Information Bulletin
Building and Safety Standards Branch
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Protection from Overheating in Dwelling Units

This bulletin provides information about new provisions in the British Columbia Building Code (Building Code) 2024 related to minimizing the risks to health and safety due to overheating in dwelling units. These new Building Code 2024 requirements apply to projects for which a building permit is applied for on or after March 8, 2024. These changes apply to new dwelling units in all large (Part 3) and smaller (Part 9) residential occupancies.

Background

Recent extreme heat events in the summer of 2021 in British Columbia had devastating impacts, attributing to 619 deaths. Similar weather episodes are projected to become hotter, longer, and more frequent as B.C.'s climate changes.

In the Report to the Chief Coroner of British Columbia, titled "Extreme Heat and Human Mortality: A Review of Heat-Related Deaths in B.C. in Summer 2021" a recommendation was made to "…ensure that the 2024 release of the BC Building Code incorporates both passive and active cooling requirements in new housing construction…".

In response, the Building Code 2024 introduced a maximum design temperature limit for a single living space in each dwelling unit to minimize the risk to health and safety from overheating. Maintaining a safe temperature in a living space in each dwelling unit can involve a combination of mechanical cooling systems and passive design measures. The designated living space provides a place of reprieve for occupants of the dwelling unit from elevated temperatures, helping increase community resiliency and saving lives. The designer can designate a living space that makes sense for the circumstances of the dwelling unit (climate, configuration, building systems, etcetera), but it must be a living space that is designated. Unfinished basements, service rooms, and crawlspaces are not living spaces[1].

In addition, designers must coordinate the specification of space-conditioning equipment (as necessary) with energy efficiency requirements of the BC Energy Step Code. In some cases, mechanical equipment such as heat-recovery ventilators and heat pumps can be used to help maintain indoor design temperatures while also helping to meet energy efficiency targets.

[1] Article 9.33.3.1. of Division B describes living spaces distinctly from other spaces in residential buildings.

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Passive Cooling Strategies and Synergies

Passive cooling strategies can be a way to effectively reduce cooling loads and the potential for overheating within dwelling units and are encouraged when demonstrating compliance.

Building orientation can be optimized to take advantage of natural ventilation, maximize natural light, and reduce unwanted solar gain.

Improved thermal performance of the building envelope can be an effective passive measure when coupled with either passive ventilation or active cooling as it helps to regulate heat transfer through the building envelope. Care must be taken as more thermally efficient buildings can have more of a propensity to overheat given that they are not able to shed internal heat as well as lesser performing buildings, thus improved thermal performance must be looked at in conjunction with other passive/active measures to reduce risks of overheating.

Externally fixed or operable shading can come in the form of either overhangs over windows, typically on the south elevation, or vertical shading on the east and west elevations and, if appropriately designed, can be effective at limiting solar heat gain in the summer while allowing solar heat gain in the winter months, thereby reducing heating demand. Examples of operable shading can include exterior sliding shade panels or exterior roll shutters. Operation would be controlled by occupants and can be deployed as necessary based on occupant needs.

Solar heat gain coefficient (SHGC) of glazing is the amount of solar radiation emitted through a window. The higher the value, the more solar radiation is emitted through the window and into the interior space. The SHGC can have a profound effect on both the Thermal Energy Demand Intensity (TEDI) as well as the potential for unwanted solar heat gain, which can contribute to overheating. When considering energy efficiency, low SHGC can help to allow solar radiation into the space, offsetting the thermal demand during the colder months of the year. However, in the context of cooling loads, high SHGC can be a detriment and can allow excessive amounts of unwanted solar radiation into the space during the warmer months of the year. The SHGC should be optimized based on heating loads, cooling loads, as well as occupant comfort and safety.

Window orientation and window to wall ratio (WWR) can impact both the heating and cooling loads. Location of windows based on building exposure should be considered to ensure that windows are not placed on elevations with high solar exposure, unless they are appropriately protected with shading (i.e. window overhangs). Similarly, the amount of glazing should be considered based on exposure and should be optimized

in the context of both cooling and heating loads. Minimizing glazing on east and west elevations should be considered given the challenge of controlling solar heat gain during the summer months.

