

[Submit a comment](#)

Proposed Change 2061

Code Reference(s): **NBC20 Div.B 1.1.3.1. (first printing)**
NBC20 Div.B 6.2.1. (first printing)
NBC20 Div.B 9.33.2.1. (first printing)
NBC20 Div.B 9.33.3. (first printing)
NBC20 Div.B 9.33.5. (first printing)

Subject: Overheating

Title: Overheating in New Dwelling Units

Description: This proposed change adds a maximum indoor air temperature for new dwelling units.

This change could potentially affect the following topic areas:

- | | |
|---|--|
| <input checked="" type="checkbox"/> Division A | <input checked="" type="checkbox"/> Division B |
| <input type="checkbox"/> Division C | <input type="checkbox"/> Design and Construction |
| <input type="checkbox"/> Building operations | <input checked="" type="checkbox"/> Housing |
| <input checked="" type="checkbox"/> Small Buildings | <input type="checkbox"/> Large Buildings |
| <input type="checkbox"/> Fire Protection | <input type="checkbox"/> Occupant safety in use |
| <input type="checkbox"/> Accessibility | <input type="checkbox"/> Structural Requirements |
| <input type="checkbox"/> Building Envelope | <input type="checkbox"/> Energy Efficiency |
| <input checked="" type="checkbox"/> Heating, Ventilating and Air Conditioning | <input type="checkbox"/> Plumbing |
| | <input type="checkbox"/> Construction and Demolition Sites |

Problem

As a result of global warming, overheating in buildings has become a greater health and safety concern. Overheating in dwelling units has become an area of health concern in all regions including those with temperate summers. The health and well-being of occupants who are directly exposed to high indoor air temperatures are affected.

These elevated indoor temperatures may strain the human physiological system and lead to serious health injury or death. Research has shown that overheating can lead to discomfort and sleep disturbances, and that older adults, children and people with certain health conditions may be more susceptible to the negative effects of overheating. Proactive measures to address overheating in new dwelling units should be introduced in the National Building Code of Canada (NBC).

Currently Sentence 9.33.3.1.(1) of Division B of the NBC requires residential buildings to be equipped with heating facilities to maintain a minimum indoor air temperature in winter. There is presently no corresponding requirement to limit the maximum indoor air temperature in summer. This may present an unacceptable risk of overheating and the associated health consequences in dwelling units.

Justification

Proposed Sentences 9.33.2.1.(2) and 9.33.3.1.(2) introduce a maximum indoor air temperature of 26°C in at least one living space in new dwelling units to be maintained by mechanical cooling or, where achievable, through passive cooling design measures.

After carrying out a heat-gain evaluation, mechanical cooling systems might be necessary to maintain a healthy living space and a reduced risk of overheating. Passive cooling measures would need to be explored at the design stage and might negate the need for mechanical cooling.

This proposed change:

- Aligns with the recently adopted change in B.C.
- Aims to establish an upper limit for indoor air temperature as the initial requirement to minimize the adverse effects of overheating on occupant health and safety in at least one living space in new dwelling units. The proposed temperature of 26°C aligns with other organizations' recommended maximum indoor air temperature, the B.C. Centre for Disease Control report to the Chief Coroner, and studies from the University of Ottawa and is supported by the World Health Organization.
- Does not resolve overheating issues in existing buildings nor resolve extreme heat events.
- References the listed July 2.5% outside design temperatures, as outlined in proposed Sentence 1.1.3.1.(4)-2025.
- Relies on 2.5% July dry temperatures for the calculation of the required capacity of cooling appliances, thereby recognizing regional considerations with respect to diverse climates and temperatures to ensure appropriate application across the country (proposed Sentence 9.33.3.1.(2)).
- Allows for design flexibility: CSA F280 is applicable when designing a single space within a dwelling unit; however, if the design encompasses the entire house, alternative standards can be considered (proposed Note A-9.33.3.1.(2)).
- Uses July 2.5% dry temperatures listed in Appendix C, which is not the projected assumption of future heat/thermal stresses. As such, some extreme weather events may exceed the capacity of cooling systems.
- Outlines the maximum indoor air temperature in at least one living space in dwelling units in proposed Sentence 9.33.3.1.(2), which is also referenced in proposed Sentence 6.2.1.2.(2), Indoor Design Temperatures.
- Recognizes that the room-by-room cooling calculations in CSA F280 are a tool for determining the sizing of the equipment and necessity of mechanical cooling for at least one living space in a dwelling unit using the 26°C temperature limit,

- as outlined in revised Sentence 9.33.5.1.(1).
- Is based on climatic data and/or passive cooling measures; mechanical cooling systems may not be necessary (Sentence 9.33.2.1.).
 - Acknowledges both vulnerability and practicality considerations.

