 8) [F99-OE1.1]

[8.4.2.8.] 8.4.2.8. ([9] 9) [F99-OE1.1]

[8.4.2.8.] 8.4.2.8. ([10] 10) [F99-OE1.1]

[8.4.2.9.] 8.4.2.9. ([1] 1) [F99-OE1.1]

[8.4.2.9.] 8.4.2.9. ([2] 2) [F99-OE1.1]

[8.4.2.10.] 8.4.2.10. ([1] 1) [F99-OE1.1]

[8.4.2.10.] 8.4.2.10. ([2] 2) [F99-OE1.1]

[8.4.2.10.] 8.4.2.10. ([3] 3) [F99-OE1.1]

[8.4.2.10.] 8.4.2.10. ([4] 4) [F99-OE1.1]

[8.4.2.10.] 8.4.2.10. ([5] 5) [F99-OE1.1]

[8.4.3.1.] 8.4.3.1. ([1] 1) no attributions

[8.4.3.1.] 8.4.3.1. ([2] 2) [F99-OE1.1]

[8.4.3.1.] 8.4.3.1. ([3] 3) [F99-OE1.1]

[8.4.3.1.] 8.4.3.1. ([4] 4) [F99-OE1.1]

[8.4.3.1.] 8.4.3.1. ([5] 5) [F99-OE1.1]

[8.4.3.1.] 8.4.3.1. ([6] 6) no attributions

[8.4.3.1.] 8.4.3.1. ([7] 7) [F99-OE1.1]

[8.4.3.1.] 8.4.3.1. ([8] 8) [F99-OE1.1]

[8.4.3.2.] 8.4.3.2. ([1] 1) no attributions

[8.4.3.2.] 8.4.3.2. ([1] 1) [F99-OE1.1]

[8.4.3.2.] 8.4.3.2. ([2] 2) [F99-OE1.1]

[8.4.3.2.] 8.4.3.2. ([3] 3) [F99-OE1.1]

[8.4.3.3.] 8.4.3.3. ([1] 1) [F99-OE1.1]

[8.4.3.3.] 8.4.3.3. ([2] 2) [F99-OE1.1]

[8.4.3.3.] 8.4.3.3. ([3] 3) [F99-OE1.1]

[8.4.3.3.] 8.4.3.3. ([3] 3) no attributions

[8.4.3.3.] 8.4.3.3. ([4] 4) no attributions

[8.4.3.4.] 8.4.3.4. ([1] 1) [F99-OE1.1]

[8.4.3.4.] 8.4.3.4. ([2] 2) [F99-OE1.1]

[8.4.3.4.] 8.4.3.4. ([3] 3) [F99-OE1.1]

[8.4.3.4.] 8.4.3.4. ([4] 4) [F99-OE1.1]

[8.4.3.5.] 8.4.3.5. ([1] 1) no attributions

[8.4.3.5.] 8.4.3.5. ([2] 2) [F99-OE1.1]

[8.4.3.5.] 8.4.3.5. ([3] 3) [F99-OE1.1]

[8.4.3.5.] 8.4.3.5. ([4] 4) [F99-OE1.1]

[8.4.3.5.] 8.4.3.5. ([5] 5) [F99-OE1.1]

[8.4.3.6.] 8.4.3.6. ([1] 1) no attributions

[8.4.3.6.] 8.4.3.6. ([1] 1) [F99-OE1.1]

[8.4.3.7.] 8.4.3.7. ([1] 1) [F99-OE1.1]

[8.4.3.8.] 8.4.3.8. ([1] 1) [F99-OE1.1]

[8.4.3.8.] 8.4.3.8. ([2] 2) [F99-OE1.1]

[8.4.3.9.] 8.4.3.9. ([1] 1) [F99-OE1.1]

[8.4.4.1.] -- ([1] --) no attributions

[8.4.4.1.] -- ([2] --) [F99-OE1.1]

[8.4.4.1.] -- ([3] --) [F99-OE1.1]

[8.4.4.1.] -- ([4] --) [F99-OE1.1]

[8.4.4.1.] -- ([5] --) no attributions

[8.4.4.1.] -- ([5] --) [F99-OE1.1]

[8.4.4.2.] -- ([1] --) [F99-OE1.1]

[8.4.4.2.] -- ([2] --) [F99-OE1.1]

[8.4.5.1.] 8.4.4.1. ([1] 1) no attributions

[8.4.5.1.] 8.4.4.1. ([2] 2) [F99-OE1.1]

[8.4.5.1.] 8.4.4.1. ([3] 3) [F99-OE1.1]

[8.4.5.1.] 8.4.4.1. ([4] 4) [F99-OE1.1]

[8.4.5.1.] 8.4.4.1. ([5] 5) [F99-OE1.1]

[8.4.5.1.] 8.4.4.1. ([6] 6) [F99-OE1.1]

[8.4.5.1.] 8.4.4.1. ([7] 7) [F99-OE1.1]

[8.4.5.2.] 8.4.4.2. ([1] 1) [F99-OE1.1]

[8.4.5.2.] 8.4.4.2. ([2] 2) [F99-OE1.1]

[8.4.5.2.] 8.4.4.2. ([3] 3) [F99-OE1.1]

[8.4.5.3.] 8.4.4.3. ([1] 1) [F99-OE1.1]

[8.4.5.3.] 8.4.4.3. ([2] 2) ([a] a) [F99-OE1.1]

[8.4.5.3.] 8.4.4.3. ([2] 2) no attributions

[8.4.5.3.] 8.4.4.3. ([3] 3) [F99-OE1.1]

[8.4.5.3.] 8.4.4.3. ([4] 4) [F99-OE1.1]

[8.4.5.3.] 8.4.4.3. ([5] 5) [F99-OE1.1]

[8.4.5.3.] 8.4.4.3. ([6] 6) [F99-OE1.1]

[8.4.5.3.] 8.4.4.3. ([7] 7) [F99-OE1.1]

[8.4.5.3.] 8.4.4.3. ([8] 8) [F99-OE1.1]

[8.4.5.4.] 8.4.4.4. ([1] 1) no attributions

[8.4.5.4.] 8.4.4.4. ([2] 2) [F99-OE1.1]

[8.4.5.5.] 8.4.4.5. ([1] 1) [F99-OE1.1]

[8.4.5.5.] 8.4.4.5. ([2] 2) [F99-OE1.1]

[8.4.5.5.] 8.4.4.5. ([3] 3) [F99-OE1.1]

[8.4.5.5.] 8.4.4.5. ([4] 4) [F99-OE1.1]

[8.4.5.5.] 8.4.4.5. ([5] 5) [F99-OE1.1]

[8.4.5.5.] 8.4.4.5. ([6] 6) [F99-OE1.1]

[8.4.5.5.] 8.4.4.5. ([7] 7) [F99-OE1.1]

[8.4.5.5.] 8.4.4.5. ([8] 8) [F99-OE1.1]

[8.4.5.5.] 8.4.4.5. ([9] 9) [F99-OE1.1]

[8.4.5.5.] 8.4.4.5. ([10] 10) [F99-OE1.1]

[8.4.5.5.] 8.4.4.5. ([11] 11) [F99-OE1.1]

[8.4.5.5.] 8.4.4.5. ([12] 12) [F99-OE1.1]

[8.4.5.6.] 8.4.4.6. ([1] 1) [F99-OE1.1]

[8.4.5.6.] 8.4.4.6. ([2] 2) [F99-OE1.1]

[8.4.5.6.] 8.4.4.6. ([3] 3) [F99-OE1.1]

[8.4.5.6.] 8.4.4.6. ([4] 4) [F99-OE1.1]

[8.4.5.7.] 8.4.4.7. ([1] 1) [F99-OE1.1]

[8.4.5.7.] 8.4.4.7. ([2] 2) no attributions

[8.4.5.7.] 8.4.4.7. ([3] 3) [F99-OE1.1]

[8.4.5.7.] 8.4.4.7. ([4] 4) [F99-OE1.1]

[8.4.5.8.] 8.4.4.8. ([1] 1) [F99-OE1.1]

[8.4.5.8.] 8.4.4.8. ([2] 2) [F99-OE1.1]

[8.4.5.9.] 8.4.4.9. ([1] 1) [F99-OE1.1]

[8.4.5.9.] 8.4.4.9. ([2] 2) no attributions

[8.4.5.9.] 8.4.4.9. ([3] 3) [F99-OE1.1]

[8.4.5.9.] 8.4.4.9. ([4] 4) [F99-OE1.1]

[8.4.5.9.] 8.4.4.9. ([5] 5) [F99-OE1.1]

[8.4.5.9.] 8.4.4.9. ([6] 6) [F99-OE1.1]

[8.4.5.9.] 8.4.4.9. ([7] 7) [F99-OE1.1]

[8.4.5.9.] 8.4.4.9. ([8] 8) [F99-OE1.1]

[8.4.5.10.] 8.4.4.10. ([1] 1) [F99-OE1.1]

[8.4.5.10.] 8.4.4.10. ([2] 2) no attributions

[8.4.5.10.] 8.4.4.10. ([3] 3) [F99-OE1.1]

[8.4.5.10.] 8.4.4.10. ([4] 4) [F99-OE1.1]

[8.4.5.10.] 8.4.4.10. ([5] 5) [F99-OE1.1]

[8.4.5.10.] 8.4.4.10. ([6] 6) [F99-OE1.1]

[8.4.5.10.] 8.4.4.10. ([7] 7) [F99-OE1.1]

[8.4.5.10.] 8.4.4.10. ([8] 8) [F99-OE1.1]

[8.4.5.10.] 8.4.4.10. ([9] 9) [F99,F100-OE1.1]

[8.4.5.11.] 8.4.4.11. ([1] 1) [F99-OE1.1]

[8.4.5.11.] 8.4.4.11. ([2] 2) [F99-OE1.1]

[8.4.5.11.] 8.4.4.11. ([3] 3) [F99-OE1.1]

[8.4.5.11.] 8.4.4.11. ([4] 4) [F99-OE1.1]

[8.4.5.11.] 8.4.4.11. ([5] 5) [F99-OE1.1]

[8.4.5.11.] 8.4.4.11. ([6] 6) [F99-OE1.1]

[8.4.5.11.] 8.4.4.11. ([7] 7) [F99-OE1.1]

[8.4.5.12.] 8.4.4.12. ([1] 1) [F99-OE1.1]

[8.4.5.13.] 8.4.4.13. ([1] 1) [F99-OE1.1]

[8.4.5.13.] 8.4.4.13. ([2] 2) [F99-OE1.1]

[8.4.5.14.] 8.4.4.14. ([1] 1) [F99-OE1.1]

[8.4.5.14.] 8.4.4.14. ([2] 2) [F99-OE1.1]

[8.4.5.14.] 8.4.4.14. ([3] 3) [F99-OE1.1]

[8.4.5.14.] 8.4.4.14. ([4] 4) [F99-OE1.1]

[8.4.5.14.] 8.4.4.14. ([5] 5) [F99-OE1.1]

[8.4.5.14.] 8.4.4.14. ([6] 6) [F99-OE1.1]

[8.4.5.15.] 8.4.4.15. ([1] 1) [F99-OE1.1]

[8.4.5.15.] 8.4.4.15. ([2] 2) [F99-OE1.1]

[8.4.5.16.] 8.4.4.16. ([1] 1) [F99-OE1.1]

[8.4.5.16.] 8.4.4.16. ([2] 2) [F99-OE1.1]

[8.4.5.17.] 8.4.4.17. ([1] 1) [F99-OE1.1]

[8.4.5.17.] 8.4.4.17. ([2] 2) [F99-OE1.1]

[8.4.5.17.] 8.4.4.17. ([3] 3) [F99-OE1.1]

[8.4.5.17.] 8.4.4.17. ([4] 4) [F99-OE1.1]

[8.4.5.17.] 8.4.4.17. ([5] 5) [F99-OE1.1]

[8.4.5.18.] 8.4.4.18. ([1] 1) [F99-OE1.1]

[8.4.5.18.] 8.4.4.18. ([2] 2) [F99-OE1.1]

[8.4.5.18.] 8.4.4.18. ([3] 3) [F99-OE1.1]

[8.4.5.18.] 8.4.4.18. ([4] 4) [F99-OE1.1]

[8.4.5.18.] 8.4.4.18. ([5] 5) [F99-OE1.1]

[8.4.5.18.] 8.4.4.18. ([6] 6) [F99-OE1.1]

[8.4.5.19.] 8.4.4.19. ([1] 1) [F99,F100-OE1.1]

[8.4.5.19.] 8.4.4.19. ([2] 2) [F99,F100-OE1.1]

[8.4.5.19.] 8.4.4.19. ([3] 3) [F100-OE1.1]

[8.4.5.20.] 8.4.4.20. ([1] 1) [F99-OE1.1]

[8.4.5.20.] 8.4.4.20. ([2] 2) [F99-OE1.1]

[8.4.5.20.] 8.4.4.20. ([3] 3) [F99-OE1.1]

[8.4.5.20.] 8.4.4.20. ([4] 4) [F99-OE1.1]

[8.4.5.20.] 8.4.4.20. ([5] 5) [F99-OE1.1]

[8.4.5.20.] 8.4.4.20. ([6] 6) [F99-OE1.1]

[8.4.5.20.] 8.4.4.20. ([7] 7) [F99-OE1.1]

[8.4.5.20.] 8.4.4.20. ([8] 8) [F99-OE1.1]

[8.4.5.20.] 8.4.4.20. ([9] 9) [F99-OE1.1]

[8.4.6.1.] 8.4.5.1. ([1] 1) no attributions

[8.4.6.2.] 8.4.5.2. ([1] 1) [F99-OE1.1]

[8.4.6.2.] 8.4.5.2. ([2] 2) [F99-OE1.1]

[8.4.6.2.] 8.4.5.2. ([3] 3) [F99-OE1.1]

[8.4.6.3.] 8.4.5.3. ([1] 1) [F99-OE1.1]

[8.4.6.3.] 8.4.5.3. ([2] 2) [F99-OE1.1]

[8.4.6.3.] 8.4.5.3. ([3] 3) [F99-OE1.1]

[8.4.6.4.] 8.4.5.4. ([1] 1) no attributions

[8.4.6.4.] 8.4.5.4. ([2] 2) [F99-OE1.1]

[8.4.6.4.] 8.4.5.4. ([3] 3) [F99-OE1.1]

[8.4.6.4.] 8.4.5.4. ([4] 4) [F99-OE1.1]

[8.4.6.4.] 8.4.5.4. ([5] 5) [F99-OE1.1]

[8.4.6.4.] 8.4.5.4. ([6] 6) [F99-OE1.1]

[8.4.6.4.] 8.4.5.4. ([7] 7) [F99-OE1.1]

[8.4.6.4.] 8.4.5.4. ([8] 8) [F99-OE1.1]

[8.4.6.5.] 8.4.5.5. ([1] 1) no attributions

[8.4.6.5.] 8.4.5.5. ([2] 2) [F99-OE1.1]

[8.4.6.5.] 8.4.5.5. ([3] 3) [F99-OE1.1]

[8.4.6.5.] 8.4.5.5. ([4] 4) [F99-OE1.1]

[8.4.6.5.] 8.4.5.5. ([5] 5) [F99-OE1.1]

[8.4.6.5.] 8.4.5.5. ([6] 6) [F99-OE1.1]

[8.4.6.5.] 8.4.5.5. ([7] 7) [F99-OE1.1]

[8.4.6.6.] 8.4.5.6. ([1] 1) no attributions

[8.4.6.6.] 8.4.5.6. ([2] 2) [F99-OE1.1]

[8.4.6.6.] 8.4.5.6. ([3] 3) [F99-OE1.1]

[8.4.6.6.] 8.4.5.6. ([4] 4) [F99-OE1.1]

[8.4.6.6.] 8.4.5.6. ([5] 5) [F99-OE1.1]

[8.4.6.6.] 8.4.5.6. ([6] 6) [F99-OE1.1]

[8.4.6.7.] 8.4.5.7. ([1] 1) no attributions

[8.4.6.7.] 8.4.5.7. ([2] 2) [F99-OE1.1]

[8.4.6.7.] 8.4.5.7. ([3] 3) [F99-OE1.1]

[8.4.6.7.] 8.4.5.7. ([4] 4) [F99-OE1.1]

[8.4.6.7.] 8.4.5.7. ([5] 5) [F99-OE1.1]

[8.4.6.7.] 8.4.5.7. ([6] 6) [F99-OE1.1]

[8.4.6.7.] 8.4.5.7. ([7] 7) [F99-OE1.1]

[8.4.6.8.] 8.4.5.8. ([1] 1) no attributions

[8.4.6.8.] 8.4.5.8. ([2] 2) [F99-OE1.1]

[8.4.6.8.] 8.4.5.8. ([3] 3) [F99-OE1.1]

[8.4.6.8.] 8.4.5.8. ([4] 4) [F99-OE1.1]

[8.4.6.8.] 8.4.5.8. ([5] 5) [F99-OE1.1]

[8.4.6.8.] 8.4.5.8. ([6] 6) [F99-OE1.1]

[8.4.6.8.] 8.4.5.8. ([7] 7) [F99-OE1.1]

[8.4.6.8.] 8.4.5.8. ([8] 8) [F99-OE1.1]

[8.4.6.8.] 8.4.5.8. ([9] 9) [F99-OE1.1]

[8.4.6.8.] 8.4.5.8. ([10] 10) [F99-OE1.1]

[8.4.6.8.] 8.4.5.8. ([11] 11) [F99-OE1.1]

[8.4.6.9.] 8.4.5.9. ([1] 1) [F99-OE1.1]

[8.4.6.9.] 8.4.5.9. ([2] 2) [F99-OE1.1]

Submit a comment

Proposed Change 1962

Code Reference(s):	**NECB20 Div.B 3.2.1.1.(1) (first printing)**
Subject:	Building Envelope - General
Title:	Use of the Term "Grade" in the NECB
Description:	This proposed change clarifies Note A-3.2.1.1.(1) by using “ground” instead of “grade” to refer to the finished ground level.
Related Code Change Request(s):	CCR 1391
Related Proposed Change(s):	PCF 1653, PCF 1840

This change could potentially affect the following topic areas:

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

Problem

In the National Building Code of Canada (NBC), “grade” is a defined term used to determine a building’s height in storeys, which in turn determines requirements for the construction and protection of that building. The NBC defines “grade” as the lowest of the average levels of finished ground adjoining each exterior wall of a building. Therefore, at any point along the length of a wall, grade may be above or below the adjacent ground level. As such, the defined term “grade” does not necessarily refer to the finished ground level.

If Code users determine the requirements for the insulation of a building component based on the definition of grade provided in the NBC, which is reproduced in the National Energy Code of Canada for Buildings (NECB), this could lead to the installation of thermal insulation that is insufficient to minimize heat loss.

Justification

In the NECB, the main purpose for references to "grade" is to establish requirements to reduce heat loss. In most instances, rather than using the defined term "grade," the NECB should refer instead to "ground," which more accurately describes the building level intended to be used to determine the required thermal resistance of the building element. The use of the defined term "grade" to determine thermal insulation requirements may lead to building elements having a thermal resistance that does not meet the objectives of the NECB.

Using the non-defined term "ground" instead of "grade" to determine the required thermal resistance of a building component will minimize heat loss and better meet the objectives of the NECB.

PROPOSED CHANGE

[3.2.1.1.] 3.2.1.1. Protection of Insulation Materials

[1] **1)** Except as provided in Sentence (2), the *building envelope* shall be designed to avoid increasing the *overall thermal transmittance* of the insulation material due to

[a] a) air leakage or convection,

[b] b) wetting, or

[c] c) moisture bypassing the plane of thermal resistance.

(See Note A-3.2.1.1.(1).)

Note A-3.2.1.1.(1) Protection of Insulation Materials.

Sentence 3.2.1.1.(1) is not intended to preclude the use of building envelope systems such as protected membrane roofing systems, vegetative roofing systems, EIFS in rainscreen applications, and exterior insulation on below-ground~~grade~~ walls.

Impact analysis

The proposed change has no cost implications, as it is not a change to the Code requirement. The change would have the benefit of clarifying the explanatory Note.

Enforcement implications

This change can be enforced by the infrastructure currently available to enforce the NECB.

Who is affected

Designers, engineers, architects, builders and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.2.1.1.] 3.2.1.1. ([1] 1) [F92-OE1.1]

Submit a comment

Proposed Change 1653

Code Reference(s):	**NECB20 Div.B 3.2.3.2.(1) (first printing)**
Subject:	Building Envelope - General
Title:	Use of the Term "Grade" in the NECB
Description:	This proposed change clarifies Note A-3.2.3.2.(1) by using “ground” instead of “grade” to refer to the finished ground level.
Related Code Change Request(s):	CCR 1391
Related Proposed Change(s):	PCF 1840, PCF 1962

This change could potentially affect the following topic areas:

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

Problem

In the National Building Code of Canada (NBC), “grade” is a defined term used to determine a building’s height in storeys, which in turn determines requirements for the construction and protection of that building. The NBC defines “grade” as the lowest of the average levels of finished ground adjoining each exterior wall of a building. Therefore, at any point along the length of a wall, grade may be above or below the adjacent ground level. As such, the defined term “grade” does not necessarily refer to the finished ground level.

If Code users determine the requirements for the insulation of a building component based on the definition of grade provided in the NBC, which is reproduced in the National Energy Code of Canada for Buildings (NECB), this could lead to the installation of thermal insulation that is insufficient to minimize heat loss.

Justification

In the NECB, the main purpose for references to “grade” is to establish requirements to reduce heat loss. In most instances, rather than using the defined term “grade,” the NECB should refer instead to “ground,” which more accurately describes the building level intended to be used to determine the required thermal resistance of the building element. The use of the defined term “grade” to determine thermal insulation requirements may lead to building elements having a thermal resistance that does not meet the objectives of the NECB.

Moreover, the titles to Article 3.2.3.2. and explanatory Note A-3.2.3.2.(1) refer to “Roofs in Contact with the Ground,” while the content of the explanatory Note uses the term “grade.” Replacing “grade” with “ground” would therefore improve the consistency and accuracy of the Note language.

PROPOSED CHANGE

[3.2.3.2.] 3.2.3.2. Thermal Characteristics of Roofs in Contact with the Ground

[1] **1)** Except as provided in Sentence (2), the *overall thermal transmittance* of below-ground roofs that are part of the *building envelope* and are less than 1.2 m below the exterior ground level shall be not greater than that shown in Table 3.2.3.1. for the applicable heating-degree-day category taken at 18°C. (See Note A-3.2.3.2.(1).)

Note A-3.2.3.2.(1) Roofs in Contact with the Ground.

Sentence 3.2.3.2.(1) refers to structures that are normally below ~~grade~~ground such as walkways or storage garages. It does not refer to structures with vegetative roofs as might be built at elevations above ~~grade~~ground.

Impact analysis

The proposed change has no cost implications, as it is not a change to a Code requirement. The change would have the benefit of clarifying the explanatory Note.

Enforcement implications

This change can be enforced by the infrastructure currently available to enforce the NECB without additional resources.

Who is affected

Designers, engineers, architects, builders and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.2.3.2.] 3.2.3.2. ([1] 1) [F92-OE1.1]

Submit a comment

Proposed Change 1859

Code Reference(s):	**NECB20 Div.B 5.1.1.2. (first printing)** **NECB20 Div.B 13.5. (first printing)**
Subject:	Alteration of Existing Buildings
Title:	Alteration of HVAC Systems
Description:	This proposed change adds requirements that define the application of NECB Part 5 to HVAC systems subjected to alteration.
Related Proposed Change(s):	PCF 1864

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Alteration of Existing Buildings.

Problem

Heating, ventilating and air-conditioning (HVAC) systems in existing buildings can remain unaltered for the life of the system, which can be many decades in some instances. Older buildings that were built to meet the requirements of past editions of the Codes tend to consume more energy than their more modern counterparts.

The alteration of the existing building also provides a good opportunity to gradually upgrade the HVAC system and any ancillary components to meet current Code requirements. However, since renovation works in existing buildings are typically more costly than when building new constructions, the requirements of NECB Part 5 applicable to these upgrades must be adapted to maintain an acceptable level of cost-effectiveness.

Justification

HVAC systems comprise different components and subsystems that are integrated and interconnected to operate as a whole. Furthermore, the design requirements for a component, subsystem or an entire HVAC system can have a cascading impact on others. NECB Part 5 reflects that complexity by providing requirements that target each component and subsystem that can also have a cascading impact. The application of these requirements to systems in existing buildings must be carefully measured to ensure a reasonable cost-effectiveness.

Consequently, Part 5 requirements have been considered for full application to

- new standalone installations or additions within existing buildings, as these can be easily designed to different requirements than the rest of the building's HVAC systems, and
- the entire scope of any alteration works.

The rest of the existing HVAC systems subject to alteration (i.e., those parts that are not affected by the initial scope of the alteration) are generally exempt because of the high cost of the related and cascading effects between components and systems that can be incurred. A few common upgrades generally considered to be cost-effective by the industry are still required.

However, when the proposed alteration work involves a significant change to the characteristics of a system (represented by a significant change in the thermal capacity of a system or in the layout of an air or water distribution system), it is deemed cost-effective in the long term for these systems to comply with all Part 5 requirements.

The threshold to determine what constitutes a "significant change" was set at 60%, as works of this magnitude generally and naturally have a significant cascading impact on existing systems, subsystems and associated systems, which require additional extensive modifications to maintain interoperability. Expanding these works to subject the entire HVAC system to the Part 5 requirements is considered cost-effective in these conditions.

PROPOSED CHANGE

[5.1.1.2.] 5.1.1.2. Application

[1] **1)** Except as permitted in Sentence~~s~~ (2) ~~and (3),~~ and except for systems and equipment used exclusively for the control of smoke in the event of a fire, this Part applies to heating, ventilating and air-conditioning systems and equipment.

[2] **2)** A heating, ventilating or air-conditioning system or part thereof may be exempted from some or all of the requirements in this Part where it can be shown that the nature of the *occupancy* or the type of heating, ventilating or air-conditioning equipment used makes it impractical to apply these requirements. (See Note A-5.1.1.2.(2).)

~~[3] **3)** This Part does not apply to the existing components of systems that are extended to serve *additions*.~~

[13.5.] -- Heating, Ventilating and Air-conditioning Systems

[13.5.1.] -- General

[13.5.1.1.] --- Scope

[1] --) This Section is concerned with HVAC systems covered in Part 5.

[13.5.1.2.] --- Application

[1] --) This Section applies to existing HVAC systems subjected to *alteration* and new HVAC systems installed in *existing buildings*.

[13.5.2.] -- Compliance

[13.5.2.1.] --- Requirements

[1] --) Except for repair and maintenance, and except as provided in Sentences (2) and (3), HVAC equipment and systems shall comply with Part 5.

[2] --) Existing HVAC equipment and systems, and replacement components, shall comply with the requirements of Part 5, adjusted as follows:

- [a] --) where leakage testing of air distribution systems is performed in compliance with Subsection 5.2.2., the entire air distribution system subjected to *alteration* shall be tested for leakage in accordance with Article 5.2.2.4., and
- [b] --) where Subsection 5.2.3. applies, fan systems need only comply with
  - [i] --) for variable-air-volume systems, Sentences 5.2.3.3.(2) and (3), and
  - [ii] --) Article 5.2.3.4., and
- [c] --) only replacement air-handling units need comply with Article 5.2.2.7., except where impractical because of structural or construction constraints.

[3] --) Parts of the HVAC system that are not subjected to *alteration* need not comply with Part 5, where

- [a] --) the added thermal load does not exceed 60% of the peak design load supplied by the existing HVAC system, and
- [b] --) the length of added and replacement ductwork or piping does not

exceed 60% of the length of ductwork or piping in the existing distribution system.

(See Note A-13.5.2.1.(3).)

Note A-13.5.2.1.(3) Criteria for Upgrading Existing HVAC Systems.

The alteration of existing HVAC systems presents an opportunity to reduce the energy use of these systems by upgrading them to meet the requirements of the current edition of the Code. The obligation to upgrade an HVAC system is triggered when at least one of two criteria is met as a result of the alteration.

The first criterion, as set out in Clause 13.5.2.1.(3)(a), applies where a significant thermal load is added to the system, for example, to a boiler plant. This criterion may be evaluated by comparing the peak thermal loads served by the system before and after its alteration.

The second criterion, as set out in Clause 13.5.2.1.(3)(b), applies where a significant length of ductwork or piping is added to or replaced in the distribution system. This criterion may be evaluated using measurements on plans that are representative of the existing installation.

Impact analysis

The impact analysis guidelines for the alteration of existing buildings require that the proposed changes be evaluated for several building vintages. The key metric of interest in the impact analysis is the marginal difference between the current market practice and the proposed changes.

Since the prescriptive requirements for the alteration of existing buildings are triggered only when alterations are performed, the metric to evaluate the impact of these requirements is defined as the comparison between the new prescriptive requirements and what would normally be done in the absence of such (i.e., current market practice).

For this analysis, four vintages of unaltered buildings were selected:

- Pre-1980
- 1980–2010
- NECB 2011
- NECB 2015

Current market practice is defined as complying with NECB 2017, and the proposed code is considered to be the NECB 2020.

To calculate the marginal energy increment, a model representing the vintage was created (see https://github.com/NREL/openstudio-standards/tree/master/lib/openstudio-standards/standards/necb). The HVAC systems were then updated in the model to comply with the NECB 2017 requirements and the thermal energy use intensity (TEUI) calculated. The same process was followed for the

NECB 2020 requirements. The marginal energy increment is the difference between these two TEUIs. This process was repeated for all the vintages for 16 archetypes in 32 locations across Canada (and later collated by region).

The primary driver of energy savings is the increased equipment efficiency from the NECB 2017 to the NECB 2020; few other differences exist (e.g., duct insulation), and their impact is negligible because they are not modeled or are narrow in scope (e.g., conditions applying to variable-air-volume systems only). The archetypes examined in this study use a range of HVAC systems. Table 1 presents the heating and cooling equipment used and their efficiencies as modeled in NECB 2017 (i.e., current practice) and in NECB 2020 (i.e., proposed code); fuel savings for each type of equipment is also estimated (i.e., how much less fuel is required).

NOTE:

- Table 1 only highlights relevant equipment efficiencies; the efficiencies related to auxiliary equipment (e.g., energy recovery ventilators, fans, pumps) were assumed to be constant and are not shown.
- Efficiencies are based on individual equipment capacities, and the values in Table 1 are representative of the class of equipment in the archetypes.

Table 1. Differences in HVAC Equipment Efficiency by Archetype

Type of Conditioning Equipment		Applicable Archetypes	Approx. NECB 2017 Efficiency Requirement	Approx. NECB 2020 Efficiency Requirement	Approx. Simple Fuel Savings, %
Heating	Furnace, gas-fired	All, excluding medium and large offices	92.4%	95%	2.7
	Boiler, gas-fired	All	83%–85%	90%	5.6–7.8
Cooling	Packaged terminal air conditioner (PTAC)	Apartments and hotels	Varies by capacity; generally, from COP 3.23 to COP 3.29 in climate zone 4		~1.8
	Unitary air conditioner; capacity < 19 kW	All, excluding medium and large offices	SEER 14	SEER 15	6.7
	Unitary air conditioner; 19 kW ≤ capacity ≤ 223 kW		No change in requirements		0
	Chiller	Medium and large offices	Varies by capacity; COP 5.7	Varies by capacity; COP 6.0	5
		Hospitals, hotels	Varies by capacity; 4.50	Varies by capacity; 4.51	0.2
	Cooling tower	Medium and large offices, hospitals, and hotels	No change in requirements for direct-contact cooling towers		0

Summary results from the simulations are presented by region in Figures 1 (TEUI reduction) and 2 (percentage reduction); positive values indicate energy savings.

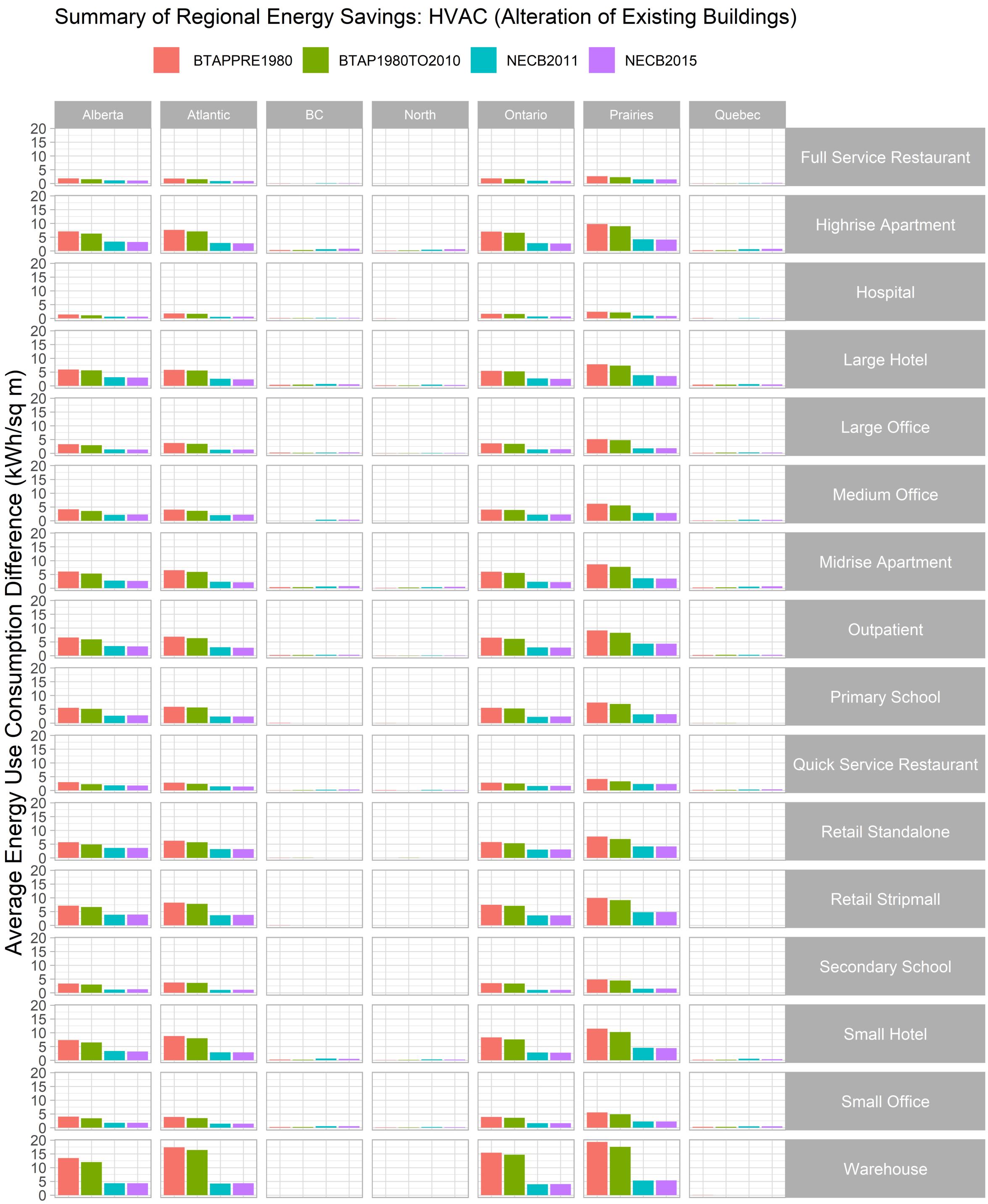


Figure 1. Marginal energy use intensity increment for various building archetypes and vintages in regions across Canada

Figure 2. Marginal percentage energy use intensity increment for various building archetypes and vintages in regions across Canada

Energy savings in British Columbia (BC), the North and Quebec are limited and are entirely attributed to cooling equipment because the archetypes assume electrical heating for those locations and there are no changes in electrical heating efficiencies (~100%). The cooling savings are minor because

- package terminal air conditioners are only used in dwelling spaces (apartments and hotels), the increased efficiency results in minor fuel savings (1.8%), and there is less energy reduction because total energy consumption is limited by the small capacities of the units;
- unitary air conditioning efficiencies have largely remained unchanged, except for smaller capacity systems (< 19 kW) that are used in archetypes with smaller energy consumption;
- Large capacity chillers (with 5% fuel savings) are limited to medium and large offices, and chillers with lower capacities have a negligible increase in efficiency (in hospitals and hotels);
- Cooling energy generally constitutes a small portion of the overall consumption

for most buildings in Canada.

Conversely, energy savings for archetypes in Alberta, Atlantic Canada, Ontario and the Prairies are around 2% or higher, as shown in Figure 2. This is the result of increased energy efficiencies of the gas-fired heating equipment in addition to the cooling energy savings previously discussed. Heating energy savings are higher because

- heating constitutes a much larger portion of the overall energy consumption of buildings in Canada, therefore, increased energy efficiencies of these equipment have a larger impact, and
- gas-fired boilers had an appreciable increase in efficiency and are modeled in all archetypes.

Over time, the HVAC energy consumption of buildings decreases as newer equipment efficiencies are required. Figure 3 presents the average HVAC (including ERVs, fans and pumps) energy consumption of each archetype by vintage, indicating a decreasing trend over time. Note that to provide more neutral datum to demonstrate the trend of HVAC performance, a 1.5 L/(s×m^2) at 75 Pa air leakage rate (as specified in Article 8.4.3.3. of Division B of the NECB 2020) was assumed for each archetype, regardless of vintage. Although this assumed air leakage rate provides a lower estimate of HVAC energy consumption in older vintages (i.e., energy consumption should be higher in older vintages), it provides a more conservative trend in declining energy consumption over time. Similarly, the differences in high-rise and midrise ventilation requirements between the NECB 2020 (ASHRAE 62.1-2016, "Ventilation and Acceptable Indoor Air Quality") and older vintages (ASHRAE 62-2001, "Ventilation for Acceptable Indoor Air Quality") were neutralized as well to demonstrate the performance of the HVAC independent of the differences in the ventilation loads of the dwelling spaces.

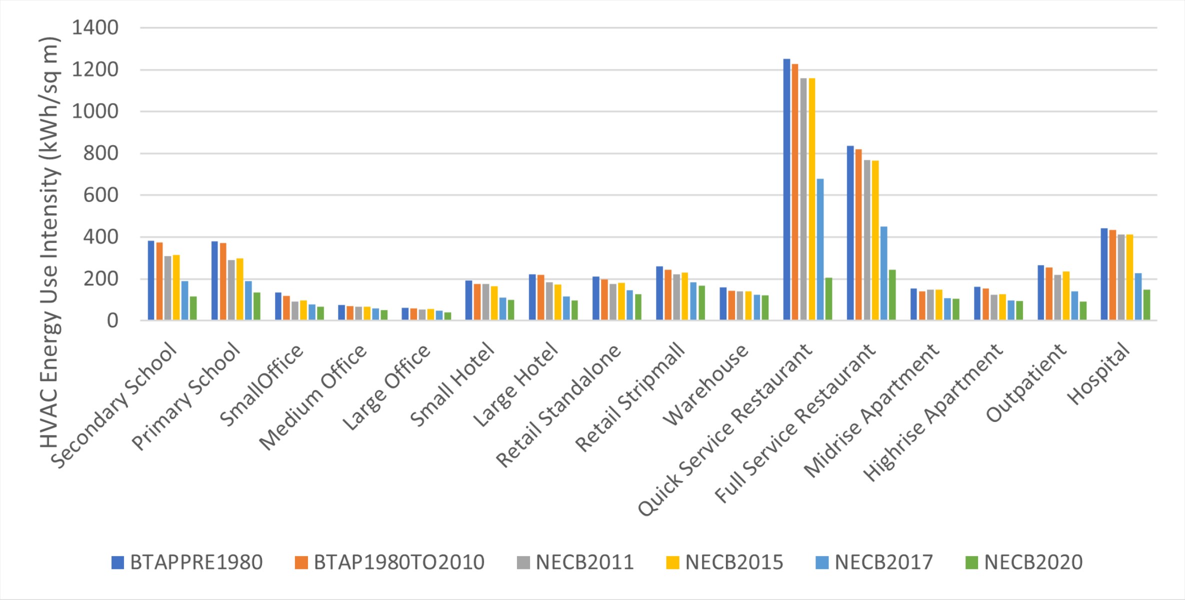


Figure 3. HVAC energy use intensity for various Canadian archetypes and vintages

Enforcement implications

The requirements for the alteration of HVAC systems in existing buildings could be enforced by the same means and resources involved in the enforcement of the prescriptive requirements of Part 5 of the NECB.

Who is affected

Designers, specification writers, manufacturers, contractors, building owners and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[5.1.1.2.] 5.1.1.2. ([1] 1) no attributions

[5.1.1.2.] 5.1.1.2. ([2] 2) no attributions

~~[5.1.1.2.] 5.1.1.2. ([3] 3) no attributions~~

[13.5.1.1.] -- ([1] --) no attributions

[13.5.1.2.] -- ([1] --) no attributions

[13.5.2.1.] -- ([1] --) no attributions

[13.5.2.1.] -- ([2] --) no attributions

[13.5.2.1.] -- ([3] --) no attributions

Submit a comment

Proposed Change 2009

Code Reference(s):	**NECB20 Div.B 8.4.2.3. (first printing)** **NBC20 Div.B 9.36.5.5.(1) (first printing)**
Subject:	NECB Climatic Values
Title:	Climatic Data for Energy Model Calculations
Description:	This proposed change updates the references to sources of climatic data used in modeling in the explanatory Notes about climatic data.

This change could potentially affect the following topic areas:

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

Problem

The existing reference to the source of climatic data is outdated in explanatory Note A-8.4.2.3. of Division B of the National Energy Code of Canada for Buildings and explanatory Note A-9.36.5.5.(1) of Division B of the National Building Code of Canada. This situation may lead to the use of inappropriate climatic data by Code users while modeling building energy consumption, potentially resulting in oversized or undersized heating and cooling systems.

Justification

Climatic data has a significant impact on the modeled building energy consumption, and the Codes should refer to recent periods of record.

PROPOSED CHANGE

NECB20 Div.B 8.4.2.3. (first printing)
[8.4.2.3.] 8.4.2.3. Climatic Data

Note A-8.4.2.3. Climatic Data.

The following data formats are acceptable to represent climatic data:

- CSV (comma-separated values),
- EPW (EnergyPlus Weather),
- TMY2 (Typical Meteorological Year 2),
- TMY3 (Typical Meteorological Year 3),
- WYEC2 or WY2 (Weather Year for Energy Calculation 2),
- WYEC3 or WY3 (Weather Year for Energy Calculation 3),

- CWEC (Canadian Weather Year for Energy Calculations),
- IWEC (International Weather for Energy Calculations), and
- CWEEDS (Canadian Weather Energy and Engineering Datasets).

The CWEC datasets represent average heating and cooling degree-days, which impact heating and cooling loads in buildings. The CWEC datasets follow the ASHRAE WYEC3~~2~~ format and ~~were~~are derived from the CWEEDS of hourly weather information for Canada ~~from the 1953-1995 period of record. The CWEC are available from Environment and Climate Change Canada at www.climate.weather.gc.ca/prods_servs/engineering_e.html~~.

More information on CWEC and CWEEDS provided by Environment and Climate Change Canada, as well as climate data files for 564 Canadian locations, is available on the following websites:

a. www.climate.weather.gc.ca/prods_servs/engineering_e.html, containing CWEEDS (in CSV and WY3 formats) and CWEC datasets (in CSV, EPW and WY3 formats) for the 1998–2017 period of record,

b. https://nrc-digital-repository.canada.ca/eng/view/object/?id=92bfa9cf-6d35-4de4-80c2-799f53961f60, containing “Typical Meteorological Years,” “Extreme Cold Years,” “Extreme Warm Years” and other reference years for design and modeling (in CSV and EPW formats) for the 1991–2021 period of record and seven future time periods coinciding with various degrees of global warming, and

c. https://nrc-digital-repository.canada.ca/eng/view/object/?id=bd339698-5eb8-4635-b411-63d4f670382b, containing complete meteorological records (in CSV format) for the 1991–2021 period of record and seven future time periods coinciding with various degrees of global warming.

