Designation: D8052/D8052M – 17

Standard Test Method for Quantification of Air Leakage in Low-Sloped Membrane Roof Assemblies[1]

This standard is issued under the fixed designation D8052/D8052M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method provides a laboratory technique for determining air leakage in low-sloped membrane roof assemblies under specified negative air pressures differences.

1.2 This test method is intended to measure air leakage of a roof assembly with rooftop penetrations.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1079 Terminology Relating to Roofing and Waterproofing

D7586/D7586M Test Method for Quantification of Air Intrusion in Low-Sloped Mechanically Attached Membrane Roof Assemblies

E283 Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

E631 Terminology of Building Constructions

E1677 Specification for Air Barrier (AB) Material or System for Low-Rise Framed Building Walls

E2357 Test Method for Determining Air Leakage of Air Barrier Assemblies

2.2 *CAN/CSA Standard:*[3]

CAN/CSA-A123.21-14 Standard Test Method for the Dynamic Wind Uplift Resistance of Membrane-roofing Systems

3. Terminology

3.1 *Definitions*—Terms used in this test method are defined in Terminology D1079, Terminology E631, Test Method E283, and Test Method D7586/D7586M.

4. Summary of Test Method

4.1 The air leakage test consists of installing a roof assembly with five typical rooftop penetrations between two chambers, a bottom chamber where the roof assembly is installed in a horizontal plane and a top chamber through which air is exhausted at a rate required to maintain the specified pressure difference across the roof assembly, and measuring the resultant air flow through the specimen. Although the roof assembly is tested in horizontal plane, the results are applicable to low slope roofs as defined in Terminology D1079.

5. Significance and Use

5.1 This test method can be useful in understanding the response of low-sloped membrane roof assemblies to air pressure differences induced across the assembly.

5.2 This test method can be useful in understanding the role of different roofing components in providing resistance to air leakage through the roof assembly.

5.3 When applying the results of tests by this test method, note that the performance of a roof or its components, or both, depends on proper installation.

5.4 This test method does not purport to establish all criteria necessary for the consideration of air movement in the design of a roof assembly. Air intrusion in roofing systems is separate and distinct from air leakage in roofing systems. Test Method D7586/D7586M provides an air intrusion test method for mechanically attached roof assemblies. The results are intended to be used for comparison purposes and likely do not represent the field installed performance of the roof assembly.

[1] This test method is under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofing and is the direct responsibility of Subcommittee D08.20 on Roofing Membrane Systems.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from Canadian Standards Association (CSA), 178 Rexdale Blvd., Toronto, ON M9W 1R3, Canada, http://www.csagroup.org.

6. Test Apparatus

6.1 This description of the apparatus is general in nature, and any arrangement of the equipment capable of performing the test method within the allowable tolerances is permitted.

6.2 The major components of the test apparatus are shown in Fig. 1 and described below:

6.2.1 *Pressure Box*—The pressure box shall consist of two test chambers designated as the top chamber and the bottom chamber.

6.2.1.1 *Top Chamber*—The interior length and width dimension of top chamber shall be minimum 6.1 m [20 ft] long and 2.44 m [8 ft] wide, respectively. It shall have a minimum height of 0.9 m [3 ft] and shall be movable. To measure the chamber pressure, it shall be fitted with at least one pressure tap. Provision shall be made for an opening on the top chamber through which the pipe network will be installed and connected to the blower. The top chamber shall be provided with window openings to view the test specimen response and a gust simulator. The gust simulator shall consist of flap valve connected to a stepping motor through a timing belt arrangement. To facilitate the control of test pressures that is applied over the test specimen, the top chamber shall be well sealed by appropriate sealing products. The top chamber shall be structurally resilient to resist deformation from wind loads induced during the wind conditioning.

NOTE 1—Sealing products such as non-hardening mastic compounds or pressure-sensitive tape can be used to achieve the air tightness in the construction of the pressure chamber, to seal the perimeter edges of the test specimen to the bottom chamber and to seal the access door to the chamber.

6.2.1.2 *Bottom Chamber*—A supporting frame for the top chamber, which shall have a minimum interior length and width dimension of 6.1 m [20 ft] long and 2.44 m [8 ft] wide, respectively, and a minimum height of 0.9 m [3 ft]. The bottom chamber shall comprise a structural support on which the test specimen shall be installed horizontally as shown in Fig. 1. The structural support shall be installed on a height adjustable platform that can accommodate membrane roof assemblies with different thickness. The bottom chamber and the structural support must be capable of supporting the loads transferred from the test assembly during the conditioned specified in 9.8.

