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(Reaffirmed 2016)**

**STANDARD FOR AIR BARRIER ASSEMBLIES -
SPECIFICATION**

Prepared and Published by:



Approved by:



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STANDARD FOR AIR BARRIER ASSEMBLIES - SPECIFICATION

PREFACE

This is the Reaffirmation of the First Edition of the Standard for Air Barrier Assemblies - Specification, CAN/ULC-S742.

This Edition of the Standard has been formally approved by the ULC Standards Committee on Air Barrier Materials and Systems.

This Standard has been developed in compliance with the requirements of SCC for accreditation of a Standards Development Organization.

Only metric SI units of measurement are used in this Standard. If a value for measurement is followed by a value in other units in parentheses, the second value may be approximate. The first stated value is the requirement.

Annex A, identified as Normative, forms a mandatory part of this Standard.

Annexes B to F, identified as Informative, are for information purposes only.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

This First Edition National Standard of Canada has been reaffirmed.

Attention is drawn to the possibility that some of the elements of this Canadian standard may be the subject of patent rights. ULC Standards shall not be held responsible for identifying any or all such patent rights.

Requests for interpretation of this Standard should be sent to ULC Standards. The requests should be worded in such a manner as to permit a "yes" or "no" answer based on the literal text of the requirement concerned.

The review and action to revise or reaffirm this Standard will not exceed 5 years from the date of publication, unless the Standard is identified as fitting within a stabilized category, whereby the review will commence within the appropriate time frame set out by ULC Standards.

This Standard is intended to be used for conformity assessment.

1. SCOPE

1.1 This standard sets out criteria for specification of air barrier assemblies that may be used in design specification documents or in manufacturer's product literature.

1.2 This standard provides the requirements and test methods for an air barrier assembly used in applications for both low-rise and high-rise buildings.

1.3 The test methods described in this standard involve measuring the air leakage rate of a representative test specimen of an air barrier assembly before and after exposure to wind pressure loading cycles and then determining an air leakage rate at a reference pressure difference (ΔP), based on the measurements.

1.4 This standard sets minimum performance requirements for the air leakage rate of air barrier assemblies based on levels of air leakage rate and wind pressure loading.

1.5 The requirements for determining the air leakage rate of air barrier components and air barrier accessories were not considered in the development of this standard.

1.6 The structural design for the transfer of loads from the air barrier assemblies to the building structure was not considered in the development of this standard.

1.7 This document does not purport to address all of the health and safety aspects associated with its use. Anyone using this Standard has the responsibility to consult the appropriate authorities and to establish health and safety practices, in conjunction with any existing applicable regulatory requirements, prior to its use.

2. REFERENCE PUBLICATIONS

2.1 The documents shown below are referenced in the text of this Standard. Unless otherwise stated elsewhere in this Standard such reference shall be considered to indicate the edition and/or revisions of the document available at the date on which the Committee approved this ULC Standard.

Documents published by the American Society for Testing and Materials (ASTM)
100 Barr Harbour Drive, PO Box C700, West Conshohocken, PA 19428-2959 U.S.A.
Telephone: (610) 832-9585
www.astm.org

- ASTM E 283-04, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors under Specified Pressure Differences across the Specimen
- ASTM E 1424-91(R 2008), Standard Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors under Specified Pressure and Temperature Differences across the Specimen
- ASTM E 2178-03, Standard Test Method for Air Permeance of Building Materials
- ASTM E 2357-05, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

Documents published by the Canadian Standards Association (CSA)
5060 Spectrum Way, Mississauga, ON L4W 5N6 Canada
Telephone: (416) 747-4000 or 1-800-469-6727
www.csa.ca

- CSA A123.21-10, Standard test method for the dynamic wind uplift resistance of membrane-roofing systems
- AAMA/WDMA/CSA 101/I.S.2/A440-08, NAFS – North American Fenestration Standard/Specification for windows, doors and skylights
- AAMA/WDMA/CSA 101/I.S.2/A440-S1-09, Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440-05 Standard/Specification for windows, doors and skylights
- CSA S478-95 (R 2001), Guideline on Durability in Buildings