Where climatic data for a target location are not available, climatic data for a representative alternative location should be selected based on the following considerations: the same climatic zone, the same geographic area or characteristics, the heating degree-days (HDD) of the alternative location are within 10% of the target location's HDD, and the January 1% heating design criteria of the alternative location is within 2°C of the target location's same criteria (see Table C-1). Where several alternative locations are representative of the climatic conditions at the target location, their proximity to the target location should also be a consideration.

NBC20 Div.B 9.36.5.5.(1) (first printing)

[9.36.5.5.] 9.36.5.5.

[1] 1) To calculate the effect of heating and cooling consumption, the energy model calculations shall be performed using climatic data measured at time intervals no greater than one hour for one year (8 760 hours) based on the average of at least 10 years of measured data collected at the weather station nearest to the region in which the proposed house is located. (See Note A-9.36.5.5.(1).)

Note A-9.36.5.5.(1) Source of Climatic Data.

Climatic data sources include the Canadian Weather Year for Energy Calculations (CWEC) datasets and the Canadian Weather Energy and Engineering Data ~~S~~sets (CWEEDS). The CWEC represent average heating and cooling degree-days which impact heating and cooling loads in buildings. The CWEC follow the ASHRAE WYEC3~~2~~ format and ~~were~~are derived from the CWEEDS of hourly weather information for Canada ~~from the 1953-1995 period of record. The CWEC are available from Environment and Climate Change Canada at climate.weather.gc.ca/prods_servs/engineering_e.html~~.

More information on CWEC and CWEEDS provided by Environment and Climate Change Canada, as well as climate data files for 564 Canadian locations, is available on the following websites:

a. www.climate.weather.gc.ca/prods_servs/engineering_e.html, containing CWEEDS (in CSV and WY3 formats) and CWEC datasets (in CSV, EPW and WY3 formats) for the 1998–2017 period of record,

b. https://nrc-digital-repository.canada.ca/eng/view/object/?id=92bfa9cf-6d35-4de4-80c2-799f53961f60, containing “Typical Meteorological Years,” “Extreme Cold Years,” “Extreme Warm Years” and other reference years for design and modeling (in CSV and EPW formats) for the 1991–2021 period of record and seven future time periods coinciding with various degrees of global warming, and

c. https://nrc-digital-repository.canada.ca/eng/view/object/?id=bd339698-5eb8-4635-b411-63d4f670382b, containing complete meteorological records (in CSV format) for the 1991–2021 period of record and seven future time periods coinciding with various degrees of global warming.

Where climatic data for a target location are not available, climatic data for a representative alternative location should be selected based on the following considerations: the same climatic zone, the same geographic area or characteristics, the heating degree-days (HDD) of the alternative location are within 10% of the target location's HDD, and the January 1% heating design criteria of the alternative location is within 2°C of the target location's same criteria (see Appendix C). Where several alternative locations are representative of the climatic conditions at the target location, their proximity to the target location should also be a consideration.

Impact analysis

This proposed change is not expected to result in additional cost for Code users, who would benefit from the use of more recent climatic data for the design of buildings and houses that more accurately reflect actual operating conditions.

Enforcement implications

This proposed change can be enforced by the existing Code enforcement infrastructure without additional resources.

Who is affected

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

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

NECB20 Div.B 8.4.2.3. (first printing)

[8.4.2.3.] 8.4.2.3. ([1] 1) [F99-OE1.1]

[8.4.2.3.] 8.4.2.3. ([2] 2) [F99-OE1.1]

NBC20 Div.B 9.36.5.5.(1) (first printing)

[9.36.5.5.] 9.36.5.5. ([1] 1) [F99-OE1.1]

Submit a comment

Proposed Change 2003

Code Reference(s):	**NECB20 Div.B 11 (first printing)**
Subject:	Greenhouse Gas Emissions
Title:	Operational GHG Emissions: Tiered Performance Requirements in the NECB
Description:	This proposed change introduces performance requirements in the NECB to reduce operational GHG emissions.
Related Proposed Change(s):	PCF 1820, PCF 1843, PCF 1989, PCF 2004, PCF 2016, PCF 2026

This change could potentially affect the following topic areas:

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

Problem

Approximately 13% of Canada's total greenhouse gas (GHG) emissions can be attributed to houses and buildings. This is primarily a result of using fossil fuels for space and water heating. Additionally, the combined impact of electricity consumption for cooling, lighting and running other appliances raises the overall contribution of buildings to GHG emissions to approximately 18%.[1] The 2020 GHG emissions from residential and building sectors are outlined in Table 1, which shows the sources and their percentage of electricity consumption.

Table 1. 2020 GHG Emissions in the Residential and Building Sectors(1)

Sector	Source	Electricity Consumption, %
Residential	Space heating	64
	Water heating	20
	Running appliances	11
	Lighting	3
	Space cooling	2
Building	Space heating	65
	Running auxiliary equipment	12
	Lighting	10
	Water heating	7
	Space cooling	3
	Other	3

Note to Table 1:

(1) https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/menus/trends/comprehensive_tables/list.cfm

There has been a growing recognition of the importance of addressing climate change and reducing GHG emissions from all sectors, including the built environment. However, the National Model Codes (the Codes) do not presently consider the type or quality of energy sources used by buildings and houses, nor do they address or regulate embodied and operational GHG emissions. As the industry moves towards higher energy efficiencies, the differences between energy sources must be examined because they contribute to GHG emissions differently. Historically, the Codes focused on design and construction requirements related to safety, structural integrity, accessibility and energy efficiency. With the latter, the emphasis was on reducing energy consumption during the construction and operational phases, but did not explicitly address operational GHG emissions. Furthermore, Canada is a large and diverse country with different climatic regions and building practices. This reality has led to regional variations in building codes and regulations, making it challenging to establish a unified approach to address operational GHG emissions at the national level.

The Codes currently contain an energy-efficiency objective and related requirements for the design and construction of new buildings and houses. In the 2020 editions of the National Energy Code of Canada for Buildings (NECB) and National Building Code of Canada (NBC), energy-efficiency tiers were introduced, containing measures that progressively increase energy efficiency and reduce the amount of energy needed to operate a building. These requirements play a crucial role in reducing GHG emissions by focusing on the amount of energy used. However, the Canadian Board for Harmonized Construction Codes (CBHCC) recognizes that energy savings alone will not lead to reducing emissions to meet the national goals stated in the Pan-Canadian Framework.

GHG emissions across Canadian provinces and territories exhibit substantial variations, influenced by factors such as population density, climate, energy sources and economic considerations.[2] Provinces and territories with larger populations, resource-based economies or heavy reliance on fossil fuels for electricity generation generally register higher emissions levels. This demonstrates a greatly varied energy landscape across Canada.

Ultimately, the goal is to reduce operational GHG emissions to zero or near zero across provinces and territories by 2050. Consequently, authorities having jurisdiction require a flexible framework to regulate GHG emissions due to building operation by using "levels" that move towards lower operational GHG emissions.

References

[1] https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/climate-plan-overview/healthy-environment-healthy-economy/annex-homes-buildings.html

[2] https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html

Justification

Since 2010, the NBC and NECB have included requirements to prevent excessive use of energy. Though these requirements have improved the energy efficiency of new houses and buildings, the Codes remain silent on the type of energy used and the emissions associated with production, distribution and use. As a result, many new Code-compliant buildings contribute GHG emissions through their year-over-year operation. Reducing these emissions is an important step to enable action towards climate goals. Climate change is the biggest challenge facing humanity today, consequently, it is vital that the Codes address this gap to support Canada in reaching its emissions reduction target of 40% below 2005 levels by 2030 and net-zero emissions by 2050. Furthermore, achieving long-term climate goals requires early action on operational GHG emissions. Failure to address this pivotal issue could impede Canada's progress towards its emissions-reduction targets, jeopardizing the ability to effectively combat climate change and protect the future well-being of the country. The commitment to a sustainable future demands that these emissions be addressed comprehensively and urgently.

If these emissions are to be regulated, designers, builders and enforcement officials need a consistent and accurate means to convert expected energy use into expected GHG emissions. For years, governments and industry have relied on emissions factors (also referred to as emissions intensity factors) for this task. Emissions factors describe the amount of GHG emissions (in kg CO_2 equivalent) per unit of energy consumed, for instance, of electricity (in kWh), of natural gas (in m^3), and of heating oil (in L). Environment and Climate Change Canada compiles this data annually and publishes estimates as part of Canada's national greenhouse gas inventory report. Emissions factors reflect the carbon intensity of different fuels, as well as regional differences in energy production and distribution. Data is generally published after two years; factors reflecting 2021 data were published in April 2023.

If Canada's energy sector were unchanging, this data would suffice for building design and Code-administration purposes. But provincial, territorial and regional utilities are presently undergoing unprecedented transition. Electric utilities are shifting away from coal power generation, while gas utilities are experimenting with new technologies to lower emissions through use of hydrogen and renewable biogas sources. These changes are expected to occur rapidly; some provincial utilities expect to reduce electric emissions by 60% or more by 2030. In this environment, referencing the most recent (2021) emissions data currently available in the Codes could encourage the construction of buildings with higher-than-expected emissions. For this reason, this proposed change is based on the best available future-looking forecasts for utility emissions, averaged for the years 2031 to 2035. Emissions factor forecasts for electricity are sourced from Environment and Climate Change Canada's most recent (2023) projections. While no similar projections are currently available for natural gas utilities, such projections are expected in future years and could be incorporated into the Codes at a later date.

PROPOSED CHANGE

[11.] 11 Tiered Operational GHG Emissions Performance Compliance

[11.1.] -- General

[11.1.1.] -- General

[11.1.1.1.] --- Scope

[1] --) This Part is concerned with GHG emissions, determined at the time of design, resulting from the supply and consumption of the energy used by the *building*

[a] --) for

[i] --) lighting components and systems, as described in Part 4,

[ii] --) systems used for heating, ventilating and air-conditioning, as described in Part 5,

[iii] --) systems used to heat *service water* and pumping systems that are part of *service water* systems, as described in Part 6, and

[iv] --) electrical power systems and motors, as described in Part 7, or

[b] --) as determined in accordance with Part 8.

[11.1.1.2.] --- Application

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

[2] --) If, during construction, the design is found to be altered from the one used in the original performance assessment, the *building* shall be reassessed for compliance with this Part.

[3] --) Except as provided in Sentence (4), the procedures stated in this Part shall be applied to a single *building* at a time.

[4] --) Where the structure is divided by *firewalls* into multiple *buildings*, the whole structure is permitted to be treated as one *building*.

[11.1.1.3.] --- Definitions

[1] --) Words that appear in italics are defined in Article 1.4.1.2. of Division A.

[2] --) For the purpose of this Part, the term "annual operational GHG emissions" shall mean the annual sum of GHG emissions produced on the *building* site in meeting the annual energy demand loads or produced off-site in generating the energy sources used to meet the annual energy demand loads.

[3] --) For the purpose of this Part, the term "operational GHG emissions target" shall mean the annual operational GHG emissions of a hypothetical replica of the proposed *building*, produced on the *building* site in meeting the *building energy target* or produced off-site in generating the energy sources used to meet the *building energy target*.

[11.1.1.4.] --- Performance Compliance

[1] --) Except as provided in Sentence (5), compliance with this Part shall be achieved by designing and constructing *buildings* in accordance with one of the GHG emissions performance levels A to F specified in Table 11.1.1.4., each of which corresponds to

- [a] --) the annual operational GHG emissions of the proposed *building*, expressed as a percent operational GHG emissions target, or
- [b] --) the percentage of improvement of the annual operational GHG emissions of the proposed *building* relative to the operational GHG emissions target of the reference *building*, expressed as a percent improvement.

Table [11.1.1.4.]
GHG Emissions Performance Levels
Forming Part of Sentences 11.1.1.4.(1) and (2)

GHG Emissions Performance Level	Percent Operational GHG Emissions Target [(1)]	Percent Improvement [(1)]
A	≤ 10%	≥ 90%
B	≤ 25%	≥ 75%
C	≤ 50%	≥ 50%
D	≤ 75%	≥ 25%
E	≤ 90%	≥ 10%
F	≤ 100%	≥ 0%

Note to Table [11.1.1.4.] :

(1) See Sentence (2).

[2] --) Compliance of the proposed *building* with one of GHG emissions performance levels A to F specified in Table 11.1.1.4. shall be determined by

- [a] --) dividing the annual operational GHG emissions of the proposed *building* by the operational GHG emissions target of the reference *building* to derive the percent operational GHG emissions target, or
- [b] --) subtracting the annual operational GHG emissions of the proposed *building* from the operational GHG emissions target of the reference *building* and dividing the result by the operational GHG emissions target of the reference *building* to derive the percent improvement.

[3] --) The annual operational GHG emissions of the proposed *building* shall be determined in accordance with Article 11.1.1.6.

[4] --) The operational GHG emissions target of the reference *building* shall be determined in accordance with Article 11.1.1.7.

[5] --) Where the *building* cannot reasonably be connected to the provincial or territorial electrical power grid, compliance with this Part shall be achieved by reporting the annual operational GHG emissions of the proposed *building* calculated in accordance with Article 11.1.1.6.

[11.1.1.5.] --- GHG Emissions Factors

(See Note A-11.1.1.5.)

[1] --) Except as provided in Sentences (2) to (5), the GHG emissions factors used in Articles 11.1.1.6.

and 11.1.1.7. shall be in conformance with the values established by the provincial or territorial government having jurisdiction.

[2] --) Where permitted by the provincial or territorial government having jurisdiction, the GHG emissions factor for an energy source may be obtained from the regulated utility responsible for providing the energy source to the *building* site.

[3] --) Except as provided in Sentence (5), where they have not been established in accordance with Sentences (1) and (2), the GHG emissions factors shall be in conformance with Tables 11.1.1.5.-A and 11.1.1.5.-B.

Table [11.1.1.5.-A]
GHG Emissions Factors for Electricity and Utility Gas by Province or Territory
Forming Part of Sentence 11.1.1.5.(3)

Province or Territory	GHG Emissions Factor, g CO_2e /kWh	
	Electricity (1)	Utility Gas (2)
British Columbia	1.32	190
Alberta	181.86	189
Saskatchewan	146.60	185
Manitoba	0.00	185
Ontario	57.90	185
Quebec	0.38	186
New Brunswick	77.88	185
Nova Scotia	161.64	190
Prince Edward Island	80.42	185
Newfoundland and Labrador	11.08	185
Yukon	25.00	190
Northwest Territories	6.82	185
Nunavut	465.16	190

Notes to Table [11.1.1.5.-A] :

(1) GHG emissions factors for electricity are an average of the 2031–2035 values provided by Environment and Climate Change Canada at data-donnees.az.ec.gc.ca/data/substances/monitor/canada-s-greenhouse-gas-emissions-projections as of June 2023.

(2) GHG emissions factors for utility gas are based on estimates in the Environment and Climate Change Canada "National Inventory Report 1990–2020: Greenhouse Gas Sources and Sinks in Canada."

Table [11.1.1.5.-B]
GHG Emissions Factors for Other Energy Sources
Forming Part of Sentence 11.1.1.5.(3)

Energy Source	GHG Emissions Factor (1)	
	In g CO_2 e/L	In g CO_2 e/kWh
Diesel	2 690	250
Oil, heating or light fuel	2 755	270
Oil, heavy fuel	3 176	274
Propane	1 548	218

Note to Table [11.1.1.5.-B] :

(1) GHG emissions factors are values provided by Environment and Climate Change Canada at www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/output-based-pricing-system/federal-greenhouse-gas-offset-system/emission-factors-reference-values.html as of June 19, 2023.

[4] --) Except as provided in Sentence (5), for energy sources supplied by a district energy plant, the GHG emissions factors shall

- [a] --) be in conformance with Table 11.1.1.5.-C, or
- [b] --) be determined by a qualified person representing the district energy plant operator (see Note A-11.1.1.5.(4)(b) and (5)).

Table [11.1.1.5.-C]
GHG Emissions Factors for Energy Sources Supplied by a District Energy Plant
Forming Part of Sentence 11.1.1.5.(4)

Energy Source	GHG Emissions Factor, (1) g CO_2 e/kWh
Chilled water	128
Hot water	362
Steam	383

Note to Table [11.1.1.5.-C] :

(1) GHG emissions factors are from ANSI/ASHRAE 228-2023, “Standard Method of Evaluating Zero Net Energy and Zero Net Carbon Building Performance.”

[5] --) For energy sources not listed in Tables 11.1.1.5.-A to 11.1.1.5.-C, the GHG emissions factors shall be determined by a qualified person. (See Note A-11.1.1.5.(4)(b) and (5).)

[11.1.1.6.] --- Annual Operational GHG Emissions of the Proposed Building

[1] --) The annual operational GHG emissions of the proposed *building*, $CO_2e_{proposed}$, in kg CO_2e, shall be determined using the following equation:

$$CO_2e_{proposed} = \sum_{ES} (E_{reg,ES} \times GEF_{ES})/1\ 000$$

where

$E_{reg,ES}$ = annual energy consumption of the equipment and systems regulated by the NECB, as listed in Clauses 8.4.2.2.(1)(a) to (g), for each energy source (ES), in KWh, determined by modeling the proposed building in accordance with Subsection 8.4.3., and

GEF_{ES} = GHG emissions factor for the corresponding energy source, in g CO_2e/kWh, as specified in Article 11.1.1.5.

[11.1.1.7.] --- Operational GHG Emissions Target of the Reference Building

[1] --) The operational GHG emissions target of the reference *building*, CO_2e_{target}, in kg CO_2e, shall be determined using the following equation:

$$CO_2e_{target} = CO_2e_{NHreg} + CO_2e_{SH} + CO_2e_{SWH}$$

where

CO_2e_{NHreg} = annual operational GHG emissions of all non-heating equipment and systems regulated by the NECB, in kg CO_2e, determined in accordance with Sentence (2),

CO_2e_{SH} = annual operational GHG emissions from space heating, in kg CO_2e, determined in accordance with Sentence (3), and

CO_2e_{SWH} = annual operational GHG emissions from *service water* heating, in kg CO_2e, determined in accordance with Sentence (4).

[2] --) The annual operational GHG emissions of all non-heating equipment and systems regulated by the NECB, CO_2e_{NHreg}, in kg CO_2e, shall be determined using the following equation:

$$CO_2e_{NHreg} = E_{NHreg} \times GEF_{elec} \Big/ 1\,000$$

where

E_{NHreg} = annual energy consumption of all non-heating systems and equipment regulated by the NECB, as listed in Clauses 8.4.2.2.(1)(b) to (d), (f) and (g), in the reference *building*, in kWh, determined by modeling the reference *building* in accordance with Subsection 8.4.4., and

GEF_{elec} = GHG emissions factor for electricity, in g CO_2e/kWh, as specified in Article 11.1.1.5.

[3] --) The annual operational GHG emissions from space heating, CO_2e_{SH}, in kg CO_2e, shall be determined using the following equation:

$$CO_2e_{SH} = TED_{SH} \times 265 \Big/ 1\,000$$

where

TED_{SH} = annual thermal energy demand of the space-heating system, including baseboard heating, in the reference *building*, in kWh, determined by modeling the reference *building* in accordance with Subsection 8.4.4., and

265 = reference GHG emissions factor for space heating, in g CO_2e/kWh.

(See Note A-11.1.1.7.(3) and (4).)

[4] --) The annual operational GHG emissions from *service water* heating, CO_2e_{SWH}, in kg CO_2e, shall be determined using the following equation:

$$CO_2e_{SWH} = TED_{SWH} \times 240 \Big/ 1\,000$$

where

TED_{SWH} = annual thermal energy demand of the *service water* heating system in the reference *building*, in kWh, determined by modeling the reference *building* in accordance with Subsection 8.4.4., and

240 = reference GHG emissions factor for *service water* heating, in g CO_2e/kWh.

(See Notes A-11.1.1.7.(3) and (4).)

Note A-11.1.1.5. Unit Conversions.

A volumetric quantity of a fuel can be converted to an equivalent amount of energy, in kWh, using the conversion factors provided in Table A-11.1.1.5.

Table [11.1.1.5.]
Unit Conversions for Energy Sources

Energy Source	Unit	Energy per Unit,[(1)] kWh
Diesel	L	10.74
Natural gas	m^3	10.36
Oil, heating or light fuel	L	10.20
Oil, heavy fuel	L	11.59
Propane	L	7.09

Note to Table [11.1.1.5.] :

(1) The energy per unit is the approximate energy content, in GJ, of the fuel from apps.cer-rec.gc.ca/Conversion/conversion-tables.aspx converted to kWh (1 GJ = 277.7778 kWh).

Note A-11.1.1.5.(4)(b) and (5) Qualified Person.

A “qualified person” is a person with training and expertise in building energy analysis and includes

a. a GHG verifier certified in accordance with ISO/IEC-17024:2012, “Conformity assessment — General requirements for bodies operating certification of persons,” who
   i. demonstrates competence with the use of ISO-14064-1:2018, “Greenhouse gases — Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals,” or
   ii. is accredited in accordance with ISO-14065:2020, “General principles and requirements for bodies validating and verifying environmental information,” and ISO 14066:2023, “Environmental information — Competence requirements for teams validating and verifying environmental information,”
b. a licensed professional engineer, and
c. a person qualified by the authority having jurisdiction.

Note A-11.1.1.7.(3) and (4) Thermal Energy Demand.

Thermal energy demand is the amount of heating energy that is output from all types of heating equipment.

For space heating, heating equipment includes electric, gas, hot water or direct-expansion (DX) heating coils of central air systems (e.g., make-up air units, air-handling units), terminal devices (e.g., baseboards, fan coils, heat pumps, reheat coils) and any other equipment used for the purpose of space heating and ventilation. The heating output of any equipment whose source of energy is not directly provided by a utility (electricity, gas or district) must still be counted towards TED_{SH}.

For service water heating, heating equipment includes electric resistance elements or gas heaters/burners of hot water storage tanks or instantaneous water heaters, heat pump water heaters and any other equipment used for the purpose of service water heating. The heating output of any equipment whose source of energy is not directly provided by a utility (electricity, gas or district) must still be counted towards TED_{SWH}.

Impact analysis

This section describes the approach that was adopted for performing an impact analysis of the proposed tiered operational GHG emissions requirements for the NECB. A similar approach was used to establish the reference GHG emissions factors values of 265 g CO_2e/kWh and 240 g CO_2e/kWh for determining the GHG emissions targets for space heating and for service water heating, respectively, in the proposed change. The GHG emissions factors for provinces and territories in Table 11.1.1.5.-A in the proposed change were used in the analysis.

The following section shows that buildings compliant with the NECB 2020 can reach different operational GHG emissions performance levels without any additional costs, depending on the primary heating type and the GHG emissions intensity of the electricity grid to which they are connected.

GHG emissions performance of NECB 2020 compliant buildings (baseline scenario)

Table 1 shows the percentage of natural-gas-heated buildings that comply with the different GHG emissions performance levels. Note that all the cases presented in Table 1 correspond to buildings that meet the minimum requirements established in the NECB 2020, so they are considered to have no incremental costs. As can be seen from Table 1, most natural-gas-heated buildings complying with the NECB 2020 will reach Level E (i.e., percent improvement ≥ 10%) or Level F (i.e., percent improvement ≥ 0%) without any incremental costs. A small number of natural-gas-heated buildings will not comply with the GHG emission requirements in certain locations, corresponding to full-service restaurants that have heating equipment with the lowest efficiencies. In most locations, the percentage of buildings that can reach Level E is higher than the percentage of buildings that can reach Level F, except for buildings located in high GHG emissions intensity grids, where the opposite is true.

Table 1. Percentage of Natural-Gas-Heated Buildings That Comply with the Operational GHG Emissions (GHGe) Performance Levels

Operational GHGe Performance Level	Percent Improvement	Provinces and Territories (primary heating: natural gas)												
		Low GHGe Intensity					Mid GHGe Intensity				High GHGe Intensity			
		BC	MB	NL	NT	QC	NB	ON	PE	YT	AB	NS	NU	SK
Level A	≥ 90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level B	≥ 75%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level C	≥ 50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level D	≥ 25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level E	≥ 10%	54%	78%	72%	66%	71%	50%	50%	50%	50%	15%	19%	34%	35%
Level F	≥ 0%	40%	22%	25%	34%	25%	47%	47%	44%	50%	81%	75%	66%	65%
Non-compliant buildings	< 0%	6%	0%	3%	0%	4%	3%	3%	6%	0%	4%	6%	0%	0%

Table 2 shows the percentage of electrically heated buildings that comply with the different GHG emissions performance levels. Note that all the cases presented in Table 2 correspond to buildings that meet the minimum requirements established in the NECB 2020, so they are considered to have no incremental costs. As can be seen from Table 2, the lowest level that can be achieved by electrically heated buildings complying with the NECB 2020 is Level E (i.e., percent improvement ≥ 10%). The only exceptions are cases in Nunavut, where all electrically heated buildings will not comply with the operational GHG requirements (the projected emissions factor for electricity is higher than the emissions factor for natural gas). However, this proposed change includes Sentence 11.1.1.4.(5) to provide a relaxation. Table 2 also shows that the majority of buildings connected to low GHG emissions intensity electrical grids (i.e., located in British Columbia, Manitoba, Newfoundland and Labrador, Northwest Territories or Quebec) can achieve the highest GHG emissions performance level (i.e., Level A: percent improvement ≥ 90%) with no incremental costs. On the other hand, most buildings connected to high GHG emissions intensity grids (i.e., located in Alberta or Nova Scotia) can only reach Level E, with some cases reaching Level D (especially in Saskatchewan). Finally, Table

2 shows that most buildings connected to mid GHG emissions intensity grids (i.e., located in New Brunswick, Ontario or Prince Edward Island) can reach Level C (i.e., percent improvement ≥ 50%) with no incremental costs, with some cases even reaching Level B (i.e., percent improvement ≥ 75%) in Yukon.

Table 2. Percentage of Electrically Heated Buildings That Comply with the Operational GHG Emissions (GHGe) Performance Levels

Operational GHGe Performance Level	Percent Improvement	Provinces and Territories (primary heating: electricity)												
		Low GHGe Intensity					Mid GHGe Intensity				High GHGe Intensity			
		BC	MB	NL	NT	QC	NB	ON	PE	YT	AB	NS	NU	SK
Level A	≥ 90%	100%	100%	84%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%
Level B	≥ 75%	0%	0%	16%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%
Level C	≥ 50%	0%	0%	0%	0%	0%	72%	97%	69%	0%	0%	0%	0%	0%
Level D	≥ 25%	0%	0%	0%	0%	0%	28%	3%	31%	0%	0%	28%	0%	90%
Level E	≥ 10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	72%	0%	10%
Level F	≥ 0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Non-compliant buildings	< 0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%

From the results shown in Tables 1 and 2, it is evident that buildings compliant with the NECB 2020 can reach different operational GHG emissions performance levels without any additional costs, depending on the primary heating type and the GHG emissions intensity of the electricity grid to which they are connected. For this reason, the impact analysis requires incremental costs to be evaluated individually, since the costs associated with reaching each GHG emissions performance level cannot be generalized to all cases.

Incremental costs of GHG emissions performance levels

This section focuses on estimating the costs associated with implementing measures that will enable buildings to reduce operational GHG emissions and thereby improve their GHG emissions performance level. Table 3 shows the measures that were considered for reducing operational GHG emissions in all evaluated building types and locations. The following sections show the GHG emissions performance levels that all buildings can reach after the implementation of each of these measures, with the associated incremental costs.

Table 3. Measures Considered for Reducing Operational GHG Emissions to Reach Higher GHG Emissions Performance Levels

Measure	Primary Space Heating	Terminal or Auxiliary Space Heating	Service Water Heating
High-efficiency furnace	Natural gas	Natural gas	Natural gas
Building envelope improvements and high-efficiency furnace	Natural gas	Natural gas	Natural gas
Building envelope improvements	Electricity	Electricity	Electricity

High-efficiency furnace (natural gas)

This measure focuses on buildings that use natural gas as the primary heating fuel, which according to Table 1 can only reach Level E (i.e., percent improvement ≥ 10%) of the GHG emissions performance levels. Table 4 shows the percentage of natural-gas-heated buildings with a high-efficiency furnace (thermal efficiency of 95%) that comply with the different GHG emissions performance levels. As can be seen in Table 4, the implementation of this measure helps all cases to meet the GHG emissions requirements (there are no non-compliant cases). In addition, this measure helps to increase the percentage of buildings that achieve Level E (i.e., percent improvement ≥ 10%), while reducing the percentage of buildings that are at Level F (i.e., percent improvement ≥ 0%).

Table 4. Percentage of Natural-Gas-Heated Buildings with High-Efficiency Warm-Air furnaces (thermal efficiency of 95%) That Comply with the Operational GHG Emissions (GHGe) Performance Levels

Operational GHGe Performance Level	Percent Improvement	Provinces and Territories (primary heating: natural gas)												
		Low GHGe Intensity					Mid GHGe Intensity				High GHGe Intensity			
		BC	MB	NL	NT	QC	NB	ON	PE	YT	AB	NS	NU	SK
Level A	≥ 90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level B	≥ 75%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level C	≥ 50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level D	≥ 25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level E	≥ 10%	69%	97%	88%	94%	92%	63%	63%	63%	91%	17%	28%	79%	58%
Level F	≥ 0%	31%	3%	13%	6%	8%	38%	38%	38%	9%	83%	72%	21%	42%
Non-compliant buildings	< 0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

The incremental costs of replacing 80% efficiency gas furnaces (i.e., typical efficiency of the baseline prototype models complying with the NECB 2020) with high-efficiency (96% efficiency) furnaces was estimated to be about \$1.29/m^2, based on an incremental cost analysis performed by the New Buildings Institute (NBI) (see Table 7).

Building envelope improvements and high-efficiency furnace (natural gas)

In addition to applying the previous measure (high-efficiency furnace), a set of building envelope improvement measures (see Table 5) were implemented in all building prototypes to obtain further operational GHG emissions reductions. Table 6 shows the percentage of natural-gas-heated buildings with a high-efficiency furnace (thermal efficiency of 95%) and improved building envelope that comply with the different GHG emissions performance levels. As can be seen in Table 6, the majority of buildings will reach Level E in all locations. Table 6 also shows that the implementation of these measures helps to substantially reduce the percentage of buildings that are at Level F (i.e., percent improvement ≥ 0%), while increasing the percentage (up to 40% in Newfoundland and Labrador) of buildings that can reach Level D (i.e., percent improvement ≥ 25%).

Table 5. Building Envelope Improvement Measures Applied to All Building Archetypes in All Locations

Building Envelope Measures
Reduce U-value of walls to 0.165 W/(m^2×K)
Reduce U-value of roofs to 0.11 W/(m^2×K)
Reduce U-value of windows to 1.44 W/(m^2×K)
Set solar heat gain coefficient to 0.4
Set normalized air leakage rate to 1 L/(s×m^2) at 75 Pa

Table 6. Percentage of Natural-Gas-Heated Buildings with High-Efficiency Warm-Air Furnaces (thermal efficiency of 95%) and Improved Building Envelopes That Comply with the Operational GHG Emissions Performance Levels

Operational GHGe Performance Level	Percent Improvement	Provinces and Territories (primary heating: natural gas)												
		Low GHGe Intensity					Mid GHGe Intensity				High GHGe Intensity			
		BC	MB	NL	NT	QC	NB	ON	PE	YT	AB	NS	NU	SK
Level A	≥ 90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level B	≥ 75%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Level C	≥ 50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 6. Percentage of Natural-Gas-Heated Buildings with High-Efficiency Warm-Air Furnaces (thermal efficiency of 95%) and Improved Building Envelopes That Comply with the Operational GHG Emissions Performance Levels (Continued)

Level D	≥ 25%	35%	25%	41%	9%	31%	22%	27%	19%	3%	6%	9%	9%	10%
Level E	≥ 10%	56%	75%	59%	91%	65%	72%	69%	75%	94%	73%	75%	81%	83%
Level F	≥ 0%	8%	0%	0%	0%	4%	6%	5%	6%	3%	21%	16%	9%	6%
Non-compliant buildings	< 0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

The costs of the improvement measures for the building envelope are summarized in Table 7, with the corresponding source of data that was used in the incremental cost analysis.

Table 7. Cost Data for Estimating the Incremental Costs of Building Envelope Improvement Measures and a High-Efficiency Furnace

Measure	Cost		Description	Source
	$/ft.^{2}	$/m^2		
Insulation(1)	0.06	0.65	Cost of blanket insulation for walls/roofs to increase R-value by 1 unit	RSMeans,(2) 2023
Gas furnace	0.12	1.29	80% to 96% efficiency gas furnace	NBI,(3) 2022
Triple-pane windows(1)	2.64	28.42	Thin triple-pane window compared to a conventional double low-e insulating glass unit	PNNL,(4) 2019
Air sealing	1.04	11.19	Aerosolized sealant to reduce normalized leakage rate to 1 L/(s×m^2) at 75 Pa	Product supplier, 2023

Notes to Table 7:

(1) Cost is per m^2 of product (insulation or windows).

(2) RSMeans data from Gordian (2023). “2023 Building Construction Costs with RSMeans data.” 81st annual edition.

(3) New Buildings Institute (NBI) (2022). “Cost Study of the Building Decarbonization Code – An analysis of the incremental first cost and life cycle cost of two common building types,” April 2022.

(4) Pacific Northwest National Laboratory (PNNL) (2019). “Double or Triple? – Factors Influencing the Window Purchasing Decisions of High-Performance Home Builders,” June 2019.

Figure 1 shows the incremental costs of installing a high-efficiency furnace and implementing improvement measures for the building envelope in locations representing the six Canadian climate zones (CZs) covered in the NECB. As shown in Figure 1, the incremental costs of increasing the efficiency of furnaces and implementing building envelope improvement measures is estimated to be around \$13/m^2 to \$35/m^2. As expected, the incremental costs of the building envelope improvement measures are lowest for buildings located in climate zone 8 because the target U-values are the values that are already mandated for buildings located in this climate zone (i.e., there are no incremental costs associated with additional insulation for walls and roofs or the installation of high-performance windows). The only costs for buildings located in climate zone 8 (Yellowknife) correspond to air-sealing costs and the incremental costs of a high-efficiency furnace.

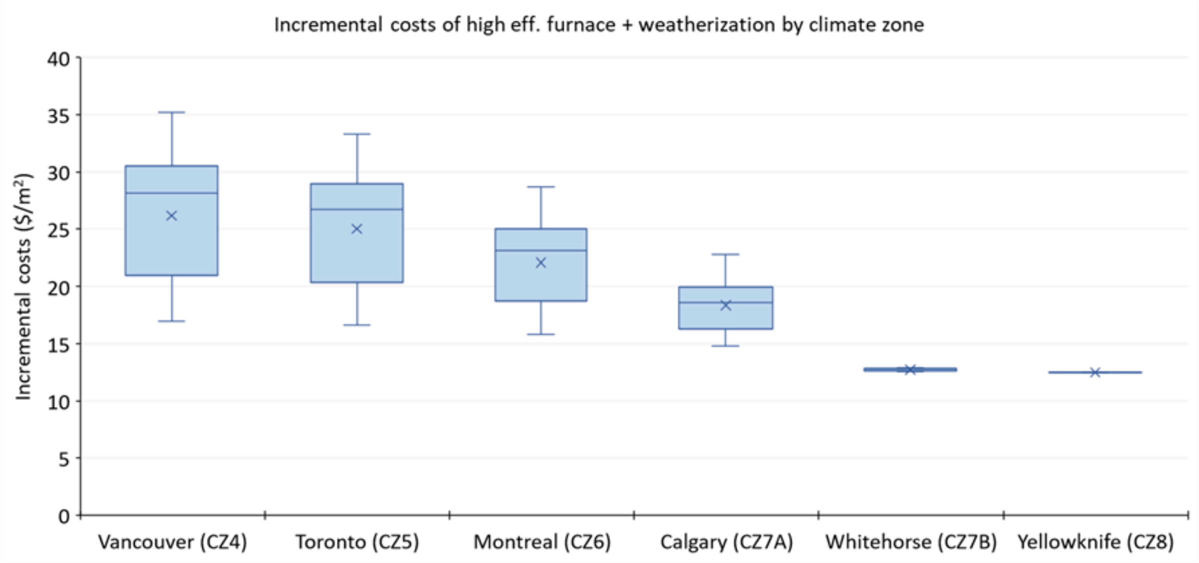


Figure 1. Incremental costs of installing a high-efficiency furnace and implementing building envelope improvement measures in locations representing the six Canadian climate zones

Building envelope improvements (electricity)

The same improvement measures for the building envelope that were applied to natural gas cases in the previous section were applied to cases that use electricity as the primary heating type. Table 8 shows the percentage of electrically heated buildings with improved building envelopes that comply with the different GHG emissions performance levels. As can be seen in Table 8, the results indicate that the GHG emissions performance of the evaluated cases is highly dependent on the carbon intensity of the electrical grid to which the buildings are connected. The building envelope improvement measures do not have a major effect on buildings connected to low GHG emissions intensity grids, as the majority of these cases already achieve the highest GHG emissions performance level (Level A: percent improvement ≥ 90%). In mid GHG emissions intensity grids, building envelope improvement measures help to increase the percentage of buildings that comply with Level C (i.e., percent improvement ≥ 50%), while reducing the percentage of buildings that comply with Level D (i.e., percent improvement ≥ 25%). Table 8 also shows that in Ontario, building envelope improvement measures can help a small percentage of buildings to reach Level B (i.e., percent improvement ≥ 75%), while eliminating the percentage of buildings that comply with Level D (i.e., percent improvement ≥ 25%). In high GHG emissions intensity grids, building envelope improvement measures help to increase the percentage of buildings that comply with Level D (i.e., percent improvement ≥ 25%), while reducing the percentage of buildings that comply with Level E (i.e., percent improvement ≥ 10%).

Table 8. Percentage of Electrically Heated Buildings with Improved Building Envelopes That Comply with the Operational GHG Emissions (GHGe) Performance Levels

Operational GHGe Performance Level	Percent Improvement	Provinces and Territories (primary heating: electricity)												
		Low GHGe Intensity					Mid GHGe Intensity				High GHGe Intensity			
		BC	MB	NL	NT	QC	NB	ON	PE	YT	AB	NS	NU	SK
Level A	≥ 90%	100%	100%	91%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%
Level B	≥ 75%	0%	0%	9%	0%	0%	0%	5%	0%	100%	0%	0%	0%	0%
Level C	≥ 50%	0%	0%	0%	0%	0%	91%	95%	88%	0%	0%	0%	0%	2%
Level D	≥ 25%	0%	0%	0%	0%	0%	9%	0%	13%	0%	31%	81%	0%	98%
Level E	≥ 10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	69%	19%	0%	0%
Level F	≥ 0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Non-compliant buildings	< 0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%

The incremental costs of the building envelope improvement measures for buildings with electric heating are similar to those estimated for buildings with natural gas heating (previous section) without the costs associated with the high-efficiency furnace ($1.29/m^2).

Enforcement implications

The enforcement of the proposed technical requirements to minimize the excessive emission of operational greenhouse gases would require additional effort by authorities having jurisdiction.

A consistent set of technical requirements to minimize the excessive emission of operational greenhouse gases across Canada would contribute to meeting provincial, territorial and federal GHG emissions reduction targets and climate action plans, including Canada’s goal to reduce its total GHG emissions to 40% to 45% below 2005 levels by 2030 and to reach net-zero GHG emissions by 2050.

Who is affected

Designers, engineers, architects, builders and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

- **[11.1.1.1.] -- ([1] --) no attributions**
- **[11.1.1.2.] -- ([1] --) no attributions**
- **[11.1.1.2.] -- ([2] --) [F101-OE2.1]**
- **[11.1.1.2.] -- ([3] --) [F101-OE2.1]**
- **[11.1.1.2.] -- ([4] --) no attributions**
- **[11.1.1.3.] -- ([1] --) no attributions**
- **[11.1.1.3.] -- ([2] --) no attributions**
- **[11.1.1.3.] -- ([3] --) no attributions**
- **[11.1.1.4.] -- ([1] --) no attributions**
- **[11.1.1.4.] -- ([1] --) [F101-OE2.1]**
- **[11.1.1.4.] -- ([2] --) [F101-OE2.1]**
- **[11.1.1.4.] -- ([3] --) no attributions**
- **[11.1.1.4.] -- ([4] --) no attributions**
- **[11.1.1.4.] -- ([5] --) [F101-OE2.1]**
- **[11.1.1.5.] -- ([1] --) [F101-OE2.1]**
- **[11.1.1.5.] -- ([2] --) [F101-OE2.1]**
- **[11.1.1.5.] -- ([3] --) [F101-OE2.1]**
- **[11.1.1.5.] -- ([4] --) [F101-OE2.1]**
- **[11.1.1.5.] -- ([5] --) [F101-OE2.1]**
- **[11.1.1.6.] -- ([1] --) [F101-OE2.1]**
- **[11.1.1.7.] -- ([1] --) [F101-OE2.1]**
- **[11.1.1.7.] -- ([2] --) [F101-OE2.1]**

[11.1.1.7.] -- ([3] --) [F101-OE2.1]

[11.1.1.7.] -- ([4] --) [F101-OE2.1]

Submit a comment

Proposed Change 1991

Code Reference(s):	**NECB20 Div.B 13.1. (first printing)** **NECB20 Div.B 13.2. (first printing)**
Subject:	Alteration of Existing Buildings
Title:	Scope and Application of Proposed Part 13
Description:	This proposed change states the scope and application of proposed Part 13 of the NECB for the alteration of existing buildings.

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Alteration of Existing Buildings.

Problem

The absence of Code requirements for existing buildings in the NECB has resulted in a patchwork approach to dealing with the alteration of existing buildings across Canada, which causes confusion for the industry, regulators and building owners/operators, and also causes potentially unsafe practices.

Authorities having jurisdiction and the industry have expressed the desire for a set of requirements that can consistently be applied to existing buildings subjected to alteration to ensure an acceptable level of safety and building performance, and that also removes ambiguity as to the degree of work required on the rest of the building. A process for the consistent application of these requirements would help reduce unnecessary variation in enforcement levels in different jurisdictions. The requirements applying to the alteration of existing buildings should be clearly stated in a new Part 13 in the NECB.

Justification

The voluntary alteration of an existing building represents an opportunity to upgrade the building’s energy performance. When significant repairs or alterations need to be made is the ideal time to consider upgrading the building’s performance where it is cost-effective to do so, thereby minimizing the incremental cost of the upgrade.

To address the alteration of existing buildings, a guiding principle of the development of provisions is that the provisions should be reasonable, pragmatic and avoid placing an undue burden on building owners. Providing exemptions from or relaxations of Code requirements that are not practical to apply to an existing building, and that do not lead to a decrease in building performance, allows the flexibility to continue using existing functional materials or equipment by extending their service life and deferring replacement costs.

Code users would benefit from a clarification of the requirements that apply to the alteration of existing buildings and the applicable permitted relaxations to Code requirements.

PROPOSED CHANGE

[13.1.] -- General

[13.1.1.] -- General

[13.1.1.1.] --- Scope

[1] --) This Part is concerned with the energy performance of *existing buildings* or parts thereof subjected to *alteration*. (See Note A-13.1.1.1.(1).)

[13.1.1.2.] --- Application

[1] --) The application of this Part shall be as described in Article 1.3.3.3.–2025 of Division A.

[13.1.1.3.] --- Defined Words

[1] --) Words that appear in italics are defined in Article 1.4.1.2.–2025 of Division A.

[2] --) For the purpose of this Part, the term “replacement” shall mean the substitution of existing equipment or an existing assembly with a similar product that achieves the same purpose at an equal or better performance level.

[13.1.1.4.] --- Performance

[1] --) Except as stated otherwise in this Part, an *alteration* to an *existing building* shall not adversely affect any aspect of *building* performance.

Note A-13.1.1.1.(1) Extent of the Alteration.

