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StoGuard® Air Barrier Materials and Assemblies Testing

Introduction

This technical paper discusses the test methods used to evaluate air barrier materials and assemblies for compliance with accepted air barrier performance requirements. ASTM test results for StoGuard® waterproof air barrier products and assemblies are presented.

Air Barriers

Air barriers resist the movement of air between the interior and exterior of a conditioned structure. This saves energy and costs by reducing demands on the heating and cooling systems of a building. Air barriers also control condensation within wall cavities by preventing the free movement of moisture laden air within the wall assembly. This improves occupant comfort and also reduces the potential for mold growth and degradation of materials that can result from excess moisture in the wall.

The air barrier also controls the movement of liquid water through the building envelope. If there is no opening through which air can pass then water will not pass either.

In practice an air barrier is not just one product. Many materials have the ability to restrict air movement. However, a building envelope is made up of different components including cladding, water-resistive barrier, windows, doors, flashing and sealants. The interfaces between these components are critical and, to a large extent, determine if the final assembly of products provides an effective air barrier system.

Materials

To be considered an air barrier material, a product must exhibit an air leakage rate of <0.02 $L/s \cdot m^2$ (<0.004 ft^3/ft^2) when tested in accordance with ASTM E 2178, *Test Method for Air Permeance of Building Materials*. ASTM E 2178 places the air barrier material over a $1m^2$ (10.8 ft^2) opening and subjects it to a series of pressure differences. The pressure difference is increased from 50 Pa to 75 Pa in stages, and then a final air leakage reading is taken at a 75 Pa pressure differential.

StoGuard materials have been tested in accordance with ASTM E 2178 over different substrates and comply with the accepted air leakage requirements. Table 1 presents ASTM E 2178 test results for StoGuard materials.

Table 1. StoGuard ASTM E 2178 Test Results

Product	Substrate	Air Leakage, $L/s \cdot m^2$
Sto Gold Coat®	CMU	<0.001
	10 mil (dry) film over screen	<0.001
Sto Gold Fill®	Air-permeable Felt	0.002
Sto EmeraldCoat®	CMU	<0.001
StoGuard® VaporSeal™	CMU	<0.001

Assemblies

ASTM E 2178 establishes that a material performs as an air barrier, but it does not address how the combination of the primary air barrier material and accessory materials function as an air barrier system.

Transitioning from a window to the field of the wall requires proper detailing and use of accessory materials that will maintain the air barrier performance over gaps and openings that are part of everyday construction.

ASTM E 2357, *Test Method for Determining Air Leakage of Air Barrier Assemblies*, addresses the transition materials and details, and measures performance of an air barrier assembly or system. Test specimens are 8-ft by 8-ft (2400 x 2400 mm) and include a panel with a rough opening (filled with a plywood blank), circular pipe penetration, HVAC duct penetration, electrical box attachments and penetrations, and brick ties. This “detail” panel also

includes transition details to adjacent framing and a concrete foundation or slab.

Figure 1. ASTM E 2357 test panel with penetration and transition details.

ASTM E 2357 includes a multi-step loading protocol which subjects the assembly to both negative and positive pressures for sustained periods and repeated cycles of rapid loading followed by positive and negative gust loading. A summary of the steps of the test method are presented in Figure 2 along with the air pressure differentials used to test StoGuard. Figure 3 illustrates the loading protocol graphically. After completion of the loading protocol, a final air leakage rate is measured and reported. The maximum allowable air leakage rate required by most codes for air barrier assemblies is 10 times more than for an air barrier material, or 0.2 L/s·m^2.

Many products meet the definition of an air barrier material. Gypsum sheathing products are the baseline materials meeting the air leakage requirement: <0.02 L/s·m^2 (<0.004cfm/ft^2). The treatment of joints between sheathing boards and the sheathing fasteners will essentially define the air barrier performance of a gypsum sheathed, framed wall assembly. Sto Corp. performed the ASTM E 2357 test with StoGuard materials used only on the joints, sheathing fasteners, and transition details (Figure 1). The air leakage rates obtained by Sto Corp. in this test are conservative values and represent the maximum air leakage that can be expected for a properly installed StoGuard system because the field of the sheathing was left untreated. Added resistance to air leakage and water resistance can be obtained by applying StoGuard coatings (Sto Gold Coat, Sto EmeraldCoat, or StoGuard Vapor Seal) to the surface of the sheathing. Each of the coating products meets the requirements of an air barrier material on their own when tested in accordance with ASTM E 2178.

The results from the ASTM E 2357 testing of StoGuard joint and penetration detail treatments are presented in Table 2.