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Telephone: (416) 757-3611, ext. 61744; FAX (613) 231-5977, "ATTN: Publications"
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- CAN/ULC-S741-08, Standard for Air Barrier Materials — Specification

3. DEFINITIONS

NOTE: Terms used in this Standard that are in *italic* print are defined as follows:

AIR BARRIER ACCESSORY — products designated to maintain air tightness between *air barrier materials*, *air barrier assemblies* and *air barrier components*, to fasten them to the structure of the building, or both (e.g., sealants, tapes, backer rods, transition membranes, fasteners, strapping, primers).

AIR BARRIER ASSEMBLY — the combination of *air barrier materials* and *air barrier accessories* that are designated and designed within the *environmental separator* to act as a continuous barrier to the movement of air through the *environmental separator* (see Figure C1 in Annex C).

AIR BARRIER COMPONENT — pre-manufactured elements such as windows, doors and service elements that are installed in the *environmental separator*.

AIR BARRIER MATERIAL — a building material that is designed and constructed to provide the primary resistance to airflow through an *air barrier assembly*.

AIR BARRIER SYSTEM — the combination of *air barrier assemblies* and *air barrier components*, connected by *air barrier accessories* that are designed to provide a continuous barrier to the movement of air through an *environmental separator*.

AIR LEAKAGE RATE $L/(s \cdot m^2 \cdot Pa)$ — the rate of airflow (L/s) driven through a unit surface area (m^2) of an assembly by a unit static pressure difference (Pa) across the assembly.

AIR PERMEANCE — the rate of airflow (L/s) through a unit area (m^2) of a material driven by unit static pressure difference (Pa) across the material.

ENVIRONMENTAL SEPARATOR — the parts of a building that separate the controlled interior environment from the uncontrolled exterior environment, or that separate spaces within a building that have dissimilar environments.

LOW SLOPED MEMBRANE ROOFING ASSEMBLY (LSMRA) — an assembly of roofing components intended to act as the preliminary *environmental separator* impermeable to air and water ingress.

PROPONENT — the party that designates/designs a specific assembly that has been qualified to the requirements of this Standard as an *air barrier assembly*.

SERVICE LIFE — the period of time during which the *air barrier assembly* or any of its *air barrier materials* or *air barrier accessories* performs without unforeseen costs or disruption for maintenance or repair. See also CSA S478.

4. CLASSIFICATION

4.1 AIR LEAKAGE

4.1.1 An *air barrier assembly* in compliance with this standard shall be classified as one of the types listed in Clause 4.1.1.1 to Clause 4.1.1.5 according to its reference *air leakage rate*.

4.1.1.1 A1 - the reference *air leakage rate* shall not exceed $0.05 \text{ L/(s}\cdot\text{m}^2)$ at a pressure difference of 75 Pa.

4.1.1.2 A2 - the reference *air leakage rate* shall not exceed $0.10 \text{ L/(s}\cdot\text{m}^2)$ at a pressure difference of 75 Pa.

4.1.1.3 A3 - the reference *air leakage rate* shall not exceed $0.15 \text{ L/(s}\cdot\text{m}^2)$ at a pressure difference of 75 Pa.

4.1.1.4 A4 - the reference *air leakage rate* shall not exceed $0.20 \text{ L/(s}\cdot\text{m}^2)$ at a pressure difference of 75 Pa.

4.1.1.5 A5 - the reference *air leakage rate* shall not exceed $0.50 \text{ L/(s}\cdot\text{m}^2)$ at a pressure difference of 75 Pa.

4.1.2 The reference *air leakage rate* is the highest *air leakage rate* of those recorded among all specimens when tested according to Section 6.

4.1.3 Where the designated plane of air tightness is a *low sloped membrane roof assembly (LSMRA)* and the waterproofing membrane serves as the *air barrier material*, the *LSMRA* shall be deemed to have *air leakage rate* not exceeding $0.20 \text{ L/(s}\cdot\text{m}^2)$ at a pressure difference of 75 Pa when the roof membrane is applied in conformance with the typical construction details contained in Annex A. For projects where an *air leakage rate* of not greater than $0.10 \text{ L/(s}\cdot\text{m}^2)$ is required or when assembly details differ from those shown in Annex A, the assembly shall be tested in accordance with the requirements of this standard.