PROPOSED CHANGE

NBC20 Div.B 1.1.3.1. (first printing)

[1.1.3.1.] 1.1.3.1. Climatic and Seismic Values

- [1] 1)** Except as provided in Sentences (2) and (4), the climatic and seismic values required for the design of *buildings* under this Code shall be in conformance with the values established by the *authority having jurisdiction*.
- [2] 2)** Where they have not been established by the *authority having jurisdiction*, the climatic values required for the design of *buildings* shall be in conformance with Sentences (3) and (4) and the values listed in Appendix C. (See Note A-1.1.3.1.(2).)
- [3] 3)** The outside winter design temperatures determined from Appendix C shall be those listed for the January 2.5% values. (See Note A-1.1.3.1.(3).)
- [4] --)** The outside summer design temperatures determined from Appendix C shall be those listed for the July 2.5% dry values.
- [5] 4)** Where they have not been established by the *authority having jurisdiction*, the seismic values required for the design of *buildings* under Part 4 and Part 9 shall be in conformance with Appendix C. (See Note A-1.1.3.1.(4).)

NBC20 Div.B 6.2.1. (first printing)

[6.2.1.] 6.2.1. General

[6.2.1.1.] 6.2.1.1. Good Engineering Practice

[6.2.1.2.] --- Indoor Design Temperatures

- [1] --)** Indoor design temperatures for mechanical heating and cooling facilities in dwelling units shall conform to Article 9.33.3.1.

[6.2.1.3.] 6.2.1.2. Outdoor Design Conditions**[6.2.1.4.] 6.2.1.3. Expansion, Contraction and System Pressure****[6.2.1.5.] 6.2.1.4. Structural Movement****[6.2.1.6.] 6.2.1.5. Installation Standards****[6.2.1.7.] 6.2.1.6. Installation – General****[6.2.1.8.] 6.2.1.7. Asbestos**

NBC20 Div.B 9.33.2.1. (first printing)**[9.33.2.1.] 9.33.2.1. Required Heating and Cooling Systems**

- [1] 1)** Residential *buildings* intended for use in the winter months on a continuing basis shall be equipped with heating facilities conforming to this Section.
- [2] --)** Except as provided in Article 9.33.5.1.-2025 or good engineering practice as described in Article 6.2.1.1., dwelling units intended for use during summer seasons on a continuing basis shall be equipped with cooling facilities conforming to this Section. (See Note A-9.33.2.1.(2).)

Note A-9.33.2.1.(2) Passive Cooling Measures.

Passive cooling measures, such as exterior shading, building orientation, insulation, low solar heat gain windows, and thermal mass, can reduce cooling loads and help to achieve the indoor air temperature specified in Sentence 9.33.3.1.(2).

NBC20 Div.B 9.33.3. (first printing)**[9.33.3.] 9.33.3. Design Temperatures****[9.33.3.1.] 9.33.3.1. Indoor Design Temperatures**

- [1] 1)** At the outside winter design temperature, required heating facilities shall be capable of maintaining an indoor air temperature of not less than
- [a] a) 22°C in all living spaces,
 - [b] b) 18°C in unfinished *basements*,
 - [c] c) 18°C in common *service rooms*, ancillary spaces and *exits* in houses with a *secondary suite*, and
 - [d] d) 15°C in heated crawl spaces.
- [2] --)** Except as provided in Sentence (3), at the outside summer design temperature, permanently installed cooling facilities shall be capable of maintaining an indoor air temperature of not more than 26°C in at least one living space in each dwelling unit.
- [3] --)** Optional comfort cooling facilities shall be designed using the indoor design temperature specified in CSA F280, "Determining the required

capacity of residential space heating and cooling appliances", or applicable documents referenced in Article 9.33.4.1.

[9.33.3.2.] 9.33.3.2. Outdoor Design Temperatures

NBC20 Div.B 9.33.5. (first printing)

[9.33.5.] 9.33.5. Heating and ~~Cooling Air-conditioning~~ Appliances and Equipment

[9.33.5.1.] 9.33.5.1. Capacity of Heating ~~and Cooling~~ Appliances

[1] 1) The required capacity of heating ~~and cooling~~ *appliances* located in a *dwelling unit*, and serving only that *dwelling unit* ~~or part of that dwelling unit~~, shall be determined, ~~using design temperatures conforming to Subsection 9.33.3.,~~ in accordance with ~~CSA F280, "Determining the required capacity of residential space heating and cooling appliances", except that the design temperatures shall conform to Subsection 9.33.3.~~

[a] --) CSA F280, "Determining the required capacity of residential space heating and cooling appliances", or

[b] --) good engineering practice as described in Article 6.2.1.1.