Unless they state otherwise, the provisions of Part 13 are not intended to require building owners to undertake work beyond the planned extent of an alteration. Certain provisions do, however, expand the extent of an alteration where it is reasonable and cost-effective to do so.

The overarching principles for the application of the provisions of Part 13 to an alteration are the following:

- to maintain or increase the overall building performance level in a practical manner,
- to avoid negative or unintended consequences and unrealistic expectations,
- to ensure that the building is left in a safe state during the alteration, and
- to encourage alterations without placing an undue burden on building owners.

[13.2.] -- Reserved

Impact analysis

The proposed changes introducing other Subsections of proposed Part 13 applying to the alteration of existing buildings provide the impact analysis for specific technical requirements individually.

It is expected that new proposed Part 13 requirements which apply to the alteration of existing buildings would provide a benefit to both the industry and authorities having jurisdiction by providing a consistent set of provisions to ensure an acceptable level of safety and building performance, and to remove ambiguity with respect to the degree of work required to improve performance in the unaltered portion of the building.

Providing exemptions for maintenance, repair or replacement with a similar component where appropriate would permit extension of the service life of materials and equipment, defer system replacement costs and improve building performance without creating undue burden on building owners.

This proposed change would help reduce administrative and enforcement costs of assessing the degree to which any particular requirement could be relaxed without affecting the level of performance of the building with respect to the Code objectives and as compared to full compliance.

Enforcement implications

It is expected that a consistent set of provisions that apply to the alteration of existing buildings would help reduce the administrative and enforcement work of assessing the degree to which any particular requirement could be relaxed without affecting the level of performance of the building with respect to the Code objectives.

The proposed changes would aid enforcement by identifying the work necessary to improve energy performance in the unaltered portion of the building.

Who is affected

Designers, specification writers, manufacturers, contractors, building owners and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[13.1.1.1.] -- ([1] --) no attributions

[13.1.1.2.] -- ([1] --) no attributions

[13.1.1.3.] -- ([1] --) no attributions

[13.1.1.3.] -- ([2] --) no attributions

[13.1.1.4.] -- ([1] --) no attributions

N/A

Submit a comment

Proposed Change 1857

Code Reference(s):	**NECB20 Div.B 13.3. (first printing)**
Subject:	Alteration of Existing Buildings
Title:	Alteration of the Building Envelope
Description:	This proposed change adds requirements defining the application of NECB Part 3 to the building envelope subjected to alteration.
Related Proposed Change(s):	PCF 1862

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Alteration of Existing Buildings.

Problem

The building envelope of existing buildings can remain untouched for decades. Older buildings designed to past criteria and codes consequently tend to consume more energy than their more modern counterparts.

The alteration of existing buildings provides a good opportunity to upgrade the building envelope assemblies to current Code requirements. However, work on the building envelope can be costly, and thus the requirements of Part 3 of the National Energy Code of Canada for Buildings (NECB) that are applicable to alterations must be adapted to maintain an acceptable cost-effectiveness.

Justification

Due to the fact that the alteration of the building envelope of an existing building can be costly, this proposed change does not differentiate between minor and major alterations. However, this proposed change provides exemptions and relaxations to maintain an acceptable cost-effectiveness.

The proposed exemptions, along with their rationales, are provided below:

- the repair, maintenance and installation of storm windows or glazing panels over existing glazing, on the basis that these alterations will likely not result in any appreciable energy savings nor be cost-effective
- the replacement of glazing in existing sash and frame, provided the energy performance is not decreased
- the alteration of roof, wall or floor cavities that are insulated to full depth with insulation having a minimum nominal value, on the basis that the existing insulation provides an acceptable level of performance
- the alteration of walls and floors, where the existing structure is without framing cavities and no new framing cavities are created, to avoid the expansion of alterations beyond their extent and avoid placing an undue burden on building owners
- the continuity of insulation, where impractical because of structural or construction constraints

The proposed relaxations, along with their rationales, are provided below:

- permitting the normalized air leakage rate of air barrier systems and the air leakage rate of assemblies to be increased, provided the increased rates will not adversely affect the structural integrity or the performance of the materials, components or assemblies of the environmental separators
- permitting the existing total vertical fenestration and door area to gross wall area ratio to be increased by the minimum amount necessary to provide the required functionality due to a change in use within the altered area or a change in building occupancy

PROPOSED CHANGE

[13.3.] -- Building Envelope

[13.3.1.] -- General

[13.3.1.1.] --- Scope

[1] --) This Section is concerned with the *building* envelope covered in Part 3.

[13.3.1.2.] --- Application

[1] --) This Section applies to existing *building* envelope subjected to *alteration* and new *building* envelope installed in *existing buildings*.

[13.3.2.] -- Compliance

[13.3.2.1.] --- Requirements

[1] --) Except as provided in Sentences (2) to (6), the *building* envelope shall comply with Part 3.

[2] --) The following need not comply with Sentence (1):

- [a] --) repair and maintenance,
- [b] --) the installation of storm windows or glazing panels over existing glazing,
- [c] --) the replacement of glazing in existing *sashes* and *frames*, provided the *overall thermal transmittance* of the replacement glazing is not more than that of the existing glazing (see Note A-13.3.2.1.(2)(c)),
- [d] --) the *alteration* of roof, wall or floor cavities that are insulated to full depth with insulation having a minimum nominal RSI value of 0.53 per 25 mm,
- [e] --) the *alteration* of walls and floors, provided the existing wall or floor has no framing cavities and no new framing cavities are created, and
- [f] --) the provision of continuity of insulation, where impractical because of structural or construction constraints.

[3] --) Vestibules need not be installed, where impractical because of structural, construction or accessibility constraints.

[4] --) Except as provided in Sentence (5), where the *alteration* of the *building* envelope reduces or does not change the vertical fenestration and door area to gross wall area ratio (FDWR) of the *building*, the FDWR need not comply with the maximum allowed by Sentence 3.2.1.4.(1).

[5] --) The existing FDWR and total *skylight* area are permitted to be increased by the minimum amount necessary to provide the functionality required as a result of a change of use within the altered area or in *building occupancy*. (See Note A-13.3.2.1.(5).)

[6] --) The maximum normalized air leakage rate specified in Sentence 3.2.4.2.(1) and the maximum air leakage rate specified in Sentence 3.2.4.3.(1) are permitted to be increased to the minimum rates that will not adversely affect the performance or structural integrity of materials, components or assemblies of the environmental separators. (See Section 5.4. of Division B of the NBC.)

Note A-13.3.2.1.(2)(c) Replacement of Existing Glazing.

The centre-of-glass U-value for the existing glazing, assuming low-conductivity spacers, provides an acceptable basis for comparison with the replacement glazing in order to demonstrate compliance with Clause 13.3.2.1.(2)(c).

Note A-13.3.2.1.(5) Increase in FDWR.

Changes of use or occupancy may necessitate the addition of vertical fenestration, skylights and/or doors to provide access to sufficient daylight, sufficient means of egress, or required functionality for the new use or occupancy.

Impact analysis

The impact analysis guidelines for the alteration of existing buildings require that the proposed changes be evaluated for several building vintages. The key metric of interest in the impact analysis is the marginal difference between the current market practice and the proposed change.
For this analysis, five vintages of unaltered buildings were selected:

- Pre-1980
- 1980–2010
- NECB 2011
- NECB 2015
- NECB 2017

Each vintage contains 16 building archetypes in 32 locations across Canada.

In contrast to the alteration of other systems that are more readily replaced (e.g., lighting, HVAC and water heating), the alteration of the building envelope requires more commitment; therefore, current market practice is defined as the original building envelope of each archetype (i.e., alterations have never previously been undertaken) and the proposed code matches the NECB 2020 requirements. In the Pre-1980 and 1980–2010 archetypes, the fenestration and door area to gross wall area ratio (FDWR) was set to the same values as in the original U.S. Department of Energy commercial archetype due to the absence of FDWR limits for those time periods. This situation results in a constant FDWR that is specific to building archetype and independent of location. Similarly, a constant air leakage rate of 1.5 L/(s×m^2) at 75 Pa (Sentence 8.4.3.3.(3) of Division B of the NECB) was set for each archetype, regardless of vintage, in order to provide a consistent datum for evaluating the impact of the prescriptive changes to the building envelope.

The only alteration of building envelope applied in the analysis was upgrading the insulation of the opaque building envelope and fenestration components. Other alterations prescribed in the NECB were not considered, these include the following:

- FDWR: according to this proposed change, the current FDWR limits do not apply unless FDWR is increased from the original ratio, even if the original already exceeds the new limits. It is assumed that most alterations would retain the original FDWR.
- Air leakage: although it is fair to assume air leakage would change, the air leakage of a building was not a prescriptive attribute prior to 2020. To provide a consistent baseline, the air leakage is set to a constant value for all archetypes,

as mentioned above.

Summary results from the simulations are presented by region in Figure 1 (thermal energy use intensity (TEUI) reduction, kWh/m^2) and Figure 2 (percentage reduction); positive values indicate energy savings.

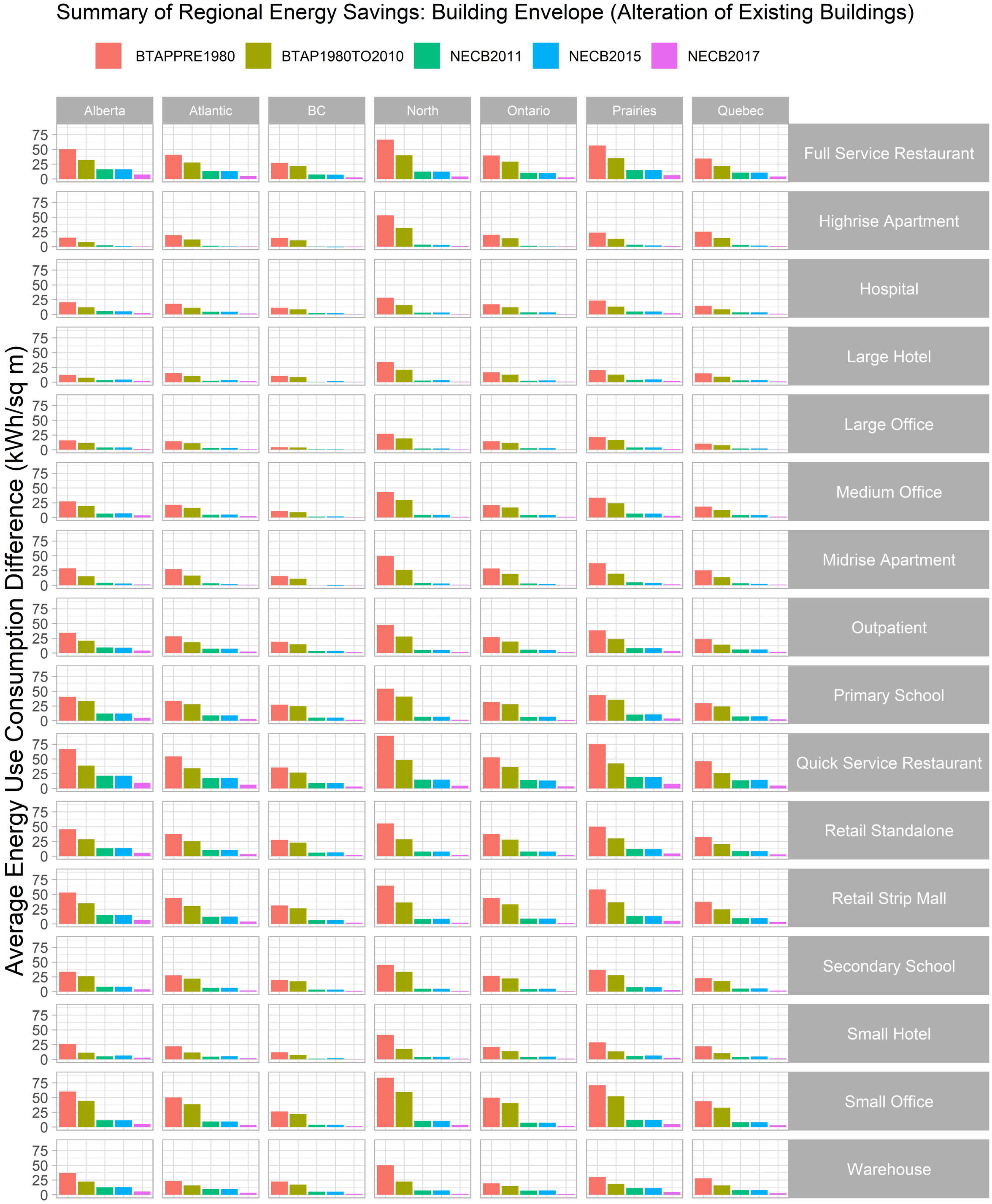


Figure 1. Marginal energy use intensity increment for various building archetypes and vintages in regions across Canada

Figure 2. Marginal percentage energy use intensity increment for various building archetypes and vintages in regions across Canada

Generally, buildings of older vintages are less insulated, therefore, upgrading the insulation to NECB 2020 levels result in higher energy savings; this saving diminishes for newer vintages as the difference in thermal transmittance also diminishes, as presented in Figure 1. However, there are exceptions. A comparison of the energy savings of the NECB 2011 and NECB 2015 vintages of most building archetypes show nearly identical values because the base prescriptive thermal transmittances of the building envelope (window and opaque surfaces) are the same in the NECB 2011 and NECB 2015. Some building archetypes, on the other hand, do not exhibit either trend.

The results for small and large hotels in the NECB 2015 and NECB 2011 vintages show that the NECB 2015 energy savings are greater than those of the NECB 2011 (e.g., see Figure 1), even though both vintages contain the same building envelope (base and upgraded). This is a result of comparing the TEUI, which encompasses the energy differences of other aspects of the building. The lighting and hot water loads decreased in the NECB 2015 vintage compared to the NECB 2011 vintage, resulting in a building with a higher heating demand. Therefore, upgrading the two vintages to the building envelope of the higher performing NECB 2020 yields higher savings in the NECB 2015 vintage.

Similarly, the multi-unit residential buildings (mid- and high-rises) also form an irregular case; in Figure 1, the savings are negligible (Atlantic region) or sometimes negative (BC), i.e., increased energy consumption occurs after upgrading the building envelope to the NECB 2020 requirements. While increasing insulation decreased the heating load, it also increased the building's cooling load. The balance of these competing energy loads is highly influenced by the location's climate; therefore, additional cooling energy may outweigh energy savings from reduced heating for archetypes that experience a comparatively mild winter and hot summer.

Figure 3 presents the heat loss per floor area (kWh/m^2) of the building envelope for each archetype, averaged over the 32 locations. The trend of diminishing energy savings for progressively newer building vintages, seen in Figure 1, is also observed in Figure 3. However, the exception found in Figure 3 is the higher heat loss of the building envelope in the NECB 2011 and NECB 2015 vintages, compared to the older Pre-1980 and 1980–2010 vintages. The older archetypes use, as a default, the FDWRs set by the U.S. DOE for the commercial archetypes that are generally lower than prescriptively set in the NECB 2011 and NECB 2015, resulting in a more insulating building envelope overall. Table 1 presents the range of FDWR of these archetypes for the different vintages. Note that these archetypes can obtain similar or better performing results for the building envelope than in the pre-2010 vintage (FDWR < 0.11), while maintaining the larger FDWR of the NECB 2011/NECB 2015 (FDWR ≥ 0.2), by using the more stringent thermal transmittance values found in the NECB 2017.

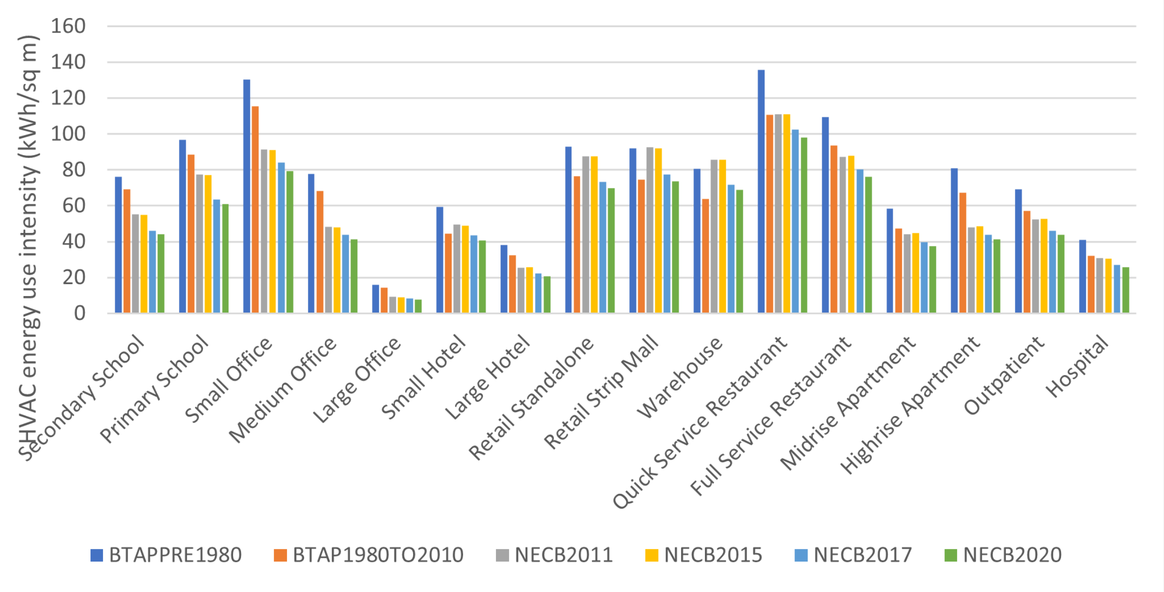
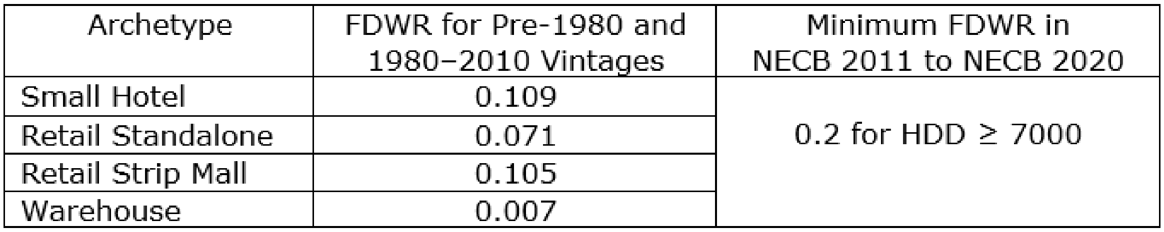


Figure 3. Heat loss intensity of the building envelope (based on floor area) for various Canadian archetypes and vintages

Table 1. FDWR of Archetypes with Higher Performing Building Envelopes in the Pre-1980 and 1980–2010 Vintages Compared to NECB Minimum Requirements



Archetype	FDWR for Pre-1980 and 1980–2010 Vintages	Minimum FDWR in NECB 2011 to NECB 2020
Small Hotel	0.109	0.2 for HDD ≥ 7000
Retail Standalone	0.071	
Retail Strip Mall	0.105	
Warehouse	0.007	

Enforcement implications

The proposed requirements for the alteration of the building envelope in existing buildings could be enforced by the existing means and resources involved in the enforcement of Part 3 requirements of the NECB.

Who is affected

Designers, specification writers, manufacturers, contractors, building owners and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[13.3.1.1.] -- ([1] --) no attributions

[13.3.1.2.] -- ([1] --) no attributions

[13.3.2.1.] -- ([1] --) no attributions

[13.3.2.1.] -- ([2] --) no attributions

[13.3.2.1.] -- ([3] --) no attributions

[13.3.2.1.] -- ([4] --) no attributions

[13.3.2.1.] -- ([5] --) no attributions

[13.3.2.1.] -- ([6] --) no attributions

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Proposed Change 1858

Code Reference(s):	**NECB20 Div.B 13.4. (first printing)**
Subject:	Alteration of Existing Buildings
Title:	Alteration of Lighting Systems
Description:	This proposed change adds requirements that define the application of NECB Part 4 to lighting systems subjected to alteration.
Related Proposed Change(s):	PCF 1863

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Alteration of Existing Buildings.

Problem

The alteration of lighting components and systems in commercial buildings is very common. However, this opportunity to make energy-efficiency improvements is not well leveraged, such as by adopting more efficient LED lighting technology and products or employing new lighting controls to dim or switch off lights when the space is not occupied.

These alteration options provide a good opportunity to upgrade lighting systems to current minimum Code requirements. However, since renovation works in existing buildings are typically more costly than when building new constructions, the lighting requirements of Part 4 of Division B of the NECB applicable to these upgrades must be adapted to maintain an acceptable level of cost-effectiveness.

Justification

With the advent of LED lighting technology and products in today’s marketplace, there are many opportunities to replace older lighting systems in existing buildings with these much more energy-efficient products as well as to employ new lighting control systems and schemes to manage more effectively the operation of lighting systems.

Examples include making better use of the daylight contribution and the ability to automatically turn off unnecessary lights to reduce the energy consumption of existing buildings. Due to the transformation of the lighting market to LED technology, the cost of LED lighting products has substantially reduced to make these products very competitive with older fluorescent lighting products.

This proposed change would align the threshold for interior lighting (2 000 W) and exterior lighting (10 luminaires) with those given in ANSI/ASHRAE/IES 90.1-2022, “Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings (I-P Edition),” and Vancouver Building By-law 2019.

PROPOSED CHANGE

[13.4.] -- Lighting

[13.4.1.] -- General

[13.4.1.1.] --- Scope

[1] --) This Section is concerned with lighting components and systems covered in Part 4.

[13.4.1.2.] --- Application

[1] --) This Section applies to existing lighting components and systems subjected to *alteration* and new lighting components and systems installed in existing *buildings*.

[13.4.2.] -- Compliance

[13.4.2.1.] --- Requirements

[1] --) Except for repair, maintenance and replacement, and except as provided in Sentences (2) to (4), lighting components and systems shall comply with Part 4.

[2] --) Where the total wattage of all new and existing interior luminaires is 2000 W or less, the following requirements apply to *interior lighting alterations*:

- [a] --) the total wattage of the new and replaced luminaires shall not exceed
  - [i] --) 50% of the total wattage of the removed luminaires, or
  - [ii] --) the *interior lighting power allowances* specified in Article 4.2.1.6., and
- [b] --) the *interior lighting* controls shall comply with Sentences 4.2.2.1.(3), (16), (18) and (20).

[3] --) Where 10 or fewer exterior luminaires are replaced, the following requirements apply to *exterior lighting alterations*,

- [a] --) the total wattage of the replaced luminaires shall not exceed
  - [i] --) 50% of the total wattage of the removed luminaires, or
  - [ii] --) the *exterior lighting* power allowances specified in Article 4.2.3.1., and
- [b] --) the *exterior lighting* controls shall comply with Article 4.2.4.1.

Impact analysis

The impact analysis guidelines for the alteration of existing buildings, as illustrated in Figure 1, require that the proposed changes be evaluated for several building vintages. The key metric of interest in the impact analysis is the marginal difference between the current market practice and the proposed change.

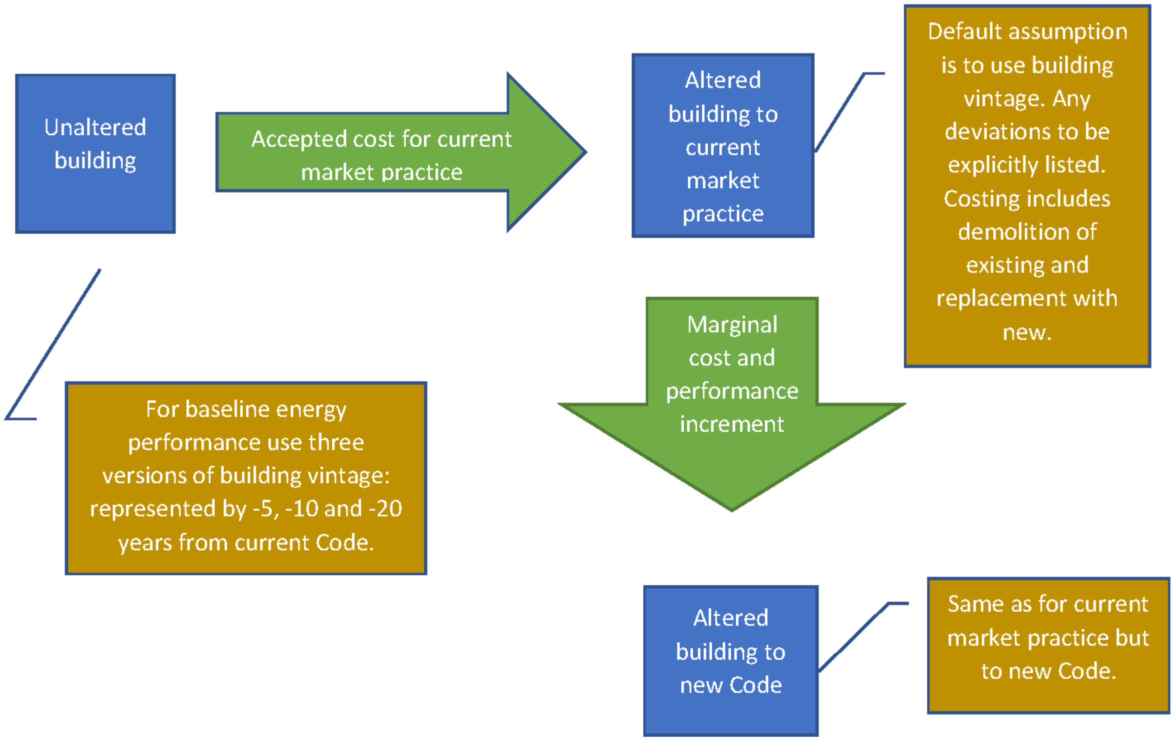

Figure 1. Impact analysis guidelines for the alteration of existing buildings

Since the prescriptive requirements for the alteration of existing buildings are triggered only when alterations are performed, the metric to evaluate the impact of the marginal cost and performance increment is defined as the comparison between the new prescriptive requirements and what would normally be done in the absence of such (i.e., current market practice).

For this analysis, four vintages of unaltered buildings were selected:

- Pre-1980
- 1980–2010
- NECB 2011
- NECB 2015

Current market practice is defined as complying with NECB 2017, and the proposed code is considered to be the NECB 2020.

To calculate the marginal energy increment, a model representing the vintage was created (see https://github.com/NREL/openstudio-standards/tree/master/lib/openstudio-standards/standards/necb). The lighting systems were then updated in the model to comply with the NECB 2017 requirements and the energy use intensity (EUI) calculated. The same process was followed for the NECB 2020 requirements. The marginal energy increment is the difference between these two EUIs. This process was repeated for all the vintages for 14 building archetypes in 32 locations across Canada; thus 1792 marginal energy increments were calculated. Summary results from the simulations are presented by region in Figures 2 and 3.

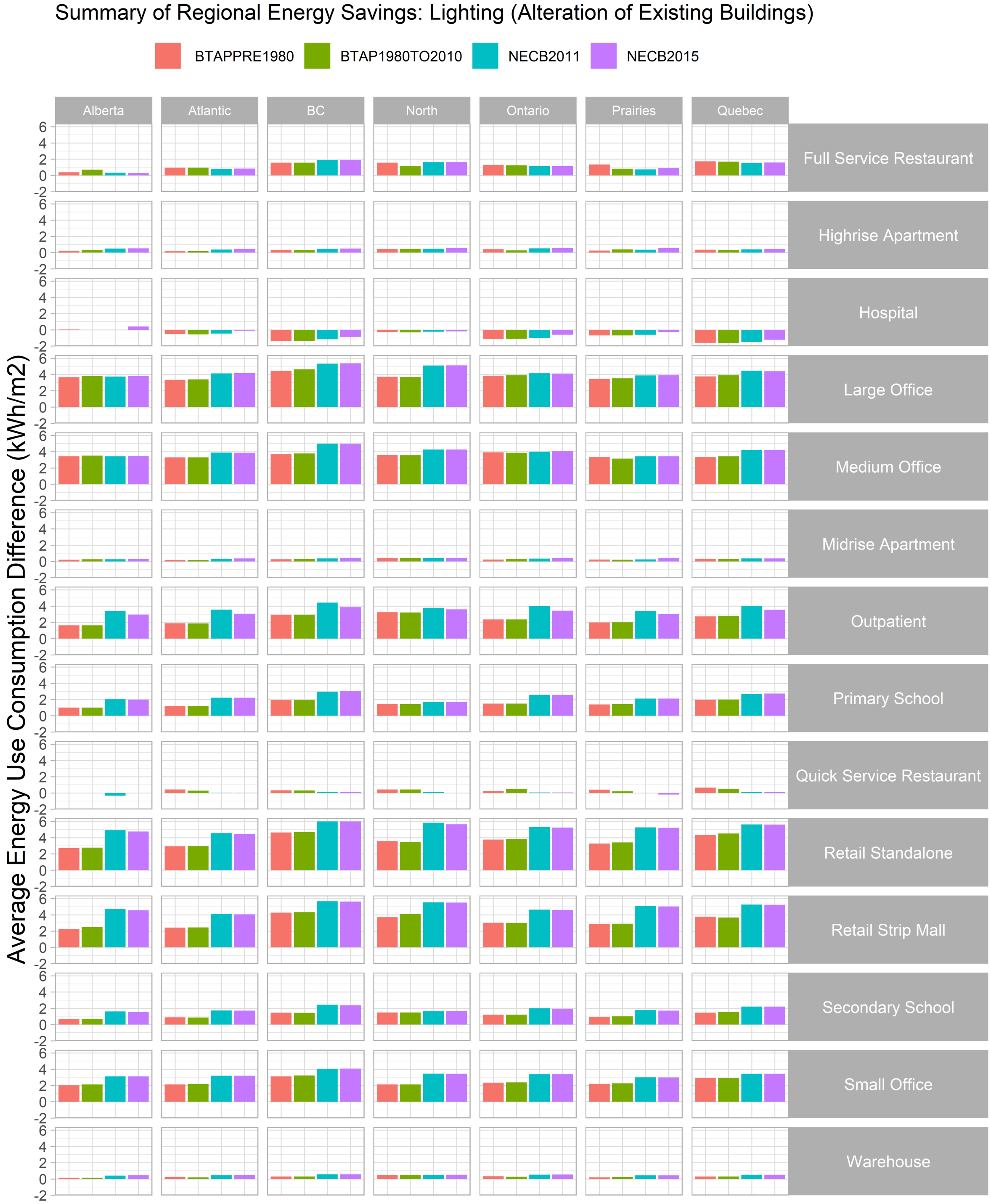

Figure 2. Marginal energy use intensity increment for various building archetypes and vintages in regions across Canada

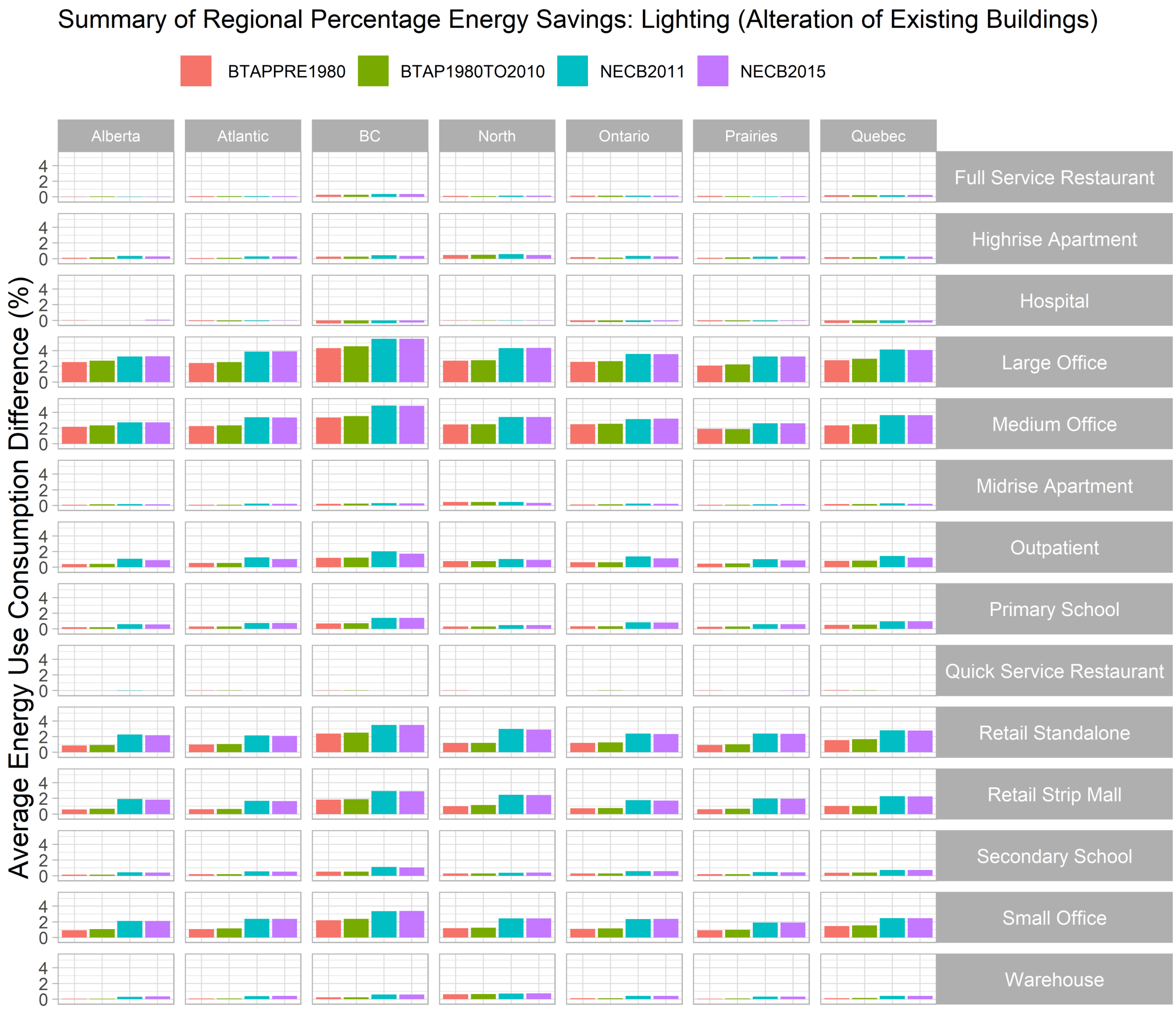

Figure 3. Marginal percentage energy use intensity increment for various building archetypes and vintages in regions across Canada

As can be seen, the increment is positive in almost all cases (i.e., the proposed change represents a reduction in energy use at the building level). The exception is the hospital archetype, where energy use increases slightly (less than 1%). This result was also observed in previous studies and is due to the increase in lighting power density (LPD) requirements for hospitals given the increased illumination requirements.

For the remainder of the archetypes, the changes are positive for all vintages and broadly similar across regions. The impact is greatest for buildings that are sensitive to lighting loads, i.e., office and retail buildings (up to 4% improvement over the current market practice). For buildings with minimally regulated lighting loads (e.g., multi-unit residential buildings (MURBs)) or energy use that is dominated by other subsystems (e.g., quick-service restaurants), the impact is minimal. Overall, the energy analysis demonstrates that the proposed change is no worse than current practice (excluding hospitals) and in some cases represents an improvement in energy performance.

The change in total lighting energy end use is presented in Figure 4. Comparing the results for the NECB 2020 and the NECB 2017 vintages, energy use increases for hospitals, but decreases for all other archetypes.

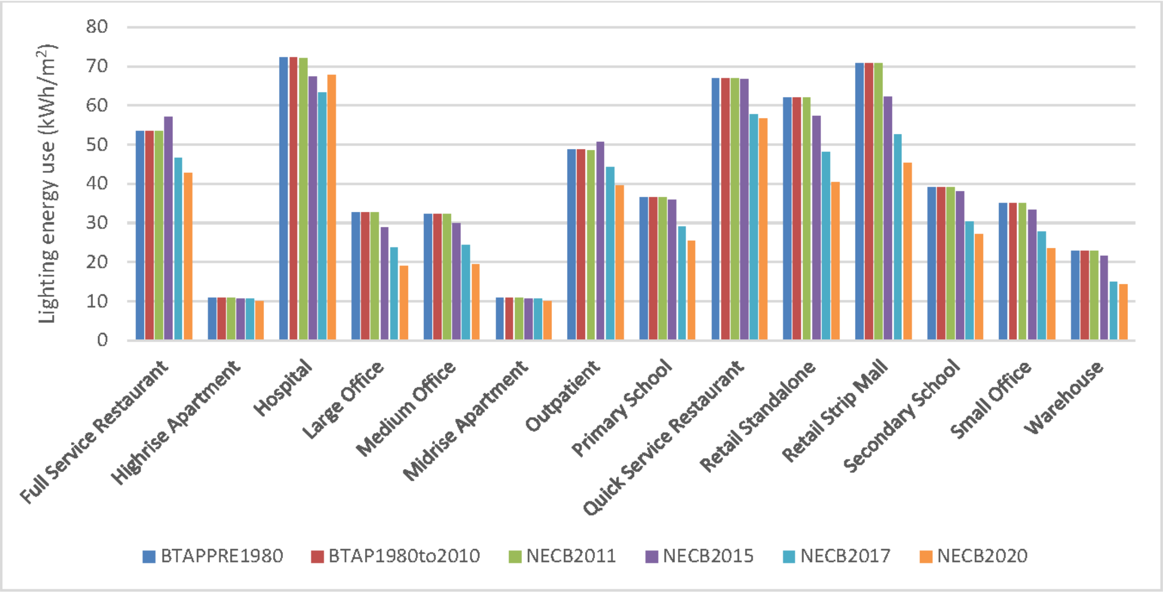

Figure 4. Lighting end use energy consumption by archetype and vintage

Cost estimates are subject to high levels of uncertainty. The following section is based on a 2019 report by Quantum Lighting Inc. on the lighting costs associated with switching from the LPDs prescribed in the NECB 2017 to those in the NECB 2020.

The costs for different fixtures to be expected in the 16 archetypes considered in this analysis are presented in Table 1. The average unit cost is the per fixture cost. Both the “Baseline” and “Current” columns refer to the same type of lighting fixture but specifically to different products with different illuminance (i.e., average performance (lm/W)). In some cases, fixtures in the baseline column are FL/CFL and are upgraded to LED; in other cases, LEDs are already used in current practice and the cost difference reflects the use of newer products.

Table 1. Changes in Per Unit Costs for Commonly Used Fixture Types

Type of Lighting Fixture	Baseline			Current Practice			Proposed Change		
	Average Performance, lm/W	Average Unit Cost, $	Average Rated Life, LM70 hours	Average Performance, lm/W	Average Unit Cost, $	Rated Life, LM70 hours	Performance Improvement, %	Unit Cost Reduction, %	Average Rated Life Improvement, %
CFL Downlight, replaced by LED	56	190.00	10 000	84	177.00	60 000	50	7	500
Inc Downlight, replaced by LED	56	153.00	5 000	84	177.00	60 000	50	-16	1100
CFL Wall Sconce, replaced by LED	56	85.00	10 000	76	75.50	60 000	36	11	500
Fl. Wall-mount Linear, replaced by LED	53	89.00	24 000	112	133.00	60 000	111	-49	150
LED Downlight	63	220.00	50 000	84	175.00	60 000	33	20	20
LED Direct	105	140.00	50 000	120	110.00	60 000	14	21	20
LED Linear Dir./Indir.	95	500.00	50 000	125	350.00	70 000	32	30	40
LED Task	56	140.00	50 000	60	29.99	50 000	7	79	0
LED Liner Wall Cover	88	230.00	50 000	150	135.00	60 000	70	41	20
LED Liner Wall Wash	75	580.00	50 000	106	520.00	50 000	41	10	0
Linear Direct Lensed	105	140.00	50 000	120	110.00	60 000	14	21	20
LED Linear Industrial	110	245.00	60 000	128	210.00	60 000	16	14	0
LED indirect Pendant	50	760.00	50 000	125	500.00	60 000	150	34	20
LED Low-Bay	117	315.00	80 000	135	225.00	100 000	15	29	25
LED High-Bay	113	450.00	100 000	145	250.00	100 000	28	44	0

Table 1 shows a cost savings instead of increase for the majority of the fixtures with the upgrades to NECB 2020 These findings, and the fact that the use of LED is already common practice for some spaces/archetypes, mean that the adherence to NECB 2020 would likely result in cost savings and a simple payback of 0 years.

Enforcement implications

The requirements for lighting in existing buildings subjected to alteration could be enforced by existing means and resources involved in the enforcement of the Part 4 requirements of the NECB.

Who is affected

Designers, specification writers, manufacturers, contractors, building owners and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[13.4.1.1.] -- ([1] --) no attributions

[13.4.1.2.] -- ([1] --) no attributions

[13.4.2.1.] -- ([1] --) no attributions

[13.4.2.1.] -- ([2] --) no attributions

[13.4.2.1.] -- ([2] --) no attributions

[13.4.2.1.] -- ([2] --) [F94-OE1.1]

[13.4.2.1.] -- ([3] --) no attributions

[13.4.2.1.] -- ([3] --) [F94-OE1.1]

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Proposed Change 1860

Code Reference(s): **NECB20 Div.B 13.6. (first printing)**

Subject: Alteration of Existing Buildings

Title: Alteration of Service Water Systems

Description: This proposed change adds requirements that define the application of NECB Part 6 to service water systems subjected to alteration.

Related Proposed Change(s): PCF 1865

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Alteration of Existing Buildings.

Problem

Service water systems are generally overlooked as an end-user of energy and, except for the replacement of central equipment, usually remain untouched for the life of the building, which can be many decades in some instances. Alteration work on an existing building provides a good opportunity to upgrade the service water systems and any ancillary components to the current Code requirements. However, since renovation works in existing buildings are typically more costly than when building new constructions, the requirements of Part 6 that apply to these upgrades must be adapted to maintain an acceptable cost-effectiveness.

Justification

Due to their simplicity, Part 6 requirements can be applied in full for minimal additional costs to the alteration of an existing building, including the installation of new systems or components.

The exception to this rule is the insulation of distribution piping. Since this piping is often hidden in walls and shafts, and is thus more difficult to access or has limited space around it, the cost-effectiveness of adding insulation in existing buildings is generally diminished and deemed cost-effective only when significant change is made to the characteristics of an existing system.

The threshold to determine what constitutes a "significant change" was set at 60%, as works of this magnitude generally and naturally have significant cascading impacts on existing systems. Expanding this type of alteration work to require the insulation of the entire distribution system is considered cost-effective in those conditions. Moreover, the insulation requirements also provide multiple options, depending on the choices made at the design stage.

Consequently, this proposed change introduces a reasonable compromise for each case that meets the intent of the Code while ensuring a suitable cost-effectiveness.

PROPOSED CHANGE

[13.6.] -- Service Water Systems

[13.6.1.] -- General

[13.6.1.1.] --- Scope

[1] --) This Section is concerned with *service water* equipment and systems covered in Part 6.

[13.6.1.2.] --- Application

[1] --) This Section applies to existing *service water* equipment and systems subjected to *alteration* and new *service water* systems installed in *existing buildings*.

[13.6.2.] -- Compliance

[13.6.2.1.] --- Requirements

[1] --) Except for repair and maintenance, and except as provided in Sentences (2) to (5), *service water* equipment and systems shall comply with Part 6.

[2] --) Except as provided in Sentences (3) and (4), parts of hot *service water* distribution systems that are not subjected to *alteration* need not comply with Article 6.2.3.1.

[3] --) Non-circulating, uninsulated hot *service water* distribution systems shall be provided with *heat traps* and be insulated in accordance with Sentence 6.2.3.1.(5).

[4] --) Except where impractical because of structural or construction constraints, existing uninsulated hot *service water* distribution systems shall comply with Sentence (5) where

- [a] --) the added *service water* heating load exceeds 60% of the hydraulic load served by the existing system, or
- [b] --) the length of added and replacement piping exceeds 60% of the length of piping in the existing system.