5. REQUIREMENTS

5.1 GENERAL REQUIREMENTS

5.1.1 All materials in the *air barrier assembly* that fall within the scope of a product standard shall meet the requirements of that product standard.

5.1.2 With the exception of air barrier assemblies described in Clause 4.1.3, the *air barrier assembly* shall be constructed with at least one *air barrier material* meeting the requirements of CAN/ULC-S741.

5.2 DETAILED REQUIREMENTS

5.2.1 Air Leakage

5.2.1.1 The classification assigned to the *air barrier assembly* in Section 4 shall be based on the reference *air leakage rate* determined at a pressure difference of 75 Pa.

5.2.1.2 Except as identified in Clause 5.2.1.3, the *air barrier assembly* shall be classified as A1 to A4, when tested in accordance with Clauses 6.3.2.1 to 6.3.2.3.

5.2.1.3 An *air barrier assembly* constructed of a combination of windows, doors or skylights shall be classified as A1 to A5, when tested in accordance with Clauses 6.3.2.2 to 6.3.2.4.

NOTE: AAMA/WDMA/CSA 101/I.S.2/A440 defines a combination assembly as an assembly formed by a combination of two or more separate fenestration products whose frames are mullied together utilizing a combination mullion or reinforcing mullion.

5.2.2 Wind Pressure Loading

5.2.2.1 No specimen shall lose its integrity during the wind pressure loading required in Subsection 6.3.3.

5.2.3 Deflection

5.2.3.1 Deflection of the specimen under wind pressure loading shall be measured and reported.

6. TESTING

6.1 SPECIMEN PREPARATION

6.1.1 The test specimens shall be representative of the *air barrier assembly* as constructed in the field and according to the *proponent's* installation instructions.

NOTE: Replicating field installation of test specimens is particularly important with respect to the continuity and structural performance of the *air barrier material* and the remainder of the *air barrier assembly* (substrate, fastening, etc.). As well, the specimens should be fabricated by personnel (e.g., journeymen, trained installers) typically employed in field construction.

6.1.2 The minimum dimensions for the test specimens shall be 2400 mm x 2400 mm.

6.1.3 At least one specimen shall be constructed to represent the *air barrier assembly* including typical joints and details that may affect the continuity and the structural support of the *air barrier material* installed in the assembly.

6.1.4 Where the *air barrier assembly* is a metal and glass curtain wall or any combination of windows, doors and skylights, a single specimen shall be prepared in accordance with ASTM E 1424.

6.1.5 The specimens shall be prepared in accordance with the requirements of CSA A123.21 where:

- A the *air barrier assembly* is a *LSMRA* to which the scope of CSA A123.21 applies; and
- B the waterproofing membrane serves as the *air barrier material*.

6.1.6 For *air barrier assemblies* not described in Clause 6.1.4 or Clause 6.1.5, the test specimens shall be prepared in accordance with ASTM E 2357.

NOTE: ASTM E 2357 requires that a base test specimen be constructed to represent the field of the *air barrier assembly* and that additional specimens (two are identified) be constructed with junctions and service penetrations. ASTM E 2357 provides guidance on circumstances when the additional specimens could be combined or eliminated.

6.1.7 For *air barriers assemblies* described in Clause 6.1.5 and Clause 6.1.6, additional specimens shall be constructed as described in Clause 6.1.7.1 and Clause 6.1.7.2.

6.1.7.1 At least one specimen to demonstrate the performance of the *air barrier assembly* containing the following:

- A service penetrations;
- B control and expansion joints, if required for the installed assembly; and
- C junctions with *air barrier components*.

6.1.7.2 At least one specimen to demonstrate the performance of the *air barrier assembly* containing the following:

- A structural penetrations, if required for the installed assembly; and
- B junctions with other *air barrier assemblies*, at the discretion of the *proponent*.