Table 2. StoGuard ASTM E 2357 Test Results

Product	Accessory Material	Air Leakage, L/s·m^2 at 75 Pa*
Sto Gold Coat	StoGuard Fabric	0.016
Sto Gold Fill	StoGuard Mesh	0.011
Sto EmeraldCoat	StoGuard Fabric	0.011
StoGuard VaporSeal	StoGuard Fabric	0.011

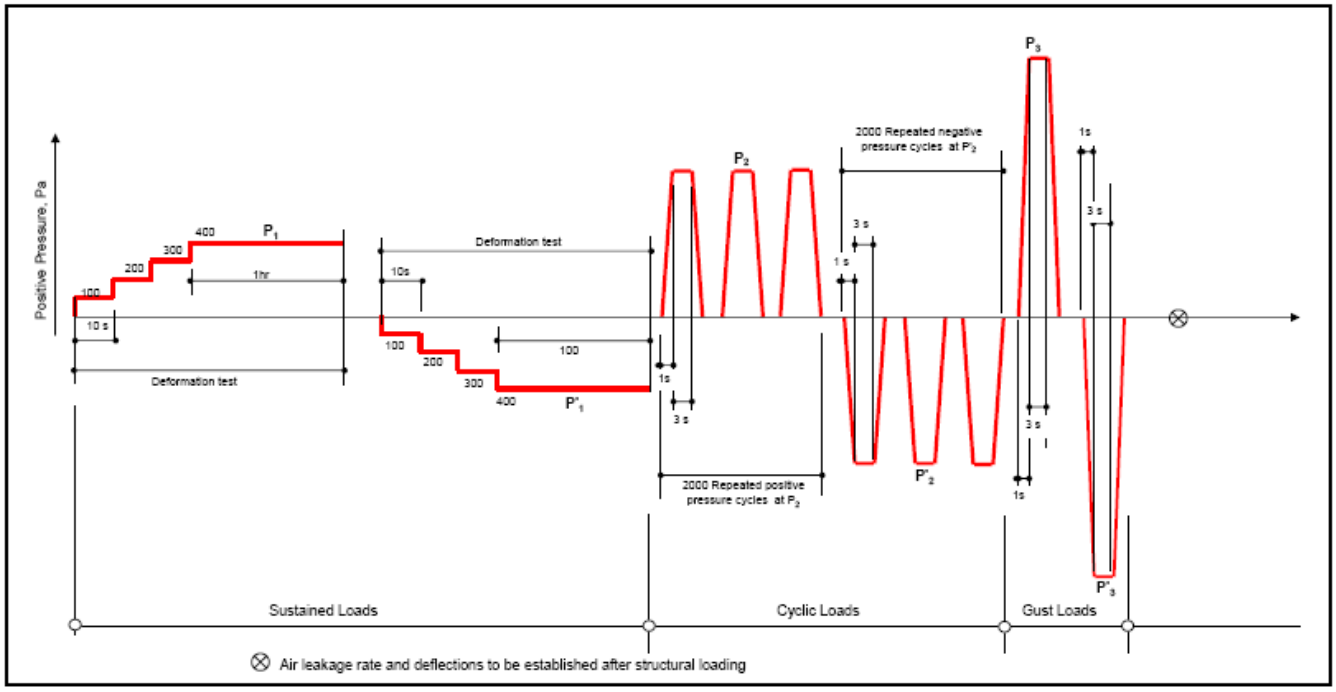
* Maximum air leakage rates measured at end of testing. Maximum allowable rate = 0.2 L/s·m^2 (0.04 cfm/ft^2).

Figure 2: ASTM E2357 Testing Summary

Step	Description	Pressure, Pa (psf)	Duration	Number of Cycles
1	Ramp to sustained positive pressure	100, 200, 300, 400 (2.09, 4.18, 6.29, 8.35)	10 seconds per increment	1 each increment
2	Sustained positive pressure	600 (12.5)	1 hour	1
3	Ramp to sustained negative pressure	-100, -200, -300, -400 (-2.09, -4.18,-6.29,-8.35)	10 seconds per increment	1 each increment
4	Sustained negative pressure	-600 (-12.5)	1 hour	1
5	Positive cyclic pressure	800 (16.7)	1 second to load 3 seconds hold 1 second to unload	2000
6	Negative cyclic pressure	-800 (-16.7)	1 second to load 3 seconds hold 1 second to unload	2000
7	Positive Gust Load	1200 (25.1)	1 second to load 3 seconds hold 1 second to unload	1
8	Negative Gust Load	-1200 (-25.1)	1 second to load 3 seconds hold 1 second to unload	1

Air leakage is measured before Step 1 and after Step 8.

Figure 3: ASTM E 2357 Loading Protocol
(Adapted from ASTM E 2357)



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