Passive ventilation can be an effective way to reduce cooling demand and increase occupant comfort during the summer months by facilitating the flow of fresh air through the dwelling unit. Strategies such as appropriate location and amount of occupant controlled operable windows can promote cross ventilation, both during the day and night, while also taking advantage of the stack effect and natural buoyancy of warm air, which could be vented through operable windows located on upper storeys.

Thermal mass of materials that are located within a dwelling unit, such as concrete, stone, and brick, contribute to regulating the interior temperature of the dwelling unit by absorbing the suns energy during the day and slowly releasing it over the night.

Reflective roofs and green roof systems that incorporate highly reflective materials with high emissivity or growing medium (intensive or extensive green roofs) can reduce the amount of heat transferred to dwelling units directly below the roof system and reduce cooling loads for the building.

Energy Modelling Considerations for Part 3

As outlined in Clause 10.2.3.4.(1)(b) of Division B, Step Code projects are to conform with the City of Vancouver Energy Modelling Guidelines (EMGs). Within the EMGs under Section 4 - Passively Cooled Buildings, it states:

For buildings that do not incorporate mechanical cooling, it must be demonstrated that interior dry bulb temperatures of occupied spaces do not exceed the 80% acceptability limits for naturally conditioned spaces, as outlined in ASHRAE 55-2010 Section 5.3, for more than 200 hours per year for any zone.

Should a project have mechanical cooling for only one living space in each dwelling unit as opposed to mechanical cooling throughout, then Section 4 applies and an analysis following ASHRAE 55 is to be conducted as stated in the EMGs.

Energy Modelling Considerations for Part 9

When conducting whole building energy modeling analysis, there can be limitations of the HOT2000 modelling software in the context of accurately predicting cooling loads, thus it would not be appropriate to use this as a means of demonstrating compliance with the 26°C indoor design temperature requirement. Sentence 9.33.5.1.(1) of Division B requires CSA F280 is to be used to determine the peak cooling loads.

Appropriate software, verified as per Section 8 of CSA F280, may be used for the calculations. A list of verified software can be found on the HVAC Designers of Canada website via the following link: https://hvacdc.ca/?page_id=406.

For demonstrating compliance with the 26°C indoor design temperature requirement, historical climate files in Appendix C of Division B are to be used unless the authority having jurisdiction has established climatic values. It is recognized that historical climate files are not projections of future extended heat waves or extreme heat events.

Coordination of Design

To appropriately accommodate for passive design elements, cooling loads, and meeting the requirement of 26°C indoor design temperature in one living space of each dwelling unit, it is recommended that the design team follow the integrated design process whereby all necessary design team members are retained early in the design process to provide their input and expertise to ensure all systems are appropriately coordinated. This will help to reduce the risk of the potential for costly changes or delays later in the construction process.

As outlined in Sentence 9.33.5.1.(1) for buildings following Part 9, CSA F280 is to be used to demonstrate compliance with the 26°C indoor design temperature requirement. It is recommended that the CSA F280 calculation be done as early in the design process as possible by either a mechanical consultant/contractor or those competent in HVAC and mechanical design to ensure that the appropriate measures are incorporated into the design.

Administrative Provisions (Division C)

Designers are reminded of the administrative provisions found in Division C of the Building Code 2024, specifically Sentence 2.2.2.1.(1) which states:

Sufficient information shall be provided to show that the proposed work will conform to this Code and whether or not it may affect adjacent property.

Designers following Part 9 are required to provide sufficient information to demonstrate that a minimum of one living space in each dwelling unit meets the 26°C indoor design temperature requirement through passive and/or active measures as per CSA F280.

Climatic Values in Appendix C

The climatic values in Appendix C of Division B are used if the authority having jurisdiction has not established climatic values. (Where the authority having jurisdiction has established climatic values, it is those values that govern.) When using the values in Appendix C for the outside summer design temperature, it is the July 2.5% dry values that apply.

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Frequently Asked Questions (FAQs)

Are there alternatives to mechanical cooling that can be incorporated into the building to reduce risks of overheating?

