Submit a comment

Proposed Change 2033

Code Reference(s):	**NBC20 Div.B 10.9. (first printing)**
Subject:	Alteration of Existing Buildings — Housing and Small Buildings
Title:	Ventilation Systems in Existing Buildings Subjected to Alteration
Description:	This proposed change introduces requirements for ventilation systems in existing buildings subjected to alteration.
Related Proposed Change(s):	PCF 1825, PCF 1827, PCF 1828, PCF 2032, 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

The provisions in Section 9.32. of the National Building Code of Canada (NBC) that address ventilation, specifically heating-season mechanical ventilation, are unclear in their application to the alteration of existing buildings. Currently, the NBC lacks clarity on the requirements for ventilation systems when alterations lead to increased airtightness of the air barrier system or replacement of service water heating or space-heating equipment, particularly fuel-fired appliances. In the latter context, changes to vented appliances that lead to the alteration of a chimney or other external vent could

cause backdrafting or spillage due to changes in the stack effect. This situation may result in inconsistent ventilation practices in existing buildings subjected to alteration, potentially compromising indoor air quality and overall occupant health.

In proposed Part 10, it is necessary to provide clear and comprehensive provisions for heating-season mechanical ventilation, especially in the context of alterations that impact an existing building's air barrier system or replace service water heating or space-heating equipment.

Justification

This proposed change is essential to address identified shortcomings in the regulation of heating-season mechanical ventilation for existing buildings subjected to alteration. Lack of clarity regarding the requirements for alterations that impact the air barrier system or replace fuel-fired appliances leaves room for misinterpretation and a potential decrease in ventilation performance. This proposed change streamlines the requirements for ventilation systems, limiting the probability that increased airtightness resulting from alterations or the replacement of fuel-fired appliances compromises indoor air quality. By explicitly defining the minimum requirements for ventilation in these specific scenarios, this proposed change intends to protect occupant health and well-being while improving energy performance.

PROPOSED CHANGE

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[10.9.] -- Housing and Small Buildings

[10.9.1.] -- Ventilation

[10.9.1.1.] --- Required Ventilation
(See Note A-10.9.1.1.)

[1] --) Except where there is an existing kitchen or bathroom exhaust device that is ducted to the outdoors, a ventilation system shall be provided in accordance with Article 9.32.1.2. where an *alteration*

[a] --) increases the airtightness of the *air barrier system*, or

[b] --) replaces a fuel-fired space- or water-heating *appliance* of other than *direct-vented* or *mechanically-vented* types with an *appliance* that is not fuel-fired or that is of *direct-vented* or *mechanically-vented* type.

[2] --) The ventilation system required by Sentence (1) shall conform to

[a] --) Clause 9.32.3.1.(1)(a), or

[b] --) Articles 9.32.3.3. to 9.32.3.5. and 9.32.3.8. to 9.32.3.13.

Note A-10.9.1.1. Required Ventilation.

Article 10.9.1.1. is intended to prevent adverse effects on the indoor air quality of a building due to an alteration that reduces the natural air change rate, such as an improvement of the building's airtightness or the removal or sealing of a natural draft chimney. 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. 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 system or components or for any other equipment identified in Article 9.32.3.8.

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].

Benefits

This proposed change ensures that, in the case of an alteration to an existing building, the risk is reduced of the entry of carbon monoxide gas into the living space of a dwelling unit that may result from excessive negative pressure created by the inadequate replacement of indoor air with outdoor air. In addition, this proposed change reduces the risk of harm to persons due to negative effects on the indoor air quality and inadequate thermal comfort of persons resulting from:

- inadequate ventilation, and
- inadequate control of
    - relative humidity,
    - indoor air temperatures,
    - airborne pollutants,
    - oxygen and other components necessary for breathable air, and
    - condensation, which could lead to the generation of pollutants from biological growth or from materials that become unstable on wetting.

Cost

The costs associated with complying with proposed Sentence 10.9.1.1.(2) only apply where there is no existing bathroom or kitchen exhaust device ducted to the outdoors. According to a Canada Mortgage and Housing Corporation report from 1990, more than 70% of new houses have bathroom or kitchen exhaust fans, which means only approximately 30% of new houses would be affected [3].

In those cases, balanced ventilation could be achieved in conformance to Clause 9.32.3.1.1.(a) or Articles 9.32.3.3. to 9.32.3.5. and 9.32.3.8. to 9.32.3.13.with use of a bathroom fan and furnace return air from a duct to the outdoors, where a forced-air heating system is present. Balanced ventilation is achieved by measuring the exhaust flow of the bathroom fan and setting the air flow in a duct to bring an equal amount of outside air to the return air plenum. Only the principal ventilation

system at normal operating exhaust capacity, as required in Article 9.32.3.3., would need to be balanced in accordance with NBC requirements (the measurement and balancing is the same as that required for heat-recovery ventilation (HRV)/energy-recovery ventilation (ERV) systems). The high exhaust rate for supplemental exhaust, as described in Article 9.32.3.7., is not required to have balanced incoming air. While the material costs for this approach are expected to be lower, the labour costs are expected to be high for the installation of the ductwork and interlocking of the bathroom and furnace fans.

Another approach for compliance is the installation of a wall- or ceiling-mounted standalone ERV system, which differs from a whole-house ERV system that is connected to the furnace. This approach is expected to cost less than if not the equivalent of the above approach, given lower labour costs despite a higher material cost. The cost of this approach is estimated to be $730 [4] for the ERV, $127.87 for a wall cap with Styrofoam adaptor [4], $89.77 for flexible insulated ducting [5], $100 for wiring, and $500 for five hours of labour (HVAC professional and electrician), totalling $1 547.64. It is expected that this ERV system would use the wiring present in the existing building to power the bathroom light.

References

(1) Statistics Canada. Evolution of housing in Canada, 1957 to 2014. May 17, 2018. https://www150.statcan.gc.ca/n1/pub/11-630-x/11-630-x2015007-eng.htm.
(2) Behan, K. and Szczepanowski, R. Residential Archetyping for Energy Efficiency — A Guide for Canadian Municipalities. Toronto: Clean Air Partnership, 2022.
(3) Hamlin, T., Forman, J. and Lubun, M. Ventilation and Airtightness in New Detached Canadian Housing. Ottawa: Canada Mortgage and Housing Corporation, 1990.
(4) Source of pricing: https://www.amazon.ca.
(5) Source of pricing: https://www.homedepot.ca.

Enforcement implications

It is expected that a consistent set of provisions that apply to the alteration of existing buildings would help reduce 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 mitigate negative consequences for ventilation due to an alteration that improves energy performance.

Who is affected

For designers, engineers and architects, this proposed change would clarify the requirements for the ventilation system of an existing building subjected to alteration. This proposed change is expected to remove potential confusion about the requirements for an alteration, thus facilitating the design process.

For builders and renovators, this proposed change is expected to reduce unnecessary work by clarifying the application of the requirements for the ventilation system in existing buildings subjected to alteration.

For buildings officials, this proposed change is expected to reduce confusion about how ventilation systems in existing buildings subjected to alteration should be regulated.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

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[10.9.1.1.] -- ([1] --) no attributions

[10.9.1.1.] -- ([1] --) [F40,F50,F53-OS3.4]

[10.9.1.1.] -- ([1] --) [F40,F50,F52-OH1.1] [F51,F52-OH1.2]

[10.9.1.1.] -- ([2] --) no attributions

[10.9.1.1.] -- ([2] --) [F40-OH1.1]