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Proposed Change 2032

Code Reference(s):	NBC20 Div.B 10.9. (first printing)
Subject:	Alteration of Existing Buildings — Housing and Small Buildings
Title:	Heat Transfer, Air Leakage and Condensation Control Requirements
Description:	This proposed change introduces requirements for the continuity of air barrier systems in existing buildings subjected to alteration.
Related Proposed Change(s):	PCF 1825, PCF 1827, PCF 1828, PCF 2033, PCF 2051

This change could potentially affect the following topic areas:

- | | |
|---|---|
| <input type="checkbox"/> Division A | <input checked="" type="checkbox"/> Division B |
| <input type="checkbox"/> Division C | <input checked="" 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 checked="" type="checkbox"/> Building Envelope | <input checked="" type="checkbox"/> Energy Efficiency |
| <input checked="" type="checkbox"/> Heating, Ventilating and Air Conditioning | <input type="checkbox"/> Plumbing |
| | <input type="checkbox"/> Construction and Demolition Sites |

General information

See the summary for subject Alteration of Existing Buildings.

Problem

The existing provisions in Section 9.25. of Division B of the National Building Code of Canada (NBC) that concern heat transfer, air leakage and condensation control lack clarity regarding the need for the continuity of air barrier systems in housing and small buildings subjected to alteration.

Specifically, more explicit guidelines are needed to address penetrations in floors-on-ground, access hatches, sump pits, and cracks in floors and walls.

A concise and comprehensive new provision is required to ensure the robustness of air barrier systems, especially where alterations affect below-grade components, to limit the probability of the infiltration of soil gas, which could lead to negative effects on the air quality of indoor spaces, which could lead to harm to persons.

Justification

The NBC lacks explicit guidance on penetrations in floors-on-ground, access hatches, sump pits, and cracks in floors and walls in existing buildings subjected to alteration. These omissions pose a risk to the overall energy efficiency of a building, which may lead to wasted energy and diminished thermal performance.

This proposed change aims to provide clear requirements for maintaining the integrity of the air barrier system to ensure that alterations do not compromise the building's energy efficiency. By addressing these specific issues in proposed Part 10, this proposed change would enhance the effectiveness of the Code requirements, promote energy efficiency practices, and reinforce the importance of a well-maintained air barrier system in housing and small buildings.

PROPOSED CHANGE

NBC20 Div.B 10.9. (first printing)

[10.9.] -- Housing and Small Buildings

[10.9.1.] -- Heat Transfer, Air Leakage and Condensation Control

[10.9.1.1.] --- Continuity of the Air Barrier System

(See Note A-10.9.1.1. (PCF 2051).)

- [1] --) *Where the continuity of the below-grade 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, where accessible,***
- [a] --) *cracks in masonry walls, concrete walls, and floors-on-ground shall be sealed.***
 - [b] --) *floors-on-ground shall conform to Sentence 9.25.3.6.(5).***
 - [c] --) *penetrations of a floor-on-ground shall conform to Sentence 9.25.3.6.(6).***
 - [d] --) *penetrations of the air barrier system shall conform to Sentence 9.25.3.3.(6), and***
 - [e] --) *access hatches and sump pit covers shall conform to Sentence 9.25.3.3.(7).***

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.²–2 500 ft.² of heated floor area and with a 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, the probability of the infiltration of soil gas is reduced by decreasing the air leakage through the foundation, floors-on-ground and any penetrations thereof. This reduces the risk of negative effects on the air quality of indoor spaces, which could lead to harm to persons.

Note that it is impossible to explore all permutations of alterations occurring to all existing dwelling units in Canada, so it is not feasible to determine the reduction factor range for the infiltration of soil gas.

In the case of radon, the actual reduction factor would be dependent on multiple factors including the existing below-grade air barrier system, the extent of the alteration, the radon concentration and permeability of the ground under the house (which is extremely variable and not predictable), and the ventilation systems, heating systems and size of the house. Similarly, the radon reduction potential for soil gas barriers installed in new construction is reported to be highly variable [3]. Nevertheless, sealing cracks and other openings in the foundation is considered a basic component of most approaches to radon reduction and can help increase their effectiveness [4].