(See Note A-13.6.2.1.(4) and (5).)

[5] --) The existing uninsulated hot *service water* distribution systems described in Sentence (4) shall comply with Article 6.2.3.1., except that

- [a] --) for circulating systems, only the supply and return piping runs where hot *service water* circulates are required to be insulated, and
- [b] --) for non-circulating systems with electric heating elements, only the piping runs along which heating elements are installed are required to be insulated.

(See Note A-13.6.2.1.(4) and (5).)

[6] --) Where the *alteration* of a *service water* heating system with a design temperature not higher than 60°C results in flow at a design discharge temperature higher than 60°C in portions of the system, separate remote heaters or booster heaters shall be installed for those portions of the system with a design temperature higher than 60°C.

Note A-13.6.2.1.(4) and (5) Insulation of Piping in Existing Hot Service Water Distribution Systems.

The alteration of an existing hot service water distribution system offers the opportunity to significantly reduce energy loss by insulating runs of uninsulated distribution piping where the temperature of the hot service water is maintained through recirculation or with heating elements. The requirement in Sentence 13.6.2.1.(5) to insulate these piping runs is triggered if at least one of two criteria is met as a result of the alteration.

The first criterion, as set out in Clause 13.6.2.1.(4)(a), applies where the service water heating load served by the system is significantly increased. This criterion may be evaluated, for example, by using the hydraulic loads, in fixture units, of the equipment and services supplied by the system (see Subsections 2.4.10. and 2.6.3. of Division B of the NPC).

The second criterion, as set out in Clause 13.6.2.1.(4)(b), applies where a significant length of piping is added to or replaced in the system. This criterion may be evaluated using measurements on plans that are representative of the existing installation.

The intent of Sentence 13.6.2.1.(5) is to ensure that existing uninsulated piping is insulated where the effort involved is reasonable, without requiring overly onerous demolition or reconstruction to access the piping. For example, piping runs in cavities within or behind masonry walls may be exempted from the insulation requirement, as may be piping runs where the available space does not allow for the installation of the required thickness of insulation. However, the opening and closing of drywall and the provision of access to a large pipe shaft are considered to be reasonable efforts.

Impact analysis

Energy Savings from Proposed Change Compared to Current Market Practices

The impact analysis guidelines for the alteration of existing buildings require that the proposed changes be evaluated for several building vintages. The key metric of interest in the impact analysis is the marginal difference between the current market practice and the proposed change.

Since the prescriptive requirements for the alteration of existing buildings are triggered only when any alteration is performed, the metric to evaluate the impact of these requirements is defined as the comparison between the new prescriptive requirements and what would normally be done in the absence of such (i.e., current market practice). For this analysis, four vintages of unaltered buildings were selected:

- Pre-1980
- 1980–2010
- NECB 2011
- NECB 2015

Current market practice is defined as complying with NECB 2017, and the proposed code is considered to be the NECB 2020.

To calculate the marginal energy increment, a model representing the vintage was created (see https://github.com/NREL/openstudio-standards/tree/master/lib/openstudio-standards/standards/necb). The service water heating equipment was then updated in the model to comply with the NECB 2017 requirements and the thermal energy use intensity (TEUI) was calculated. The same process was followed for the NECB 2020 requirements. The marginal energy increment is the difference between these two TEUIs.

This process was repeated for all the vintages for 16 archetypes in 31 locations across Canada (and later collated by region).

Summary results from the simulations are presented by region in Figures 1 (TEUI reduction) and 2 (percentage reduction); positive values indicate energy savings.

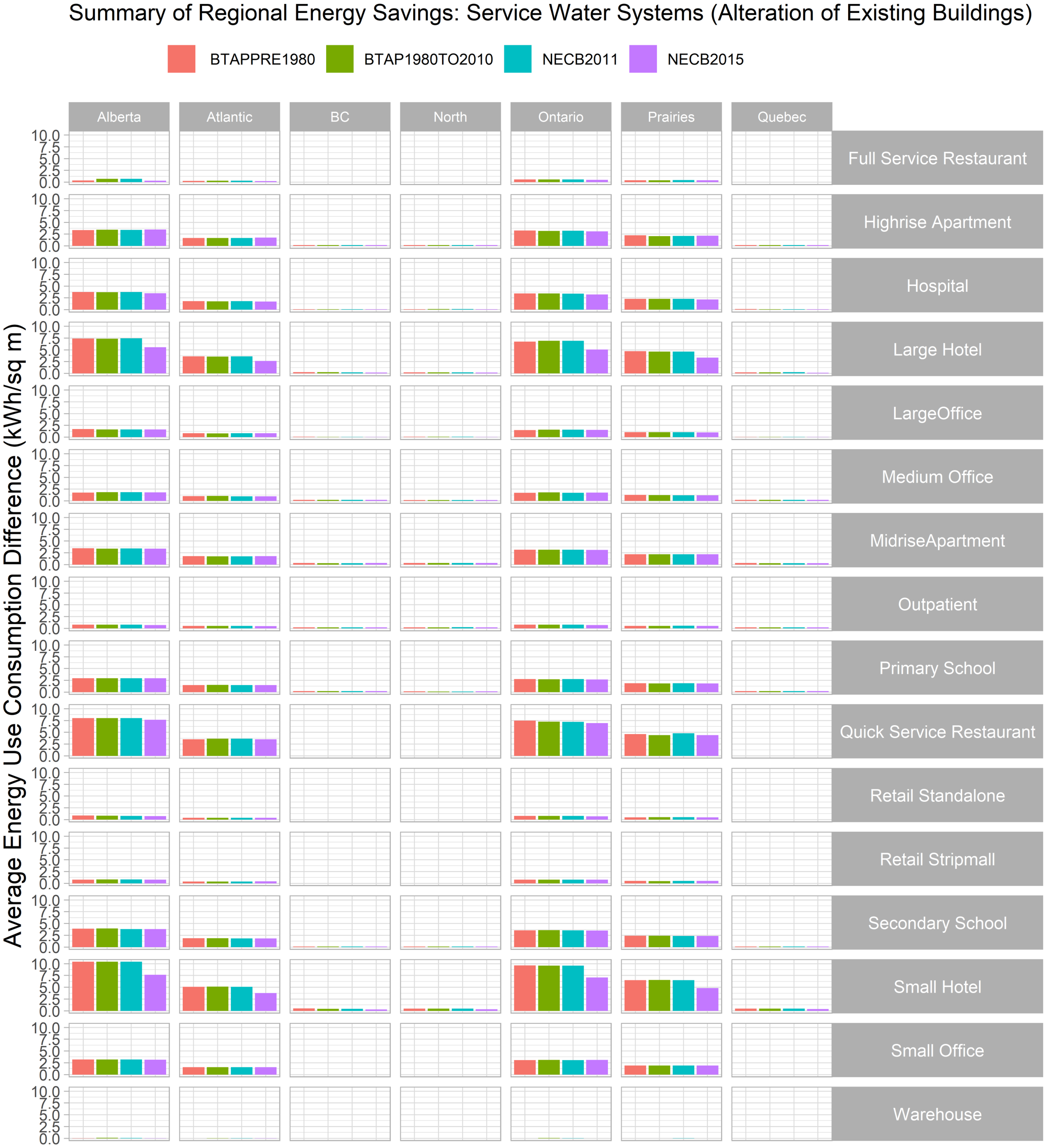

Figure 1. Marginal energy use intensity increment for various building archetypes and vintages in regions across Canada

Figure 2. Marginal percentage energy use intensity increment for various building archetypes and vintages in regions across Canada

The results indicate energy savings for some regions, while only negligible savings for others (BC, Quebec, and the North), given the use of electric water heaters in the archetypes located in those regions. Given this current market practice, the performance of electric water heaters is similar to the proposed Code requirements. The only difference is in the specification of a limit for standby loss in NECB 2020, which was not present in NECB 2017. Standby loss is dependent on tank volume; therefore, minor energy savings are realized in archetypes with larger water heaters (e.g., mid- and high-rise apartments) and near-zero energy savings for those with smaller systems.

In general, for any archetype in a specific region, the absolute energy savings (i.e., TEUI) in Figure 1 are fairly uniform across the four building vintages, since only the provisions for service water heating systems have changed. Minor variations in absolute savings are attributed to the cross effect between the changes to the performance of water heaters and their thermal impact on the building. The only larger variation is found in the small and large hotel archetypes, which is caused by a larger difference in water demand profiles for hotel space types between NECB 2015 and earlier vintages.

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This variation is shown in Figure 3, which presents the energy use intensity of service water heating for each archetype by vintage and highlights the hot service water energy savings brought about by the NECB 2020.

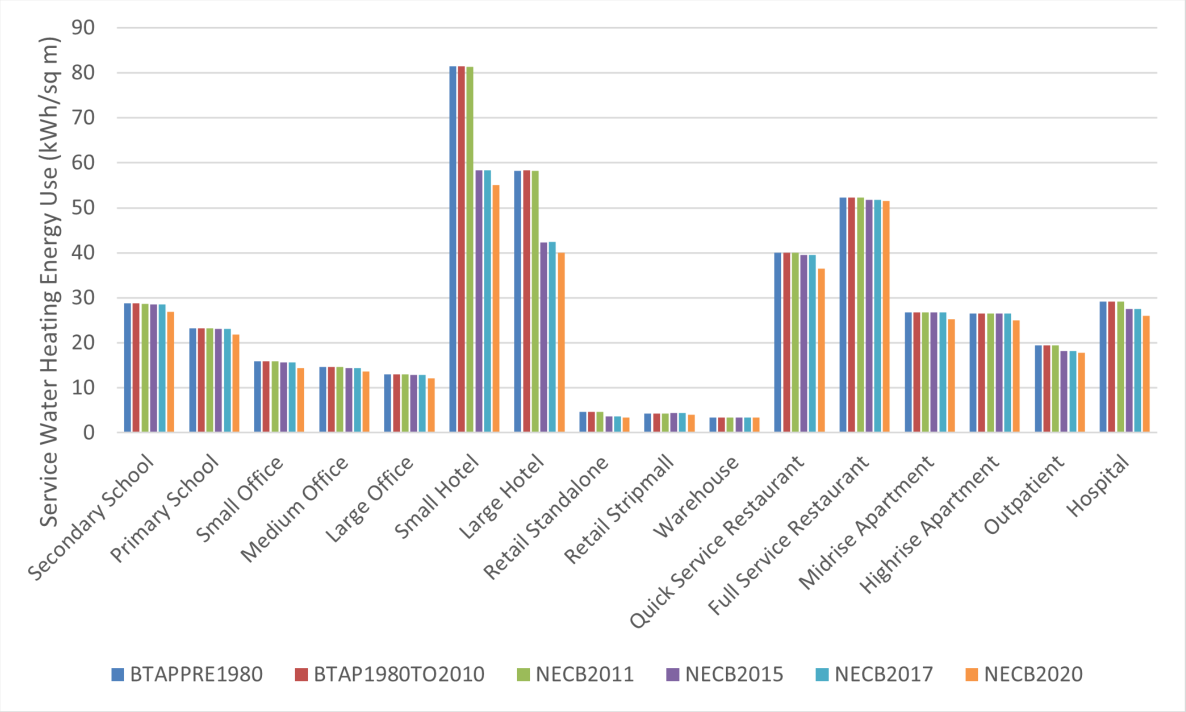


Figure 3. Energy use intensity of service water heating for various Canadian archetypes and vintages

Heat Loss in Hot Service Water Pipes: Uninsulated versus Insulated

Proposed Sentence 13.6.2.1.(4) requires the partial insulation of specific non-insulated distribution networks when any alteration on the network is considered to be significant. Energy savings following the insulation of uninsulated distribution networks have been calculated as follows:

1. Heat loss differences per unit length have been evaluated for each case, for various pipe types and diameters.
2. For the small hotel archetype, representative pipe lengths and diameters have been established for a recirculation system providing hot service water to each suite.
3. Annual energy use reduction has been calculated assuming the continuous operation of the recirculation system.

Recirculation systems are common in certain building archetypes that have a central hot water service system, such as hotels and multi-unit residential buildings. These systems are also occasionally present in other occupancies (e.g., office buildings, community facilities). For the purpose of this impact analysis, the small hotel archetype is considered a good example that can be scaled up and down proportionally to represent other archetypes.

1) Estimated Heat Loss Rate per Unit Length of Pipe

The calculations of heat loss differences per unit length were performed using NAIMA's 3EPlus piping insulation calculator (https://www.3eplus.org/), which is referenced in the ASHRAE Handbook — Fundamentals) and in accordance with ASTM C680, "Standard Practice for Estimate of the Heat Gain or Loss and the Surface Temperatures of Insulated Flat, Cylindrical, and Spherical Systems by Use of Computer Programs." The analysis assumes steady state 1D heat transfer: i.e., the R-value of the pipe is negligible given the inner surface temperature of the pipe is approximately equal to the water temperature. The following conditions were evaluated:

- steel, copper and PVC (polymer) piping
- 0.5 in., 0.75 in., 1 in., 1.5 in., 2 in. NPS pipe (1 m long)
- water at 60°C and ambient air at 20°C
- 850F Mineral Fiber Pipe Type I insulation
    - thermal conductivity: 0.036 W/(m×K) at 38°C
    - 0 mm or 25.4 mm thickness
- ε = 0.9 all-service jacket

Table 1. Heat Loss per Unit Length of Pipe at Various Pipe Sizes and Insulation Thicknesses

Pipe	Pipe Size, in.	Insulation Thickness, mm	Heat Flow, W/m
Steel	0.5	0	34.6
		25.4	6.9
Copper		0	30.8
		25.4	6.9
PVC		0	27.0
		25.4	6.5
Steel	0.75	0	41.9
		25.4	8.3
Copper		0	37.3
		25.4	8.3
PVC		0	33.0
		25.4	7.8
Steel	1	0	51.1
		25.4	8.6
Copper		0	45.3
		25.4	8.6
PVC		0	40.8
		25.4	8.2
Steel	1.5	0	71.1
		25.4	11.2
Copper		0	62.6
		25.4	11.2
PVC		0	53.9
		25.4	10.6
Steel	2	0	87.1
		25.4	13.1
Copper		0	76.5
		25.4	13.1
PVC		0	65.6
		25.4	12.4

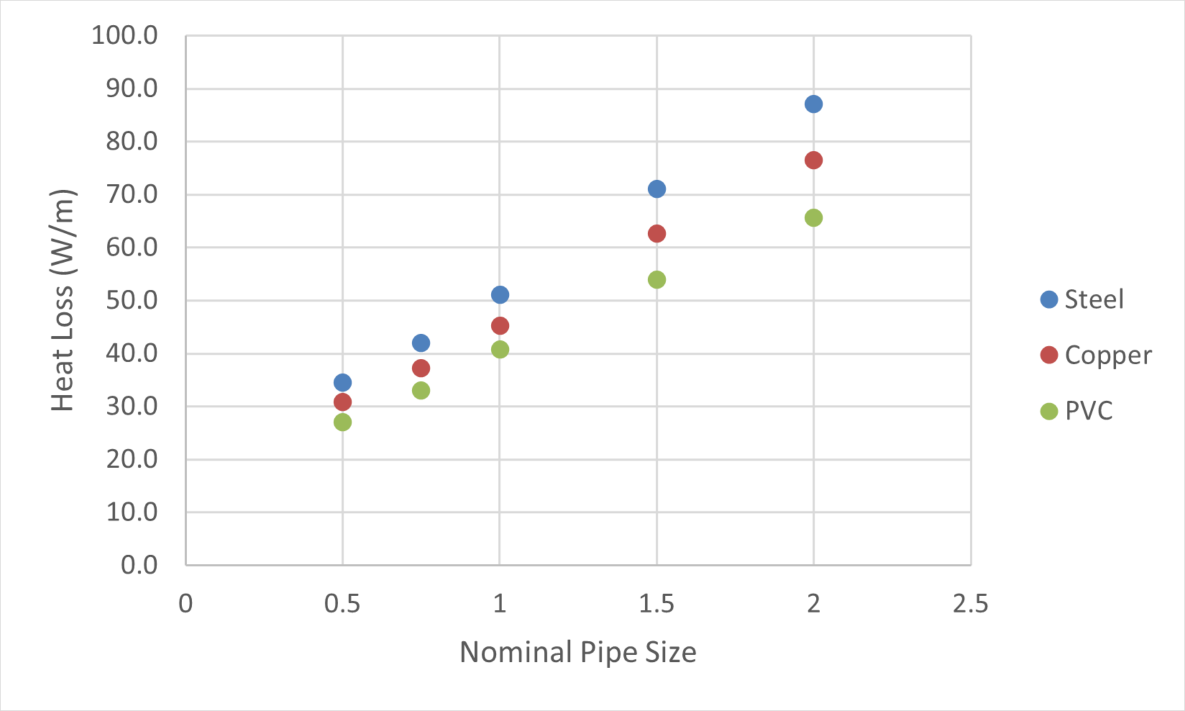


Figure 4. Heat loss of uninsulated pipes

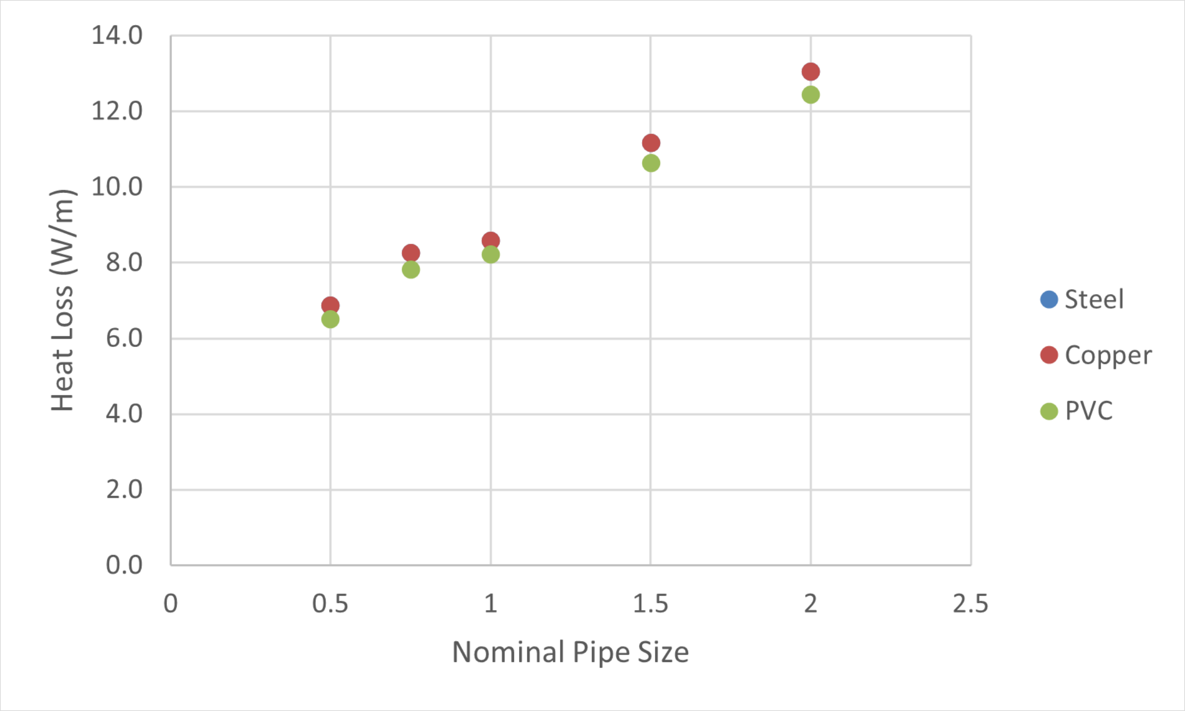


Figure 5. Heat loss of insulated pipes(1)

Note to Figure 5:

(1) Insulated steel and copper have the same heat loss values.

2) Estimated Heat Loss Rate of Pipes for the Small Hotel Archetype

The hot service water recirculation system (supply and return piping) designed for the small hotel archetype is broken down by the following pipe sizes:

- 300 m, ½ in. NPS
- 100 m, ¾ in. NPS
- 100 m, 1 in. NPS
- 90 m, 1-1/2 in. NPS

The estimated total heat loss rates from uninsulated and insulated pipes are shown in Table 2, along with the heat loss rate reduction due to the insulation (at a thickness of 25.4 mm).

Table 2. Heat Loss Rate and Heat Loss Rate Reduction due to Insulation of Pipes for the Small Hotel Archetype

Pipe Material	Total Pipe Heat Loss, W		Heat Loss Reduction Due to Insulation, W	Heat Loss Reduction Due to Insulation, %
	No Insulation	25.4 mm Insulation		
Steel	26 079	4 768	21 311	82
Copper	23 134	4 768	18 366	79
PVC	20 331	4 504	15 827	78

3) Total Demand for Service Water Heating (Service Water Heater Energy + Pipe Heat Loss) for Small Hotel Archetype

Assuming a copper pipe network and continuous operation, the annual service water heating energy consumption in kWh/year (service water heater energy + pipe heat loss) is presented in Tables 3 and 4 for uninsulated and insulated pipes, respectively; a corresponding set of results in kWh/m^2/year are presented in Tables 5 and 6. A summary highlighting the energy savings of the overall system with and without pipe insulation is provided in Table 7.

Table 3. Total Energy Consumption for Service Water Heating (Uninsulated Pipes)

SWH Component	BTAPPRE1980	BTAP1980TO2010	NECB2011	NECB2015	NECB2017	NECB2020
Water heater energy consumption, kWh/year	326 849	326 875	326 542	234 139	234 170	220 932
Uninsulated pipe heat loss, kWh/year	202 653					
Total annual service water heating consumption, kWh/year	529 502	529 528	529 195	436 792	436 823	423 585

Table 4. Total Energy Consumption for Service Water Heating (Insulated Pipes)

SWH Component	BTAPPRE1980	BTAP1980TO2010	NECB2011	NECB2015	NECB2017	NECB2020
Water heater energy consumption, kWh/year	326 849	326 875	326 542	234 139	234 170	220 932
Insulated pipe heat loss, kWh/year	4 768					
Total annual service water heating consumption, kWh/year	331 617	331 643	331 310	238 907	238 938	225 700

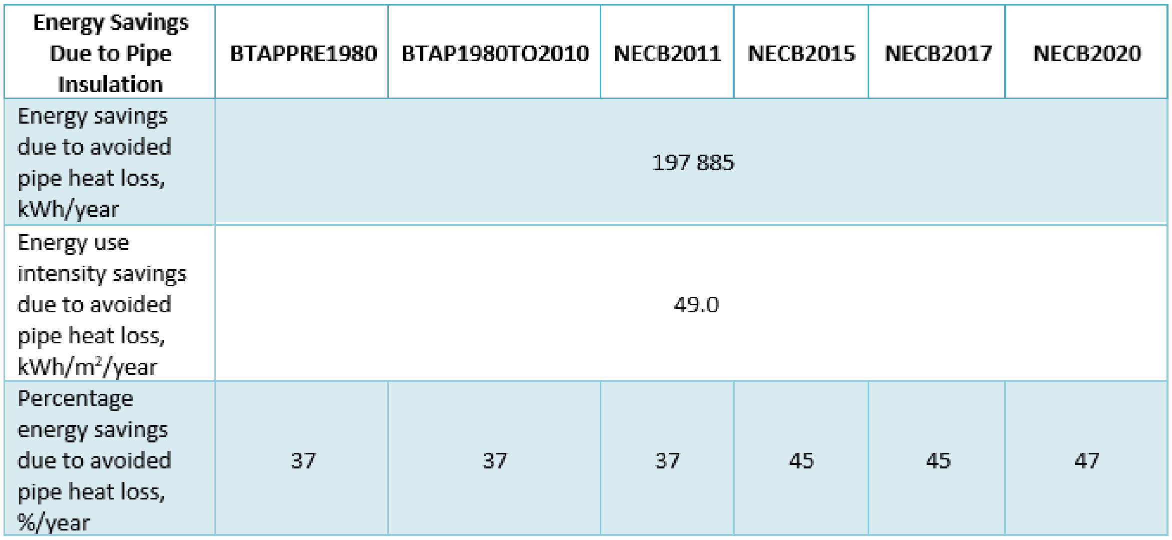
Table 5. Total Energy Use Intensity of Service Water Heating (Uninsulated Pipes)

SWH Component	BTAPPRE1980	BTAP1980TO2010	NECB2011	NECB2015	NECB2017	NECB2020
Water heater energy use intensity, kWh/m^2/year	81.0	81.0	81.0	58.0	58.0	54.8
Uninsulated pipe heat loss intensity, kWh/m^2/year	50.2					
Total annual service water heating energy use intensity, kWh/m^2/year	131.2	131.2	131.2	108.2	108.2	105.0

Table 6. Total Energy Use Intensity of Service Water Heating (Insulated Pipes)

SWH Component	BTAPPRE1980	BTAP1980TO2010	NECB2011	NECB2015	NECB2017	NECB2020
Water heater energy use intensity, kWh/m^2/year	81.0	81.0	81.0	58.0	58.0	54.8
Insulated pipe heat loss intensity, kWh/m^2/year	1.2					
Total annual service water heating energy use intensity, kWh/m^2/year	82.2	82.2	82.2	59.2	59.2	56.0

Table 7. Summary of Heat Energy Savings due to Pipe Insulation



Energy Savings Due to Pipe Insulation	BTAPPRE1980	BTAP1980TO2010	NECB2011	NECB2015	NECB2017	NECB2020
Energy savings due to avoided pipe heat loss, kWh/year	197 885					
Energy use intensity savings due to avoided pipe heat loss, kWh/m^2/year	49.0					
Percentage energy savings due to avoided pipe heat loss, %/year	37	37	37	45	45	47

Enforcement implications

The requirements for the alteration of service water systems in existing buildings can be enforced by the same means and resources involved in the enforcement of the prescriptive requirements of Part 6 of the NECB.

Who is affected

Designers, specification writers, manufacturers, contractors, building owners and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[13.6.1.1.] -- ([1] --) no attributions

[13.6.1.2.] -- ([1] --) no attributions

[13.6.2.1.] -- ([1] --) no attributions

[13.6.2.1.] -- ([2] --) no attributions

[13.6.2.1.] -- ([3] --) no attributions

[13.6.2.1.] -- ([4] --) no attributions

[13.6.2.1.] -- ([5] --) [F96-OE1.1]

[13.6.2.1.] -- ([6] --) [F92,F93-OE1.1]

Submit a comment

Proposed Change 1861

Code Reference(s):	**NECB20 Div.B 13.7. (first printing)**
Subject:	Alteration of Existing Buildings
Title:	Alteration of Electrical Power Systems and Motors
Description:	This proposed change adds requirements that define the application of NECB Part 7 to electrical powers systems and motors subjected to alteration.
Related Proposed Change(s):	PCF 1866

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Alteration of Existing Buildings.

Problem

The alteration of electrical power systems and motors in commercial buildings is not very common. However, during the alteration process, the opportunity to make energy-efficiency improvements is often not well leveraged. If taken, this opportunity could significantly reduce the energy use of the buildings.

There are good opportunities to upgrade the electrical power systems and motors to the current minimum requirements of the Code, in terms of low voltage drops in the replacement of electrical feeders to acceptable levels, replacing old inefficient motors and building transformers with more efficient ones.

Not upgrading electrical power systems and motors to a reasonable energy-efficiency performance level may be a missed opportunity to benefit from energy and cost savings over time through lower energy bills.

Justification

Although the alteration of existing electrical power systems and motors is not very common, their replacement would need to meet the minimum requirements for energy efficiency of the current Code, where warranted.

However, existing electrical power systems and motors could be re-used, provided the operating efficiency of the equipment remains similar to the level obtained before the alteration took place.

PROPOSED CHANGE

[13.7.] -- Electrical Power Systems and Motors

[13.7.1.] -- General

[13.7.1.1.] --- Scope

[1] --) This Section is concerned with electrical power systems and motors covered in Part 7.

[13.7.1.2.] --- Application

[1] --) This Section applies to existing electrical power systems and motors subjected to *alteration* and new electrical power systems and motors installed in *existing buildings*.

[13.7.2.] -- Compliance

[13.7.2.1.] --- Requirements

[1] --) Except as provided in Sentence (2), electrical power systems and motors shall comply with Part 7.

[2] --) Sentence (1) does not apply to

[a] --) repair and maintenance, and

[b] --) the relocation or reuse of existing equipment at the same *building* site.

Impact analysis

By referring to the existing provisions in Part 7 of the Code, the proposed Code requirements for new or replacement transformers and motors reference CSA standards that have not been significantly changed in several years. All equipment available on the market is expected to meet the requirements of the CSA standards. Therefore, this proposed change would not impose an additional burden.

Enforcement implications

The requirements for electrical power systems in existing buildings subjected to alteration could be enforced by existing means and resources involved in the enforcement of the Part 7 requirements of the NECB.

Who is affected

Designers, specification writers, manufacturers, contractors, building owners and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[13.7.1.1.] -- ([1] --) no attributions

[13.7.1.2.] -- ([1] --) no attributions

[13.7.2.1.] -- ([1] --) no attributions

[13.7.2.1.] -- ([2] --) no attributions

Submit a comment

Proposed Change 1862

Code Reference(s):	**NECB20 Div.C 1.2.1.1. (first printing)** **NECB20 Div.C 2.2. (first printing)**
Subject:	Alteration of Existing Buildings
Title:	Alteration of the Building Envelope
Description:	This proposed change adds administrative requirements related to the alteration of the building envelope.
Related Proposed Change(s):	PCF 1857

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Alteration of Existing Buildings.

Problem

Division C of the National Model Codes requires that the authority having jurisdiction (AHJ) be provided with adequate documentation and other information, such as drawings and equipment specifications, in order to verify compliance with the Code. With the introduction of the proposed requirements for the alteration of existing buildings in the NECB 2025, there will be a need for information and calculations related to the extent of the alterations.

Failure to provide adequate documentation and level of detail regarding the alterations would make it difficult for AHJs to verify that the proposed alterations conform to the Code. This situation could also lead to inconsistency in the design, construction and performance of the alterations, which could cause confusion and conflict between designers, manufacturers, AHJs and the legal community.

These conflicts would occur when

- AHJs request documentation during permit reviews to prove Code compliance,
- designers require Code compliance for use of their design specifications on a project, or
- disputes arise which require litigation.

Justification

Providing administrative guidance in Division C on the proper reporting techniques for documentation and calculations related to the alteration of existing buildings for compliance with the NECB is necessary to ensure building officials are provided with an appropriate level of detail to assess Code compliance.

PROPOSED CHANGE

[1.2.1.1.] 1.2.1.1. Non-defined Terms

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

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

[3] **3)** Where acceptable solutions are referred to in Division C, they shall be the provisions stated in Parts 3 to 8, 10 and 13~~10~~ of Division B.

[4] **4)** Where alternative solutions are referred to in Division C, they shall be the alternative solutions mentioned in Clause 1.2.1.1.(1)(b) of Division A.

[2.2.] 2.2. Administration

[2.2.1.] 2.2.1. Administration

[2.2.1.1.] 2.2.1.1. Conformance with Administrative Requirements

[2.2.2.] 2.2.2. Information Required for Proposed Work

[2.2.2.1.] 2.2.2.1. General Information Required

[2.2.2.2.] 2.2.2.2. Design Calculations and Analysis

[2.2.2.3.] 2.2.2.3. Documentation on the Building Envelope

[2.2.2.4.] 2.2.2.4. Documentation on Lighting Systems

[2.2.2.5.] 2.2.2.5. Documentation on HVAC Systems

[2.2.2.6.] 2.2.2.6. Documentation on Service Water Heating Systems

[2.2.2.7.] 2.2.2.7. Documentation on Electrical Power Systems and Motors

[2.2.2.8.] 2.2.2.8. Documentation Requirements for Building Performance Compliance

[2.2.3.] -- Information Required for Alteration Work

[2.2.3.1.] --- General Information Required

[1] --) Sufficient information shall be provided to show that the proposed *alteration* will conform to this Code and whether or not it will affect adjacent property. (See Note A-2.2.2.1.(1).)

[2] --) Plans shall be drawn to scale and shall indicate the nature and scope of the proposed *alteration* and proposed *occupancy* in sufficient detail to establish that, when completed, the proposed *alteration* and the proposed *occupancy* will conform to this Code.

[3] --) If the proposed *alteration* is changed during construction, information on the changes shall comply with the requirements of this Section for *alteration* work.

[2.2.3.2.] --- Design Calculations and Analysis

[1] --) The calculations and analysis carried out in the process of ensuring conformity with the requirements of this Code shall be available for inspection upon request.

[2.2.3.3.] --- Documentation on the Alteration of the Building Envelope

[1] --) The following documentation on the *alteration* of the *building envelope* shall be provided:

- [a] --) documentation on new or altered components, assemblies or systems in accordance with Article 2.2.2.3., and
- [b] --) justifications and support documentation for the proposed air leakage rates of the air barrier system or *air barrier assemblies* of the areas of the *building envelope* subjected to *alteration*, in support of the exception permitted in Sentence 13.3.2.1.(6)-2025 (PCF 1857) of Division B.

Impact analysis

Administering the enforcement of the Code is the normal business of the existing enforcement infrastructure.

The enforcement of these administrative requirements is not expected to be time-consuming or add significantly to the workload that is the normal course of business for building inspectors. The overall impact would be a significant improvement in the ability of AHJs to successfully verify Code compliance.

Enforcement implications

The enforcement of the administrative requirements for the alteration of the building envelope in existing buildings can be accomplished with the same means and resources involved in the enforcement of Part 3 of the NECB.

However, there could be an increase in enforcement and permit-review responsibilities. Requiring information about alteration work would facilitate enforcement.

Who is affected

Designers, specification writers, manufacturers, contractors, building owners and building officials.

Submit a comment

Proposed Change 1863

Code Reference(s):	**NECB20 Div.C 2.2. (first printing)**
Subject:	Alteration of Existing Buildings
Title:	Alteration of Lighting Systems
Description:	This proposed change adds administrative requirements related to the alteration of lighting systems.
Related Proposed Change(s):	PCF 1858

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Alteration of Existing Buildings.

Problem

Division C of the National Energy Code of Canada for Buildings (NECB) requires that the authority having jurisdiction be provided with adequate documentation and other information, such as drawings and equipment specifications, in order to verify compliance with the Code. With the introduction of requirements for the alteration of existing buildings in the NECB 2025, there will be a need for information and calculations related to the extent of the alterations.

Failure to provide adequate documentation and level of detail regarding the alterations would make it difficult for authorities having jurisdiction to verify that the proposed alterations conform to the Code. This situation could also lead to inconsistency in the

design, construction and performance of the alterations, which could cause confusion and conflict between designers, manufacturers, authorities having jurisdiction and the legal community.

These conflicts would occur when

- authorities having jurisdiction request documentation during permit reviews to prove Code compliance,
- designers require Code compliance for use of their design specifications on a project, or
- disputes arise which require litigation.

Justification

Providing administrative guidance in Division C on the proper reporting techniques for documentation and calculations related to the alteration of existing buildings for compliance with the NECB is necessary to ensure building officials are provided with an appropriate level of detail to assess Code compliance.

PROPOSED CHANGE

[2.2.] 2.2. Administration

[2.2.1.] 2.2.1. Administration

[2.2.1.1.] 2.2.1.1. Conformance with Administrative Requirements

[2.2.2.] 2.2.2. Information Required for Proposed Work

[2.2.2.1.] 2.2.2.1. General Information Required

[2.2.2.2.] 2.2.2.2. Design Calculations and Analysis

[2.2.2.3.] 2.2.2.3. Documentation on the Building Envelope

[2.2.2.4.] 2.2.2.4. Documentation on Lighting Systems

[2.2.2.5.] 2.2.2.5. Documentation on HVAC Systems

[2.2.2.6.] 2.2.2.6. Documentation on Service Water Heating Systems

[2.2.2.7.] 2.2.2.7. Documentation on Electrical Power Systems and Motors

[2.2.2.8.] 2.2.2.8. Documentation Requirements for Building Performance Compliance

[2.2.3.] -- Information Required for Alteration Work

[2.2.3.1.] --- Documentation on the Alteration of Lighting Systems

[1] --) The following documentation on the *alteration* of lighting systems shall be provided:

- [a] --) an as-built single-line diagram of the lighting control system showing the location of each illuminated zone and associated switches and controls, including the extent of the areas subjected to *alteration*,
- [b] --) *installed interior lighting power*, in kW, of the new and altered luminaires within the scope of the *alteration*,
- [c] --) if the total wattage of new and altered luminaires is not greater than the threshold stated in Sentence 13.4.2.1.(2)-2025 of Division B (PCF 1858), the *interior lighting* power, in kW, of existing lighting systems within the scope of the *alteration*,
- [d] --) average lighting power density, in W/m^2, for the areas within the scope of the *alteration*, obtained by dividing the *installed interior lighting power* by the total floor area of the *alteration*,

[e] --) if the *building* area method is used to determine the *interior lighting power allowance*, the associated lighting power density, in W/m², and the gross lighted area, in m²,

[f] --) if the space-by-space method is used to determine the *interior lighting power allowance*, a detailed line-by-line breakdown of spaces, their floor area, in m², the associated lighting power densities, in W/m², and the resulting lighting power allowances, in kW,

[g] --) *interior lighting power allowance*, in kW, for the scope of the *alteration*,

[h] --) installed interior automatic controls and justification for exemptions,

[i] --) *exterior lighting* power, in kW, including a detailed line-by-line breakdown of spaces and/or functions, and the extent of areas subjected to *alteration*,

[j] --) if the number of new and altered exterior luminaires within the scope of the *alteration* is less than the threshold stated in Sentence 13.4.2.1.(3)-2025 of Division B (PCF 1858), the *exterior lighting* power, in kW, of existing *exterior lighting* systems within the scope of the *alteration*, and

[k] --) installed exterior automatic controls within the scope of the *alteration* and justification for spaces and/or functions exempted.

Impact analysis

Administering the enforcement of the Code is the normal business of the existing enforcement infrastructure. The enforcement of these administrative requirements is not expected to be time-consuming or add significantly to the workload that is the normal course of business for building inspectors. The overall impact would be a significant improvement in the ability of authorities having jurisdiction to successfully verify Code compliance.

Enforcement implications

The enforcement of the administrative requirements for the alteration of lighting systems in existing buildings can be accomplished with the same means and resources involved in the enforcement of NECB Part 4. However, there could be an increase in enforcement and permit-review responsibilities.

Requiring information about alteration work would facilitate enforcement.

Who is affected

Designers, specification writers, manufacturers, contractors, building owners and building officials.

Submit a comment

Proposed Change 1864

Code Reference(s):	**NECB20 Div.C 2.2. (first printing)**
Subject:	Alteration of Existing Buildings
Title:	Alteration of HVAC Systems
Description:	This proposed changes adds administrative requirements related to the alteration of HVAC systems.
Related Proposed Change(s):	PCF 1859

This change could potentially affect the following topic areas:

☐ Division A
☑ Division C
☐ Building operations
☑ Small Buildings
☐ Fire Protection
☐ Accessibility
☐ Building Envelope
☑ Heating, Ventilating and Air Conditioning

☐ Division B
☑ Design and Construction
☐ Housing
☑ Large Buildings
☐ Occupant safety in use
☐ Structural Requirements
☑ Energy Efficiency
☐ Plumbing
☐ Construction and Demolition Sites

General information

See the summary for subject Alteration of Existing Buildings.

Problem

Division C of the National Energy Code of Canada for Buildings (NECB) requires that the authority having jurisdiction be provided with adequate documentation and other information, such as drawings and equipment specifications, in order to verify compliance with the Code. With the introduction of requirements for the alteration of existing buildings in the NECB 2025, there will be a need for information and calculations related to the extent of the alterations.

Failure to provide adequate documentation and level of detail regarding the alteration would make it difficult for authorities having jurisdiction to verify that the proposed alterations conform to the Code. This situation could also lead to inconsistency in the

design, construction and performance of the alterations, which could cause confusion and conflict between designers, manufacturers, authorities having jurisdiction and the legal community.

These conflicts would occur when

- authorities having jurisdiction request documentation during permit reviews to prove Code compliance,
- designers require Code compliance for use of their design specifications on a project, or
- disputes arise which require litigation.

Justification

Providing administrative guidance in Division C on the proper reporting techniques for documentation and calculations related to the alteration of existing buildings for compliance with the NECB is necessary to ensure building officials are provided with an appropriate level of detail to assess Code compliance.

PROPOSED CHANGE

[2.2.] 2.2. Administration

[2.2.1.] 2.2.1. Administration

[2.2.1.1.] 2.2.1.1. Conformance with Administrative Requirements

[2.2.2.] 2.2.2. Information Required for Proposed Work

[2.2.2.1.] 2.2.2.1. General Information Required

[2.2.2.2.] 2.2.2.2. Design Calculations and Analysis

[2.2.2.3.] 2.2.2.3. Documentation on the Building Envelope

[2.2.2.4.] 2.2.2.4. Documentation on Lighting Systems

[2.2.2.5.] 2.2.2.5. Documentation on HVAC Systems

[2.2.2.6.] 2.2.2.6. Documentation on Service Water Heating Systems

[2.2.2.7.] 2.2.2.7. Documentation on Electrical Power Systems and Motors

[2.2.2.8.] 2.2.2.8. Documentation Requirements for Building Performance Compliance

[2.2.3.] -- Information Required for Alteration Work

[2.2.3.1.] --- Documentation on the Alteration of HVAC Systems

[1] --) The following documentation on the *alteration* of HVAC systems shall be provided:

- [a] --) documentation on new and altered components, equipment and systems, in accordance with Article 2.2.2.5., and
- [b] --) thermal load and ductwork or piping length calculations for existing HVAC systems.

Impact analysis

Administering the enforcement of the Code is the normal business of the existing enforcement infrastructure. The enforcement of these administrative requirements is not expected to be time-consuming or add significantly to the workload that is the normal course of business for building inspectors. The overall impact would be a significant improvement in the ability of authorities having jurisdiction to successfully verify Code compliance.

Enforcement implications

The enforcement of the administrative requirements for the alteration of HVAC systems in existing buildings can be accomplished with the same means and resources involved in the enforcement of NECB Part 5. However, there could be an increase in enforcement and permit-review responsibilities.

Requiring information about alteration work would facilitate enforcement.

Who is affected

Designers, specification writers, manufacturers, contractors, building owners and building officials.

Submit a comment

Proposed Change 1865

Code Reference(s): **NECB20 Div.C 2.2. (first printing)**
Subject: Alteration of Existing Buildings
Title: Alteration of Service Water Systems
Description: This proposed change adds administrative requirements related to the alteration of service water systems.
Related Proposed Change(s): PCF 1860

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Alteration of Existing Buildings.

Problem

Division C of the National Energy Code of Canada for Buildings (NECB) requires that the authority having jurisdiction be provided with adequate documentation and other information, such as drawings and equipment specifications, in order to verify compliance with the Code. With the introduction of requirements for the alteration of existing buildings in the NECB 2025, there will be a need for information and calculations related to the extent of the alterations.

Failure to provide adequate documentation and level of detail regarding the alterations would make it difficult for authorities having jurisdiction to verify that the proposed alterations conform to the Code. This situation could also lead to inconsistency in the

design, construction and performance of the alterations, which could cause confusion and conflict between designers, manufacturers, authorities having jurisdiction and the legal community.

These conflicts would occur when

- authorities having jurisdiction request documentation during permit reviews to prove Code compliance,
- designers require Code compliance for use of their design specifications on a project, or
- disputes arise which require litigation.

Justification

Providing administrative guidance in Division C on the proper reporting techniques for documentation and calculations related to the alteration of existing buildings for compliance with the NECB is necessary to ensure building officials are provided with an appropriate level of detail to assess Code compliance.