NOTE: In general, two separate specimens will be required to address the details described in 6.1.7.1 and 6.1.7.2 for the product range of a given *proponent*, however these details may be tested in one specimen where they can be constructed into one specimen without violating manufacturer requirements for clearances, for example.

6.2 SPECIMEN CONDITIONING

6.2.1 Sufficient time shall be permitted for all materials in the test specimens to reach their in-service state according to the *proponent's* design specifications.

6.3 TEST METHODS

6.3.1 Sequence of Testing

6.3.1.1 Testing of the specimen(s) shall be performed in the following sequence:

- A Step 1: *Air leakage rate* at ambient temperature (optional).
- B Step 2: Wind pressure loading.
- C Step 3: Deflection.
- D Step 4: *Air leakage rate*:
 - (i) at ambient temperature, and
 - (ii) at cold temperature.

6.3.2 Air Leakage Rate

6.3.2.1 The *air leakage rate* of the *air barrier assembly* at ambient temperature shall be determined in accordance with

- A the *air leakage rate* procedure described in ASTM E 2357; or
- B ASTM E 283 using 5 pressure differences between 0 Pa and the maximum pressure difference specified in the static air leakage test in CSA A123.21, where:
 - (i) the *air barrier assembly* is a *LSMRA* to which the scope of CSA A123.21 applies; and
 - (ii) the waterproofing membrane serves as the *air barrier material*.

6.3.2.2 The results for each test series shall be fitted to a mathematical equation of the form $q = A \cdot \Delta P^n$ using the method of least squares to establish the relationship between *air leakage rate* (q) and pressure difference (ΔP), where A is a constant and the value of n is between 0.5 and 1.0.

6.3.2.3 The *air leakage rate* of the *air barrier assembly* at cold temperature shall be determined in accordance with the *air leakage rate* procedure described in ASTM E 1424 at a cold side temperature of -20 ± 2 °C and warm side temperature of $+20 \pm 2$ °C.

NOTE: Thermal insulation may have to be added to the test specimen in order for these test conditions to be achievable in *air barrier assemblies* that do not already contain thermal insulation. In these cases, the thermal insulation must be located according to the intended use of the *air barrier assembly* in the field (i.e., toward the warm side for exterior *air barrier assemblies* and toward the cold side for interior *air barrier assemblies*). For *air barrier assemblies* that do not contain thermal insulation as a component of the assembly, the added insulation material shall be a fibrous insulation with limited resistance to air flow.

6.3.2.4 The *air leakage rate* of an *air barrier assembly* constructed using a combination of windows, doors or skylights shall be determined in accordance with the procedures described in AAMA/WDMA/CSA 101/I.S.2/A440 including Canadian requirements and the Canadian Supplement CSA AAMA/WDMA/CSA 101/I.S.2/A440-S1.

6.3.3 Wind Pressure Loading

6.3.3.1 Select the target sustained wind pressure difference (P_1) and maximum building height (H).

NOTE: The selected values (P_1 , H) will limit the use of the *air barrier assembly* to applications in locations with equal or lower sustained 1 in 50 hourly design wind pressure difference (Q_{50}) and buildings of that maximum height. The selected values will be shown on required labels and marking.

6.3.3.2 The wind pressure loading test shall be completed in accordance with the requirements of:

- A Clauses 6.3.3.3 to 6.3.3.6; or
- B Level A as described in CSA A123.21, where:
 - (i) the *air barrier assembly* is a *LSMRA* to which the scope of CSA A123.21 applies; and
 - (ii) the waterproofing membrane serves as the *air barrier material*.

6.3.3.3 Select a cyclic and gust wind pressure difference pair (P_2 and P_3) from Table 1 corresponding to the target sustained wind pressure difference (P_1) and maximum building height (H).

6.3.3.4 Subject the test specimens to air pressure differences according to Figure 1 for a wall *air barrier assembly* and Figure 2 for a roof *air barrier assembly*.