[9.33.5.2.] 9.33.5.2. Installation Standards

[1] 1) Except as provided in Articles 9.33.5.3. and 9.33.5.4., the installation of heating and ~~cooling air-conditioning~~ *appliances and* equipment, including mechanical refrigeration equipment, and including provisions for mounting, clearances and air supply, shall conform to applicable provincial or territorial regulations or municipal bylaws or, in the absence of such regulations or bylaws, to

[a] a) CSA B51, "Boiler, pressure vessel, and pressure piping code",

[b] b) CSA B52, "Mechanical refrigeration code",

[c] c) CSA B139 Series, "Installation code for oil-burning equipment",

[d] d) CSA B149.1, "Natural gas and propane installation code",

[e] e) CSA C22.1, "Canadian Electrical Code, Part I", or

[f] f) CAN/CSA-C448 Series, "Design and installation of earth energy systems".

(See also Sentence 9.33.5.3.(1).)

[9.33.5.3.] 9.33.5.3. Design, Construction and Installation Standard for Solid-Fuel-Burning Appliances

[9.33.5.4.] 9.33.5.4. Fireplaces

Impact analysis

Refer to the supporting document for the complete impact analysis.

Executive summary

The proposed change described in PCF 2061 is recommending that the National Building Code of Canada mandate the addition of an acceptable upper indoor temperature that must be maintained in a single living space within each dwelling unit by the addition of mechanical cooling and/or by passive design measures. This report summarizes the impact analysis for implementing a maximum indoor air temperature for a single living space in a dwelling unit by the addition of mechanical cooling.

The benefits of reducing indoor air temperatures by installing single room ductless mini-split air conditioning (DMSAC) units in Part 9 dwelling units, and apartment type dwelling units, followed a pattern typical of preventive interventions, with the direct costs incurred up front and a delay before the full benefits are experienced. The direct benefits included the number of overheating related deaths prevented and any treatment costs avoided following the reduction in indoor air temperatures. The results of the analysis were presented in two parts:

- i. Example case: single room DMSAC units in dwelling units, including apartment type dwelling units, built in 1 year.
- ii. Full analysis: single room DMSAC units in dwelling units, including apartment type dwelling units, built over a 20-year period, the lifespan of the DMSAC units.

The methodology used to estimate the benefits provided by installing a DMSAC unit in a single living space in each dwelling unit, including apartment type dwelling units, was defined as follows:

- Two estimates (lower and upper) of current overheating related deaths associated with extreme heat events (estimated using a cutoff of 2.5th temperature percentile).
- Expected 100% effectiveness of the DMSAC in new dwelling units, assuming use by the occupants, in reducing illness and death associated with extreme heat events only.
- 20-year service life of the DMSAC

The annual cost for the 12-month period between July 1, 2021, and June 30, 2022, for installing a 9000 BTU/h single room DMSAC units in 221,492 dwellings of all types, including apartment type dwellings, is estimated to be \$475 398 711. The estimated operational costs over the 1-year period is estimated to be \$43 123 518. It is estimated that the lifespan of a DMSAC will be 20 years with minimal maintenance. The total cost of both the initial installation and operation costs at the end of the 20-year

time period is estimated to be \$1 337 869 100. The total treatment costs for illnesses related to overheating during extreme heat events over the 20-year time period is estimated to range between \$2 430 920 and \$14 853 880 for the lower and upper estimates, respectively. The cumulative number of overheating related deaths prevented over 20-year period during extreme heat events was estimated to be 2,520 and 17,290 for the lower and upper estimates, respectively, in the residents of all dwellings completed over 20 years following the installation of the DMSAC.

The impact analysis on installing a DMSAC unit in a single living space in each dwelling unit, including apartment type dwellings, demonstrates that the main benefit would be preventing 2 520 to 17 290 overheating associated deaths during extreme heat events in Canada over 20 years should the proposed change be adopted. Although the costs incurred for installing DMSAC units in all dwelling types, including apartment type dwellings, always exceeded the savings from preventing cases requiring overheating related illness treatment during extreme heat events, the cumulative cost per overheating death prevented decreased steeply after implementation and was lower than the Treasury Board of Canada Secretariat value of statistical life (VSL) after 1 year to 9 years for direct cost comparisons, and after 1 year to 19 years for direct and indirect cost comparisons.

Enforcement implications

This proposed change could be enforced by the infrastructure currently available to enforce the Codes.

Who is affected

- Homeowners and occupants would see an increase in the cost of their dwelling unit.
- Builders would need to incorporate the proposed change into the construction process for dwelling units.
- Architects, engineers, designers and contractors.
- Authorities having jurisdiction would need training to understand how to apply the new requirements.