In summary, it is expected that failing to maintain the below-grade air barrier system could increase the infiltration of soil gas, whereas sealing all penetrations within the extent of an alteration is expected to always benefit the indoor air quality in the house by reducing the infiltration of soil gas from below grade.

Costs

Using the building archetype described above to comply with proposed Clauses 10.9.1.1.(1)(a) and (b), a flexible sealant can be used. A half-litre container of flexible sealant costs \$20 [5], and two containers may be needed, for a total cost of \$40. Hiring a tradesperson in London to do the installation, which may require three hours of labour at roughly \$50 per hour, would cost a total of \$150.

To satisfy proposed Clauses 10.9.1.1.(1)(b) and (d), tubes of acoustical sealant are needed, which cost approximately \$15 per 825 mL tube [6]. Assuming that the extent of the alteration to the archetype house is the basement, this may require up to four tubes of sealant (using a 6.35 mm bead of sealant, as recommended for maximum performance), for a total cost of \$60.

To comply with proposed Clause 10.9.1.1.(1)(e), weather stripping is needed, which can cost between \$15 and \$25 per roll [7], and a sump pit cover can cost \$130 [8]. A floor drain that is compliant with proposed Clause 10.9.1.1.(1)(c) should be installed, which costs approximately \$27 [9]. Assuming that all of these changes and costs were required, the total cost, including labour, would be approximately \$432.

References

- [1] Statistics Canada:
<https://www150.statcan.gc.ca/n1/pub/11-630-x/11-630-x2015007-eng.htm>
- [2] Behan, K., and Szczepanowski, R. 2022. Residential Archotyping for Energy Efficiency Programs. Clean Air Partnership. Available at:
<https://www.cleanairpartnership.org/wp-content/uploads/2023/01/Archotyping-Guide-For-Energy-Efficiency-Programs-1.pdf>
- [3] World Health Organization. 2009. WHO Handbook on Indoor Radon: A Public Health Perspective. Available at:
<https://www.who.int/publications/i/item/9789241547673>
- [4] Health Canada. 2023. Radon Reduction Guide for Canadians. Available at:
<https://www.canada.ca/content/dam/hc-sc/documents/services/environmental-workplace-health/reports-publications/radiation/radon-reduction-guide-canadians-hc.pdf>
- [5] Source of pricing: <https://www.homedepot.ca/product/flex-seal-liquid-clear-16-oz-liquid-rubber-sealant-coating/1001720796>
- [6] Source of pricing: <https://www.homedepot.ca/product/lepage-pl-acousti-seal-sound-absorbing-vapor-barrier-adhesive-black-flexible-825ml/1000409510>
- [7] Source of pricing: <https://www.canadiantire.ca/en/cat/tools-hardware/exterior-repair-maintenance-supplies/weatherstripping-DC0001772.html>
- [8] Source of pricing: <https://www.homedepot.com/p/Everbilt-Radon-Mitigation-Basin-Cover-THD1085/300484358>
- [9] Source of pricing: <https://www.radondetect.ca/Dranjer-D-R2-floor-drain.html>

Enforcement implications

It is expected that having 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 maintain the integrity of the air barrier system.

Who is affected

Designers, engineers and architects: This proposed change clarifies the requirements for the continuity of air barrier systems in existing buildings subjected to alteration. This proposed change is expected to eliminate potential confusion about the requirements related to an alteration, thus easing the design process.

Builders and renovators: This proposed change is expected to reduce unnecessary work by clarifying the application of air leakage requirements in existing buildings subjected to alteration.

Building officials: This proposed change is expected to reduce confusion about how to regulate air barrier systems related to the alteration of existing buildings.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

NBC20 Div.B 10.9. (first printing)

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

[10.9.1.1.] -- ([1] --) ([b] --)

[10.9.1.1.] -- ([1] --) ([c] --)

[10.9.1.1.] -- ([1] --) ([d] --)

[10.9.1.1.] -- ([1] --) ([e] --)