6.2.2 *Air System*—A controllable blower designed to provide the required airflow at the specified negative pressures. The blower shall be capable of creating suction pressures of up to 5 kPa [100 psf].

6.2.3 *Pressure Measuring Apparatus*—A device for measuring the test pressure difference within a tolerance of ±2 % of the reading or ±2.5 Pa [0.05 psf], whichever is greater.

6.2.4 *Airflow Measurement System*—A device to measure the air flow into the test chamber or through the test specimen.

NOTE 2—The accuracy of the specimen leakage flow measurement is affected by the accuracy of the flowmeter and amount of extraneous leakage of the apparatus (see Annex A1 of Test Method E283).

6.2.5 *Data Acquisition System*—A computer based system capable of reading and recording the pressure and airflow measurements.

7. Test Specimen

7.1 The specimens tested shall be representative of the field built roofing assemblies. Therefore, the test specimens shall be fabricated as prescribed by the proponent in providing for the specimen construction required herein.

7.2 The test specimen shall include the following five penetrations: wooden curb, metal curb, cast iron plumbing vent with pre-manufactured boot, ABS (Acrylonitrile butadiene styrene), or PVC (Polyvinyl Chloride) plumbing vent with field fabricated pipe seal, and a roof drain (see Fig. 2). All

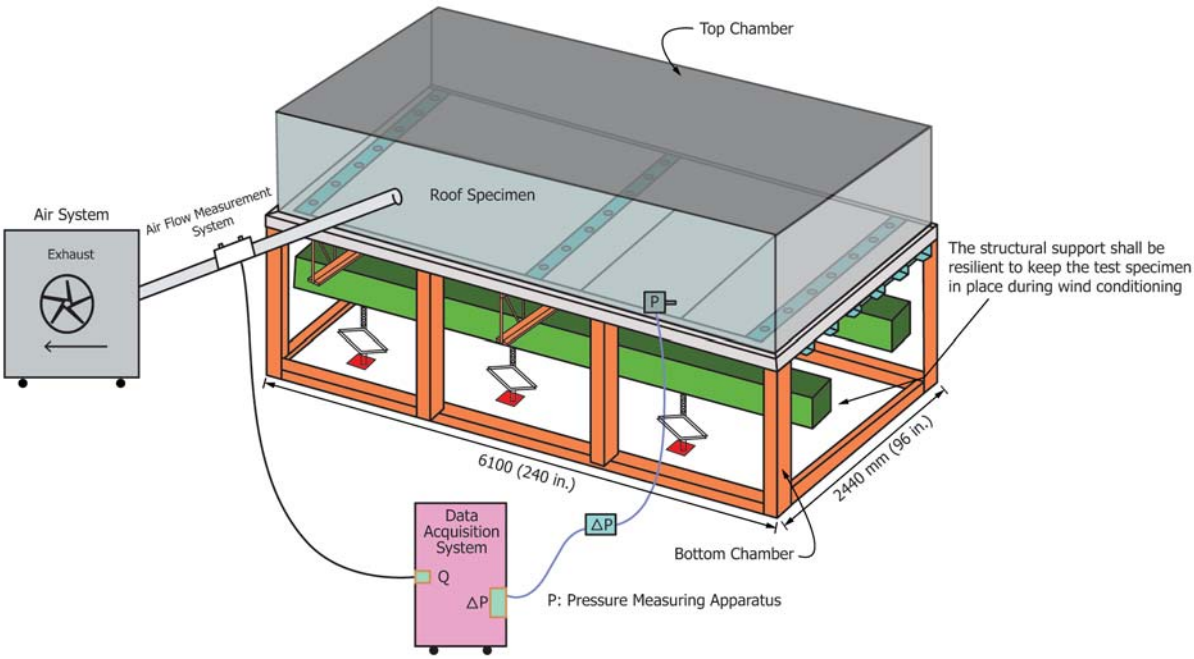

FIG. 1 Air Leakage Test Apparatus

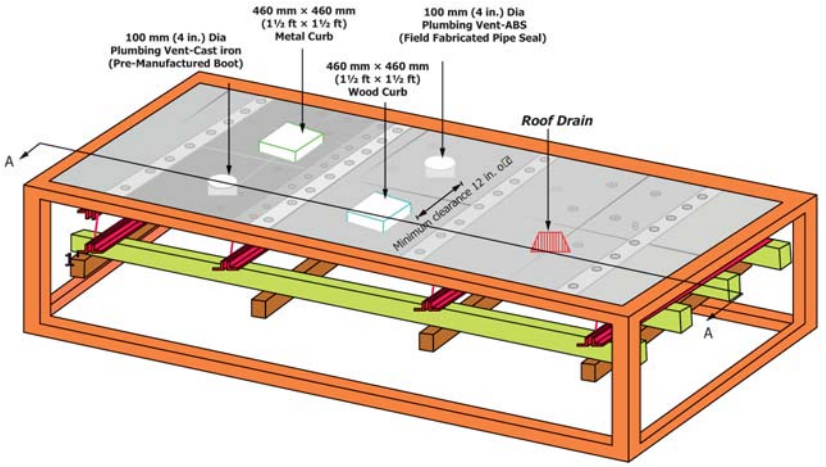

FIG. 2 Typical Layout of Test Specimen

penetrations shall be installed in accordance with the manufacturer's installation instructions. The penetrations shall be covered (see Fig. 3) to ensure that the measured air leakage is through the test specimen and not through the penetrations during the testing.