Supporting Document(s)

[Impact Analysis for PCF 2061: Overheating in New Dwelling Units \(impact_analysis_for_pcf_2061_final.pdf\)](#)

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

NBC20 Div.B 1.1.3.1. (first printing)

[1.1.3.1.] -- ([4] --) no attributions

NBC20 Div.B 6.2.1. (first printing)

[6.2.1.1.] 6.2.1.1. ([1] 1) ([a] a) to ([e] e) [F31,F51-OP1.1]

[6.2.1.1.] 6.2.1.1. ([1] 1) ([a] a) to ([c] c),([e] e) to ([i] i) [F40,F50,F51,F52,F54,F63-OH1.1]

[6.2.1.1.] 6.2.1.1. ([1] 1) ([a] a) to ([c] c),([e] e) to ([h] h) [F50,F51,F52,F54,F63-OH1.2,OH1.3]

[6.2.1.1.] 6.2.1.1. ([1] 1) [F31,F50,F51,F52,F54,F63-OS3.2,OS3.4]

[6.2.1.1.] 6.2.1.1. ([1] 1) ([d] d) [F01-OS1.1]

[6.2.1.2.] -- ([1] --) no attributions

[6.2.1.3.] 6.2.1.2. ([1] 1) no attributions

[6.2.1.3.] 6.2.1.2. ([2] 2) [F40,F50-OH1.1]

[6.2.1.3.] 6.2.1.2. ([3] 3) [F40,F43,F44,F50-OH1.1]

[6.2.1.3.] 6.2.1.2. ([3] 3) [F44-OS3.4]

[6.2.1.4.] 6.2.1.3. ([1] 1) [F20-OS3.2]

[6.2.1.5.] 6.2.1.4. ([1] 1) [F23-OS3.1]

[6.2.1.5.] 6.2.1.4. ([1] 1) [F51,F63,F50-OH1.1,OH1.2,OH1.3]

[6.2.1.6.] 6.2.1.5. ([1] 1) [F43-OS1.1]

[6.2.1.6.] 6.2.1.5. ([1] 1) [F43-OS3.4]

[6.2.1.6.] 6.2.1.5. ([1] 1) [F43-OP1.1]

[6.2.1.7.] 6.2.1.6. ([1] 1) [F82-OS1.1]

[6.2.1.7.] 6.2.1.6. ([1] 1) [F82-OS3.4]

[6.2.1.7.] 6.2.1.6. ([1] 1) [F82-OP1.1]

[6.2.1.7.] 6.2.1.6. ([2] 2) [F31-OS3.1]

[6.2.1.7.] 6.2.1.6. ([3] 3) [F81-OS3.2,OS3.3,OS3.4]

[6.2.1.7.] 6.2.1.6. ([3] 3) [F81-OS1.1]

[6.2.1.8.] 6.2.1.7. ([1] 1) [F43-OH1.1]

NBC20 Div.B 9.33.2.1. (first printing)

[9.33.2.1.] 9.33.2.1. ([1] 1) [F51,F52-OH1.2] [F63-OH1.1]

[9.33.2.1.] 9.33.2.1. ([1] 1) [F63-OS2.3]

[9.33.2.1.] -- ([2] --) [F51-OH1.2]

NBC20 Div.B 9.33.3. (first printing)

[9.33.3.1.] 9.33.3.1. ([1] 1) [F51-OH1.2]

[9.33.3.1.] -- ([2] --) [F51-OH1.2]

[9.33.3.1.] -- ([3] --) [F51-OH1.2]

[9.33.3.2.] 9.33.3.2. ([1] 1) no attributions

NBC20 Div.B 9.33.5. (first printing)

[9.33.5.1.] 9.33.5.1. ([1] 1) [F63-OH1.1] [F51-OH1.2]

[9.33.5.1.] 9.33.5.1. ([1] 1) [F63-OS2.3]

[9.33.5.2.] 9.33.5.2. ([1] 1) [F01-OP1.1] Applies to heating equipment.

[9.33.5.2.] 9.33.5.2. ([1] 1) [F41,F63,F50-OH1.1] [F51,F52-OH1.2]

[9.33.5.2.] 9.33.5.2. ([1] 1) [F63-OS2.3] Applies to heating equipment.

[9.33.5.2.] 9.33.5.2. ([1] 1) [F44-OS3.4] Applies to heating equipment.

[9.33.5.2.] 9.33.5.2. ([1] 1) [F01-OS1.1] Applies to heating equipment.

[9.33.5.3.] 9.33.5.3. ([1] 1) [F41,F43-OH1.1] [F51-OH1.2]

[9.33.5.3.] 9.33.5.3. ([1] 1) [F51-OS2.3]

[9.33.5.3.] 9.33.5.3. ([1] 1) [F43-OS3.4]

[9.33.5.3.] 9.33.5.3. ([1] 1) [F01-OS1.1]

[9.33.5.3.] 9.33.5.3. ([1] 1) [F01-OP1.1]

[9.33.5.4.] 9.33.5.4. ([1] 1) no attributions