PROPOSED CHANGE

[2.2.] 2.2. Administration

[2.2.1.] 2.2.1. Administration

[2.2.1.1.] 2.2.1.1. Conformance with Administrative Requirements

[2.2.2.] 2.2.2. Information Required for Proposed Work

[2.2.2.1.] 2.2.2.1. General Information Required

[2.2.2.2.] 2.2.2.2. Design Calculations and Analysis

[2.2.2.3.] 2.2.2.3. Documentation on the Building Envelope

[2.2.2.4.] 2.2.2.4. Documentation on Lighting Systems

[2.2.2.5.] 2.2.2.5. Documentation on HVAC Systems

[2.2.2.6.] 2.2.2.6. Documentation on Service Water Heating Systems

[2.2.2.7.] 2.2.2.7. Documentation on Electrical Power Systems and Motors

[2.2.2.8.] 2.2.2.8. Documentation Requirements for Building Performance Compliance

[2.2.3.] -- Information Required for Alteration Work

[2.2.3.1.] --- Documentation on the Alteration of Service Water Systems

[1] --) The following documentation on the *alteration* of *service water* systems shall be provided:

- [a] --) documentation on new and altered components, equipment and systems in accordance with Article 2.2.2.6., and
- [b] --) hydraulic load and piping length calculations for existing hot *service water* distribution systems.

Impact analysis

Administering the enforcement of the Code is the normal business of the existing enforcement infrastructure. The enforcement of these administrative requirements is not expected to be time-consuming or add significantly to the workload that is the normal course of business for building inspectors. The overall impact would be a significant improvement in the ability of authorities having jurisdiction to successfully verify Code compliance.

Enforcement implications

The enforcement of the administrative requirements for the alteration of service water systems in existing buildings can be accomplished with the same means and resources involved in the enforcement of NECB Part 6. However, there could be an increase in enforcement and permit-review responsibilities.

Requiring information about alteration work would facilitate enforcement.

Who is affected

Designers, specification writers, manufacturers, contractors, building owners and building officials.

Submit a comment

Proposed Change 1866

Code Reference(s): **NECB20 Div.C 2.2. (first printing)**

Subject: Alteration of Existing Buildings

Title: Alteration of Electrical Power Systems and Motors

Description: This proposed change adds administrative requirements related to the alteration of electrical power systems and motors.

Related Proposed Change(s): PCF 1861

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Alteration of Existing Buildings.

Problem

Division C of the National Energy Code of Canada for Buildings (NECB) requires that the authority having jurisdiction be provided with adequate documentation and other information, such as drawings and equipment specifications, in order to verify compliance with the Code. With the introduction of the proposed requirements for the alteration of existing buildings in the NECB 2025, there will be a need for information and calculations related to the extent of the alterations.

Failure to provide adequate documentation and level of detail regarding the alterations would make it difficult for authorities having jurisdiction to verify that the proposed alterations conform to the Code. This situation could also lead to inconsistency in the

design, construction and performance of the alterations, which could cause confusion and conflict between designers, manufacturers, authorities having jurisdiction and the legal community.

These conflicts would occur when

- authorities having jurisdiction request documentation during permit reviews to prove Code compliance,
- designers require Code compliance for use of their design specifications on a project, or
- disputes arise which require litigation.

Justification

Providing administrative guidance in Division C on the proper reporting techniques for documentation and calculations related to the alteration of existing buildings for compliance with the NECB is necessary to ensure building officials are provided with an appropriate level of detail to assess Code compliance.

PROPOSED CHANGE

[2.2.] 2.2. Administration

[2.2.1.] 2.2.1. Administration

[2.2.1.1.] 2.2.1.1. Conformance with Administrative Requirements

[2.2.2.] 2.2.2. Information Required for Proposed Work

[2.2.2.1.] 2.2.2.1. General Information Required

[2.2.2.2.] 2.2.2.2. Design Calculations and Analysis

[2.2.2.3.] 2.2.2.3. Documentation on the Building Envelope

[2.2.2.4.] 2.2.2.4. Documentation on Lighting Systems

[2.2.2.5.] 2.2.2.5. Documentation on HVAC Systems

[2.2.2.6.] 2.2.2.6. Documentation on Service Water Heating Systems

[2.2.2.7.] 2.2.2.7. Documentation on Electrical Power Systems and Motors

[2.2.2.8.] 2.2.2.8. Documentation Requirements for Building Performance Compliance

[2.2.3.] -- Information Required for Alteration Work

[2.2.3.1.] --- Documentation on the Alteration of Electrical Power Systems and Motors

[1] --) The following documentation on the *alteration* of electrical power systems and motors shall be provided:

- [a] --) an as-built single-line diagram of the *building*'s existing and altered electrical distribution system indicating the locations of new and existing means to monitor energy consumption,
- [b] --) schematic diagrams of existing and altered electrical control systems for systems other than heating, ventilating and air-conditioning, *service water* heating, and lighting, and
- [c] --) the manufacturers' operational manuals for all existing and altered electrical equipment.

Impact analysis

Administering the enforcement of the Code is the normal business of the existing enforcement infrastructure. The enforcement of these administrative requirements is not expected to be time-consuming or add significantly to the workload that is the normal course of business for building inspectors. The overall impact would be a significant improvement in the ability of authorities having jurisdiction to successfully verify Code compliance.

Enforcement implications

The enforcement of the administrative requirements for the alteration of electrical power systems and motors in existing buildings can be accomplished with the same means and resources involved in the enforcement of NECB Part 7. However, there could be an increase in enforcement and permit-review responsibilities.

Requiring information about alteration work would facilitate enforcement.

Who is affected

Designers, specification writers, manufacturers, contractors, building owners and building officials.

Submit a comment

Proposed Change 1840

Code Reference(s):	**NECB20 Div.C 2.2.2.3.(1) (first printing)**
Subject:	Building Envelope - General
Title:	Use of the Term "Grade" in the NECB
Description:	This proposed change clarifies the documentation on the building envelope required by Sentence 2.2.2.3.(1) by using “ground” instead of “grade” to refer to the finished ground level.
Related Code Change Request(s):	CCR 1391
Related Proposed Change(s):	PCF 1653, PCF 1962

This change could potentially affect the following topic areas:

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

Problem

In the National Building Code of Canada (NBC), “grade” is a defined term used to determine a building’s height in storeys, which in turn determines requirements for the construction and protection of that building. The NBC defines “grade” as the lowest of the average levels of finished ground adjoining each exterior wall of a building. Therefore, at any point along the length of a wall, grade may be above or below the adjacent ground level. As such, the defined term “grade” does not necessarily refer to the finished ground level.

If Code users determine the requirements for the insulation of a building component based on the definition of grade provided in the NBC, which is reproduced in the National Energy Code of Canada for Buildings (NECB), this could lead to the installation of thermal insulation that is insufficient to minimize heat loss.

Justification

In the NECB, the main purpose for references to “grade” is to establish requirements to reduce heat loss. In most instances, rather than using the defined term “grade,” the NECB should refer instead to “ground,” which more accurately describes the building level intended to be used to determine the required thermal resistance of the building element. The use of the defined term “grade” to determine thermal insulation requirements may lead to building elements having a thermal resistance that does not meet the objectives of the NECB.

The proposed change would replace the term “grade” with “ground” in Clause 2.2.2.3.(1)(i) of Division C, such that the Clause describes the required documentation for opaque walls that are above ground or in contact with the ground rather than opaque walls that are strictly above or below grade. This proposed change would clarify the documentation on the building envelope required by Sentence 2.2.2.3.(1).

PROPOSED CHANGE

[2.2.2.3.] 2.2.2.3. Documentation on the Building Envelope

[1] **1)** The following documentation on the *building envelope* shall be provided for the proposed *building* and, if Section 3.3. of Division B is applied, for the reference *building* as well:

  [a] a) gross wall area,
  [b] b) total window area,
  [c] c) total exterior door area,
  [d] d) gross roof area,
  [e] e) total *skylight* area,
  [f] f) ratio of total *skylight* area to gross roof area,
  [g] g) exposed floor areas,
  [h] h) ratio of total vertical *fenestration* and door area to gross wall area,
  [i] i) *overall thermal transmittance* of
    [i] i) opaque walls (~~above and below *grade*~~above-ground walls and walls in contact with the ground),
    [ii] ii) roofs (~~above and below *grade*~~above-ground roofs and roofs in contact with the ground),
    [iii] iii) floors (exposed floors and floors in contact with the ground)
    [iv] iv) *fenestration*,
    [v] v) doors forming part of the *building envelope*, and
    [vi] vi) *skylights*,
  [j] j) description and location of *air barrier assemblies* in *opaque building assemblies*,
  [k] k) air leakage characteristics of *fenestration* and doors that act as environmental separators,

[l] l) heat loss coefficient for the *building*, determined as the sum of the products of area and *overall thermal transmittance* for all above-ground *building envelope* components, and

[m] m) heat loss coefficient for the *building*, normalized by dividing the value from Clause (l) by the total floor area.

Impact analysis

The proposed change has no cost implications, as it is not a change to the Code requirement. The change would clarify the intended meaning of the provision.

Enforcement implications

This change can be enforced by the infrastructure currently available to enforce the NECB.

Who is affected

Designers, engineers, architects, builders and building officials.

Submit a comment

Proposed Change 1807

Code Reference(s):	**NFC20 Div.B 2.3.2. (first printing)**
Subject:	Large Farm Buildings (General)
Title:	Introduction of Requirements for Screens and Curtains Used in Farm Buildings
Description:	This proposed change introduces flame-testing requirements for screens and curtains used in farm buildings, and includes options to divide screens and curtains into smaller, non-contiguous areas.
Related Code Change Request(s):	CCR 1644

This change could potentially affect the following topic areas:

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

Problem

Article 2.3.2.1. of Division B of the National Fire Code of Canada (NFC) requires that fabrics and films be flame resistant when used in open floor areas exceeding 500 m^2 in certain occupancies. A similar requirement does not exist for screens and curtains used in agricultural occupancies.

Many agricultural occupancies use screens and curtains within the building envelope as part of the building use. Most notably, greenhouse operations often use blackout, energy conservation or light diffusion screens and curtains below ceilings and adjacent to walls to control growing conditions and reduce light pollution. These screens and curtains can be of significant size and, if exposed to flame, can contribute to the rapid spread of fire, which may delay evacuation and potentially cause harm to the occupants of the building.

Flame-resistant screens and curtains are currently available in the Canadian marketplace. The cost and continuity of farming operations are key issues within the agricultural industry. As such, reasonable provisions need to be added to the Code to balance these issues with the life-safety aspects of large farm buildings.

Justification

Sentence 2.3.2.1.(1) requires that drapes and curtains used in Group A, B1, D, E and F occupancies conform to CAN/ULC-S109, "Standard Method for Flame Tests of Flame-Resistant Fabrics and Films," in open floor areas exceeding 500 m^2. However, this provision does not limit the size (i.e., areas) of the drapes or curtains.

The new provisions for large farm buildings introduced in the latest edition of the NFC allow most agricultural occupancies to have an unlimited building area; however, there are few requirements for fire compartmentalization within those buildings. Large, contiguous screen and curtain areas can promote the spread of fire and can delay persons from exiting the farm building safely.

To limit the probability of such a scenario, this proposed change would define the contiguous area of screens and curtains (for both horizontal and vertical applications) when used in agricultural occupancies that exceed the 500 m^2 limit set in Clause 2.3.2.1.(1)(c).

Given the potential for screen and curtain use throughout the unlimited floor areas in large farm buildings, this proposed change would provide the following suitable methods for dividing large screens and curtains into non-contiguous areas:

- providing physical space between sections of screens and curtains,
- including fire separations where feasible, and
- making use of fire breaks using fabrics tested in accordance with CAN/ULC-S109.

PROPOSED CHANGE

[2.3.2.] 2.3.2. Flame Resistance

[2.3.2.1.] 2.3.2.1. Drapes, Curtains and Decorative Materials

[2.3.2.2.] 2.3.2.2. Flame-Retardant Treatments

[2.3.2.3.] 2.3.2.3. Textiles in Group B Occupancies

[2.3.2.4.] --- Textiles in Group G Occupancies

[1] --) Except as provided in Sentence (2), contiguous horizontal or vertical interior screens or curtains exceeding 500 m^2 in area and used in a Group

G, Division 1, 2 or 3 *occupancy* shall conform to CAN/ULC-S109, "Standard Method for Flame Tests of Flame-Resistant Fabrics and Films". (See Note A-2.3.2.4.(1).)

[2] --) Screens or curtains are not considered to be contiguous for the purpose of Sentence (1) where they are separated by

[a] --) a distance of at least 3 m,

[b] --) a screen or curtain that is at least 3 m wide and that conforms to CAN/ULC-S109, "Standard Method for Flame Tests of Flame-Resistant Fabrics and Films," or

[c] --) a *fire separation* having a *fire-resistance rating* of at least 45 min.

(See Note A-2.3.2.4.(2).)

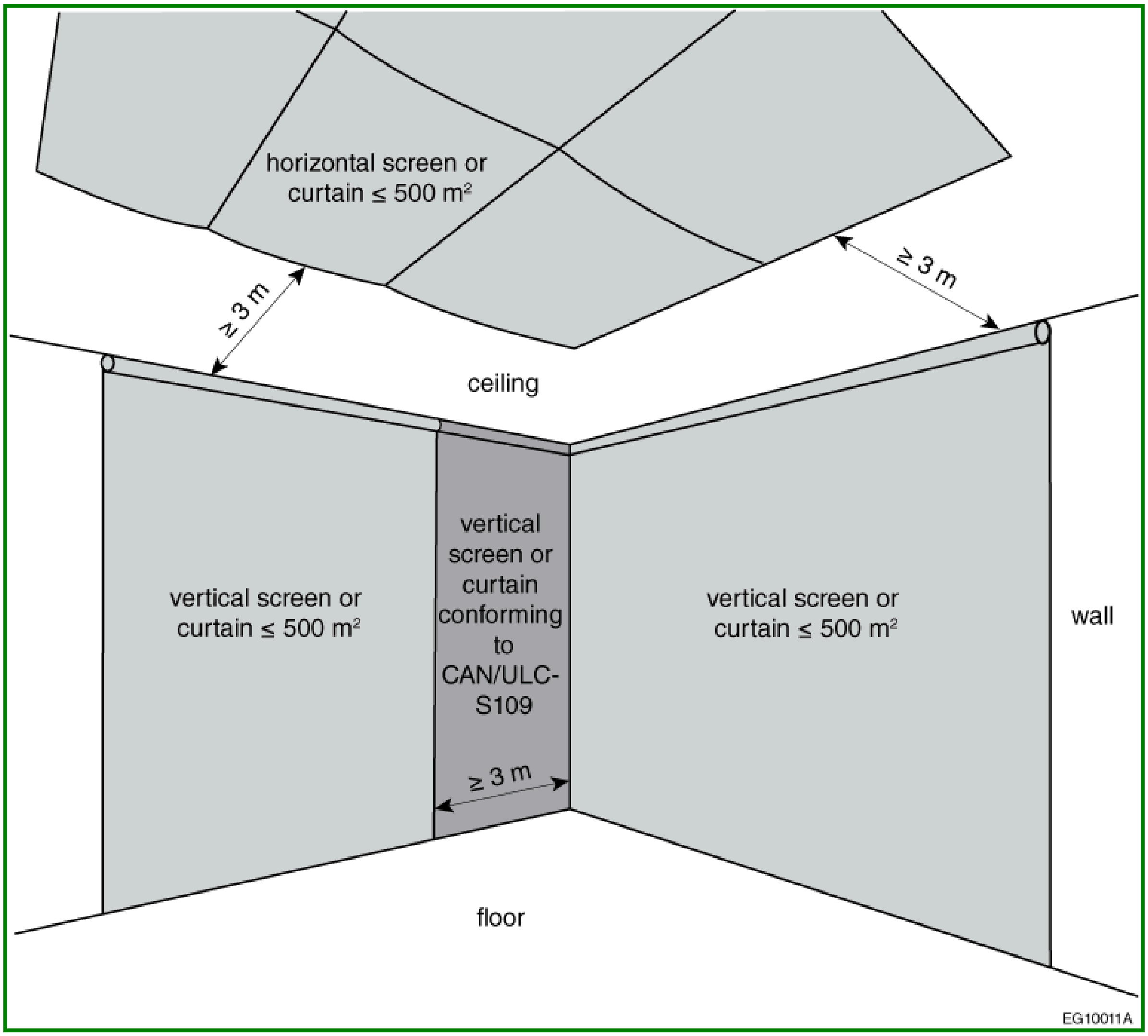
Note A-2.3.2.4.(1)

Sentence 2.3.2.4.(1) is not intended to apply to bird-control screens made from lightweight plastic mesh.

Note A-2.3.2.4.(2)

Figure A-2.3.2.4.(2) shows examples of screens or curtains separated, in accordance with Sentence 2.3.2.4.(2), by a distance of at least 3 m (measured from the edge of the horizontal screen or curtain on the ceiling to the uppermost edge of the vertical screen or curtain on the wall) or by a screen or curtain that is at least 3 m wide (measured from the edge of one vertical screen or curtain to the edge of the other vertical screen or curtain) and that conforms to CAN/ULC-S109, "Standard Method for Flame Tests of Flame-Resistant Fabrics and Films."

Figure [A-2.3.2.4.(2)]
Examples of screens or curtains separated by a distance of at least 3 m or by a screen or curtain that is at least 3 m wide and that conforms to CAN/ULC-S109



Impact analysis

Most manufacturers of screens and curtains have flame-resistant options available; however, the standard to which they are tested varies. Some manufacturers may need to have their products tested in Canada before those products can enter the Canadian marketplace.

It is anticipated that the cost of flame-resistant screens and curtains conforming to CAN/ULC-S109 will be 15% to 65% higher than the cost of non-tested screens and curtains (based on information collected from one of the major suppliers in Canada). For example, applying the proposed requirements and using flame-resistant screens in a 20-acre greenhouse of typical area dimensions (400 m × 200 m) would increase the cost by 3% to 35% compared to using screens that are not tested to be flame-resistant. The range of the increase in cost depends on the purpose of the product (i.e., for blackout, energy conservation or light diffusion), whether both the ceiling and walls of the entire facility have screens installed, and which method is used to divide up the area of non-tested screens into non-contiguous areas less than 500 m^2 (by separating them using materials listed in CAN/ULC-S109).

This proposed change will limit the risk to the life safety of occupants where large areas of screens or curtains are operationally required in agricultural occupancies. This proposed change will provide a number of practical options to limit the amount of flame-resistant materials needed in large open floor areas, thereby reducing the cost of compliance.

Enforcement implications

This proposed change can be enforced by the existing framework without additional resources. Authorities having jurisdiction are familiar with flame-test requirements for materials. The proposed methods for dividing curtains and screens are straightforward and easy to implement in practice.

Who is affected

People concerned with the design, construction and operation of farm buildings, namely, engineers, architects, building owners and regulators.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[2.3.2.1.] 2.3.2.1. ([1] 1) [F02-OP1.2]

[2.3.2.1.] 2.3.2.1. ([1] 1) [F02-OS1.2,OS1.5]

[2.3.2.2.] 2.3.2.2. ([1] 1) [F82-OP1.2]

[2.3.2.2.] 2.3.2.2. ([1] 1) [F82-OS1.2,OS1.5]

[2.3.2.3.] 2.3.2.3. ([1] 1) [F02-OP1.2]

[2.3.2.3.] 2.3.2.3. ([1] 1) [F02-OS1.2]

[2.3.2.3.] 2.3.2.3. ([2] 2) [F02-OS1.2]

[2.3.2.3.] 2.3.2.3. ([2] 2) [F02-OP1.2]

[2.3.2.3.] 2.3.2.3. ([3] 3) no attributions

[2.3.2.4.] -- ([1] --) [F02-OS1.2,OS1.5]

[2.3.2.4.] -- ([2] --) no attributions

Submit a comment

Proposed Change 2010

Code Reference(s):
NFC20 Div.B 3.1.2.7. (first printing)
NFC20 Div.B 3.2.2.5. (first printing)
NFC20 Div.B 3.2.7.14. (first printing)
NFC20 Div.B 3.3.2. (first printing)
NFC20 Div.B 5.1. (first printing)
NFC20 Div.B 5.2.3. (first printing)
NFC20 Div.B 5.5.3.1. (first printing)
NFC20 Div.B 5.6.1. (first printing)

Subject: Fire Safety Plan

Title: Deletion of Redundant Provisions Pointing to the Fire Safety Plan in the NFC

Description: This proposed change deletes redundant provisions that point to Section 2.8., Emergency Planning, from other Parts of the NFC.

This change could potentially affect the following topic areas:

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

Problem

In the 2020 edition of the National Fire Code of Canada (NFC), fire safety plan requirements were consolidated in Section 2.8. of Division B. However, pointer provisions were left in other Parts of the NFC where the previous requirements related to the fire safety plan existed to direct Code users to Section 2.8. for the consolidated requirements. These pointer provisions are redundant and may cause confusion for Code users, as they are not consistently provided in all situations where a fire safety plan is required.

If a pointer to Section 2.8. is not provided for buildings or occupancies where a fire safety plan is actually required, then Code users may assume that a fire safety plan is not needed. Therefore, Code users may fail to refer to Section 2.8. for the applicable requirements. The lack of a fire safety plan could lead to delays in evacuation and emergency responder operations, which could lead to harm to persons.

Justification

Requirements related to the fire safety plan have been consolidated in Section 2.8. of the NFC 2020. This proposed change would delete redundant provisions from Parts 3 and 5 that point Code users to Section 2.8. for the consolidated requirements on the preparation of a fire safety plan.

Section 2.8. is intended to be the central location for Code users to find all of the applicable requirements related to the fire safety plan. Article 2.8.1.1. already lists all of the situations where a fire safety plan is required. As such, the pointer provisions in other Parts of the NFC are unnecessary and can be deleted.

PROPOSED CHANGE

NFC20 Div.B 3.1.2.7. (first printing)

~~[3.1.2.7.] **3.1.2.7. Fire Safety Plan**~~

~~[1] **1)** A fire safety plan conforming to Section 2.8. shall be prepared.~~

NFC20 Div.B 3.2.2.5. (first printing)

[3.2.2.5.] **3.2.2.5. Fire Safety Plan**

~~[1] **1)** A fire safety plan conforming to Section 2.8. and Sentence (2) shall be prepared.~~

[2] **2)** The storage method and maximum height of storage as established in the fire safety plan in accordance with Clauses 2.8.2.4.(2)(b) and (c) shall be posted in the storage area.

[3] **3)** Signs required in Sentence (2) shall have
  [a] a) a minimum dimension of 200 mm, and
  [b] b) letters not less than 25 mm high.

NFC20 Div.B 3.2.7.14. (first printing)

[3.2.7.14.] **3.2.7.14. Placards**

[1] **1)** *Individual storage areas* used for the storage of *dangerous goods* and laboratories where *dangerous goods* are used shall be clearly designated as such by posted placards conforming to TC SOR/2001-286, "Transportation of Dangerous Goods Regulations (TDGR)", and Sentences (2) to (4). (See Note A-3.2.7.14.(1).)

[2] **2)** Where the *dangerous goods* identified in Sentence (1) consist of a single product, only the UN number need be posted.

[3] **3)** Where the *dangerous goods* identified in Sentence (1) consist of multiple products within the same class, the individual class and division placard shall be posted.

[4] **4)** Where the *dangerous goods* identified in Sentence (1) consist of more than one class of products, a placard for each individual class, or the ”Danger” placard shown in TC SOR/2001-286, "Transportation of Dangerous Goods Regulations (TDGR)", shall be posted at the entrance to the storage area.

~~[5] **5)** *Individual storage areas* described in Sentence (1) shall be identified in the fire safety plan as required in Article 2.8.2.4.~~

NFC20 Div.B 3.3.2. (first printing)

[3.3.2.] 3.3.2. General

[3.3.2.1.] 3.3.2.1. Application

[3.3.2.2.] 3.3.2.2. Height

[3.3.2.3.] 3.3.2.3. Individual Storage Areas and Clearances

[3.3.2.4.] 3.3.2.4. Storage beneath Power Lines

[3.3.2.5.] 3.3.2.5. Fire Department Access

[3.3.2.6.] 3.3.2.6. Fencing

[3.3.2.7.] 3.3.2.7. Maintenance

[3.3.2.8.] 3.3.2.8. Ignition Sources

~~[3.3.2.9.] 3.3.2.9. Fire Safety Plan~~

~~[1] **1)** A fire safety plan conforming to Section 2.8. shall be prepared.~~

[3.3.2.10.] 3.3.2.10. Portable Extinguishers

[3.3.2.11.] 3.3.2.11. Site Preparation

[3.3.2.12.] 3.3.2.12. Fuel Dispensing

[3.3.2.13.] 3.3.2.13. Spill Control

[3.3.2.14.] 3.3.2.14. Fire Separation

[3.3.2.15.] 3.3.2.15. Fire Protection

NFC20 Div.B 5.1. (first printing)

[5.1.] 5.1. General

[5.1.1.] 5.1.1. Scope

[5.1.1.1.] 5.1.1.1. Application

[5.1.1.2.] 5.1.1.2. Explosives

[5.1.1.3.] 5.1.1.3. Display Fireworks

[5.1.2.] 5.1.2. Electrical Installations

[5.1.2.1.] 5.1.2.1. Hazardous Locations

[5.1.2.2.] 5.1.2.2. General

[5.1.3.] 5.1.3. Ventilation

[5.1.3.1.] 5.1.3.1. Ventilation

[5.1.4.] 5.1.4. Flash Point

[5.1.4.1.] 5.1.4.1. Flash Point

~~[5.1.5.] 5.1.5. Fire Safety Plan~~

~~[5.1.5.1.] 5.1.5.1. Fire Safety Plan~~

~~[1] 1)~~ ~~A fire safety plan conforming to Section 2.8. shall be prepared.~~

NFC20 Div.B 5.2.3. (first printing)

[5.2.3.] 5.2.3. Prevention of Fires

[5.2.3.1.] 5.2.3.1. Location of Operations

[5.2.3.2.] 5.2.3.2. Protection of Combustible and Flammable Materials

[5.2.3.3.] 5.2.3.3. Fire Watch

[5.2.3.4.] 5.2.3.4. Work on Containers, Equipment or Piping

[5.2.3.5.] 5.2.3.5. Work Adjacent to Piping

[5.2.3.6.] 5.2.3.6. Fire Extinguishing Equipment

~~[5.2.3.7.] 5.2.3.7. Fire Safety Plan~~

~~[1] **1)**~~ ~~A fire safety plan conforming to Section 2.8. shall be prepared for *buildings* and areas described in Article 2.8.1.1. where hot works are conducted.~~

NFC20 Div.B 5.5.3.1. (first printing)

[5.5.3.1.] 5.5.3.1. Emergency Planning

~~[1] **1)**~~ ~~A fire safety plan conforming to Section 2.8. shall be prepared.~~

[2] **2)** Except as provided in Sentences (3) to (6), a laboratory shall conform to the requirements for emergency planning stated in Section 2.8.

[3] **3)** Personnel working in a laboratory shall be trained in the safe handling and use of *dangerous goods*, in conformance with Article 3.2.7.15.

[4] **4)** *Dangerous goods* shall be identified in conformance with Article 3.2.7.13.

[5] **5)** The laboratory shall be clearly designated as an area containing *dangerous goods* in conformance with Article 3.2.7.14.

[6] **6)** Measures shall be taken to prevent access to the laboratory by unauthorized persons.

NFC20 Div.B 5.6.1. (first printing)

[5.6.1.] 5.6.1. General

[5.6.1.1.] 5.6.1.1. Application

[5.6.1.2.] 5.6.1.2. Measures to Mitigate Fire Spread to Adjacent Buildings

~~[5.6.1.3.] 5.6.1.3. Fire Safety Plan~~

~~[1] **1)**~~ ~~A fire safety plan conforming to Section 2.8. shall be prepared.~~

[5.6.1.4.] 5.6.1.4. Access for Firefighting

[5.6.1.5.] 5.6.1.5. Portable Extinguishers

[5.6.1.6.] 5.6.1.6. Standpipe Systems

[5.6.1.7.] 5.6.1.7. Hot Surface Applications

[5.6.1.8.] 5.6.1.8. Ignition Sources

[5.6.1.9.] 5.6.1.9. Building Services at Demolition Sites

[5.6.1.10.] 5.6.1.10. Fuel Supply Installation

[5.6.1.11.] 5.6.1.11. Tank, Piping and Machinery Reservoir Safety at Demolition Sites

[5.6.1.12.] 5.6.1.12. Fire Separations in Partly Occupied Buildings

[5.6.1.13.] 5.6.1.13. Protection during Shutdown

[5.6.1.14.] 5.6.1.14. Watch

[5.6.1.15.] 5.6.1.15. Smoking Restrictions

[5.6.1.16.] 5.6.1.16. Provision for Egress

[5.6.1.17.] 5.6.1.17. Fire Warning

[5.6.1.18.] 5.6.1.18. Storage and Use of Dangerous Goods

[5.6.1.19.] 5.6.1.19. Temporary Enclosures

[5.6.1.20.] 5.6.1.20. Disposal of Combustible Refuse

Impact analysis

This proposed change has no associated cost implications.

This proposed change would eliminate confusion arising from the inconsistent presence of provisions that point to Section 2.8. for requirements related to the fire safety plan. In turn, this proposed change would prevent the misinterpretation of the Code and facilitate enforcement of Code requirements related to the fire safety plan.

Enforcement implications

This proposed change would be enforced by the infrastructure that is currently available to enforce the Code. This proposed change would reduce the potential for confusion or misinterpretation on when the requirements of Section 2.8. related to the fire safety plan would apply.

Who is affected

Designers, contractors, building owners, emergency responders and building officials.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

NFC20 Div.B 3.1.2.7. (first printing)

~~**[3.1.2.7.] 3.1.2.7. ([1] 1) no attributions**~~

NFC20 Div.B 3.2.2.5. (first printing)

~~**[3.2.2.5.] 3.2.2.5. ([1] 1) no attributions**~~

[3.2.2.5.] 3.2.2.5. ([2] 2) [F81,F02,F12-OP1.2]

[3.2.2.5.] 3.2.2.5. ([2] 2) [F81-OS1.1] [F81,F02,F12-OS1.2]

[3.2.2.5.] 3.2.2.5. ([3] 3) [F81,F02,F12-OP1.2]

[3.2.2.5.] 3.2.2.5. ([3] 3) [F81-OS1.1] [F81,F02,F12-OS1.2]

NFC20 Div.B 3.2.7.14. (first printing)

[3.2.7.14.] 3.2.7.14. ([1] 1) [F12,F81-OS3.4]

[3.2.7.14.] 3.2.7.14. ([1] 1) [F12-OS1.1,OS1.2] [F81-OS1.1]

[3.2.7.14.] 3.2.7.14. ([2] 2) [F12-OS3.4]

[3.2.7.14.] 3.2.7.14. ([2] 2) [F12-OS1.2]

[3.2.7.14.] 3.2.7.14. ([3] 3) [F12-OS3.4]

[3.2.7.14.] 3.2.7.14. ([3] 3) [F12-OS1.2]

[3.2.7.14.] 3.2.7.14. ([4] 4) [F12-OS3.4]

[3.2.7.14.] 3.2.7.14. ([4] 4) [F12-OS1.2]

~~**[3.2.7.14.] 3.2.7.14. ([5] 5) no attributions**~~

NFC20 Div.B 3.3.2. (first printing)

[3.3.2.1.] 3.3.2.1. ([1] 1) no attributions

[3.3.2.1.] 3.3.2.1. ([1] 1) no attributions

[3.3.2.2.] 3.3.2.2. ([1] 1) [F04-OP3.1]

[3.3.2.2.] 3.3.2.2. ([1] 1) [F04-OS1.5]

[3.3.2.3.] 3.3.2.3. ([1] 1) no attributions

[3.3.2.3.] 3.3.2.3. ([2] 2) [F03-OP3.1]

[3.3.2.4.] 3.3.2.4. ([1] 1) [F06-OS1.1]

[3.3.2.4.] 3.3.2.4. ([1] 1) [F01,F06-OP3.1]

[3.3.2.5.] 3.3.2.5. ([1] 1) [F12-OP3.1]

[3.3.2.5.] 3.3.2.5. ([2] 2) [F12-OP3.1]

[3.3.2.6.] 3.3.2.6. ([1] 1) [F34-OS3.4]

[3.3.2.6.] 3.3.2.6. ([1] 1) [F34-OH5]

[3.3.2.6.] 3.3.2.6. ([1] 1) [F34-OP3.1]

[3.3.2.6.] 3.3.2.6. ([2] 2) [F12-OP3.1]

[3.3.2.7.] 3.3.2.7. ([1] 1) ([b] b) [F12-OP3.1]

[3.3.2.7.] 3.3.2.7. ([1] 1) ([a] a)

[3.3.2.7.] 3.3.2.7. ([2] 2) ([b] b) [F12-OP3.1]

[3.3.2.7.] 3.3.2.7. ([2] 2) ([a] a)

[3.3.2.8.] 3.3.2.8. ([1] 1) [F01-OP3.1]

[3.3.2.8.] 3.3.2.8. ([2] 2) [F01-OP3.1]

[3.3.2.8.] 3.3.2.8. ([3] 3) ([b] b) [F03-OS1.2]

[3.3.2.8.] 3.3.2.8. ([3] 3) [F01,F03-OP3.1]

~~[3.3.2.9.] 3.3.2.9. ([1] 1) no attributions~~

[3.3.2.10.] 3.3.2.10. ([1] 1) no attributions

[3.3.2.10.] 3.3.2.10. ([2] 2) [F02-OP3.1]

[3.3.2.11.] 3.3.2.11. ([1] 1) [F04-OS1.2]

[3.3.2.11.] 3.3.2.11. ([1] 1) [F20-OS3.4]

[3.3.2.11.] 3.3.2.11. ([1] 1) [F04,F12-OP3.1]

[3.3.2.12.] 3.3.2.12. ([1] 1) no attributions

[3.3.2.12.] 3.3.2.12. ([2] 2) [F03-OP3.1]

[3.3.2.13.] 3.3.2.13. ([1] 1) no attributions

[3.3.2.14.] 3.3.2.14. ([1] 1) [F03-OP3.1]

[3.3.2.15.] 3.3.2.15. ([1] 1) [F02-OP3.1]

NFC20 Div.B 5.1. (first printing)

[5.1.1.1.] 5.1.1.1. ([1] 1) no attributions

[5.1.1.2.] 5.1.1.2. ([1] 1) [F01,F02-OS1.1]

[5.1.1.3.] 5.1.1.3. ([1] 1) [F01,F02-OS1.1]

[5.1.2.1.] 5.1.2.1. ([1] 1) [F01-OS1.1]

[5.1.2.2.] 5.1.2.2. ([1] 1) [F01-OS1.1]

[5.1.2.2.] 5.1.2.2. ([1] 1) no attributions

[5.1.3.1.] 5.1.3.1. ([1] 1) [F01-OS1.1]

[5.1.4.1.] 5.1.4.1. ([1] 1) no attributions

~~[5.1.5.1.] 5.1.5.1. ([1] 1) no attributions~~

NFC20 Div.B 5.2.3. (first printing)

[5.2.3.1.] 5.2.3.1. ([1] 1) [F01-OS1.1]

[5.2.3.1.] 5.2.3.1. ([2] 2) ([c] c) [F01-OS1.1] [F02-OS1.2]

[5.2.3.1.] 5.2.3.1. ([2] 2) ([c] c) [F01-OP1.1] [F02-OP1.2]

[5.2.3.1.] 5.2.3.1. ([2] 2) ([b] b)

[5.2.3.1.] 5.2.3.1. ([2] 2) ([a] a)

[5.2.3.1.] 5.2.3.1. ([3] 3) ([a] a) [F01-OS1.1]

[5.2.3.1.] 5.2.3.1. ([3] 3) ([b] b)

[5.2.3.2.] 5.2.3.2. ([1] 1) [F01-OS1.1]

[5.2.3.2.] 5.2.3.2. ([2] 2) [F01-OS1.1]

[5.2.3.2.] 5.2.3.2. ([3] 3) [F01-OS1.1] [F02-OS1.2]

[5.2.3.2.] 5.2.3.2. ([3] 3) [F01-OP1.1] [F02-OP1.2]

[5.2.3.2.] 5.2.3.2. ([4] 4) [F01-OS1.1]

[5.2.3.3.] 5.2.3.3. ([1] 1) [F01-OS1.1] [F02-OS1.2]

[5.2.3.3.] 5.2.3.3. ([1] 1) [F01-OP1.1] [F02-OP1.2]

[5.2.3.4.] 5.2.3.4. ([1] 1) [F01-OS1.1]

[5.2.3.4.] 5.2.3.4. ([2] 2) [F81,F20-OS3.1]

[5.2.3.4.] 5.2.3.4. ([3] 3) [F01-OS1.1]

[5.2.3.4.] 5.2.3.4. ([3] 3) no attributions

[5.2.3.5.] 5.2.3.5. ([1] 1) ([b] b) [F81-OS1.1]

[5.2.3.5.] 5.2.3.5. ([1] 1) ([a] a)

[5.2.3.6.] 5.2.3.6. ([1] 1) [F02-OS1.2]

~~[5.2.3.7.] 5.2.3.7. ([1] 1) no attributions~~

NFC20 Div.B 5.5.3.1. (first printing)

~~[5.5.3.1.] 5.5.3.1. ([1] 1) no attributions~~

[5.5.3.1.] 5.5.3.1. ([2] 2) no attributions

[5.5.3.1.] 5.5.3.1. ([2] 2) no attributions

[5.5.3.1.] 5.5.3.1. ([3] 3) no attributions

[5.5.3.1.] 5.5.3.1. ([4] 4) no attributions

[5.5.3.1.] 5.5.3.1. ([5] 5) no attributions

[5.5.3.1.] 5.5.3.1. ([6] 6) [F34-OS1.1]

[5.5.3.1.] 5.5.3.1. ([6] 6) [F34-OS3.4]

[5.5.3.1.] 5.5.3.1. ([6] 6) [F34-OH5]

NFC20 Div.B 5.6.1. (first printing)

[5.6.1.1.] 5.6.1.1. ([1] 1) no attributions

[5.6.1.2.] 5.6.1.2. ([1] 1) [F02,F03-OP3.1]

~~[5.6.1.3.] 5.6.1.3. ([1] 1) no attributions~~

[5.6.1.4.] 5.6.1.4. ([1] 1) [F12-OS1.2]

[5.6.1.4.] 5.6.1.4. ([1] 1) [F12-OP1.2]

[5.6.1.4.] 5.6.1.4. ([2] 2) [F12-OS1.2,OS1.5]

[5.6.1.4.] 5.6.1.4. ([2] 2) [F12-OP1.2]

[5.6.1.4.] 5.6.1.4. ([3] 3) [F12-OS1.2,OS1.5]

[5.6.1.4.] 5.6.1.4. ([3] 3) [F12-OP1.2]

[5.6.1.4.] 5.6.1.4. ([4] 4) [F12-OS1.2,OS1.5]

[5.6.1.4.] 5.6.1.4. ([4] 4) [F12-OP1.2]

[5.6.1.4.] 5.6.1.4. ([5] 5) [F12-OS1.2,OS1.5]

[5.6.1.4.] 5.6.1.4. ([5] 5) [F12-OP1.2]

[5.6.1.5.] 5.6.1.5. ([1] 1) [F12-OS1.2]

[5.6.1.5.] 5.6.1.5. ([1] 1) [F12-OP1.2]

[5.6.1.5.] 5.6.1.5. ([2] 2) [F02-OS1.2]

[5.6.1.5.] 5.6.1.5. ([2] 2) [F02-OP1.2]

[5.6.1.6.] 5.6.1.6. ([1] 1) [F02,F12-OS1.2]

[5.6.1.6.] 5.6.1.6. ([1] 1) [F02,F12-OP1.2]

[5.6.1.6.] 5.6.1.6. ([2] 2) [F02,F12-OS1.2]

[5.6.1.6.] 5.6.1.6. ([2] 2) [F02,F12-OP1.2]

[5.6.1.6.] 5.6.1.6. ([2] 2) ([c] c)

[5.6.1.6.] 5.6.1.6. ([3] 3) [F12,F82-OS1.2]

[5.6.1.6.] 5.6.1.6. ([3] 3) [F12,F82-OP1.2]

[5.6.1.7.] 5.6.1.7. ([1] 1) no attributions

[5.6.1.7.] 5.6.1.7. ([2] 2) [F01-OS1.1]

[5.6.1.7.] 5.6.1.7. ([2] 2) [F01-OP1.1]

[5.6.1.7.] 5.6.1.7. ([3] 3) [F01-OS1.2]

[5.6.1.7.] 5.6.1.7. ([3] 3) [F01-OP1.2]

[5.6.1.8.] 5.6.1.8. ([1] 1) [F01-OS1.1]

[5.6.1.8.] 5.6.1.8. ([1] 1) [F01-OP1.1]

[5.6.1.8.] 5.6.1.8. ([2] 2) [F01-OS1.1,OS1.2]

[5.6.1.8.] 5.6.1.8. ([2] 2) [F01-OP1.1]

[5.6.1.9.] 5.6.1.9. ([1] 1) [F01,F43-OS1.1]

[5.6.1.9.] 5.6.1.9. ([1] 1) [F01,F43-OP1.1]

[5.6.1.9.] 5.6.1.9. ([1] 1) [F32-OS3.3]

[5.6.1.9.] 5.6.1.9. ([2] 2) [F81-OS1.1,OS1.2]

[5.6.1.9.] 5.6.1.9. ([2] 2) [F81-OP1.1,OP1.2]

[5.6.1.9.] 5.6.1.9. ([3] 3) [F32-OS3.4]

[5.6.1.9.] 5.6.1.9. ([3] 3) [F01-OS1.1,OS1.2]

[5.6.1.10.] 5.6.1.10. ([1] 1) [F81,F43-OS1.1]

[5.6.1.11.] 5.6.1.11. ([1] 1) no attributions

[5.6.1.11.] 5.6.1.11. ([2] 2) [F01,F43-OS1.1] [F01-OS1.1]

[5.6.1.11.] 5.6.1.11. ([3] 3) [F01,F81-OS1.1]

[5.6.1.11.] 5.6.1.11. ([4] 4) [F01,F43-OS1.1]

[5.6.1.12.] 5.6.1.12. ([1] 1) [F03-OS1.2]

[5.6.1.12.] 5.6.1.12. ([1] 1) [F03-OP1.2]

[5.6.1.13.] 5.6.1.13. ([1] 1) [F12,F82-OS1.2]

[5.6.1.13.] 5.6.1.13. ([1] 1) [F12,F82-OP1.2]

[5.6.1.13.] 5.6.1.13. ([1] 1) [F02-OP3.1]

[5.6.1.13.] 5.6.1.13. ([2] 2) [F02-OP1.2]

[5.6.1.13.] 5.6.1.13. ([2] 2) [F02-OP3.1]

[5.6.1.13.] 5.6.1.13. ([2] 2) [F02-OS1.2,OS1.5]

[5.6.1.13.] 5.6.1.13. ([2] 2) no attributions

[5.6.1.14.] 5.6.1.14. ([1] 1) [F02-OS1.2,OS1.5]

[5.6.1.14.] 5.6.1.14. ([2] 2) [F02-OS1.5,OS1.2]

[5.6.1.14.] 5.6.1.14. ([3] 3) [F13-OS1.5,OS1.2]

[5.6.1.15.] 5.6.1.15. ([1] 1) [F01-OS1.1]

[5.6.1.16.] 5.6.1.16. ([1] 1) [F10,F82-OS3.7]

[5.6.1.16.] 5.6.1.16. ([2] 2) [F10,F82-OS3.7]

[5.6.1.17.] 5.6.1.17. ([1] 1) [F11-OS1.5]

[5.6.1.18.] 5.6.1.18. ([1] 1) no attributions

[5.6.1.18.] 5.6.1.18. ([2] 2) no attributions

[5.6.1.18.] 5.6.1.18. ([3] 3) no attributions

[5.6.1.19.] 5.6.1.19. ([1] 1) [F01-OS1.1,OS1.2]

[5.6.1.20.] 5.6.1.20. ([1] 1) [F02-OS1.1,OS1.2]

[5.6.1.20.] 5.6.1.20. ([1] 1) [F02-OP1.2]

Submit a comment

Proposed Change 1934

Code Reference(s):	**NFC20 Div.B 3.2.7.9. (first printing)**
Subject:	Automatic Sprinkler System
Title:	Standardization of Terminology in NFC Sprinkler Requirements
Description:	This proposed change is one of a series of proposed changes that standardize the terminology related to sprinklers in the NFC.
Related Proposed Change(s):	PCF 1910, PCF 1912, PCF 1915, PCF 1916, PCF 1917, PCF 1920, PCF 1921, PCF 1922, PCF 1924, PCF 1925, PCF 1926, PCF 1927, PCF 1928, PCF 1929, PCF 1930, PCF 1931, PCF 1932, PCF 1933

This change could potentially affect the following topic areas:

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

Problem

Currently, various wordings and phrases are used in the National Building Code of Canada (NBC) 2020 and National Fire Code (NFC) 2020 to describe whether or not sprinklers are mandated in the space or area in question. Inconsistent use of terminology could create confusion or misunderstanding.

