

## Conformity Assessment to Air Barrier System and Air Barrier Material Requirements of the NBC

**NRC-CCMC**

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The National Building Code of Canada (NBC) requires that an 'effective' air barrier system be incorporated within the building envelope. Although the NBC addresses the performance characteristics to be considered to show that an effective air barrier system has been achieved the NBC does not prescribe any specific test protocols with acceptance criteria to verify compliance of proprietary air barrier 'systems' nor a procedure for air barrier 'materials'. The Canadian Construction Materials Centre (CCMC) has developed a test protocol for the evaluation of proprietary air barrier 'systems' and air barrier 'materials' according to the intent of the NBC.

The CCMC evaluations of an air barrier 'system' or an air barrier 'material' focus on the five main principal requirements of any air barrier system, specifically that an air barrier system must:

- Have an acceptable air leakage rate;
- Be continuous throughout the building envelope;
- Withstand structural wind loading expected during its service life;
- Be durable; and
- Be buildable or reproducible in the field

### Evaluation of Air Barrier Materials

Consistent with the first principle listed above, the NBC specifies that the 'material' that provides the principal resistance to air leakage within the air barrier system is required to have an average leakage characteristic not greater than  $0.02 \text{ L}/(\text{s}\cdot\text{m}^2)$  at 75 Pascals (Pa) pressure difference. (This represents the leakage rate, for example, through a 12.7-mm sheet of unpainted gypsum wallboard.) Part 9 does not currently contain quantitative requirements for maximum allowable air leakage rate of either an air barrier system or the materials used to form it. It provides a list of materials considered to have low air permeability, all of which have air leakage characteristics that are  $0.02 \text{ L}/(\text{s}\cdot\text{m}^2)$  at 75 Pa or less, as required in Part 5.

The CCMC evaluation of an air barrier 'material' involves testing no less than five  $1 \text{ m}^2$  specimens through a range of air pressures following a carefully prescribed procedure. The data is then

plotted and the air leakage rate @ 75 Pa is derived from the linear regression of the data points. This air leakage rate value must not exceed the  $0.02 \text{ L}/(\text{s}\cdot\text{m}^2)$  which is then published in a CCMC Evaluation Report for the proprietary air barrier 'material'. CCMC also confirms that the material conforms to its respective product standard to ensure durability of the material.

(At the request of industry, this CCMC protocol is presently being incorporated into a CGSB standard.)

The NBC specifies that the air barrier system must also be continuous across construction joints, control and expansion joints, at penetrations through an assembly, and at junctions with other assemblies. To address these NBC requirements, CCMC requires that the proponent of the air barrier 'material' define their proprietary air barrier 'system' to be constructed in the field. An appendix to the CCMC Evaluation Report contains a summary of the proponent's 'system' which has not been evaluated by CCMC.

The CCMC Evaluation Report clearly states that the building official must determine whether they accept the system details as forming an 'effective' air barrier system for their jurisdiction. As the structural integrity of the fasteners and the joints of the system has not been tested, the system may be acceptable in urban, low wind or sheltered areas while it may not be acceptable in exposed or high wind areas. Thus, the CCMC Evaluation Report for an air barrier 'material' may not result in product acceptance throughout all regions in Canada.

### Evaluation of Air Barrier Systems

The code committee responsible for air barrier system requirements recognized that, ideally, the maximum air leakage rate of the air barrier system (including materials and joints) should be specified. To help designers, the Appendix to Part 5 of the 1995 NBC provides a list of recommended maximum air leakage rates for the air barrier system suitable for most climates in Canada. During the development of the CCMC test protocol and evaluation criteria for air barrier systems these 'recommended' air leakage rates were revisited.



Complex mathematical modelling was undertaken for various wall types varying the air barrier properties, location of the air barrier and varying properties of the other wall components. The climates of Edmonton, Halifax and Ottawa were simulated for temperature, wind pressure, wind direction and vapour pressure. A new permissible air leakage rate for the air barrier 'system' was established as follows:

Water Vapour Permeance (WVP) of Outermost (Non-Vented) Layer of Wall Assembly ng/(Pa·s·m <sup>2</sup> )	Maximum Permissible Air Leakage Rates L/(s·m <sup>2</sup> ) at 75 Pa
15 < WVP < 60	0.05
60 < WVP < 170	0.10
170 < WVP < 800	0.15
> 800	0.20

This table is different from the table in the Part 5 Appendix and forms the basis of CCMC's evaluation criteria for an air barrier system.

To qualify, a minimum of three full-scale (i.e., 2.4 m x 2.4 m) wall specimens must be tested. One specimen must represent the air barrier system within the opaque insulated portion of the wall while the second and third specimens, to verify continuity, contain penetrations and joints (i.e., window, pipe, duct, concrete sill, etc.). These joints must be sealed by the accessories as part of the proprietary air barrier system. Before these specimens are measured for air leakage, they are structurally "aged" to represent the struc-

tural wind loading to be experienced by the air barrier system in the field over an extended period. The structural wind loading consists of one-hour sustained loads, 2000 cyclic loads and one gust wind load.

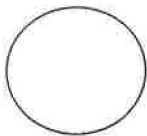
After structural loading the air leakage of the three specimens through a range of pressure differentials is measured. The air leakage rate of the system is assigned based on a criteria accounting for the variability between the specimens built in a fashion similar to the field situation.

The CCMC evaluation also includes a durability assessment of the air barrier system materials and accessories. The materials forming the principal plane of airtightness must be capable of maintaining their strength and air permeance properties after aging.

A successful evaluation of an air barrier system is published in a CCMC Evaluation Report containing a detailed description of all the salient features making up the conforming proprietary air barrier system.

For more information on the development of the CCMC test protocol and evaluation criteria IRC has published a new publication entitled, Air Barrier Systems for Walls of Low-Rise Buildings: Performance and Assessment. The publication also discusses the intent of the NBC requirements and the relationship between the vapour barrier and air barrier. For CCMC evaluations of air barrier materials (2 published) and air barrier systems (1 soon to be published) please consult the Registry of Product Evaluations available through IRC's clients services at 1-800-672-7900. ☼

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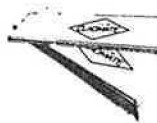
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