STANDARDS EXPLAINED
ASTM E 2178: STANDARD TEST METHOD FOR AIR PERMEANCE OF BUILDING MATERIALS

As the demand for highly energy efficient and durable buildings continues to increase, so does the requirement for wall systems performance which entails proper building enclosure design, material selection, and component detailing. One of the key aspects of achieving a highly efficient and durable building is the ability to protect the building from unwanted air and water infiltration, which would include the use of a complete air barrier system. As an air barrier material is an integral part of this system, it is critical that the material be fully tested to ensure that the material is able to perform in the environment that it is going to exposed to.

An essential part of air barrier performance is that an air barrier material have low air permeance. The most common test method for this is ASTM E2178, the Standard Test Method for Air Permeance of Building Materials. Air barrier materials are defined by their air permeance, that is, the amount of air that migrates through them. The accepted level of air permeance of materials defined in many codes and standards around the country is less than 0.004 cfm/ft² @ 1.57 lb/ft² (0.02 L/(s • m²) @ 75 Pa). In other words, this defines the maximum allowable air permeance for a material that can be used as part of the air-barrier system. This value is also the threshold used by the Air Barrier Association of America (ABAA) in their evaluation of air barrier materials.


It is important to understand that this is a test method, and not a specification, meaning that it provides methods on the testing procedure, but does not include specific performance requirements that the material is required to meet.

The purpose of this test is to measure the air permeance of flexible sheet or rigid panel-type materials, consisting of materials such as: self-adhered sheet air barriers, fluid applied membranes, medium density sprayed polyurethane foam, mechanically fastened commercial building wraps, and boardstock air barriers. It is important to differentiate the term air permeance (the air that passes through the material) from air leakage, which is the air that passes through holes or gaps.

The test method requires that 5 specimens with a dimension of 1m x 1m are tested using an apparatus similar to that depicted in Figure 1 and Figure 2. This apparatus involves an air-tight chamber, a flow measuring device, a pressure measuring device, and a vacuum blower.

Each of these 5 specimens are conditioned for 7 days at 21°C (70°F) and 50% RH and then subjected to various pressure differentials ranging from 25 Pa to 300 Pa (0.52 psf to 6.25 psf) with the intent of determining an assigned air permeance rate of the material at the reference pressure difference ($\Delta P$) of 75 Pa.

For materials, such as flexible sheets, or fluid-applied membranes, they must be tested over a rigid support that has an air permeance that is greater than that of the test specimen ensuring that the air barrier material being tested is the most restrictive. Typically this is accomplished by an open grill or wire mesh that provides the support.

The procedure first involves wrapping the sample in 6mil polyethylene which is then clamped with a gasket within the test chamber. Following this, the wrapped specimen is then subjected to the following pressure differentials, 25, 50, 75, 100, 150, and 300 Pascals. This allows measurement of the extraneous air leakage. Once completed, the polyethylene is then cut, and the specimen is then exposed to these same pressure differentials, providing a total air flow rate. To ensure that there is consistency, measurement is then re-done at 100, 75 and 50 Pa. The corresponding value needs to be within 10%.

To determine the flow rate of the specimen at each of these pressures, the extraneous air flow rate is subtracted from the total air flow rate to provide the flow rate through the air barrier specimen. With this flow rate value, and taking into account the area of the specimen, and pressure differential, the air permeance can then be calculated and reported.

An independent test report shall contain detailed information about the material tested, including thickness, along with the sampling procedure used. The results are to include the measured air flow rates and pressure differentials in both graphical and tabulated forms for each of the specimens tested.

The above information provides an overview of the ASTM E2178 test procedure used for air permeance testing of air barrier materials. W. R. MEADOWS has tested all of our AIR-SHIELD air barrier materials using this test method and independent test results are available upon request.

Figure 2: Air permeance apparatus for testing to ASTM E2178. Credit: Architectural Testing, Inc.