This proposed change standardizes Code wording to clarify where sprinklers are mandated by the NFC by using the defined term "sprinklered" and thereby eliminates any potential confusion.

Justification

As defined in the NFC, “sprinklered (as applying to a building or part thereof) means that the building or part thereof is equipped with a system of automatic sprinklers.”

In the NBC 2020 and the NFC 2020, 11 different phrases are used to indicate where sprinklers are mandated, while 8 different phrases are used to indicate where sprinklers are not mandated. In all cases, the defined term “sprinklered” could be used. Not standardizing this terminology could potentially cause confusion among architects and designers as to where sprinklers are mandated. Revising the Code wording to use the defined term “sprinklered” would introduce consistency as well as eliminate any potential confusion.

Table 1 shows the different phrases used in the NBC and NFC to indicate where sprinklers are mandated, along with their frequency.

Table 1. Existing Phrases Indicating Where Sprinklers Are Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… to have an automatic sprinkler system installed throughout …”	NBC	1
“… an automatic sprinkler system shall be installed in …”	NBC	1
“… sprinklers shall be installed in …”	NBC	2
“… sprinklers shall be provided for …”	NBC	1
“… sprinklers shall not be omitted in …”	NBC	1
“… in which an automatic sprinkler system is installed …”	NBC	1
“… in which a sprinkler system is installed …”	NBC	2
“… in which a sprinkler system has been installed …”	NBC	1
“… area served by the sprinkler system …”	NBC	1
“… sprinklers are installed in …”	NBC	1
“… shall be equipped throughout with a sprinkler system …”	NFC	1

Table 2 shows the different phrases used in the NBC and NFC to indicate where sprinklers are not mandated, along with their frequency.

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC

Phrase	Code	Number of Occurrences
“… do not require the installation of an automatic sprinkler system …”	NBC	1
“… in which an automatic sprinkler system is not required to be installed …”	NBC	1
“… sprinklers are not required in …”	NBC	1

Table 2. Existing Phrases Indicating Where Sprinklers Are Not Mandated in the NBC and NFC (Continued)

Phrase	Code	Number of Occurrences
"… that is not protected by an automatic sprinkler system …"	NBC	1
"… in which sprinklers are not installed …"	NBC	2
"… where a sprinkler system is not installed …"	NBC	1
"… in which an automatic sprinkler system is not installed …"	NBC	2
"… need not be equipped throughout with a sprinkler system …"	NFC	2

PROPOSED CHANGE

[3.2.7.9.] 3.2.7.9. Fire Suppression Systems

[1] **1)** Except as permitted in Sentences (2) and (3) and in Part 4, *buildings* used for the storage of *dangerous goods* regulated by this Subsection shall be ~~equipped throughout with a sprinkler system~~*sprinklered* or equipped with another fire suppression system, designed in conformance with Part 2 and good engineering practice with respect to specific *dangerous goods*. (See Note A-3.2.7.9.(1).)

[2] **2)** *Buildings* described in Sentence (1) need not be *sprinklered* or equipped ~~throughout~~ with ~~a sprinkler system or~~ another fire suppression system, provided that

- [a] a) the sum of *individual storage areas* in the *building* used for the storage of *dangerous goods*, other than substances classified as miscellaneous *dangerous goods* with no other class and those covered in Part 4, does not exceed 100 m^2, and
- [b] b) the *dangerous goods* are
  - [i] i) separated in conformance with Table 3.2.7.6., and
  - [ii] ii) stored in *fire compartments* separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* of not less than 2 h.

[3] **3)** *Buildings* described in Sentence (1) need not be *sprinklered* or equipped ~~throughout~~ with ~~a sprinkler system or~~ another fire suppression system, provided that storage consists only of *dangerous goods* classified as non-flammable, non-toxic gases with no subsidiary class of oxidizing substances.

Impact analysis

This proposed change clarifies Code language by using the defined term for consistency. This proposed change would facilitate interpretation of the Code requirements and eliminate potential confusion. As a result, it is expected that a consistent and appropriate level of safety would be provided without any confusion. No additional costs are expected.

Enforcement implications

This proposed change is intended to clarify the intent of the requirements, which should aid in the understanding and enforcement of the Code.

Who is affected

Authorities having jurisdiction, designers and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.2.7.9.] 3.2.7.9. ([1] 1) [F02-OP1.2]

[3.2.7.9.] 3.2.7.9. ([1] 1) [F02-OS1.2]

[3.2.7.9.] 3.2.7.9. ([2] 2) [F02,F03-OP1.2] [F01-OP1.1]

[3.2.7.9.] 3.2.7.9. ([2] 2) [F02,F03-OS1.2] [F01-OS1.1]

[3.2.7.9.] 3.2.7.9. ([3] 3) no attributions

Submit a comment

Proposed Change 1805

Code Reference(s):	**NFC20 Div.B 4.1.1.1. (first printing)** **NFC20 Div.B 4.3.13.1. (first printing)** **NFC20 Div.B 4.3.13.4. (first printing)** **NFC20 Div.B 4.3.13.5. (first printing)** **NFC20 Div.B 4.3.13.6. (first printing)**
Subject:	Storage Tanks
Title:	Reference to CSA B139:19 Series without Capacity Restriction
Description:	This proposed change removes the capacity restriction on aboveground storage tanks from the reference to CSA B139 Series, “Installation code for oil-burning equipment.”
Related Code Change Request(s):	CCR 1548, CCR 1866
Related Proposed Change(s):	PCF 1354

This change could potentially affect the following topic areas:

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

Problem

The National Fire Code of Canada (NFC) 2020 currently references the 2019 edition of CSA B139 Series, "Installation code for oil-burning equipment." However, the NFC limits the application of the standard to individual aboveground storage tanks that have a maximum individual capacity of 2 500 L and a maximum aggregate capacity of 5000 L (based on a previous edition of the standard). For aboveground storage tanks having an individual capacity of greater than 2 500 L and aggregate capacity of more than 5 000 L, Part 4 of Division B of the NFC would apply.

This tank capacity restriction requires owners, engineers and contractors to rely on the NFC for specifications on larger aboveground storage tank installations. But, CSA B139 Series:19, the most current edition, contains more comprehensive and specific requirements for such applications than the NFC does.

Furthermore, there is much confusion among regulators, consultants, stakeholders and building owners with regard to which Code or standard (and which edition) applies. Various jurisdictions across the country have varied ways of regulating storage tanks by applying the NFC or different editions of CSA B139 Series.

As of May 2020, Nova Scotia, Quebec, Ontario and Manitoba (which covers about 67% of the Canadian population) had adopted CSA B139 Series:15 for large tanks installed inside buildings. The status of adoption is unknown for Prince Edward Island, New Brunswick and Yukon; however, the rest of the provinces and territories (PTs) have adopted the NFC, as illustrated in Figure 1.

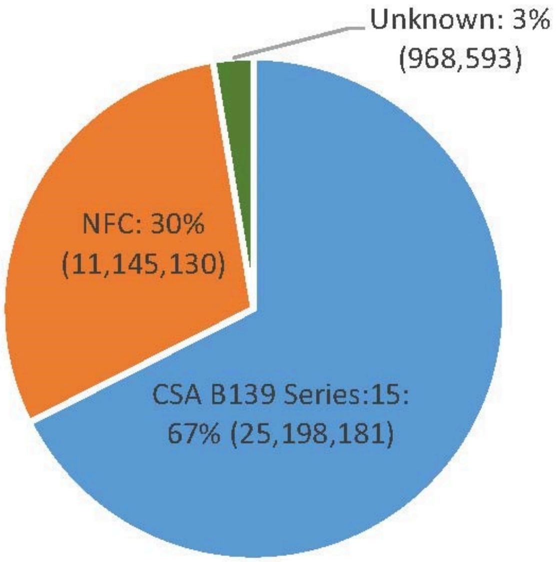


Figure 1. Regulatory authority (NFC, CSA B139 Series:15 or unknown) for storage tanks with an individual capacity greater than 2 500 L by percentage of the Canadian population in 2020

It is worth noting that neither British Columbia nor Alberta actively uses CSA B139 Series. Moreover, British Columbia does not enforce Part 4 of the NFC, which is used on a voluntary basis. In Alberta, Part 4 of the NFC has been adopted for oil-burning equipment, but the use and installation of this type of equipment are largely unregulated. Installations tend to be approved and installed as part of a larger building design, with very little regulatory oversight. PTs may adopt the NFC and CSA B139 Series through separate statutes or government departments, potentially presenting regulatory conflicts without an understanding of precedence (i.e., which edition of a standard applies, which Code or standard applies).

Some jurisdictions only adopt the NFC, and some fire officials either use little guidance from the NFC or use CSA B139 Series without regulatory authority. The regulatory conflict is quite evident for tank systems used by federal departments and on federal lands. Most federal departments use the NFC directly or as referenced in other legislation. Some federal departments have also adopted CSA B139 Series without harmonization with the NFC.

It would be beneficial to provide consistent, harmonized requirements for aboveground storage tanks across Canada.

Justification

CSA B139 Series has been a recognized standard for the installation of oil-burning equipment since 1956. Until 2015, the standard primarily addressed heating oil systems for domestic use. In 2015, the standard underwent a major overhaul to include tanks greater than 2 500 L. CSAB139 Series:15 standard was divided into the following sections:

- General requirements for large installations
- General requirements for stationary engines
- General requirements for special installations
- Installation code for oil-burning equipment for residential and small commercial buildings

On May 13, 2020, representatives of the CSA B139 Technical Committee compared the CSA B139 requirements with those of the NFC. The presentation concluded that there were no major differences or conflicts that would present additional risk to personal safety or structures. CSA B139 Series offers more options for individual and aggregate tank capacity but with increased levels of protection, commensurate with increased liquid volumes. The presentation included a summary of harmony and variance between the NFC and CSA B139 Series, as well as unique requirements contained in the standard.

Results of the comparison are as follows. Of a total of 256 requirements,

- 170 requirements are the same
- 22 requirements are not applicable to CSA B139 Series because the NFC item only applies to flammable liquids (Class I), which is outside the scope of CSA B139 Series
- 27 requirements are in agreement, based on the reasonable interpretation that the CSA B139 Series requirement is equivalent to the NFC requirement
- 5 are permitted by the NFC but not by CSA B139 Series, are duplicates, or are general statements that cannot be demonstrated.
- 32 requirements in CSA B139 Series do not comply with those of the NFC.

Note that the above requirements include CSA B139 Series requirements related to the same or similar NFC requirements. They do not include additional CSA B139 Series requirements unique to the standard, to which the NFC does not have a similar requirement.

An explanation of CSA B139 Series differences from the NFC follows:

- Many are related to operations, such as the removal of combustibles for fire prevention and protection, emergency response plan, drainage/removal of liquid from the secondary containment, leak detection, etc.
- Some are related to oil clean-up when a spill occurs and removal of contaminated soil (possible cross-over with environmental legislation).
- Some requirements are related to the termination location of a tank's normal and emergency vents.
- A number of differences are related to leak detection commissioning and periodic testing of underground and aboveground tanks and associated piping. CSA B139 Series does not include ongoing monitoring of aboveground piping.

Note that there is no change required for the requirements in the NFC 2020 that are not addressed by the CSA B139 Series listed above; the Code requirements prevail.

CSA B139 Series was developed to address the specific requirements of the application. The specificity is found in system requirements such as for auxiliary tanks, control valves, return lines, and appliance exhaust installation. Incremental requirements found in CSA B139 Series are primarily developed for systems inside buildings.

In 2022, the variances between the NFC and the standard were reviewed. No major differences in requirements between the two documents were concluded to exist that would present a safety concern. As a result of this analysis, the CSA Technical Committee is also endeavouring to make minor changes to CSA B139 Series to address the minor conflicts identified.

Without the restriction on tank capacity, referencing CSA B139 Series for appropriate technical guidance would reduce the possibility of incorrectly installed systems that could lead to failures, environmental pollution, fires and explosions.

PROPOSED CHANGE

[4.1.1.1.] 4.1.1.1. Application

[1] **1)** Except as provided in Sentences (2) and (3), this Part applies to the storage, handling, use and processing of

[a] a) *flammable liquids* and *combustible liquids* in *buildings*, structures and open areas,

[b] b) water-miscible liquid mixtures classified as *flammable liquids* or *combustible liquids* in conformance with Article 4.1.2.2. in *buildings*, structures and open areas, and

[c] c) *dangerous goods* classified as flammable gases at *fuel-dispensing stations*.

(See Note A-4.1.1.1.(1).)

[2] **2)** Areas in *process plants*, where conditions must be addressed by design and operational details specific to the hazard, need not conform to this Part, where alternative protection is provided in conformance with

Article 1.2.1.1. of Division A. (See Note A-4.1.1.1.(2).)

[3] 3) This Part shall not apply to

- [a] a) the transportation of *flammable liquids* or *combustible liquids* under TC SOR/2001-286, "Transportation of Dangerous Goods Regulations (TDGR)",
- [b] b) except as provided in Sentence (4)-2025, *appliances* and their ancillary equipment within the scope of CSA B139 Series, "Installation code for oil-burning equipment", ~~except for aboveground *storage tanks* with an individual capacity exceeding 2 500 L~~(see Note A-4.1.1.1.(3)(b)),
- [c] c) except as provided in Sentence (5~~4~~), the storage of *flammable liquids* or *combustible liquids* on farms for individual farm use, or
- [d] d) the storage of aerosol products covered under Subsection 3.2.5.

[4] --) The *appliances* and ancillary equipment referred to in Clause (3)(b) shall comply with the applicable operational requirements of this Part.

[5] 4) The storage of *flammable liquids* or *combustible liquids* on farms for individual farm use shall be in conformance with Section 4.12.

[6] 5) In addition to the requirements in this Part, the storage, handling and use of *flammable liquids* and *combustible liquids* in laboratories shall be in conformance with Section 5.5.

[7] 6) Unless otherwise specified, this Section shall apply to all areas involved in the storage, handling or use of *flammable liquids* and *combustible liquids* covered in this Part.

Note A-4.1.1.1.(3)(b)

Ancillary equipment covered in CSA B139 Series, "Installation code for oil-burning equipment", includes storage tanks and piping that supply oil-burning equipment, diesel-engine-driven emergency generators and fire pumps. Part 4 of the NFC does not generally apply to such tanks and piping systems.

However, the operational requirements contained in Part 4, which are not included in CSA B139 Series, are applicable to appliances and ancillary equipment within the scope of this standard. Examples of such operational requirements include keeping storage tanks free of vegetation, performing liquid inventory reconciliation, providing tank vehicle access to storage tanks, and providing safe storage of oily rags.

[4.3.13.1.] 4.3.13.1. Occupancy

[1] 1) Except as provided in Article 4.3.13.2., *storage tanks* located inside *buildings* shall ~~conform to Subsections 4.3.13. to 4.3.15. and~~ be permitted in

- [a] a) *industrial occupancies*, and
- [b] b) *occupancies* other than *industrial occupancies* where *combustible liquids* are stored and used as fuel for oil-burning equipment, emergency generators and fire pumps.

[4.3.13.4.] 4.3.13.4. Maximum Quantities and Location

[1] **1)** Except as provided in Subsection 4.2.8. and in Sentence (2), *storage tanks* for *flammable liquids* or *combustible liquids* shall be

- [a] a) located in dedicated storage rooms conforming to Subsection 4.3.14., and
- [b] b) located in conformance with Tables 4.3.13.4.-A ~~and 4.3.13.4.-B (see Note A-4.3.13.4.(1)(b))~~.

Table [4.3.13.4.-A] 4.3.13.4.-A
Indoor Tank Storage in Industrial Occupancies
Forming Part of Sentences [4.3.13.4.] 4.3.13.4.([1] 1) and ([2] 2), and 4.3.13.8.(1)

Class of Liquid	**Storage Level**	**Maximum Quantity per Storage Room (1), L**	
		One or More Tanks	
		Protected Storage (2)	**Unprotected Storage**
Class I	*First storey*	40 000	25 000
	Storeys above the *first storey*	7 500	Not permitted
	Basement	Not permitted	Not permitted
Classes II and IIIA	*First storey*	200 000	100 000
	Storeys above the *first storey*	20 000	Not permitted
	Basement	20 000	Not permitted

Notes to Table [4.3.13.4.-A] 4.3.13.4.-A:

(1) See Subsection 4.3.14.

(2) See Article 4.2.7.6.

~~Table [4.3.13.4.-B] 4.3.13.4.-B~~
~~Indoor Tank Storage in Occupancies Using Oil-Burning Equipment, Emergency Generators and Fire Pumps~~
~~Forming Part of Sentences [4.3.13.4.] 4.3.13.4.([1] 1) and 4.3.13.5.(1) and (2)~~

~~**Class of Liquid**~~	~~**Storage Level**~~	~~**Quantity per Protected Storage Room (1) , L**~~	
		~~**Individual Tank**~~	~~**Aggregate**~~
~~Classes II and IIIA~~	~~*First storey* (2)~~	~~> 2 500 (3)~~	~~200 000~~
		~~> 20 000 (4)~~	
	~~*Basement* and *storeys* above the *first storey*~~	~~> 2 500 (3)~~	~~20 000~~
		~~> 20 000 (4)~~	~~45 000~~

~~**Notes to Table [4.3.13.4.-B] 4.3.13.4.-B:**~~

(1) ~~See Article 4.2.7.6.~~

(2) ~~For *industrial occupancies* where the tanks are located in a separate storage room from the equipment, refer to Table 4.3.13.4.-A.~~

(3) ~~See Sentence 4.3.13.5.(1).~~

(4) ~~See Sentence 4.3.13.5.(2).~~

---

[2] **2)** When quantities greater than those permitted for incidental use in Subsection 4.2.8. are required for special process operations, *storage tanks* for *flammable liquids* or *combustible liquids* are permitted to be located outside of a storage room referred to in Sentence (1), provided that

[a] a) total quantities per *fire compartment* are not more than one-half the quantities permitted in Table 4.3.13.4.-A,

[b] b) they are located on the *first storey*, and

[c] c) the installation conforms to Articles 4.3.13.9. to 4.3.13.12.

~~**Note A-4.3.13.4.(1)(b)**~~

~~Table 4.3.13.4.-B deals with storage tanks that are outside the scope of CSA B139~~

~~Series, "Installation code for oil-burning equipment" (which limits the capacity of individual storage tanks to 2 500 L and their aggregate capacity to 5 000 L) and harmonizes requirements for all occupancies using oil-burning equipment, emergency generators and fire pumps.~~

~~[4.3.13.5.]~~ ~~4.3.13.5.~~ ~~Storage Tank Construction~~

~~[1]~~ ~~1)~~ ~~*Storage tanks* with an individual capacity exceeding 2 500 L but not exceeding 20 000 L that are used in conformance with Table 4.3.13.4.-B shall be~~

  [a] a) ~~of double-walled construction in conformance with Clause 4.3.1.2.(1)(e) or a minimum of 300 deg. secondarily contained construction, and~~

  [b] b) ~~monitored for leakage in conformance with Sentence 4.4.2.1.(7).~~

~~[2]~~ ~~2)~~ ~~*Storage tanks* with an individual capacity exceeding 20 000 L that are used in conformance with Table 4.3.13.4.-B shall~~

  [a] a) ~~conform to Clause 4.3.1.2.(1)(l), and~~

  [b] b) ~~be monitored for leakage in conformance with Sentence 4.4.2.1.(7).~~

~~[4.3.13.6.]~~ ~~4.3.13.6.~~ ~~Piping Systems~~

~~[1]~~ ~~1)~~ ~~Piping systems serving oil-burning equipment, diesel-engine-driven emergency generators and fire pumps shall conform to CSA B139 Series, "Installation code for oil-burning equipment".~~

Impact analysis

Although CSA B139 Series has much more specific guidance on the installation of oil-burning equipment (especially for inside building application) than the NFC does, compliance with CSA B139 Series instead of the Part 4 of NFC is not more expensive. In most cases, companies responsible for the design and installation of oil-burning equipment are qualified and use the same industry standards that led to the development of CSA B139 Series. In practice, the NFC is not used to design and install these systems.

However, the NFC requirements were extensively used in the development of the 2015 edition of CSA B139 Series. There are many commonalities in the two documents, such as the recognition of technical standards for storage tanks, piping, leak detection, overfill prevention, and sump construction and setbacks. At least the 2015 edition of CSA B139 has been adopted by authorities having jurisdiction that represent 67% of the Canadian population. Referencing the most current edition of CSA B139 Series in the NFC without tank capacity restriction would simplify the enforcement of the Code and eliminate potential confusion for the industry and authorities having jurisdiction.

This proposed change clarifies the application of the NFC and the referenced standard for regulators and Code users to eliminate potential confusion in practice. Specific requirements in CSA B139 Series provide clarification for all stakeholders, as follows:

- for installers, the standard provides more details and clear guidance on the installation, and
- for regulators, the standard provides more specifications for compliance.

No training for Code users is anticipated to be required since the industry and regulators are already familiar with the requirements in the NFC and CSA B139 Series, and apply the requirements during equipment installation.

Enforcement implications

This proposed change can be enforced by the infrastructure currently available to enforce the Code.

Who is affected

Regulators, engineers, building owners, contractors, fire services, and storage tank manufacturers.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[4.1.1.1.] 4.1.1.1. ([1] 1) no attributions

[4.1.1.1.] 4.1.1.1. ([1] 1) ([b] b)

[4.1.1.1.] 4.1.1.1. ([2] 2) no attributions

[4.1.1.1.] 4.1.1.1. ([3] 3) ([a] a), ([b] b), ([d] d)

[4.1.1.1.] 4.1.1.1. ([3] 3) ([c] c)

[4.1.1.1.] -- ([4] --) ([b] b),

[4.1.1.1.] 4.1.1.1. ([5] 4) no attributions

[4.1.1.1.] 4.1.1.1. ([6] 5) no attributions

[4.1.1.1.] 4.1.1.1. ([7] 6) no attributions

[4.3.13.1.] 4.3.13.1. ([1] 1) [F01,F02-OS1.1]

[4.3.13.1.] 4.3.13.1. ([1] 1) [F01,F02-OP1.1]

[4.3.13.1.] 4.3.13.1. ([1] 1) ([a] a)

[4.3.13.4.] 4.3.13.4. ([1] 1) ([b] b) [F01-OS1.1] [F02-OS1.2]

[4.3.13.4.] 4.3.13.4. ([1] 1) ([b] b) [F01-OP1.1] [F02-OP1.2]

[4.3.13.4.] 4.3.13.4. ([1] 1) ([a] a)

[4.3.13.4.] 4.3.13.4. ([2] 2) ([c] c)

[4.3.13.4.] 4.3.13.4. ([2] 2) no attributions

~~**[4.3.13.5.] 4.3.13.5. ([1] 1) ([a] a) [F01,F20,F43,F80,F81-OS1.1]**~~

~~**[4.3.13.5.] 4.3.13.5. ([1] 1) ([a] a) [F01,F20,F43,F80,F81-OP1.1]**~~

~~**[4.3.13.5.] 4.3.13.5. ([1] 1) ([b] b) [F01,F43,F82-OS1.1]**~~

~~**[4.3.13.5.] 4.3.13.5. ([1] 1) ([b] b) [F01,F43,F82-OP1.1]**~~

~~**[4.3.13.5.] 4.3.13.5. ([1] 1) ([b] b)**~~

~~**[4.3.13.5.] 4.3.13.5. ([1] 1) ([b] b) [F20,F43,F80,F81-OH5]**~~

~~**[4.3.13.5.] 4.3.13.5. ([2] 2) ([a] a)**~~

~~**[4.3.13.5.] 4.3.13.5. ([2] 2) ([b] b) [F01,F43,F82-OS1.1]**~~

~~**[4.3.13.5.] 4.3.13.5. ([2] 2) ([b] b) [F01,F43,F82-OP1.1]**~~

~~**[4.3.13.5.] 4.3.13.5. ([2] 2) ([b] b)**~~

~~**[4.3.13.5.] 4.3.13.5. ([2] 2) ([b] b) [F20,F43,F80,F81-OH5]**~~

~~**[4.3.13.6.] 4.3.13.6. ([1] 1) [F01-OS1.1]**~~

~~**[4.3.13.6.] 4.3.13.6. ([1] 1) [F01-OP1.1]**~~

Submit a comment

Proposed Change 1844

Code Reference(s):	**NFC20 Div.B 4.1.6.3. (first printing)**
Subject:	Other — Hazardous Materials and Activities
Title:	Deletion of Reference to Withdrawn Document
Description:	This proposed change deletes the reference to ULC/ORD-C410A-94, “Absorbents for Flammable and Combustible Liquids,” from explanatory Note A-4.1.6.3.(3)(b).

This change could potentially affect the following topic areas:

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

Problem

ULC/ORD-C410A-94, "Absorbents for Flammable and Combustible Liquids," which is currently referenced in explanatory Note A-4.1.6.3.(3)(b), was withdrawn by ULC Standards in 2018.

The withdrawn other recognized document (ORD) is over 20 years old. Since the industry was not requesting testing or certification to the ORD, ULC decided to withdraw the ORD. It did not receive adverse comments from certification bodies, the industry or others.

Keeping the reference to the ORD in the NFC would not provide any clarification of the Code requirement. Instead, referring to this withdrawn document could create confusion for Code users when they see the document is referenced in the Code but no longer available in practice.

Justification

At the mid-cycle review of updates to referenced documents in the NFC, it was noted that ULC/ORD-C410A-94 was

- withdrawn in 2018, and
- no longer used in practice.

Therefore, it was agreed to delete the reference to the withdrawn ORD from the NFC to eliminate potential confusion for Code users.

The ORD was not a consensus-based standard but a document produced as an interim solution until a standard could be developed. ULC withdrew the document because the industry was not asking for certification of products covered by this document, and there was no demand to develop it into a standard. In the absence of the ORD's guidance, Code users would rely on the manufacturer's guidance or on best engineering practice to deal with spilled or leaked flammable or combustible liquids.

EXISTING PROVISION

4.1.6.3. Spills and Leaks

1) Maintenance and operating procedures shall be established to prevent the escape of *flammable liquids* or *combustible liquids* to areas where they could create a fire or explosion hazard.

2) Except as provided in Sentence (3), all reasonable steps shall be taken to recover escaped liquid and to remove or treat contaminated soil.

3) Spilled or leaked *flammable liquids* or *combustible liquids* shall be
  a) flushed to a location where they will not create a fire or explosion hazard, or any risk to public health or safety, or
  b) neutralized or absorbed and cleaned up with the aid of a product that is compatible and non-reactive with the liquid being cleaned up (see Note A-4.1.6.3.(3)(b)), and
    i) deposited in a receptacle conforming to Article 2.4.1.3., or
    ii) disposed of in a manner that does not create a fire or explosion hazard.

Note A-4.1.6.3.(3)(b)

Information on the compatibility and reactivity of liquids can be found in the Safety Data Sheets for each liquid.

An absorbent material conforming to ULC/ORD-C410A, "Absorbents for Flammable and Combustible Liquids", is acceptable.

PROPOSED CHANGE

[4.1.6.3.] 4.1.6.3. Spills and Leaks

Note A-4.1.6.3.(3)(b)

Information on the compatibility and reactivity of liquids can be found in the Safety Data Sheets for each liquid.

~~An absorbent material conforming to ULC/ORD-C410A, "Absorbents for Flammable and Combustible Liquids", is acceptable.~~

Impact analysis

The proposed change has no associated cost implications because there is no document that replaces the withdrawn ORD and Code users can use the manufacturer's guidance or best engineering practice to deal with spilled or leaked flammable or combustible liquids.

This proposed change would eliminate confusion arising from referencing a withdrawn document, which would facilitate the enforcement of the Code requirement.

Enforcement implications

The proposed change could be enforced by the infrastructure currently available to enforce the Code. Since the withdrawn ORD is not used by the industry, the proposed change would reduce the potential for confusion or misinterpretation for the agencies that enforce the Code requirement.

Who is affected

Builders, consumers, manufacturers, regulators and designers.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[4.1.6.3.] 4.1.6.3. ([1] 1) [F82,F44-OS1.1,OS1.2]

[4.1.6.3.] 4.1.6.3. ([1] 1) [F82,F44-OP1.1,OP1.2]

[4.1.6.3.] 4.1.6.3. ([2] 2) [F44-OP1.1,OP1.2]

[4.1.6.3.] 4.1.6.3. ([2] 2) [F44-OS1.1,OS1.2]

[4.1.6.3.] 4.1.6.3. ([2] 2) [F44-OH5]

[4.1.6.3.] 4.1.6.3. ([3] 3) ([a] a) [F01,F02-OS1.1] ([b] b) [F02-OS1.1,OS1.2]

[4.1.6.3.] 4.1.6.3. ([3] 3) ([a] a) [F44-OP1.1,OP1.2] ([b] b) [F02-OP1.1,OP1.2]

Submit a comment

Proposed Change 1914

Code Reference(s):	**NFC20 Div.B 5.5.5.1. (first printing)**
Subject:	Dangerous Goods — Laboratories
Title:	Maximum Quantities of Dangerous Goods Kept in Laboratories
Description:	This proposed change revises Article 5.5.5.1. to require that quantities of all classes of dangerous goods, including compressed gases, be minimized and to provide the maximum quantities permitted for use in laboratories.

This change could potentially affect the following topic areas:

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

Problem

The storage of dangerous goods classified as flammable liquids, combustible liquids and compressed gases is permitted within a fire compartment in accordance with Subsections 3.2.8. and 3.2.9. of the National Fire Code of Canada (NFC) 2020. Article 5.5.5.1. provides the maximum quantities of dangerous goods classified as flammable liquids and combustible liquids for use and storage in laboratories; however, Article 5.5.5.1. does not cover compressed gases by specifying the maximum quantities.

Small quantities of compressed gases that fall below the maximum quantities stated in Table 3.2.7.1. are exempted from the requirements of Subsection 3.2.7. Subsection 3.2.8. applies to the indoor storage of dangerous goods classified as flammable, toxic and oxidizing gases. However, the requirements in Articles 3.2.8.2. and 3.2.8.3. may be overly onerous or impractical for a laboratory in terms of the limitations on the quantities of compressed gases, construction of the storage room, and storage of other materials. These requirements could lead to unnecessary construction costs and operation difficulties for laboratories. As such, there is a need to permit the storage of small quantities of compressed gases in laboratories.

There is a distinction between the permitted quantities of "in use" dangerous goods and "for use" dangerous goods, and both are distinct from stored dangerous goods. The quantity of compressed gases considered to be "in use" is not currently regulated since compressed gases in cylinders that are connected to equipment are not included in the calculation of the in-storage volume since they are classified as "in use". But the hazards associated with the presence of cylinders of dangerous goods classified as compressed gases in laboratories that are used for experiments, measurement, etc. are equivalent to the hazards associated with them in storage. Moreover, in a laboratory setting, the presence of "in use" compressed gases in cylinders may be increased in various research fields, e.g., microbiology, which requires an increased number of cylinders for use in labs with microbiological incubators.

Sentence 5.5.5.1.(1), supported by its explanatory Note, currently sets the limit on the quantities of dangerous goods, excluding compressed gases, that are actually "in use" during normal operations. Regardless, the quantities of dangerous goods in a laboratory should be limited in accordance with Table 3.2.7.1. whether or not the dangerous goods are "in use" during normal operations.

In addition, the existing NFC requirements may unintentionally permit increased quantities of "for use" (i.e., quantities "in use" and quantities kept outside of storage areas) dangerous goods in a laboratory by not limiting the quantities of these goods that are stored and kept in the laboratory on a non-permanent basis and that are not connected to equipment. Limiting these quantities is one of the main reasons why this proposed change introduces requirements on "for use" dangerous goods.

Therefore, this proposed change limits the maximum quantities of dangerous goods, including compressed gases, used in laboratories and refers Code users to Parts 3 and 4 for the storage requirements for dangerous goods.

Justification

The quantities of dangerous goods classified as compressed gases in a laboratory within a fire compartment that are either "for use" (inclusive of the quantity of "in use" dangerous goods) or stored for future use present the same hazard to people and the building in a fire emergency, upon accidental release of the gases into the atmosphere. When a cylinder of compressed gases is exposed to flame, the hazard associated with the expansion of the gas inside the cylinder is identical whether the cylinder is for use, in use or stored. Therefore, in laboratories, it is necessary to limit the quantities of compressed gases that are not in storage to reduce the fire and explosion risk to the building and occupants.

In 2009, there was a fire in the zoology building at the University of Manitoba which resulted in millions of dollars in damages. The fire occurred in a building that stored about 250 different types of chemicals. Toxic fumes from the fire resulted in the evacuation of other parts of the campus not directly affected by the fire and deterred firefighters and hazardous materials personnel from approaching the site for an extended period time, which allowed the fire to spread beyond the laboratories.

It is understood that some quantities of dangerous goods are required to ensure the normal operation of the various experiments in laboratories; however, the vast majority of cylinders of dangerous goods classified as compressed gases found in laboratories pose a serious threat to the safety of people, first responders and to the building.

In addition to the exemptions for small quantities of dangerous goods previously mentioned in Part 3, Part 4 also permits small quantities of these goods classified as flammable liquids and combustible liquids to be located outside of a cabinet or storage room in certain situations. These exemptions are provided on the basis that they do not pose a significant hazard to persons, buildings or facilities and should also apply to the quantities of dangerous goods used in laboratories.

In other words, the quantities of dangerous goods that are in use must not exceed the small quantities exempted from the storage requirements in Parts 3 and 4 to help avoid situations where a large quantity of these dangerous goods still presents a high risk.

To address these concerns, Sentence 5.5.5.1.(1)-2025 provides restrictions on the permitted quantities of "for use" dangerous goods in a laboratory. The concept of "for use" dangerous goods is introduced to refer to the limited quantities of dangerous goods that exist in a laboratory, whether they are connected (i.e., "in use") or intended to be connected to equipment (i.e., kept outside of storage areas) during normal operations. Explanatory Note A-5.5.5.1.-2025 further clarifies the meaning of "for use" and "in use".

Since small quantities of dangerous goods that are frequently needed are permitted to be kept in the laboratory, the quantities of "for use" dangerous goods are typically greater than those of "in use" dangerous goods. The quantities of "for use" dangerous goods in a laboratory should be minimized. They should not exceed the quantities allowed in a single fire compartment that are exempted from the requirements for designated storage areas and cabinets as stated in Parts 3 and 4, on the basis that they present at least the same level of risk whether they are stored or connected to equipment, i.e., "in use" during normal operations. The intent of Clause 5.5.5.1.(1)(b) is to remind Code users that the storage of large quantities of dangerous goods needs to comply with the storage requirements in Parts 3 and 4 outside of the laboratory.

Sentence 5.5.5.1.(2)-2025 provides the maximum quantities of dangerous goods classified as flammable liquids and combustible liquids permitted for use in laboratories. The importance of locating the limited quantities of dangerous goods specifically in the basement of a laboratory, i.e., one or more storeys below the first storey of the laboratory's building, is based on the fact that vapours from dangerous goods classified as flammable liquids and combustible liquids are typically heavier than air and dedicated ventilation on the floor level, or natural ventilation to open air, may be expected to be less effective in a basement.

For the purpose of this Section, a "laboratory" is defined as a room or facility where dangerous goods are used, stored for use or handled for experimental purposes; however, the definition does not distinguish between laboratories in educational, hospital or industrial settings.

Clause 5.5.5.1.(1)(b)-2025 is only applicable to Group A, Division 2 educational occupancies or Group D major occupancies, but not Group B occupancies. The fire hazard associated with laboratories is relatively the same in all occupancies; however, the personal safety hazard is greater in Group B major occupancies. Group B occupancies include Division 1 detention occupancies, Division 2 treatment occupancies, and Division 3 care occupancies.

Therefore, the quantities of dangerous goods in a Group B major occupancy are determined in accordance with Sentence 4.2.6.3.(1), which allows lesser quantities than the revised Clause 5.5.5.1.(2)(b) applying to Group A, Division 2 or a Group D occupancies.

Sentence 5.5.5.1.(1)-2025 is intended to clarify that the specific requirements of Section 5.5. override those of Parts 3 and 4 in case of conflict and to direct Code users to Parts 3 and 4 for requirements for the storage of dangerous goods outside laboratories. This new Sentence would mean that dangerous goods used in areas other than laboratories are required to comply with other NFC requirements and that, where the Section is silent, other NFC requirements are applicable to laboratories. For example, Class 1 flammable liquids are limited to 10 L in a basement in accordance with Sentence 4.1.5.8.(1).

Sentence 5.5.5.1.(3)-2025 provides the maximum quantities of dangerous goods classified as compressed gases permitted for use in laboratories, similar to the requirements for dangerous goods classified as flammable liquids and combustible liquids. To establish the maximum quantities, the limits listed in Table 6.3.1.1. of the NFPA 55-2020, “Compressed Gases and Cryogenic Fluids Code,” were considered and converted into metric units (m^3) from imperial units ($ft.^3$).

The maximum allowable quantity of hazardous materials per control area is specified in Table 6.3.1.1 of NFPA 55. See Table 1 for a comparison of maximum quantities proposed for the NFC and in NFPA 55.

Table 1. Maximum Quantities of Hazardous Materials

Type of Hazardous Material	NFC		NFPA 55
	Sentence 5.5.5.1.(4)-2025		Table 6.3.1.1
	Sprinklered m^3 ($ft.^3$)	Unsprinklered m^3 ($ft.^3$)	m^3 ($ft.^3$)(1)
Flammable gas	56 (1 978)	28 (938)	approximately 28 m^3 (1 000)
Oxidizing gas	85 (3 000)	43 (1 519)	approximately 43 m^3 (1 500)
Toxic gas	46 (1 623)	23 (812)	approximately 23 m^3 (810)

Note to Table 1:

(1) Values in lb. were converted to $ft.^3$ using the following equation: Volume of total gas in $ft.^3$ = (lb. gas)×[379.3(ideal gas law conversion factor) $ft.^3$/lb.−mole] ÷ (molecular weight of gas in lb./lb.−mole). The quantity limit in Table 6.3.1.1 of NFPA 55 is at 50% reduced capacity. The limit is permitted to be 100% when automatic sprinklers are installed in accordance with NFPA 13, "Standard for the Installation of Sprinkler Systems," which is consistent with the conditions stated in the NFC.

This proposed change restricts the quantities permitted in buildings depending on whether a sprinkler system is provided. The quantities permitted for the Group A, Division 2 educational occupancy and Group B major occupancies are reduced by 50%. This practice is generally consistent with the NFPA 55 limits for low hazard laboratories.

Sentence 5.5.5.1.(4)-2025 clarifies that the quantities in the piping system do not need to be counted towards the maximum quantities specified in Sentences (2) and (3)-2025. The piping system that supplies dangerous goods from an external source (such as a storage tank) to the laboratory is typically equipped with a remote device to control the shut-off valve. Articles 4.5.7.2. and 4.5.9.4. provide shut-off requirements for dangerous goods classified as flammable liquids and combustible liquids.
Clause 5.5.5.3.(3)(b) requires that each point of supply and use of cylinders or piping systems for dangerous goods classified as compressed gases be provided with a manual shut-off valve. As such, the amount contained in the piping systems is exempted when maximum allowable quantities are calculated.

This proposed change would help avoid situations where large quantities of dangerous goods exist (either stored or used) in laboratories. It would permit a maximum quantity of dangerous goods for use inside laboratories based on the types of materials, location, occupancy and existence of a sprinkler system.

EXISTING PROVISION

5.5.5.1. Maximum Quantities

1) The quantity of *dangerous goods* kept in a laboratory shall be minimized and shall not exceed the lesser of
  a) the supply necessary for normal operation, or
  b) when located in
    i) a Group A, Division 2 educational or a Group D *major occupancy*, 300 L of *flammable liquids* and *combustible liquids*, of which not more than 50 L shall be Class I liquids, or
    ii) a Group B *major occupancy*, the quantities of *flammable liquids* and *combustible liquids* permitted in Sentence 4.2.6.3.(1).

(See Note A-5.5.5.1.(1).)

2) Quantities of *flammable liquids* and *combustible liquids* in excess of those permitted in Sentence (1) shall be stored in
  a) cabinets conforming to Subsection 4.2.10. except that, in laboratories described in Clause (1)(b), the total quantity of *flammable liquids* and *combustible liquids* stored in such cabinets shall not exceed the quantity permitted for one cabinet, or
  b) a room conforming to Subsection 4.2.9.

3) Quantities of *dangerous goods* other than *flammable liquids* and *combustible liquids* in excess of those permitted in Sentence (1) shall be stored outside of the laboratory in conformance with Part 3.

Note A-5.5.5.1.(1)

The intent of Sentence 5.5.5.1.(1) is to limit the quantities of dangerous goods that are

a. stored outside of storage areas and cabinets referred to in Sentences 5.5.5.1.(2) and (3),
b. kept in the laboratory on a permanent or semi-permanent basis, e.g. dangerous goods that are normally kept out overnight because they are frequently needed, and
c. connected to equipment and/or devices required to conduct an experiment in the laboratory.

The intent is also to limit the quantities of dangerous goods that are actually “in use” during normal operations and those used for special experiments or processes, which may require that greater quantities be brought into the laboratory for the duration of these operations.

However, the quantities of dangerous goods in a laboratory should be limited to the quantities allowed in a single fire compartment as stated in Part 3, on the basis that they present at least the same level of risk whether they are stored or connected to equipment, i.e. “in use” during normal operations.

PROPOSED CHANGE

[5.5.5.1.] 5.5.5.1. Maximum Quantities

(See Note A-5.5.5.1.)

[1] --) Except as provided in Sentences (2) and (3)-2025, the quantities of *dangerous goods* available for use in a laboratory shall be kept to a minimum and shall

[a] --) not exceed the quantities necessary for normal operations, and

[b] --) be stored outside the laboratory in conformance with Part 3 or 4.

[2] 1) The quantit~~y~~ies of *dangerous goods* classified as *flammable liquids* or *combustible liquids*~~kept~~ available for use in a laboratory shall be ~~minimized~~kept to a minimum and shall not exceed ~~the lesser of~~

[a] a) when located in a *basement*, the ~~supply necessary for normal operation~~quantities permitted in Part 4, or

[b] b) when located in a Group A, Division 2 educational or Group D *major occupancy* not in a *basement*, 300 L of which not more than 50 L shall be Class I liquids.

[i] i) ~~a Group A, Division 2 educational or a Group D *major occupancy*, 300 L of *flammable liquids* and *combustible liquids*, of which not more than 50 L shall be Class I liquids, or~~

[ii] ii) ~~a Group B *major occupancy*, the quantities of *flammable liquids* and *combustible liquids* permitted in Sentence 4.2.6.3.(1).~~

~~(See Note A-5.5.5.1.(1).)~~

[3] --) The quantities of *dangerous goods* classified as compressed gases that are kept in the open area of a laboratory in a *building* containing any *major occupancy* other than an *industrial occupancy* shall not exceed

[a] --) in a *sprinklered building*,
  [i] --) 56 m^3 of *dangerous goods* classified as flammable gases,
  [ii] --) 85 m^3 of *dangerous goods* classified as oxidizing gases, or
  [iii] --) 46 m^3 of *dangerous goods* classified as toxic gases,
[b] --) in a *building* that is not *sprinklered*,
  [i] --) 28 m^3 of *dangerous goods* classified as flammable gases,
  [ii] --) 43 m^3 of *dangerous goods* classified as oxidizing gases, or
  [iii] --) 23 m^3 of *dangerous goods* classified as toxic gases, or
[c] --) in a *building* containing a Group A, Division 2 educational or Group B *major occupancy*, 50% of the quantities stated in Clauses (a) and (b).