NOTE: Testing of *LSMRAs* according to Figure 2 will only be required when it is intended to demonstrate an *air leakage rate* of not greater than $0.10 \text{ L/(s}\cdot\text{m}^2)$ at a pressure difference of 75 Pa or when assembly details differ from those shown in Annex A.

6.3.3.5 Apply the initial air pressure differences in increments of 100 Pa until the sustained wind pressure difference value (P_1) is reached.

6.3.3.6 Observe the condition of the specimens during the wind pressure loading test and record any evidence of compromised structural integrity.

6.3.4 Deflection

6.3.4.1 The level set for the cyclic air pressure difference as selected in Clause 6.3.3.3 for both positive and negative pressures (P_2 , P'_2) shall be applied once for a period of 10 s.

6.3.4.2 The maximum deflection shall be recorded for both positive and negative pressure differences (P_2 , P'_2).

7. REPORTING REQUIREMENTS

7.1 GENERAL

7.1.1 In addition to the information specified in the individual test methods, all reports describing the testing of the *air barrier assembly* according to this standard shall include the following information:

- A The *proponent's* name and address;
- B General description, drawings and schematics of the *air barrier assembly* clearly identifying the *air barrier material(s)*, *air barrier accessories*, location within the *environmental separator*, fastening and continuity details, and transfer of loads to the building superstructure;
- C Descriptions of test apparatus, calibration standards and their source(s);
- D The name and location of the laboratory performing the tests and, if applicable, the accreditation agency for the laboratory;
- E A summary of measured results (preferably in a table) compared to the requirements of this standard with indication that the property has passed/failed;
- F The *air leakage rate* classification (A1.....A5) together with the sustained hourly wind pressure load (S) and building height (H); and

NOTE: Example: "Class A1 (S450/H80)" indicates that the *air barrier assembly* was tested successfully to a reference *air leakage rate* of $0.05 \text{ L/(s}\cdot\text{m}^2)$ at a sustained hourly wind pressure load (equal to P_1), S, of 450 Pa and cyclic and gust wind pressure differences (P_2 , P_3) equivalent to a maximum building height, H, of 80 m.

- G An appendix to the report containing the test data used to generate the above items.

7.2 DESCRIPTION OF SPECIMENS

7.2.1 The description of all test specimens shall include construction type, date of construction, who fabricated the specimens, and a Bill of Materials with the types, names, part numbers, quantities and descriptions of the materials (including Standards complied with), components and accessories and an assembly drawing indicating their locations.

7.2.2 The description of all test specimens shall include the identification data for traceability of all materials, components and accessories and “Expiry” dates, if applicable.

7.2.3 For each specimen, detailed drawings (and photographs) shall be provided showing the *air barrier material(s)*, continuity, structural support, fastening schedule, *air barrier accessories*, structural and service penetrations, control and expansion joints, and junctions with *air barrier components*.

7.3 CONDITIONS DURING TESTING

7.3.1 For each specimen, if applicable, the climatic conditions at the beginning of the test and at the end of test shall be reported. Parameters include wind speed, atmospheric pressure, and temperature difference across the specimen.

7.4 AIR LEAKAGE

7.4.1 For each specimen, the report shall identify the test procedure used and the time and date of the test.

7.4.2 For each specimen, all *air leakage rates* shall be calculated based on the series of tests performed in Clause 6.3.2. and all calculated values shall be reported.

7.4.3 The reference *air leakage rate* and the resulting classification of the *air barrier assembly* shall be reported.

7.5 WIND PRESSURE LOADING

7.5.1 The report shall identify:

- A the selected sustained wind pressure difference (P_1);
- B the selected maximum building height (H); and
- C the resulting cyclic and gust wind pressure differences (P_2 , P_3).

7.5.2 For each specimen, the report shall include a statement regarding the structural integrity and, if applicable, a description of any defect, failure or structural insufficiencies observed during the wind pressure loading procedure.

7.6 DEFLECTION

7.6.1 For each specimen, the report shall include the maximum deflection measured for both positive and negative pressure differences, together with a description of the corresponding assembly element and a drawing giving the location in each case.