7.3 The perimeter edges of the structural deck shall be flush to the interior of the bottom chamber and shall be sealed to the bottom chamber using suitable sealing products as shown in the cross-sectional view (Fig. 3). This is crucial to ensure that the deck seams or joints are the flow paths and not the deck edges.

7.4 When insulated test specimens are tested, the top surface of the insulation board shall be flush with the top edges of the bottom chamber.

7.5 To ensure that edges of the roofing membrane are not part of the flow paths during air leakage testing, the roofing membrane shall have a minimum overhang of 600 mm [24 in.] on all the four sides and shall be sealed to the outside of the bottom chamber as shown in Fig. 3 by suitable sealing products (see Note 1).

8. Calibration

8.1 Calibration shall be performed in accordance to the procedure described in Test Method E283.

9. Test Procedure

9.1 With the test specimen constructed in the bottom chamber and covered with the top chamber, the test procedure comprises of measuring the extraneous leakage of the top chamber and air leakage of the test specimen.

9.2 Ensure that the top chamber is tightly fixed to the bottom chamber during the test to make sure that no membrane slippage occurs. (See Note 3.)

NOTE 3—Clamping devices or gaskets may be used for tightening the top chamber to the bottom chamber.

9.3 To measure the extraneous leakage, close the gust simulator, cover the specimen appropriately with a continuous sheet of roofing membrane or a polyethylene sheet, and connect the air system and airflow measurement system as shown in Fig. 3.

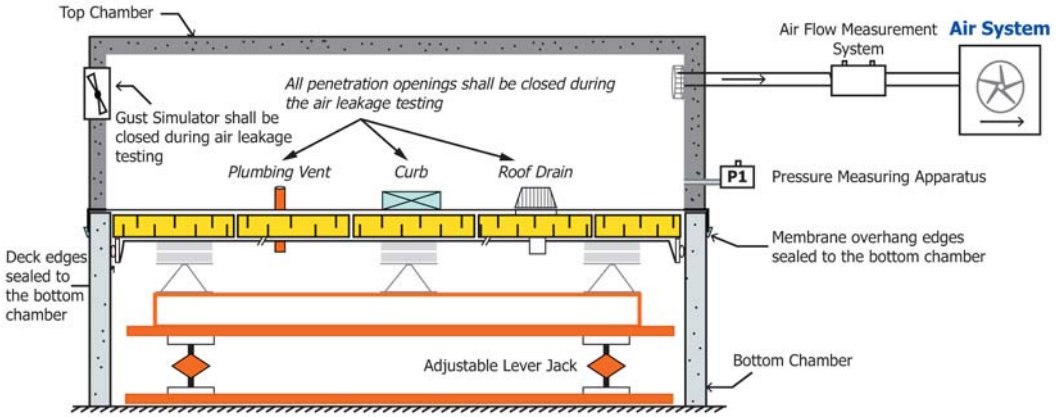

FIG. 3 General Arrangement of the Air Leakage Setup