(See Note A-3.2.8.2.(2).)

[4] --) The quantities of *dangerous goods* permitted by Sentences (1) to (3)-2025 do not include the quantities of *dangerous goods* contained in piping systems conveying the *dangerous goods* from an external source to the laboratory.

~~**[5] 2)**~~ ~~Quantities of *flammable liquids* and *combustible liquids* in excess of those permitted in Sentence (1) shall be stored in~~

[a] a) ~~cabinets conforming to Subsection 4.2.10. except that, in laboratories described in Clause (1)(b), the total quantity of *flammable liquids* and *combustible liquids* stored in such cabinets shall not exceed the quantity permitted for one cabinet, or~~
[b] b) ~~a room conforming to Subsection 4.2.9.~~

~~**[6] 3)**~~ ~~Quantities of *dangerous goods* other than *flammable liquids* and *combustible liquids* in excess of those permitted in Sentence (1) shall be stored outside of the laboratory in conformance with Part 3.~~

Note A-5.5.5.1.~~(1)~~

~~The intent of Sentence 5.5.5.1.(1)~~Article 5.5.5.1.~~is to~~ limits the quantities of dangerous goods classified as flammable liquids, combustible liquids or compressed gases that are available for use in a laboratory, including quantities that are

- stored outside of storage areas and cabinets ~~referred to in Sentences 5.5.5.1.(2) and (3)~~,
- kept in the laboratory on a permanent or semi-permanent basis~~,~~ (e.g. dangerous goods that are normally kept out overnight because they are frequently needed), and
- connected, or intended to be connected, to equipment ~~and/~~or devices required to conduct an experiment in the laboratory.

The ~~intent is also to~~ limits stated in Article 5.5.5.1. include the quantities of dangerous goods that are actually ~~“~~in use~~”~~ during normal operations and ~~those~~ the quantities used during~~for~~ special experiments or processes, which may require that greater quantities be brought into the laboratory for the duration of these operations.

Small quantities of dangerous goods may be stored in a laboratory because they are frequently needed. As such, the quantities of dangerous goods available for use in a laboratory are typically greater than the quantities actually in use. However, the quantities of dangerous goods available for use ~~in a laboratory~~ should be minimized. ~~limited to~~ They should not exceed the quantities ~~allowed~~ in a single fire compartment that are exempted from the requirements for storage in designated areas or cabinets as stated in Parts 3 and 4, on the basis that they present at least the same level of risk whether they are stored or connected to equipment~~,~~ (i.e. ~~“~~in use~~”~~ during normal operations).

Impact analysis

There are many different types of indoor and outdoor storage cabinets that are commercially available and compliant with the Code requirements. Some additional cost is expected if installation of additional storage cabinets is necessary, whether the cabinets are located indoors or outdoors, in order to limit the quantities of dangerous goods in laboratories. The overall cost of the installation of storage cabinets differs greatly according to their specifications (hazardous material class, indoor or outdoor, capacity, presence of fume hood, etc.) and ranges between $300 and over $40,000.

It is also expected that such costs can be minimized by implementing better storage practices of the quantities of dangerous goods in laboratories and allocating a dedicated storage room. The storage of dangerous goods should already comply with the current Code requirements in Parts 3 and 4, so no additional cost is anticipated. Instead of storing excess amounts of dangerous goods, more frequent scheduled delivery of goods would minimize the risks associated with storing such goods without having a negative impact on the scheduled experimental work.

Providing maximum allowable quantities for occupancies including educational and Group B major occupancies would minimize the serious threat to the safety of people and first responders, and to the building.

Enforcement implications

This proposed change regarding dangerous goods classified as compressed gases is consistent with the requirements of NFPA 55, which facilitates the enforcement the Code requirements by the industry and authorities having jurisdiction.

This proposed change is intended to provide descriptive information on maximum quantities of dangerous goods allowed in a laboratory, which should aid in the understanding and enforcement of the Code.

Who is affected

Designers, building officials, fire services, building operations personnel and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[5.5.5.1.] -- ([1] --) (a) [F02-OS1.2]

[5.5.5.1.] -- ([1] --) (a) [F02-OP1.2]

[5.5.5.1.] -- ([1] --) (b)

[5.5.5.1.] 5.5.5.1. ([2] 1) ([a] a)

[5.5.5.1.] 5.5.5.1. ([2] 1) ([b] b) [F02-OS1.2]

[5.5.5.1.] 5.5.5.1. ([2] 1) ([b] b) [F02-OP1.2]

[5.5.5.1.] -- ([3] --) [F02-OS1.2]

[5.5.5.1.] -- ([3] --) [F02-OP1.2]

[5.5.5.1.] -- ([4] --) no attributions

~~[5.5.5.1.] 5.5.5.1. ([5] 2) ([a] a),([b] b)~~

~~[5.5.5.1.] 5.5.5.1. ([5] 2) ([a] a)~~

~~[5.5.5.1.] 5.5.5.1. ([6] 3) [F02-OS1.2]~~

~~[5.5.5.1.] 5.5.5.1. ([6] 3) [F02-OP1.2]~~

~~[5.5.5.1.] 5.5.5.1. ([6] 3) no attributions~~

Submit a comment

Proposed Change 1690

Code Reference(s):	**NPC20 Div.A 1.4.1.2. (first printing)**
Subject:	Defined Terms
Title:	Condensate Drainage
Description:	The proposed change introduces the defined term "condensate drainage system" in the NPC and revises the definitions of the terms "clear-water waste" and "drainage system" to address condensate drainage.
Related Proposed Change(s):	PCF 1692, PCF 1959, PCF 2014

This change could potentially affect the following topic areas:

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

Problem

"Condensate drainage system" is not a defined term in the National Plumbing Code of Canada (NPC) 2020. "Clear-water waste" and "drainage system" are defined terms, but their definitions need revision to provide more clarity about their application related to condensate drainage.

The NPC dictates the connection methods for the part of the pipe or tube connecting the condensation drain pan to a building's plumbing drainage system. However, as heat recovery ventilators and evaporators include such pipes and tubes, it may be assumed that the pipe or tube is not part of a plumbing installation, but rather is part of a heating, ventilation and air-conditioning (HVAC) installation.

The definitions related to condensate drainage in the NPC need to be revised to ensure that the installation of these pipes and tubes is regulated and, therefore, always carried out according to best practices. Otherwise, problems of leaks, odours, blockages and mould may occur.

Improper installation can also contribute to the spread of fire or the release of smoke, where the Code user has not complied with regulations governing the non-combustibility of building components. Improper installation affects the health of occupants as well as the building structure.

Justification

Including the definition of “condensate drainage system” in the NPC would facilitate the inclusion of these systems within the scope of a plumbing system and support subsequent Code changes to incorporate prescriptive requirements for condensate drains.

This proposed change provides clarity to Code users by providing guidance on how to approach condensation evacuation. This proposed change would also ensure that the installation is completed correctly by the necessary tradespersons (plumbers) and that the minimum requirements for materials, slopes, diameters, and protection against odours for tubing would be easily identifiable and appropriate for the location of the installation.

PROPOSED CHANGE

[1.4.1.2.] 1.4.1.2. Defined Terms

[1] **1)** The words and terms in italics in this Code shall have the following meanings (an asterisk (*) following a defined word or term indicates that the definition for that word or term is taken from the NBC):

Clear-water waste means waste water with impurity levels that will not be harmful to health and may include cooling water or~~and~~ condensate drainage from heating (including neutralized condensate from a combustion process), refrigeration and air-conditioning equipment and cooled condensate from steam heating systems, but does not include *storm water*. (See Note A-1.4.1.2.(1).)

Condensate drainage system means a *drainage system* that conducts condensate.

Drainage system means an assembly of pipes, fittings, *fixtures*, *traps* and appurtenances that is used to convey *sewage*, *clear-water waste* or *storm water* to a public sewer or a *private sewage disposal system* or a *condensate drainage system*, but does not include *subsoil drainage pipes*. (See Figure A-1.4.1.2.(1)-F in Note A-1.4.1.2.(1).)

Impact analysis

This proposed change has been identified as low impact since condensate drains are currently required to be installed as part of plumbing systems; this proposed definition is intended to clarify application.

Evacuating condensation is necessary, the cost and impact of doing so incorrectly may sometimes be the same as or more than that of a correctly installed system. Therefore, there is no cost impact as this proposed change ensures that the minimum requirements are clearly defined in order to be met.

Correct installation may even cost less than having to address future issues caused by incorrect insulation.

Enforcement implications

This proposed change should assist in the clarification of scope for plumbing drainage systems.

Additional training or resources required for enforcement officials (authorities having jurisdiction) are not expected as a result of the proposed change.

Who is affected

Designers, installers, suppliers, regulators and owners.

Submit a comment

Proposed Change 1707

Code Reference(s):	**NPC20 Div.A 1.4.1.2. (first printing)**
Subject:	Defined Terms
Title:	Macerating Toilet System
Description:	This proposed change introduces a definition for “macerating toilet system" in the NPC.
Related Proposed Change(s):	PCF 1706

This change could potentially affect the following topic areas:

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

Problem

The following terms may create confusion when used in the context of the National Model Codes: “toilet,” “water closet” (or “WC”), “washroom,” “rest room,” and “bathroom.” Also, these terms may appear at times to have the same meaning. Although these terms are used in common language, the intended meanings as used in the Codes may differ.

For clarity, a definition for the term “macerating toilet system” should be added to differentiate it from the term "toilet," which in the Codes should never appear alone. In the National Plumbing Code of Canada (NPC), the term “macerating toilet system” is currently not defined, which creates enforcement challenges for authorities having jurisdiction.

Justification

Defining the term “macerating toilet system” in the NPC is required to provide clarity and consistency for Code users and facilitate enforcement for authorities having jurisdiction.

This proposed change adds a definition that is consistent with industry standards, e.g., ASME A112.3.4/CSA B45.9, "Macerating Toilet Systems and Waste-Pumping Systems for Plumbing Fixtures," and the 2024 edition of the IAPMO “Uniform Plumbing Code.”

PROPOSED CHANGE

[1.4.1.2.] 1.4.1.2. Defined Terms

[1] 1) The words and terms in italics in this Code shall have the following meanings (an asterisk (*) following a defined word or term indicates that the definition for that word or term is taken from the NBC):

Macerating toilet system means a system comprised of a sump with a macerating pump and with connections for a water closet and other plumbing *fixtures*, which is designed to accept, grind and pump waste to a *sanitary drainage system.*

Impact analysis

No negative impacts are expected as a result of this proposed change as the term already appears in the NPC.

This proposed change would reduce confusion regarding the appropriate definition of macerating toilet systems.

Enforcement implications

By adding the definition, this proposed change would provide clarity and consistency for Code users and facilitate enforcement for authorities having jurisdiction.

Who is affected

Building and plumbing officials, building owners and designers of commercial buildings.

Submit a comment

Proposed Change 992

Code Reference(s):	**NPC20 Div.B 2.2.2. (first printing)**
Subject:	Materials and Equipment
Title:	Standard for Wall Carriers for Water Closets
Description:	This proposed change introduces a reference to a standard for wall carriers for water closets.
Related Code Change Request(s):	CCR 976

This change could potentially affect the following topic areas:

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

Problem

The National Plumbing Code of Canada (NPC) does not reference standards or provide specifications for wall carriers for water closets. As a result, it is unclear which wall carriers should be installed, where permitted.

The Code needs to reference a standard for wall carriers to ensure their proper selection and installation. Failure of non-compliant fixtures could lead to unsanitary conditions and harm to persons.

Justification

This proposed change includes a reference to ASME A112.6.1M-1997, “Floor-Affixed Supports for Off-The-Floor Plumbing Fixtures for Public Use,” a new standard for the performance of wall carriers for water closets. This requirement would address a gap in the NPC and prevent the installation of improper supports for water closets. Ensuring compliance with this standard is crucial to guarantee that the wall carriers installed meet the specified requirements mandated for their performance. This proposed change is intended to mitigate the risk of failure resulting from non-compliant fixtures, which could otherwise lead to unsanitary conditions and harm to persons.

PROPOSED CHANGE

NPC20 Div.B 2.2.2. (first printing)

[2.2.2.] 2.2.2. Fixtures

[2.2.2.1.] 2.2.2.1. Surface Requirements

[2.2.2.2.] 2.2.2.2. Conformance to Standards

[2.2.2.3.] 2.2.2.3. Showers

[2.2.2.4.] 2.2.2.4. Concealed Overflows

[2.2.2.5.] 2.2.2.5. Water Closets in Public Washrooms

[2.2.2.6.] --- Wall Carriers for Water Closets

[1] --) Where the wall carrier referred to in Sentence 2.3.3.8.(5) is attached to the floor, the wall carrier shall conform to ASME A112.6.1.M-1997, “Floor-Affixed Supports for Off-The-Floor Plumbing Fixtures for Public Use.”

Impact analysis

This proposed change mandates the installation of certified wall carriers for water closets. The proposed change will result in an increase in manufacturer testing and certification of products.

Although wall carriers for water closets have been in use for many years, some of these fixtures lacked certification and failed to meet the required standard. Opting to use certified products ensures consistent construction and proper sanitary practices and promotes safer usage of the fixture by the public.

Enforcement implications

No adverse enforcement implications are anticipated.

This proposed change clarifies the NPC requirements regarding the installation of wall carriers for water closets, fixtures that have been in use for many years.

Who is affected

Authorities having jurisdiction and Code users.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

NPC20 Div.B 2.2.2. (first printing)

[2.2.2.1.] **2.2.2.1. ([1] 1) [F41-OH2.4]**

[2.2.2.2.] **2.2.2.2. ([1] 1) [F80-OH2.1,OH2.4]**

[2.2.2.2.] **2.2.2.2. ([1] 1) [F80-OS3.1,OS3.2]**

[2.2.2.3.] **2.2.2.3. ([1] 1) [F80-OH2.1]**

[2.2.2.3.] **2.2.2.3. ([1] 1) [F80-OP5]**

[2.2.2.3.] **2.2.2.3. ([2] 2) [F80-OH2.1]**

[2.2.2.3.] **2.2.2.3. ([2] 2) [F40-OP5]**

[2.2.2.3.] **2.2.2.3. ([3] 3) [F45-OH2.1]**

[2.2.2.3.] **2.2.2.3. ([4] 4) [F45-OH2.1]**

[2.2.2.3.] **2.2.2.3. ([4] 4) no attributions**

[2.2.2.4.] **2.2.2.4. ([1] 1) [F41,F81-OH2.1,OH2.4]**

[2.2.2.5.] **2.2.2.5. ([1] 1) [F30-OH2.1,OH2.4]**

[2.2.2.6.] -- ([1] --) [F30-OH2.1,OH2.4]

[2.2.2.6.] -- ([1] --) [F80-OS3.1]

Submit a comment

Proposed Change 1692

Code Reference(s):	**NPC20 Div.B 2.2.5. (first printing)** **NPC20 Div.B 2.4.1.1. (first printing)** **NPC20 Div.B 2.4.2.1. (first printing)** **NPC20 Div.B 2.4.2.3. (first printing)** **NPC20 Div.B 2.4.3. (first printing)** **NPC20 Div.B 2.4.5. (first printing)** **NPC20 Div.B 2.4.9. (first printing)**
Subject:	Drainage Systems
Title:	Small Diameter Piping in Condensate Drainage Systems
Description:	This proposed change introduces requirements for condensate drainage systems that serve heating, ventilating and air-conditioning systems.
Related Proposed Change(s):	PCF 1690, PCF 1959, PCF 2014

This change could potentially affect the following topic areas:

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

Problem

The National Plumbing Code of Canada (NPC) 2020 does not currently permit small-diameter piping with drain-waste-vent ratings for the drainage of condensate systems. As a result, Code users are not permitted to use piping of less than nominal pipe size (NPS) 1-1/4, except as a connection to a macerating toilet system. This situation also leads to the issue of not being able to follow the manufacturer’s instructions, which usually state that the evacuation tube or pipe should be NPS 1/2 or NPS 3/4.

This problem may lead to faulty installation, leading to leaks, mould, odours and the blocking or clogging of the evacuation pipe. All of these issues can cause harm to persons, unsanitary conditions, and the deterioration of property. This situation may also potentially lead to an increase in the amount of insurance claims submitted, especially in the case of mould.

Justification

This proposed change would allow existing piping and common practice for small-diameter condensate drainage systems to comply with the NPC. Code users would be able to refer to Code requirements for use of smaller diameter tubes or pipes.

The proposed change provides clarity on how to approach condensation, building size and occupancy in multi- or single-appliance systems.

The probability of faulty leaks, mould, odours and blocking would be reduced, thus also reducing the risk of harm to persons or property.

PROPOSED CHANGE

[2.2.5.] 2.2.5. Non-Metallic Pipe and Fittings

(For a summary of pipe applications, see Note A-2.2.5. to 2.2.8.)

[2.2.5.1.] 2.2.5.1. Fibrocement Pipe and Fittings

[2.2.5.2.] 2.2.5.2. Concrete Pipe and Fittings

[2.2.5.3.] 2.2.5.3. Vitrified Clay Pipe and Fittings

[2.2.5.4.] 2.2.5.4. Polyethylene Pipe and Fittings

[2.2.5.5.] 2.2.5.5. Polyethylene Pipe Used Underground

[2.2.5.6.] 2.2.5.6. Crosslinked Polyethylene Pipe and Fittings

[2.2.5.7.] 2.2.5.7. PVC Pipe and Fittings

[2.2.5.8.] 2.2.5.8. CPVC Pipe, Fittings and Solvent Cements

[2.2.5.9.] 2.2.5.9. Plastic Pipe, Fittings and Solvent Cement Used Underground

[2.2.5.10.] 2.2.5.10. Transition Solvent Cement

[2.2.5.11.] 2.2.5.11. Plastic Pipe, Fittings and Solvent Cement Used in Buildings

[2.2.5.12.] 2.2.5.12. Polyethylene/Aluminum/Polyethylene Composite Pipe and Fittings

[2.2.5.13.] 2.2.5.13. Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene Composite Pressure Pipe and Fittings

[2.2.5.14.] 2.2.5.14. Polypropylene Pipe and Fittings

[2.2.5.15.] 2.2.5.15. Polyethylene of Raised Temperature Tube and Fittings

[2.2.5.16.] 2.2.5.16. Cellular Core PVC Pipe and Fittings

Note A-2.2.5. to 2.2.8. Pipe and Fitting Applications.

Table [2.2.5. to 2.2.8.] A-2.2.5. to 2.2.8.
Summary of Pipe and Fitting Applications

NPC References	Types of Piping and Fittings	Standard References	Use of Piping and Fittings (1) (2)								
			Drainage System			Venting System		Potable Water System			
			Above-ground inside building	Under-ground under building	Building sewer	Above-ground	Under-ground	Aboveground		Underground	
								Cold	Hot	Under building	Outside building
2.2.5.1.(1)	Fibrocement DWV pipe										
	Type 1, Class 3000 Type 2, Class 4000	CAN/CSA-B127.3	P	P	P	P	P	N	N	N	N
2.2.5.2.	Concrete sewer pipe										
	Sewer, storm drain and culvert	CSA A257.1	N	P (3)	P	N	N	N	N	N	N
	Reinforced culvert, storm drain and sewer	CSA A257.2	N	P (3)	P	N	N	N	N	N	N
2.2.5.3.	Vitrified clay pipe	CSA A60.1-M	N	P	P	N	P	N	N	N	N
2.2.5.4.	PE water pipe and tubing										

NPC References	Types of Piping and Fittings	Standard References	Use of Piping and Fittings (1) (2)								
			Drainage System			Venting System		Potable Water System			
			Above-ground inside building	Under-ground under building	Building sewer	Above-ground	Under-ground	Aboveground		Underground	
								Cold	Hot	Under building	Outside building
	Series 160 sizes with compression fittings	CSA B137.1	N	N	N	N	N	N	N	P (4)	P (4)
	Series 50, 75, 100 and 125		N	N	N	N	N	N	N	N	N
2.2.5.5.(1)	PE plastic pipe (DR-PR) based on outside diameter	ASTM F714	N	P	P	N	P	N	N	N	N
2.2.5.6.	PEX pressure tubing	CSA B137.5	N(4)	N	N	N	N	P (5) (6)	P (5) (6)	P	P
2.2.5.7.(1)	PVC water pipe										
	Dimension ratios (DR) or standard dimension ratios (SDR) 14, 17, 18, 21, 25 and 26	CSA B137.3	N(4)	N	N	N	N	P (5) (6)	N	P (7)	P (7)

NPC References	Types of Piping and Fittings	Standard References	Use of Piping and Fittings (1) (2)								
			Drainage System			Venting System		Potable Water System			
			Above-ground inside building	Under-ground under building	Building sewer	Above-ground	Under-ground	Aboveground		Underground	
								Cold	Hot	Under building	Outside building
	Schedule 40 in sizes from NPS ½ to NPS 2½ inclusively										
	Schedule 80 in sizes from NPS ½ to NPS 6 inclusively										
2.2.5.7.(2)	PVC fittings										
	Schedule 40	ASTM D2466	N(4)	N	N	N	N	P (5) (6)	N	N	N
	Schedule 80	ASTM D2467	N(4)	N	N	N	N	P (5) (6)	N	P	P
2.2.5.7.(3)	PVC pressure fittings	CSA B137.2	N (8)	N	N	N	N	P (5) (6)	N	P	P
2.2.5.8.	CPVC water pipe	CSA B137.6	N(4)	N	N	N	N	P (5) (6) (9)	P (5) (6) (9)	P (9)	P (9)
2.2.5.9.	ABS Schedule 40 DWV pipe with a cellular core	ASTM F628	P (5) (6)	P	P	P (5) (6)	P	N	N	N	N

NPC References	Types of Piping and Fittings	Standard References	Use of Piping and Fittings (1) (2)								
			Drainage System			Venting System		Potable Water System			
			Above-ground inside building	Under-ground under building	Building sewer	Above-ground	Under-ground	Aboveground		Underground	
								Cold	Hot	Under building	Outside building
	Plastic sewer pipe PS ≥ 320 kPa	CSA B182.1	N	P	P	N	N	N	N	N	N
	PVC sewer pipe (PSM type) ≤ 35-SDR	CSA B182.2	N	P	P	N	P	N	N	N	N
	Profile PVC sewer pipe PS ≥ 320 kPa	CSA B182.4	N	P	P	N	P	N	N	N	N
	Profile PE sewer pipe PS ≥ 320 kPa	CSA B182.6	N	P	P	N	P	N	N	N	N
2.2.5.9. and 2.2.5.10.	ABS DWV pipe	CSA B181.1	P (5) (6)	P	P	P (5) (6)	P	N	N	N	N
	PVC DWV pipe	CSA B181.2	P (5) (6)	P	P	P (5) (6)	P	N	N	N	N
2.2.5.12.	PE/AL/PE pressure pipe	CSA B137.9	N(4)	N	N	N	N	P (5) (6)	N	P	P
2.2.5.13.	PEX/AL/PEX pressure pipe	CSA B137.10	N(4)	N	N	N	N	P (5) (6)	P (5) (6)	P	P
2.2.5.14.	PP-R pressure pipe	CSA B137.11	N(4)	N	N	N	N	P (5) (6)	P (5) (6)	P	P

NPC References	**Types of Piping and Fittings**	**Standard References**	**Use of Piping and Fittings (1) (2)**								
			Drainage System			**Venting System**		**Potable Water System**			
			Above-ground inside building	**Under-ground under building**	**Building sewer**	**Above-ground**	**Under-ground**	**Aboveground**		**Underground**	
								Cold	**Hot**	**Under building**	**Outside building**
2.2.5.15.	PE-RT tube	CSA B137.18	N	N	N	N	N	P (5) (6)	P (5) (6)	P	P
2.2.5.16.	Cellular core PVC pipe	ASTM F3128	P (5) (6) (10)	P (10)	N	P (5) (6) (10)	P (10)	N	N	N	N
2.2.6.1.	Cast-iron soil pipe	CSA B70	P	P	P	P	P	N	N	N	N
2.2.6.4.	Ductile-iron water pipe	ANSI/AWWA C151/A21.51	P	P	P	P	P	P	P	P	P
2.2.6.5.	Screwed cast-iron fittings	ASME B16.4	N	N	N	N	N	P	P	P	P
2.2.6.6.	Screwed malleable-iron fittings	ASME B16.3	N	N	N	N	N	P	P	P	P
2.2.6.7.	Welded and seamless steel galvanized pipe	ASTM A53/A53M	P	N	N	P	N	P (11)	P (11)	P (11)	P (11)
2.2.6.8.	Corrugated steel galvanized pipe	CAN/CSA-G401	N	N	P (12)	N	N	N	N	N	N

NPC References	Types of Piping and Fittings	Standard References	Use of Piping and Fittings (1) (2)								
			Drainage System			Venting System		Potable Water System			
			Above-ground inside building	Under-ground under building	Building sewer	Above-ground	Under-ground	Aboveground		Underground	
								Cold	Hot	Under building	Outside building
2.2.6.9.	Sheet metal pipe (13)	—	N	N	N	N	N	N	N	N	N
2.2.6.10.	Stainless steel pipe	ASTM A312/A312M	P	P	P	P	P	P	P	P	P
2.2.6.14.	Stainless steel tube	ASTM A269/A269M	N(4)	N	N	N	N	P	P	P	P
2.2.7.1.	Copper and brass pipe										
	Copper	ASTM B42	P	P	P	P	P	P	P	P	P
	Red brass	ASTM B43	P	P	P	P	P	P	P	P	P
2.2.7.3.	Brass or bronze threaded water fittings	ASME B16.15	N(4)	N	N	N	N	P	P	P	P
2.2.7.4.	Copper tube										
	Types K and L hard temper	ASTM B88	P	P	P	P	P	P	P	N	N
	Types K and L soft temper		N(4)	N	N	N	N	P	P	P	P
	Type M hard temper		P	N	N	P	N	P	P	N	N

NPC References	**Types of Piping and Fittings**	**Standard References**	**Use of Piping and Fittings (1) (2)**								
			Drainage System			**Venting System**		**Potable Water System**			
			Above-ground inside building	**Under-ground under building**	**Building sewer**	**Above-ground**	**Under-ground**	**Aboveground**		**Underground**	
								Cold	**Hot**	**Under building**	**Outside building**
	Type M soft temper		N(4)	N	N	N	N	N	N	N	N
	Type DWV	ASTM B306,	P (14)	N	N	P (14)	N	N	N	N	N
2.2.7.5.	Solder-joint drainage fittings	ASME B16.23 and ASME B16.29	P	P	P	P	P	N	N	N	N
2.2.7.6.	Solder-joint water fittings	ASME B16.18 and ASME B16.22	N(4)	N	N	P	P	P	P	P	P
2.2.7.8.	Lead sanitary drainage pipe	—	P	P	N	P	P	N	N	N	N
2.2.8.1.	Polyolefin laboratory drainage systems	CSA B181.3	P (5) (6)	P	P	P (5) (6)	P	N	N	N	N

Notes to Table [2.2.5. to 2.2.8.] A-2.2.5. to 2.2.8.:

(1) N = not permitted and P = permitted.

(2) Where firestops are pierced by pipes, the integrity of the firestop must be maintained.

(3) Gasketted joints required.

(4) Permitted only for water service pipe.

(5) Combustible piping in noncombustible construction is subject to the requirements of Sentence 3.1.5.19.(1) of Division B of the NBC.

(6) Combustible piping that penetrates a fire separation is subject to the requirements in Articles 3.1.9.4. and 9.10.9.7. to 9.10.9.9. of Division B of the NBC.

(7) Not permitted in hot water systems.

(8) Permitted for piping in *condensate drainage systems* and *macerating toilet systems* less than *NPS* 1¼.

(9) Not to exceed design temperature and design pressure stated in Sentence 2.2.5.8.(2).

(10) Permitted only in residential buildings containing 1 or 2 dwelling units and row houses that do not exceed 3 storeys in height.

(11) Permitted only in buildings of industrial occupancy as described in the NBC, or for the repair of existing galvanized steel piping systems.

(12) Permitted underground only in a storm drainage system.

(13) Permitted only for an external leader.

(14) Not permitted for the fixture drain or vent below the flood level rim of a flush-valve-operated urinal.

[2.4.1.1.] 2.4.1.1. General

[1] **1)** This Section applies to *sanitary drainage systems*, *storm drainage systems*, *condensate drainage systems,* *combined building drains* or *combined building sewers*.

[2.4.2.1.] 2.4.2.1. Connections to Sanitary Drainage Systems

[1] 1) Except as provided in Sentence (2)-2025, ~~F~~f*ixtures* shall be *directly connected* to a *sanitary drainage system*, except that

- [a] a) drinking fountains are permitted to be
  - [i] i) *indirectly connected* to a *sanitary drainage system*, or
  - [ii] ii) connected to a *storm drainage system*, provided that where the system is subject to *backflow*, a *backwater valve* is installed in the fountain *fixture drain* (see ~~Note A-2.4.2.1.(1)(a)(ii) and (e)(vi)~~Note A-2.4.2.1.(a)(ii) and (2)),
- [b] b) drainage pans on heating/cooling units and *condensate drainage systems* serving heating, ventilating and air-conditioning systems are permitted to be connected to a *storm drainage system*, provided that where the system is subject to *backflow*, a *backwater valve* is installed,
- [c] c) a floor drain is permitted to be connected to a *storm drainage system*, provided it is located where it can receive only *clear-water waste* or *storm water*, and
- [d] d) *fixtures* or appliances that discharge only *clear-water waste* are permitted to be connected to a *storm drainage system* or be drained onto a roof.~~, and~~
- ~~[e] e) the following devices shall be *indirectly connected* to a *drainage system:*~~
  - ~~[i] i) a device for the display, storage, preparation or processing of food or drink,~~
  - ~~[ii] ii) a sterilizer,~~
  - ~~[iii] iii) a device that uses water as a cooling or heating medium,~~
  - ~~[iv] iv) a water operated device,~~
  - ~~[v] v) a water treatment device, or~~
  - ~~[vi] vi) a drain or overflow from a *water system* or a heating system (see Note A-2.4.2.1.(1)(a)(ii) and (e)(vi)).~~

[2] --) Except as provided in Sentences 2.4.2.3.(2) and (3), the following devices shall be *indirectly connected* to a *drainage system*:

- [a] --) a device for the display, storage, preparation or processing of food or drink,
- [b] --) a sterilizer,
- [c] --) a device that uses water as a cooling or heating medium,
- [d] --) a water-operated device,
- [e] --) a water treatment device,
- [f] --) a drain or overflow from a *water system* or a heating system,
- [g] --) a device that produces *clear-water waste* as condensate, and
- [h] --) a device that produces condensate from a combustion process (see Note A-2.4.2.1.(a)(ii) and (2)).

[3] 2) The connection of a *sanitary drainage pipe* to a *nominally horizontal sanitary drainage pipe* or to a *nominally horizontal offset* in a *stack* shall be not less than 1.5 m measured horizontally from the bottom of a *stack* or from the bottom of the upper vertical section of the *stack* that

[a] a) receives a discharge of 30 or more *fixture units*, or

[b] b) receives a discharge from *fixtures* located on 2 or more *storeys*.

(See Note A-2.4.2.1.(2).)

[4] **3)** No other *fixture* shall be connected to a lead bend or stub that serves a water closet.

[5] **4)** Where a change in direction of more than 45° occurs in a *sanitary drainage pipe* that serves more than one clothes washer, and in which pressure zones are created by detergent suds, no other *sanitary drainage pipe* shall be connected to it within a length less than

[a] a) 40 times the *nominal pipe size* of the *sanitary drainage pipe* or 2.44 m maximum vertical, whichever is less, before changing direction, and

[b] b) 10 times the *nominal pipe size* of the *nominally horizontal sanitary drainage pipe* after changing direction.

(See Note A-2.4.2.1.(4) and (5).)

[6] **5)** Where a *vent pipe* is connected into the suds pressure zone referred to in Sentence (4), no other *vent pipe* shall be connected to that *vent pipe* within the height of the suds pressure zone. (See Note A-2.4.2.1.(4) and (5).)

[2.4.2.3.] 2.4.2.3. Direct Connections

[1] **1)** Two or more *fixture outlet pipes* that serve outlets from a single *fixture* that is listed in ~~Clause 2.4.2.1.(1)(e)~~Sentence 2.4.2.1.(2) are permitted to be *directly connected* to a *branch* that

[a] a) has a *nominal pipe size* of not less than *NPS* 1¼, and

[b] b) is terminated above the *flood level rim* of a *directly connected fixture* to form an *air break*.

[2] **2)** *Fixture drains* from *fixtures* that are listed in ~~Subclauses 2.4.2.1.(1)(e)(i), (e)(ii)~~Clauses 2.4.2.1.(2)(a), (b) and (h)-2025 are permitted to be *directly connected* to a pipe that

[a] a) is terminated to form an *air break* above the *flood level rim* of a *fixture* that is *directly connected* to a *sanitary drainage system*, and

[b] b) is extended through the roof when *fixtures* on 3 or more *storeys* are connected to it (see ~~Note A-2.4.2.1.(1)(a)(ii) and (e)(vi)~~Note A-2.4.2.1.(1)(a)(ii) and (2)).

[3] **3)** *Fixture drains* from *fixtures* that are listed in ~~Subclauses 2.4.2.1.(1)(e)(iii) to (e)(vi)~~ Clauses 2.4.2.1.(2)(c) to (g)-2025 are permitted to be *directly connected* to a pipe that

[a] a) is terminated to form an *air break* above the *flood level rim* of a *fixture* that is *directly connected* to a *storm drainage system*, and

[b] b) is extended through the roof when *fixtures* on 3 or more *storeys* are connected to it.

[2.4.3.] 2.4.3. Location of Fixtures

[2.4.3.1.] 2.4.3.1. Urinals

[2.4.3.2.] 2.4.3.2. Restricted Locations of Indirect Connections and Traps

[2.4.3.3.] 2.4.3.3. Equipment Restrictions Upstream of Grease Interceptors

[2.4.3.4.] 2.4.3.4. Fixtures Located in Chemical Storage Locations

[2.4.3.5.] 2.4.3.5. Macerating Toilet Systems

[2.4.3.6.] 2.4.3.6. Drains Serving Elevator Pits

[2.4.3.7.] --- Condensate Drainage and Macerating Toilet Systems

[1] --) Piping in *condensate drainage systems* and *macerating toilet systems* that is less than *NPS* 1¼ shall comply with Subsections 2.2.5. to 2.2.7. (See Note A-2.2.5. to 2.2.8.)

[2.4.5.] 2.4.5. Traps

[2.4.5.1.] 2.4.5.1. Traps for Sanitary Drainage Systems

[2.4.5.2.] 2.4.5.2. Traps for Storm Drainage Systems

[2.4.5.3.] 2.4.5.3. Connection of Subsoil Drainage Pipe to a Sanitary Drainage System

[2.4.5.4.] --- Traps for Condensate Drainage Systems

[1] --) Where a *condensate drainage system* is connect to equipment in two or more rooms, *traps* shall be installed between the equipment connection and the *condensate drainage system.* (See Note A-2.4.5.4.(1)-2025.)

[2.4.5.5.] 2.4.5.4. Location and Cleanout for Building Traps

[2.4.5.6.] 2.4.5.5. Trap Seals

Note A-2.4.5.4.(1)-2025 Traps for Condensate Drainage Systems.

Manufacturers may specify additional requirements for traps for condensate drainage systems beyond the prescriptive requirement of Sentence 2.4.5.4.(1)-2025.

[2.4.9.] 2.4.9. Size of Drainage Pipes

[2.4.9.1.] 2.4.9.1. No Reduction in Size

[2.4.9.2.] 2.4.9.2. Serving Water Closets

[2.4.9.3.] 2.4.9.3. Size of Fixture Outlet Pipes

[1] **1)** Except as provided in Sentence (2), the *nominal pipe size* of *fixture outlet pipes* shall conform to Table 2.4.9.3.

[2] **2)** The part of the *fixture outlet pipe* that is common to 3 compartments of a sink shall be one *NPS* larger than the largest *fixture outlet pipe* of the compartments that it serves. (See Note A-2.4.9.3.(2).)

Table [2.4.9.3.] 2.4.9.3.
Minimum Permitted Size of Fixture Outlet Pipe and Hydraulic Loads for Fixtures (1)
Forming Part of Sentences [2.4.9.3.] 2.4.9.3.([1] 1) and 2.4.10.2.(1)

Fixture	**Minimum *Nominal Pipe Size* of *Fixture Outlet Pipe*, *NPS***	**Hydraulic Load, *fixture units***
Autopsy table	1½	2
Bathroom group		
(a) with flush tank	n/a	6
(b) with direct flush valve	n/a	8
Bathtub (with or without shower)	1½	1½
Bath: foot, sitz or slab	1½	1½
Beer cabinet	1½	1½
Bidet	1¼	1
Clothes washer		
(a) domestic (1)	n/a	2
(b) commercial	n/a	2
Condensate drain (2)		
(a) domestic	½	½

Fixture	**Minimum *Nominal Pipe Size* of *Fixture Outlet Pipe, NPS***	**Hydraulic Load, *fixture units***
(b) commercial	¾	1
Dental unit or cuspidor	1¼	1
Dishwasher		
(a) domestic type	1½	1½ no load when connected to garbage grinder or domestic sink
(b) commercial type	2	3
Drinking fountain	1¼	½
Floor drain (3)	2	2 with *NPS* 2 *trap*
		3 with *NPS* 3 *trap*
Garbage grinder, commercial type	2	3
Icebox	1¼	1
Laundry tray		
(a) single or double units or 2 single units with common *trap*	1½	1½
(b) 3 compartments	1½	2
Lavatory		
(a) barber or beauty parlor	1½	1½
(b) dental	1¼	1
(c) domestic type, single or	1¼	1 with *NPS* 1¼ *trap*
2 single with common *trap*		1½ with *NPS* 1½ *trap*
(d) multiple or industrial type	1½	according to Table 2.4.10.2.
Macerating toilet system	¾	4
Potato peeler	2	3
Shower drain		

Fixture	**Minimum *Nominal Pipe Size* of *Fixture Outlet Pipe, NPS***	**Hydraulic Load, *fixture units***
Total volume of discharge from all shower heads and body sprays:		
(a) < 9.5 LPM	1½	1½
(b) 9.5 LPM to 20 LPM	2	3
(c) > 20 LPM	3	6
Sink		
(a) domestic and other small types with or without garbage grinders, single, double or 2 single with a common *trap*	1½	1½
(b) Other sinks	1½	1½ with *NPS* 1½ *trap*
		2 with *NPS* 2 *trap*
		3 with *NPS* 3 *trap*
Urinal		
(a) pedestal, siphon-jet or blowout type	2	4
(b) stall, washout type	2	2
(c) wall		
(i) washout type	1½	1½
(ii) other types	2	3
Water closet		
(a) with flush tank	3	4
(b) with direct flush valve	3	6

Notes to Table [2.4.9.3.] 2.4.9.3.:

(1) See Note A-Table 2.4.9.3.

(2) Multiple or manifold applications shall conform to Table 2.4.10.12. for semi-continuous flow.

(3) No hydraulic load for *emergency floor drains*.

[3] **3)** Where clothes washers do not drain to a laundry tray, the *trap* inlet shall be not less than *NPS* 2 and be fitted with a vertical standpipe that is not less than 600 mm long measured from the *trap weir* and terminates above the *flood level rim* of the clothes washer. (See Note A-2.4.9.3.(3).)

[2.4.9.4.] 2.4.9.4. Size of Building Drain and Building Sewer

[2.4.9.5.] 2.4.9.5. Offset in Leaders

[2.4.9.6.] --- Condensate Drainage Systems

[1] --) Except as provided in Sentences (2) and 2.4.2.3.(1), the size of piping in a *condensate drainage system* shall be not less than *NPS* ¾.

[2] --) Piping in *condensate drainage systems* serving *dwelling units* shall be not less than *NPS* ½.

Impact analysis

No increase in cost is expected as this proposed change provides clarity about the pre-existing provision on the evacuation of condensation.

This proposed change may reduce the cost of maintenance as it may be more costly to correct issues caused by improper installation.

Enforcement implications

This proposed change clarifies the application of the Code for plumbing drainage systems.

Additional training or resources required for enforcement officials (authorities having jurisdiction) are not expected as a result of the proposed change.