Yes, passive cooling strategies may be used as an alternative or a supplement to mechanical cooling where it can be shown that the passive design measures can help limit the maximum indoor design temperature to 26°C. These include natural ventilation, shading, insulation, and thermal mass storage to moderate the indoor air temperatures.

What types of mechanical cooling systems can be used to satisfy the new provisions? Can a plug-in air-conditioning unit be used to satisfy the new provisions?

There are various cooling systems that may be used such as ducted air-conditioning units, ductless mini-split air conditioners, heat pumps, and geothermal to name a few.

Plug-in units such as air-conditioning insert units installed in window openings are not considered to meet the new provisions. If mechanical cooling systems are required, the mechanical cooling equipment is to form part of a system that is integral to the building.

Can a common space (i.e. laundry room) shared between two dwelling units (i.e. secondary suite) be used as a cooling room to satisfy the new overheating provisions?

No. Each dwelling unit requires its own living space capable of maintaining an indoor design temperature of not more than 26°C. A secondary suite is, by definition, a separate and independent dwelling unit.

For the purposes of the minimum required area to be cooled, what is a 'living space'?

A living space is not a defined term in the Building Code, however Article 9.33.3.1. of Division B uses the term "living space" in differentiating indoor design temperature from other identified areas in a residential occupancy. As such, unfinished basements, service rooms, ancillary spaces, exits, and heated crawl spaces are not living spaces.

Protection from overheating is required in at least one living space so that occupants can spend an extended period of time in a place of reprieve with minimal discomfort. A bathroom or laundry room would not provide suitable 'living space' for an extended period of time, nor a space intended to be temporarily and intermittently occupied such as a closet or pantry.

It is not required that the living space protected from temperatures above 26°C be a bedroom, but it is intended to be a space the occupants can use to continue daily life while avoiding the harmful effects of elevated indoor temperatures. In adaptable dwelling units for example, the protected living space should be a living space designated as adaptable.

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How can I demonstrate compliance with the new overheating provisions?

Part 9 designers are to use CSA F280 "Determining the Required Capacity of Residential Space Heating and Cooling Appliances" in determining the minimum capacity required to meet the cooling requirement. Applicants are required to provide sufficient information, as per Sentence 2.2.2.1.(1) of Division C, to demonstrate that a minimum of one living space in each dwelling unit meets the 26°C requirement.

Part 3 designers are to follow the energy modelling procedures as required under Division B, Article 10.2.3.4. Further, should mechanical cooling only be provided for one living space in each dwelling unit, then ASHRAE 55 "Thermal Environmental Conditions for Human Occupancy" analysis is to be performed as outlined in the City of Vancouver Energy Modelling Guidelines. Similar to Part 9 designers, applicants are to provide sufficient information as per Sentence 2.2.2.1.(1) of Division C.

Are the new overheating requirements for new construction or existing units?

The overheating requirements are for newly constructed residential occupancies.

What is the maximum indoor design temperature that is required in the new overheating provisions? Does this maximum indoor design temperature apply to the whole building?

The new overheating provisions require at least one living space that is capable of maintaining an indoor air temperature of not more than 26°C. The 26°C maximum was informed, in part, based on a report from the BC Centre for Disease Control to the Chief Coroner of British Columbia titled "Extreme Heat and Human Mortality: A review of Heat-Related Deaths in B.C. in Summer 2021" that revealed the dangers of extreme heat for people when indoor air temperatures remained above 26°C throughout the heat event.

Where can I find more guidance on overheating?

BC Housing, in collaboration with BC Hydro, the City of Vancouver, the City of New Westminster, and the Province of BC, published a Design Guide Supplement on Overheating and Air Quality: https://www.bchousing.org/publications/BC-Energy-Step-Code-Guide-Supplemental.pdf.

The University of British Columbia commissioned the report "Designing Climate Resilient Multifamily Buildings": https://planning.ubc.ca/sites/default/files/2020-05/REPORT_UBC_Climate%20Resilient%20Multifamily%20Buildings.pdf

BC Housing published Builder Insight Number 19 – Modelling the Future Climate in Passively Cooled Buildings: https://www.bchousing.org/publications/Builder-insight-19-Modelling-the-future-climate-in-passively-cooled-buildings.pdf