Who is affected

Designers, installers, suppliers, regulators and building owners.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[2.2.5.1.] 2.2.5.1. ([1] 1) [F20-OH2.1]

[2.2.5.1.] 2.2.5.1. ([1] 1) [F20-OP5]

[2.2.5.2.] 2.2.5.2. ([1] 1) [F20-OH2.1]

[2.2.5.2.] 2.2.5.2. ([2] 2) [F20-OH2.1]

[2.2.5.2.] 2.2.5.2. ([3] 3) [F20-OH2.1]

[2.2.5.2.] 2.2.5.2. ([4] 4) [F20-OH2.1]

[2.2.5.2.] 2.2.5.2. ([5] 5) [F20-OH2.1]

[2.2.5.3.] 2.2.5.3. ([1] 1) [F20-OH2.1]

[2.2.5.3.] 2.2.5.3. ([2] 2) [F20-OH2.1]

[2.2.5.3.] 2.2.5.3. ([3] 3) [F20-OH2.1]

[2.2.5.4.] 2.2.5.4. ([1] 1) [F20-OH2.1,OH2.2,OH2.3]

[2.2.5.4.] 2.2.5.4. ([1] 1) [F20-OP5]

[2.2.5.4.] 2.2.5.4. ([2] 2) [F20-OP5]

[2.2.5.4.] 2.2.5.4. ([3] 3) [F20-OP5]

[2.2.5.5.] 2.2.5.5. ([1] 1) [F72-OH2.1,OH2.3]

[2.2.5.6.] 2.2.5.6. ([1] 1) [F20-OH2.2]

[2.2.5.6.] 2.2.5.6. ([1] 1) [F20-OP5]

[2.2.5.7.] 2.2.5.7. ([1] 1) [F20-OH2.1,OH2.2,OH2.3]

[2.2.5.7.] 2.2.5.7. ([1] 1) [F20-OP5]

[2.2.5.7.] 2.2.5.7. ([2] 2) [F20-OH2.1,OH2.2,OH2.3]

[2.2.5.7.] 2.2.5.7. ([2] 2) [F20-OP5]

[2.2.5.7.] 2.2.5.7. ([3] 3) [F20-OH2.1,OH2.2,OH2.3]

[2.2.5.7.] 2.2.5.7. ([3] 3) [F20-OP5]

[2.2.5.7.] 2.2.5.7. ([4] 4) [F20-OP5]

[2.2.5.8.] 2.2.5.8. ([1] 1) [F20-OH2.2,OH2.3,OH2.4]

[2.2.5.8.] 2.2.5.8. ([1] 1) [F20-OP5]

[2.2.5.8.] 2.2.5.8. ([2] 2) [F20-OP5]

[2.2.5.9.] 2.2.5.9. ([1] 1) [F20,F80,F81-OH2.1]

[2.2.5.9.] 2.2.5.9. ([1] 1) [F20,F80,F81-OP5]

[2.2.5.10.] 2.2.5.10. ([1] 1) [F20,F80,F81-OH2.1,OH2.3]

[2.2.5.10.] 2.2.5.10. ([2] 2) [F20,F80,F81-OH2.1,OH2.3]

[2.2.5.11.] 2.2.5.11. ([1] 1) [F20,F80,F81-OH2.1,OH2.3]

[2.2.5.11.] 2.2.5.11. ([2] 2) no attributions

[2.2.5.11.] 2.2.5.11. ([3] 3) no attributions

[2.2.5.12.] 2.2.5.12. ([1] 1) [F20,F80,F81-OH2.1,OH2.2,OH2.3]

[2.2.5.12.] 2.2.5.12. ([1] 1) [F20-OP5]

[2.2.5.12.] 2.2.5.12. ([2] 2) [F20-OP5]

[2.2.5.12.] 2.2.5.12. ([2] 2) [F20-OH2.1,OH2.2,OH2.3]

[2.2.5.12.] 2.2.5.12. ([3] 3) [F20-OP5]

[2.2.5.12.] 2.2.5.12. ([3] 3) [F20-OH2.1,OH2.2,OH2.3]

[2.2.5.12.] 2.2.5.12. ([4] 4) [F20-OP5]

[2.2.5.12.] 2.2.5.12. ([4] 4) [F20-OH2.1,OH2.2,OH2.3]

[2.2.5.13.] 2.2.5.13. ([1] 1) [F20-OH2.1,OH2.2,OH2.3]

[2.2.5.13.] 2.2.5.13. ([1] 1) [F20-OP5]

[2.2.5.14.] 2.2.5.14. ([1] 1) [F20-OH2.1,OH2.2,OH2.3]

[2.2.5.14.] 2.2.5.14. ([1] 1) [F20-OP5]

[2.2.5.15.] 2.2.5.15. ([1] 1) [F20,F70,F80-OH2.2]

[2.2.5.15.] 2.2.5.15. ([1] 1) [F20,F70,F80-OP5]

[2.2.5.15.] 2.2.5.15. ([2] 2) [F80,F81-OH2.1]

[2.2.5.15.] 2.2.5.15. ([2] 2) [F20,F70,F80-OP5]

[2.2.5.16.] 2.2.5.16. ([1] 1) [F20-OH2.1,OH2.2,OH2.3]

[2.2.5.16.] 2.2.5.16. ([1] 1) [F20-OP5]

[2.2.5.16.] 2.2.5.16. ([2] 2) [F20-OH2.1]

[2.2.5.16.] 2.2.5.16. ([2] 2) [F20-OP5]

[2.2.5.16.] 2.2.5.16. ([3] 3) no attributions

[2.4.1.1.] 2.4.1.1. ([1] 1) no attributions

[2.4.2.1.] 2.4.2.1. ([1] 1)

[2.4.2.1.] 2.4.2.1. ([1] 1) [F72-OH2.1]

[2.4.2.1.] 2.4.2.1. ([1] 1) ~~([a] a)~~ ~~[F81-OH2.2]~~

[2.4.2.1.] 2.4.2.1. ([1] 1) ~~([b] b)~~ ~~[F81-OH2.2]~~

[2.4.2.1.] 2.4.2.1. ([1] 1) ~~([c] c)~~ ~~[F81-OH2.1]~~

[2.4.2.1.] 2.4.2.1. ([1] 1) ~~([d] d)~~ ~~[F81-OH2.1]~~

[2.4.2.1.] 2.4.2.1. ([1] 1) ~~([e] e)~~ ~~[F81-OH2.1]~~

[2.4.2.1.] -- ([2] --) no attributions

[2.4.2.1.] 2.4.2.1. ([3] 2) [F81-OH1.1]

[2.4.2.1.] 2.4.2.1. ([4] 3) [F81-OH1.1]

[2.4.2.1.] 2.4.2.1. ([5] 4) [F81-OH1.1]

[2.4.2.1.] 2.4.2.1. ([6] 5) [F81-OH1.1]

[2.4.2.3.] 2.4.2.3. ([1] 1) [F81-OH2.2]

[2.4.2.3.] 2.4.2.3. ([2] 2) ~~[F81-OH2.1,OH2.4]~~

[2.4.2.3.] 2.4.2.3. ([3] 3) ~~[F81-OH2.4]~~

[2.4.3.1.] 2.4.3.1. ([1] 1) [F81-OH2.4]

[2.4.3.2.] 2.4.3.2. ([1] 1) [F81-OH2.1,OH2.4]

[2.4.3.3.] 2.4.3.3. ([1] 1) [F81-OH2.1]

[2.4.3.3.] 2.4.3.3. ([2] 2) no attributions

[2.4.3.4.] 2.4.3.4. ([1] 1) [F81-OS1.1]

[2.4.3.4.] 2.4.3.4. ([1] 1) [F43-OH5]

[2.4.3.5.] 2.4.3.5. ([1] 1) [F72-OH2.1]

[2.4.3.6.] 2.4.3.6. ([1] 1) ([a] a) [F62-OP5]

[2.4.3.6.] 2.4.3.6. ([1] 1) ([b] b) [F81-OH2.1]

[2.4.3.7.] -- ([1] --) no attributions

[2.4.5.1.] 2.4.5.1. ([1] 1) [F81-OH1.1]

[2.4.5.1.] 2.4.5.1. ([2] 2) no attributions

[2.4.5.1.] 2.4.5.1. ([3] 3) no attributions

[2.4.5.1.] 2.4.5.1. ([4] 4) no attributions

[2.4.5.1.] 2.4.5.1. ([5] 5) no attributions

[2.4.5.1.] 2.4.5.1. ([6] 6) [F81-OH1.1]

[2.4.5.1.] 2.4.5.1. ([6] 6) [F81-OP5]

[2.4.5.2.] 2.4.5.2. ([1] 1) [F81-OH1.1]

[2.4.5.2.] 2.4.5.2. ([2] 2) [F81-OH1.1]

[2.4.5.2.] 2.4.5.2. ([3] 3) [F81-OP5]

[2.4.5.3.] 2.4.5.3. ([1] 1) [F81-OH2.1]

[2.4.5.3.] 2.4.5.3. ([1] 1) [F81-OH1.1]

[2.4.5.4.] -- ([1] --) [F40,F41-OH1.1]

[2.4.5.5.] 2.4.5.4. ([1] 1) [F81-OH2.1]

[2.4.5.6.] 2.4.5.5. ([1] 1) [F81-OH1.1]

[2.4.9.1.] 2.4.9.1. ([1] 1) [F81-OH2.1]

[2.4.9.1.] 2.4.9.1. ([1] 1) [F81-OH1.1]

[2.4.9.2.] 2.4.9.2. ([1] 1) [F81-OH2.1]

[2.4.9.2.] 2.4.9.2. ([2] 2) [F81-OH2.1]

[2.4.9.2.] 2.4.9.2. ([3] 3) [F81-OH2.1]

[2.4.9.2.] 2.4.9.2. ([4] 4) [F81-OH2.1]

[2.4.9.3.] 2.4.9.3. ([1] 1) [F81-OH2.1]

[2.4.9.3.] 2.4.9.3. ([2] 2) [F81-OH2.1]

[2.4.9.3.] 2.4.9.3. ([3] 3) [F81-OP5]

[2.4.9.3.] 2.4.9.3. ([3] 3) [F81-OH1.1]

[2.4.9.4.] 2.4.9.4. ([1] 1) [F81-OH2.1]

[2.4.9.5.] 2.4.9.5. ([1] 1) [F81-OH2.1,OH2.3]

[2.4.9.5.] 2.4.9.5. ([2] 2) [F81-OH2.1]

[2.4.9.6.] -- ([1] --) [F20-OH2.1,OH2.2]

[2.4.9.6.] -- ([1] --) [F20-OH2.1,OH2.2]

Submit a comment

Proposed Change 1729

Code Reference(s):	**NPC20 Div.B 2.2.10.4. (first printing)**
Subject:	Piping
Title:	Mechanical Couplings
Description:	This proposed change adds requirements for plain-end-type mechanical couplings for pressure applications by referencing ANSI/AWWA&nbps;C227-17, “Bolted, Split-Sleeve Couplings.”
Related Code Change Request(s):	CCR 1449

This change could potentially affect the following topic areas:

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

Problem

Currently, there is no provision in the National Plumbing Code of Canada (NPC) defining the minimum level of performance for mechanical couplings used to join plain-end pipe in pressure applications. As such, there is a need to introduce requirements for these couplings into the NPC.

In the absence of such minimum requirements, there is a risk that mechanical couplings of inferior quality could be installed, which could result in leaks and damage to property, which could lead to unnecessary costs related to repair and disruption of operations.

Justification

Adding ANSI/AWWA C227-17, “Bolted, Split-Sleeve Couplings,” to the NPC would establish minimum performance requirements for plain-end-type mechanical couplings used in pressure applications to ensure such couplings are properly selected and installed. Plain-end pipe is commonly used and accepted in municipal and industrial process piping systems that have significant system pressures.

This proposed change would ensure these couplings meet a minimum level of quality and would facilitate consistent product application, which would help to mitigate the risk of leaks, damage to property and unnecessary repair costs.

PROPOSED CHANGE

[2.2.10.4.] 2.2.10.4. Mechanical Couplings

[1] **1)** Groove- and shoulder-type mechanical couplings for pressure applications shall conform to CSA B242, "Groove- and Shoulder-Type Mechanical Pipe Couplings".

[2] **--)** Plain-end-type mechanical couplings for pressure applications shall conform to ANSI/AWWA C227-17,“Bolted, Split-Sleeve Couplings.”

[3] **2)** Mechanical couplings for non-pressure applications shall conform to CSA B602, "Mechanical couplings for drain, waste, and vent pipe and sewer pipe".

Impact analysis

This proposed change is expected to have a positive impact, as it would align the NPC with current industry practice by ensuring that plain-end-type mechanical couplings meet a minimum level of performance and safety when used in pressure applications. Adding a reference to a standard would decrease the risk of confusion for building officials, designers, specification writers, contractors and manufacturers, as there would be explicit minimum performance requirements within the Code.

Plain-end-type mechanical couplings are already commonly installed in pressure piping systems. Adding a reference to a standard would decrease the risk of confusion for Code users and lighten the workloads of building officials, designers, specification writers, contractors and manufacturers, as there would be explicit minimum performance requirements referenced within the Code similar to those in CSA B242, “Groove- and Shoulder-Type Mechanical Pipe Couplings” and CSA B602, “Mechanical couplings for drain, waste, and vent pipe and sewer pipe.”

Installers and building officials would need to verify that the materials have been tested according to the standard.

There are costs to manufacturers associated with the introduction of a new material or product standard into the Code. These costs, which include initial testing to acquire certification and ongoing testing to maintain it, vary greatly, ranging from few hundred dollars (e.g., to measure dimensions to the specifications) to a few hundred thousand dollars (e.g., for complete hydrostatic stress testing with chlorine resistance), depending on the complexity of test, the availability of certified testing labs, etc.

These associated costs may be considered a required initial investment to acquire market share for the product, but they may also be a barrier to entry for smaller companies. If manufacturers of the product intend to enter the market with proof of its Code compliance, it is up to them to decide whether it is financially viable to bear the cost. Otherwise, no additional costs are expected to be incurred by Code users.

Enforcement implications

Provincial or territorial authorities, municipal inspectors and authorities having jurisdiction, and other provincial, territorial or municipal service providers would need to ensure that a certified product complying with manufacturing and potable water standards is installed.

This can be accomplished through communication with the certifying agency or through confirmation online or with the manufacturer’s published literature.

Who is affected

Designers, specifiers, contractors, manufacturers, building owners and building officials (i.e., authorities having jurisdiction).

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[2.2.10.4.] 2.2.10.4. ([1] 1) [F80-OP5]

[2.2.10.4.] -- ([2] --) [F80-OP5]

[2.2.10.4.] 2.2.10.4. ([3] 2) [F80-OH2.1,OH2.3]

Submit a comment

Proposed Change 1693

Code Reference(s):	**NPC20 Div.B 2.3.4.5. (first printing)**
Subject:	Piping
Title:	Support for Nominally Horizontal Piping
Description:	This proposed change introduces horizontal spacing of supports for solid wall PVC plastic pipe.
Related Code Change Request(s):	CCR 1281, CCR 1483

This change could potentially affect the following topic areas:

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

Problem

The current 1.2 m pipe support spacing in Table 2.3.4.5. of Division B of the National Plumbing Code of Canada (NPC) applies to all PVC pipe sizes. There is currently no differentiation for larger diameter pipes, which can be adequately supported by increased spacing. The use of supports at closer spacings than needed results in unnecessary additional costs and time for installation.

Cellular core PVC pipe was included as a pipe material option in the NPC 2020, but has not been included in Table 2.3.4.5. As such, there is currently no required pipe support spacing for this material, which could lead to inadequate support. This situation can lead to stress on the pipe and sagging, which can lead to degradation and breakdown.

Larger diameter PVC pipe and cellular core PVC pipe are increasingly used by the industry; therefore, the spacing requirements should be revised to state proper support spacing for these products based on a water-filled product at maximum temperature.

Justification

This proposed change adds a new row to Table 2.3.4.5. to incorporate different pipe sizes and corresponding pipe support spacing for solid wall PVC pipe. The clarity provided in directly linking support spacing to pipe size will allow the cost-effective installation of pipe supports, avoiding unnecessary costs.

This proposed change also adds cellular core PVC to the list of materials requiring a pipe support spacing of 1.2 m. This would help prevent the improper installation of pipe supports for this product, which mitigates the risk of pipe damage and degradation. Furthermore, this proposed change aligns Table 2.3.4.5. with Article 2.2.5.16. by including cellular core PVC pipe.

PROPOSED CHANGE

[2.3.4.5.] 2.3.4.5. Support for Horizontal Piping

[1] 1) *Nominally horizontal* piping that is inside a *building* shall be braced to prevent swaying and buckling and to control the effects of thrust.

[2] 2) *Nominally horizontal* piping shall be supported as stated in Table 2.3.4.5.

[3] 3) Where PVC, CPVC or ABS plastic pipe is installed,

- [a] a) the pipe shall be aligned without added strain on the piping,
- [b] b) the pipe shall not be bent or pulled into position after being welded, and
- [c] c) hangers shall not compress, cut or abrade the pipe.

[4] 4) Where PEX, PE-RT, PP-R, PE/AL/PE or PEX/AL/PEX plastic pipe or tube is installed, hangers shall not compress, cut or abrade the pipe.

Table [2.3.4.5.] 2.3.4.5.
Support for Nominally Horizontal Piping
Forming Part of Sentence [2.3.4.5.] 2.3.4.5.([2] 2)

Piping Material	Maximum Horizontal Spacing of Supports, m	Additional Support Conditions
ABS, solid wall ABS or cellular core PVC ~~plastic~~ pipe	1.2	At the end of *branches* or *fixture drains* and at changes in direction and elevation
Solid wall PVC pipe		

Piping Material	Maximum Horizontal Spacing of Supports, m	Additional Support Conditions
• diameter < *NPS* 4	1.2	At the end of *branches* or *fixture drains* and at changes in direction and elevation
• diameter ≥ *NPS* 4 and < *NPS* 12	2.0	
• diameter ≥ *NPS* 12	3.0	
ABS or PVC ~~plastic~~ *trap arm* or *fixture drain* pipe > 1 m long	n/a	As close as possible to the *trap*
Cast-iron pipe	3.0	At or adjacent to each hub or joint
Cast-iron pipe with mechanical joints that is ≤ 300 mm long between adjacent fittings	1.0	None
Copper tube or copper and brass pipe, hard temper		
• diameter > *NPS* 1	3.0	None
• diameter ≤ *NPS* 1	2.5	
Copper tube, soft temper	2.5	None
CPVC pipe	1.0	None
Galvanized iron or steel pipe		
• diameter ≥ *NPS* 6	3.75	None
• diameter < *NPS* 6	2.5	
Lead pipe	Throughout length of pipe	None
PE/AL/PE composite pipe	1.0	None
PEX/AL/PEX composite pipe	1.0	None
PEX plastic pipe	0.8	None
PE-RT tube	0.8	None
PP-R plastic pipe	1.0	At the end of *branches* and at changes in direction and elevation
Stainless steel pipe		

Piping Material	Maximum Horizontal Spacing of Supports, m	Additional Support Conditions
• diameter ≥ *NPS* 1	3.0	None
• diameter < *NPS* 1	2.5	
Stainless steel tube		
• diameter ≥ *NPS* 1	3.0	None
• diameter < *NPS* 1	2.5	

[5] **5)** Where hangers are used to support *nominally horizontal* piping, the hangers shall be
- [a] a) supported by metal rods of not less than
  - [i] i) 6 mm diam to support piping of *NPS* 2 or less,
  - [ii] ii) 8 mm diam to support piping of *NPS* 4 or less, and
  - [iii] iii) 13 mm diam to support piping over *NPS* 4, or
- [b] b) solid or perforated metal straps not less than
  - [i] i) 0.6 mm thick and 12 mm wide to support piping of *NPS* 2 or less, and
  - [ii] ii) 0.8 mm thick and 18 mm wide to support piping of *NPS* 4 or less.

[6] **6)** Where a hanger is attached to concrete or masonry, it shall be fastened by metal or expansion-type plugs that are inserted or built into the concrete or masonry.

Impact analysis

There are no additional costs associated with this proposed change, which enables construction efficiency and permits PVC piping to be supported at increased levels while maintaining functionality.

This proposed change also provides clarity regarding the spacing of supports for cellular core PVC pipe, which is required at a spacing already used in the Code, so no additional cost is expected to support this product.

Enforcement implications

No additional resources are needed for the enforcement of this proposed change.

Who is affected

Designers, installers, suppliers, regulators and building owners.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[2.3.4.5.] 2.3.4.5. ([1] 1) [F20-OS3.1]

[2.3.4.5.] 2.3.4.5. ([1] 1) [F20-OH2.1,OH2.3]

[2.3.4.5.] 2.3.4.5. ([1] 1) [F20-OP5]

[2.3.4.5.] 2.3.4.5. ([2] 2) [F20-OS3.1]

[2.3.4.5.] 2.3.4.5. ([2] 2) [F20-OH2.1]

[2.3.4.5.] 2.3.4.5. ([2] 2) [F20-OP5]

[2.3.4.5.] 2.3.4.5. ([3] 3) [F20-OP5]

[2.3.4.5.] 2.3.4.5. ([3] 3) [F20,F81-OS3.1]

[2.3.4.5.] 2.3.4.5. ([3] 3) [F20-OH2.1]

[2.3.4.5.] 2.3.4.5. ([4] 4) [F81-OP5]

[2.3.4.5.] 2.3.4.5. ([4] 4) [F81-OS3.1]

[2.3.4.5.] 2.3.4.5. ([5] 5) [F20,F21-OP5]

[2.3.4.5.] 2.3.4.5. ([5] 5) [F20-OS3.1]

[2.3.4.5.] 2.3.4.5. ([5] 5) [F20-OH2.1]

[2.3.4.5.] 2.3.4.5. ([6] 6) [F20-OP5]

[2.3.4.5.] 2.3.4.5. ([6] 6) [F20-OS3.1]

[2.3.4.5.] 2.3.4.5. ([6] 6) [F20-OH2.1]

Submit a comment

Proposed Change 1727

Code Reference(s):	**NPC20 Div.B 2.4.4.4. (first printing)**
Subject:	Drainage Systems
Title:	Neutralization Tanks
Description:	This proposed change removes dilution as an acceptable method for the treatment of corrosive or acid waste to better protect the environment and plumbing infrastructure.
Related Code Change Request(s):	CCR 1628

This change could potentially affect the following topic areas:

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

Problem

The National Plumbing Code of Canada (NPC) 2020 allows for both dilution and neutralization as methods to treat corrosive or acid waste before it is discharged into drainage systems. However, the use of dilution tanks has several disadvantages compared to neutralization, as dilution wastes water and energy, increases greenhouse gas emissions and contributes to the degradation of plumbing infrastructure.

Further, the option for dilution in the NPC is inconsistent with current practice. The preferred method is neutralization. Currently, the only available option for discharging corrosive waste into a city sewer is to follow local sewer use bylaws. Notably, the Canadian Model Sewer Use Bylaw prohibits dilution in Section 4 (Prohibition of Dilution).

Justification

The proposed change would remove dilution as an acceptable means of treating corrosive or acid waste to avoid contradiction with local sewer use bylaws and subsequent confusion for Code users. The change would bring NPC requirements for the treatment of such waste into alignment with those in the Canadian Model Sewer Use Bylaw and better protect plumbing infrastructure and the environment from harsh chemicals.

An acceptable pH range for waste water is specified in the Canadian Model Sewer Use Bylaw and local sewer use bylaws.

PROPOSED CHANGE

[2.4.4.4.] 2.4.4.4. ~~Neutralizing and Dilution~~Neutralization Tanks

[1] 1) Where a *fixture* or equipment discharges corrosive or acid waste, it shall discharge into a ~~neutralizing or dilution~~neutralization tank that is connected to the *sanitary drainage system* through

[a] a) a *trap*, or

[b] b) an indirect connection.

(See Note A-2.4.4.4.(1).)

[2] 2) ~~Neutralizing and dilution~~A neutralization tank~~s~~ shall have a method for neutralizing the liquid it contains.

Impact analysis

This proposed change would result in more efficient and safer treatment of corrosive or acid waste, which would decrease operational and end use costs for municipalities.

The benefits of the use of appropriate and environmentally responsible methods to dispose of corrosive or acid waste also include water savings and a decreased need for energy to provide clean water to users.

Enforcement implications

Provincial or territorial authorities, municipal inspectors and authorities having jurisdiction, and other provincial, territorial or municipal service providers would need to monitor and enforce compliance with the revised requirement.

Who is affected

Designers, builders and authorities having jurisdiction.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[2.4.4.4.] 2.4.4.4. ([1] 1) [F80-OS3.4]

[2.4.4.4.] 2.4.4.4. ([2] 2) [F43-OH5]

[2.4.4.4.] 2.4.4.4. ([2] 2) [F80-OH2.1]

Submit a comment

Proposed Change 1790

Code Reference(s):	**NPC20 Div.B 2.4.6. (first printing)** **NPC20 Div.B 2.4.10.4. (first printing)**
Subject:	Drainage Systems
Title:	Emergency Roof Drainage
Description:	This proposed change clarifies the requirements for storm drainage systems and expands on the use of an emergency overflow as a separate system at critical points in the storm drainage system.
Related Code Change Request(s):	CCR 1430

This change could potentially affect the following topic areas:

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

Problem

The provisions in the current edition of the National Plumbing Code of Canada (NPC) regarding emergency roof drainage do not require that the emergency roof overflows drain to a system that is separate from the primary system. If there is a blockage in the primary system downstream of the roof drains, and both the primary and emergency roof drains drain into the same leader immediately under the roof, then the emergency roof drain will not be effective.

In addition, Sentence 2.4.10.4.(4) of Division B does not specify if the "minimum of 2 roof drains" include the emergency drain or if this requirement is referring to two roof drains from the primary system.

The location from which the height of the parapet is measured is also not specified. This can lead to inadequate emergency overflow measures, which may lead to unintended water retention or pooling on the roof and subsequent water infiltration, which can lead to damage to the building or facility.

Justification

This proposed change would clarify the existing provisions for drainage systems using scuppers or low parapet walls and would also give Code users the additional options of using a completely separate emergency roof drainage system or connecting the emergency roof drains to an oversized main system.

These various options would give Code users the ability to reduce the risk of overloading the storm drainage system during a significant rain event or in the event of a blockage, which would otherwise have the potential to negatively impact building occupants and the building itself.

PROPOSED CHANGE

[2.4.6.] 2.4.6. Arrangement of Drainage Piping

[2.4.6.1.] 2.4.6.1. Separate Systems

[2.4.6.2.] 2.4.6.2. Location of Sanitary Drainage Pipes

[2.4.6.3.] 2.4.6.3. Sumps or Tanks

[2.4.6.4.] 2.4.6.4. Protection from Backflow

[2.4.6.5.] 2.4.6.5. Mobile Home Sewer Service

[2.4.6.6.] --- Emergency Roof Drainage Systems

[1] --) Where the height of the parapet is more than 150 mm above the level of the roof membrane at the roof drain or exceeds the height of the adjacent wall flashing, emergency *roof drains* or scuppers described in Clause 2.4.10.4.(2)(c) shall be provided. (See Note A-2.4.6.6.(1).)

[2] --) Except as provided in Sentence (3), an emergency roof *drainage system* shall be independent of the primary roof *drainage system*.

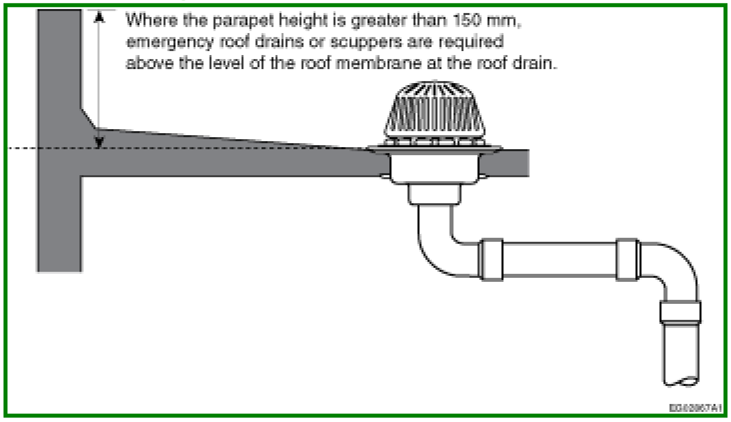
[3] --) An emergency roof *drainage system* is permitted to be connected to a primary roof *drainage system* at

- [a] --) the *storm building drain*, or
- [b] --) a vertical *leader* not located immediately under the roof served by

the emergency and primary roof drainage systems.

Note A-2.4.6.6.(1) Parapet Height.

Figure [A-2.4.6.6.(1)]
Parapet height



[2.4.10.4.] 2.4.10.4. Hydraulic Loads from Roofs or Paved Surfaces

[1] **1)** Except as provided in Sentence (2), the hydraulic load in litres from a roof or paved surface is the maximum 15 min rainfall determined in conformance with Subsection 1.1.3. of Division B of the NBC, multiplied by the sum of

- [a] a) the area in square metres of the horizontal projection of the surface drained, and
- [b] b) one-half the area in square metres of the largest adjoining vertical surface.

(See Note A-2.4.10.4.(1).)

[2] **2)** *Flow control roof drains* may be installed, provided

- [a] a) the maximum drain down time does not exceed 24 h,
- [b] b) the roof structure is designed to carry the load of the stored water,
- [c] c) one or more scuppers are installed not more than 30 m apart along the perimeter of the *building* so that
  - [i] i) up to 200% of the 15-minute rainfall intensity can be handled, and
  - [ii] ii) the maximum depth of controlled water is limited to 150 mm,
- [d] d) they are located not more than 15 m from the edge of the roof and not more than 30 m from adjacent drains, and
- [e] e) there is at least one drain for each 900 m^2.

[3] **3)** Hydraulic loads, in litres per second, for *flow control roof drains* and restricted paved area drains shall be determined according to rain intensity-duration frequency curves as compiled by Environment Canada using 25-year frequencies.

~~[4] 4) Where the height of the parapet is more than 150 mm or exceeds the~~

~~height of the adjacent wall flashing,~~

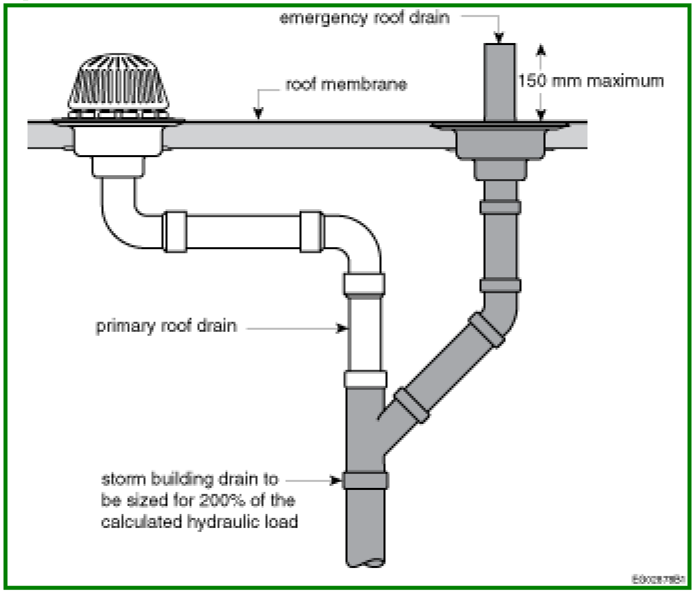
[a] a) ~~emergency roof overflows or scuppers described in Clause (2)(c) shall be provided, and~~

[b] b) ~~there shall be a minimum of 2 *roof drains*.~~

[5] --) A storm building drain serving both the primary and emergency roof drainage systems, as described in Clause 2.4.6.6.(3)(a), shall be sized for 200% of the calculated hydraulic load determined in accordance with Subsection 2.4.10. (See Note A-2.4.10.4.(5).)

Note A-2.4.10.4.(5) Storm Building Drain Serving Both the Primary and Emergency Roof Drainage Systems.

Figure [A-2.4.10.4.(5)]
Storm building drain serving both the primary and emergency roof drainage systems



Impact analysis

This proposed change will benefit Code users by providing additional clarity to existing provisions, which will reduce the risk of unnecessary spending. This proposed change will also provide Code users with a number of options to determine the best drainage system for their specific situation.

As the current drainage provision in the NPC leaves room for interpretation and is incomplete, the cost of the drainage system can vary drastically depending on how the provision is interpreted by the authority having jurisdiction (AHJ). While the option chosen by the designer/contractor will still determine the cost, the clarification of the drainage requirements and the multiple options permitted with this proposed change would allow the designer/contractor to use the least expensive option.

If the option chosen is to introduce a scupper or lower parapet, then there will be no increase in cost as this is already an option in the current edition of the Code. However, if the option chosen is to avoid having scuppers, then the cost of the drainage system will vary. For example, using a combined primary/emergency drainage system would increase the cost by approximately 50%. The following examples represent three drainage options with varying cost implications (the hourly rates for labour were calculated using RSMeans Online):

- Option 1: At a height of 30 feet, the cost of a 3-inch PVC pipe for the roof drain is estimated to be $1,501.59 nationally (Table 1) when using a vertical leader, no firestopping and no roof drain included.
- Option 2: Under the same scenario as Option 1, the cost of a combined primary/emergency drainage system using a 3-inch PVC pipe for the primary roof drain and a 4-inch PVC pipe for the emergency roof drain attached to a 4-inch leader is estimated to be $2,260.36 nationally (Table 1). This is a difference of $758.77 or an increase of 50.5% from Option 1.
- Option 3: The cost of a separate primary drainage system and emergency drainage system at a height of 30 feet using a 4-inch leader connected to a primary roof drain with a 4-inch PVC pipe installed 15 feet away from an emergency roof drain with a 25 foot, 4-inch PVC pipe is estimated to be $2,791.80 nationally (Table 1). This is a difference of $1,290.21 or an increase of 85.9% from Option 1, and a difference of $531.44 of an increase of 23.5% from Option 2.

Although the costs associated with Option 3 are highest based on the use of primary/emergency drainage systems, the option has been included in this proposed change to allow designers/contractors to use alternative systems if they so desire.

Table 1. The average costs associated with the three options across the provinces and territories.

	Average Cost of Option 1 ($)	Average Cost of Option 2 ($)	Average Cost of Option 3 ($)	Factor Compared to the National Average
National[1]	1,501.59	2,260.36	2,791.80	-
Alberta	1,541.81	2,320.91	2,866.58	1.03
British Columbia	1,538.90	2,316.52	2,861.17	1.02
Manitoba	1,417.36	2,133.57	2,635.20	0.94
New Brunswick	1,412.61	2,126.42	2,626.37	0.94
Newfoundland	1,427.42	2,148.71	2,653.90	0.95
Northwest Territories	1,542.52	2,321.98	2,867.90	1.03
Nunavut	1,501.59	2,260.36	2,791.80	1.00
Nova Scotia	1,472.76	2,216.96	2,738.20	0.98
Ontario	1,564.94	2,355.73	2,909.59	1.04
Prince Edward Island	1,318.70	1,985.05	2,451.76	0.88

Quebec	1,506.00	2,267.00	2,800.00	1.00
Saskatchewan	1,423.95	2,143.49	2,647.46	0.95
Yukon	1,413.74	2,128.12	2,628.47	0.94

Note: [1]The national average was determined by taking an average of all municipalities in Canada and comparing it to the average of the municipalities in a specific province or territory.

Enforcement implications

This proposed change would have a positive effect on the enforcement of the Code requirements due to the clarification of the wording in the existing provision, which is incomplete and unclear.

No additional training or resources are anticipated to be necessary for Code users.

Who is affected

Building occupants, plumbers, designers, builders and AHJs.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[2.4.6.1.] 2.4.6.1. ([1] 1) [F81-OH2.1]

[2.4.6.1.] 2.4.6.1. ([2] 2) [F81-OH2.1]

[2.4.6.1.] 2.4.6.1. ([3] 3) [F81-OH1.1]

[2.4.6.2.] 2.4.6.2. ([1] 1) [F81-OH2.2]

[2.4.6.3.] 2.4.6.3. ([1] 1) [F81-OH2.1]

[2.4.6.3.] 2.4.6.3. ([2] 2) [F81-OH2.1]

[2.4.6.3.] 2.4.6.3. ([2] 2) [F40,F81-OH1.1]

[2.4.6.3.] 2.4.6.3. ([3] 3) [F40,F81-OH2.1]

[2.4.6.3.] 2.4.6.3. ([3] 3) [F40,F81-OH1.1]

[2.4.6.3.] 2.4.6.3. ([4] 4) [F81-OH2.1]

[2.4.6.3.] 2.4.6.3. ([5] 5) [F81-OH2.1]

[2.4.6.3.] 2.4.6.3. ([6] 6) [F81-OH2.1]

[2.4.6.3.] 2.4.6.3. ([7] 7) [F81-OH2.1]

[2.4.6.3.] 2.4.6.3. ([8] 8) [F81-OH2.1]

[2.4.6.4.] 2.4.6.4. ([1] 1) [F81-OH2.1]

[2.4.6.4.] 2.4.6.4. ([2] 2) no attributions

[2.4.6.4.] 2.4.6.4. ([3] 3) [F81-OH2.1]

[2.4.6.4.] 2.4.6.4. ([4] 4) [F81-OH2.1]

[2.4.6.4.] 2.4.6.4. ([4] 4) [F81-OH1.1]

[2.4.6.4.] 2.4.6.4. ([5] 5) [F81-OH1.1]

[2.4.6.4.] 2.4.6.4. ([5] 5) [F81-OH2.1]

[2.4.6.5.] 2.4.6.5. ([1] 1) [F81-OH2.1]

-- (--) [F62,F81-OP5]

-- (--) no attributions

-- (--) [F81-OP5]

[2.4.10.4.] 2.4.10.4. ([1] 1) [F81-OP5]

[2.4.10.4.] 2.4.10.4. ([1] 1) [F20,F81-OS2.1]

[2.4.10.4.] 2.4.10.4. ([2] 2) [F20,F81-OP5]

[2.4.10.4.] 2.4.10.4. ([2] 2) ([a] a),([d] d),([e] e) [F41,F81-OH2.4]

[2.4.10.4.] 2.4.10.4. ([2] 2) ([b] b),([c] c) [F20,F81-OS2.1]

[2.4.10.4.] 2.4.10.4. ([2] 2) no attributions

[2.4.10.4.] 2.4.10.4. ([3] 3) [F20,F81-OP5]

[2.4.10.4.] 2.4.10.4. ([3] 3) [F20,F81-OS2.1]

~~[2.4.10.4.] 2.4.10.4. ([4] 4) [F21,F81-OP5]~~

~~[2.4.10.4.] 2.4.10.4. ([4] 4) [F20,F81-OS2.1]~~

-- (--) [F20,F81-OP5]

-- (--) [F20,F81-OS2.1]

Submit a comment

Proposed Change 1370

Code Reference(s):	**NPC20 Div.B 2.4.9.1. (first printing)**
Subject:	Drainage Systems
Title:	Size of Storm Drainage Pipes
Description:	This proposed change extends sizing requirements already in place for soil or waste pipes to storm drainage pipes.
Related Code Change Request(s):	CCR 1115, CCR 1823

This change could potentially affect the following topic areas:

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

Problem

Sentence 2.4.9.1.(1) of Division B of the National Plumbing Code of Canada (NPC) prohibits sanitary drainage pipes from draining into pipes of a smaller diameter. A similar provision does not exist for storm drainage pipes. If a storm drainage pipe is installed so that it drains into a smaller-diameter pipe, this can lead to drainage system blockages and water retention issues, which can lead to an increase in impactful vibrations in the piping system due to hydraulic jumps. These issues may lead to unsanitary conditions, system integrity problems and flooding, which may lead to deterioration of property and harm to persons.

Justification

The proposed change would add a Sentence to Article 2.4.9.1. prohibiting storm drainage pipes from draining into smaller-diameter pipes. Requiring a storm drainage pipe to be of a nominal pipe size (NPS) not less than the NPS of the largest storm drainage pipe that drains into it would limit the probability of flow restrictions that can cause accumulation of sludge and solids, which can lead to drainage system blockages. The proposed change would therefore reduce the risk of unsanitary conditions, which can lead to harm to persons.

PROPOSED CHANGE

[2.4.9.1.] 2.4.9.1. No Reduction in Size

[1] 1) A *sanitary drainage pipe* shall be of a *nominal pipe size* not less than the *NPS* of

[a] a) a *vent pipe* that is connected to it, or

[b] b) the largest *sanitary drainage pipe* that drains into it.

[2] --) Except as provided in Article 2.4.10.13, a storm drainage pipe shall be of a *nominal pipe size* not less than the *NPS* of the largest storm drainage pipe that drains into it.

Impact analysis

In cases where an installer may have installed a smaller-diameter storm drainage pipe for a larger-diameter pipe to drain into, there will be a marginal cost increase to use a storm drainage pipe of an equal or larger NPS. For example, according to RSMeans, the average cost per metre of NPS 3 and NPS 4 acrylonitrile-butadiene-styrene (ABS) pipe is $143 and $178, respectively; thus a pipe size increase from NPS 3 to NPS 4 represents a cost increase of approximately $35 per metre.

The proposed change would facilitate the smooth flow of storm water by preventing parts of the storm drainage system from being undersized, which would reduce the risk of potential problems (e.g., property damage) related to backflow and avoid the cost to resolve them.

Enforcement implications

The proposed change would support and facilitate enforcement by building officials and regulators, as pipe sizing requirements would be more consistent. No additional training or resources would be required for building officials (i.e., authorities having jurisdiction) to enforce the proposed change.

Who is affected

Designers, specifiers, manufacturers, building owners, building officials and contractors.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[2.4.9.1.] 2.4.9.1. ([1] 1) [F81-OH2.1]

[2.4.9.1.] 2.4.9.1. ([1] 1) [F81-OH1.1]

[2.4.9.1.] -- ([2] --) no attributions

[2.4.9.1.] -- ([2] --) [F81-OH2.1]

Submit a comment

Proposed Change 2024

Code Reference(s):	**NPC20 Div.B 2.6.1.6. (first printing)**
Subject:	Water-Use Efficiency
Title:	Clarification of Maximum Water Usage for Dual-Flush Water Closets
Description:	This proposed change clarifies the maximum water usage requirements for the full and reduced flush cycles of dual-flush water closets.

This change could potentially affect the following topic areas:

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

Problem

Table 2.6.1.6. in Division B of the National Plumbing Code of Canada states that 4.8 Lpf is the maximum water usage per flush cycle permitted for dual-flush water closets for residential use. However, the intent of the Code is to allow a maximum water usage of 6.0 Lpf for a full flush and 4.1 Lpf for a reduced flush.

This information is currently provided in the first column of Table 2.6.1.6., but its presentation and location may create confusion for Code users and authorities having jurisdiction as to which maximum value is applicable. The 4.8 Lpf value currently provided in the second column is actually intended to represent the effective (or average) water usage of the fixture.

This confusion could lead to the installation of fixtures that do not comply with the intent of the Code, which could lead to either unnecessary extra costs or excessive water use, depending on how the current maximum water usage per flush cycle value (4.8 Lpf) is interpreted.

Justification

This proposed change would eliminate confusion about the maximum water usage per flush cycle permitted for dual-flush water closets by deleting the reference to 4.8 Lpf in Table 2.6.1.6. and replacing it with 6.0/4.1 Lpf.

The additional clarity provided by this proposed change to Table 2.6.1.6. would help to mitigate the risk of confusion among Code users and authorities having jurisdiction, which would limit the probability of fixture installations not complying with the intent of the Code.

Further, by including all intended maximum values for the water usage per flush cycle in the second column, the structure of Table 2.6.1.6. is maintained (i.e., the first column identifies the type of fixture, while the second column identifies the maximum water usage), which should also clarify the Code requirement and its application.

PROPOSED CHANGE

NPC20 Div.B 2.6.1.6. (first printing)

[2.6.1.6.] 2.6.1.6. Flushing Devices

[1] **1)** Flushing devices that serve water closets or urinals shall have sufficient capacity and be adjusted to deliver at each operation a volume of water that will thoroughly flush the *fixture* or *fixtures* they serve.

[2] **2)** Where a manually operated flushing device is installed, it shall serve only one *fixture*.

[3] **3)** Except as provided in Sentence (4), water closets and urinals shall have an integral means of limiting the maximum amount of water used in each flush cycle to that specified in Table 2.6.1.6.

Table [2.6.1.6.] 2.6.1.6.
Water Usage per Flush Cycle
Forming Part of Sentence [2.6.1.6.] 2.6.1.6.([3] 3)

Fixtures	**Maximum Water Usage per Flush Cycle, Lpf**
Water closets – residential	
single-flush	4.8

Fixtures	**Maximum Water Usage per Flush Cycle, Lpf**
dual-flush~~: 6.0/4.1 Lpf~~	~~4.8~~6.0/4.1
Water closets – industrial, commercial, institutional	6.0
Urinals	1.9

[4] **4)** In residential retrofits, a maximum water usage of 6.0 Lpf shall be permitted for single-flush water closets where it can be demonstrated that a maximum water usage of 4.8 Lpf would be impracticable given the existing *building* or municipal infrastructure.

[5] **5)** Except where installed in *buildings* not intended to be occupied year-round, flush-tank-type urinals shall be equipped with a device capable of preventing flush cycles when they are not in use. (See Note A-2.6.1.6.(5).)

Impact analysis

No additional cost as a result of the proposed change is anticipated.

Rather, the clarification provided by this proposed change should limit unnecessary additional costs to meet the intended Code requirement where 4.8 Lpf in Table 2.6.1.6. is currently being misinterpreted as the maximum full flush value.

Enforcement implications

Enforcement of this proposed change could be achieved by using the same enforcement methods that are currently in place to verify the specifications and performance of a water closet installed in new construction.

This proposed change should make enforcement easier for authorities having jurisdiction as it clarifies the values for maximum water usage per flush cycle for dual-flush water closets.

Who is affected

This proposed change could impact builders, consumers, manufacturers and product suppliers. However, the impact is expected to be negligible since dual-flush water closets are already on the market with 6.0 Lpf and 4.1 Lpf as the maximum water usage per full and reduced flush cycles, respectively.

This proposed change should confirm for manufacturers supplying dual-flush water closets, for example, with full and reduced cycle values of 4.8 Lpf and 3.5 Lpf or 6.0 Lpf and 4.8 Lpf, that either product would comply with the Code requirements.

Similarly, this proposed change would support manufacturers supplying only dual-flush water closets with 6.0 Lpf and 4.8 Lpf cycle values.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

NPC20 Div.B 2.6.1.6. (first printing)

[2.6.1.6.] 2.6.1.6. ([1] 1) [F72-OH2.1]

[2.6.1.6.] 2.6.1.6. ([2] 2) [F72-OH2.1]

[2.6.1.6.] 2.6.1.6. ([3] 3) [F130-OE1.2]

[2.6.1.6.] 2.6.1.6. ([4] 4) [F81-OH2.1]

[2.6.1.6.] 2.6.1.6. ([5] 5) [F130-OE1.2]